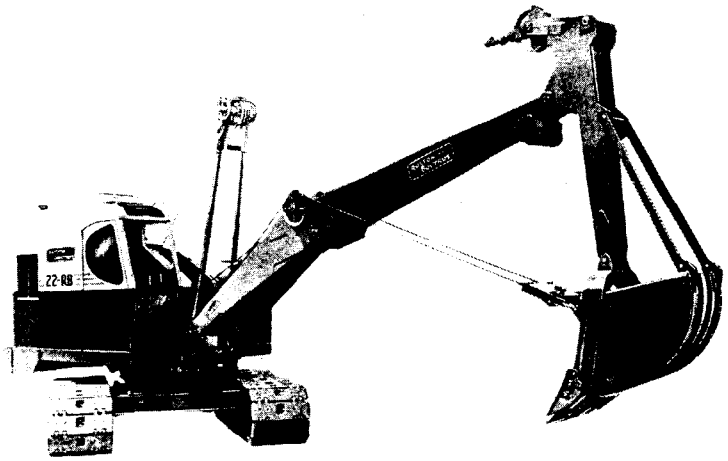
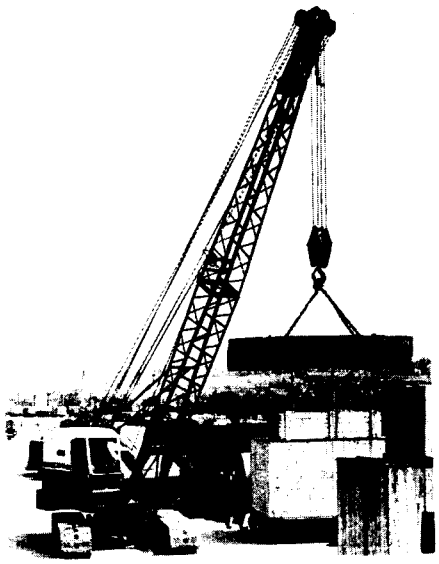
SECTION 1

CONTENTS

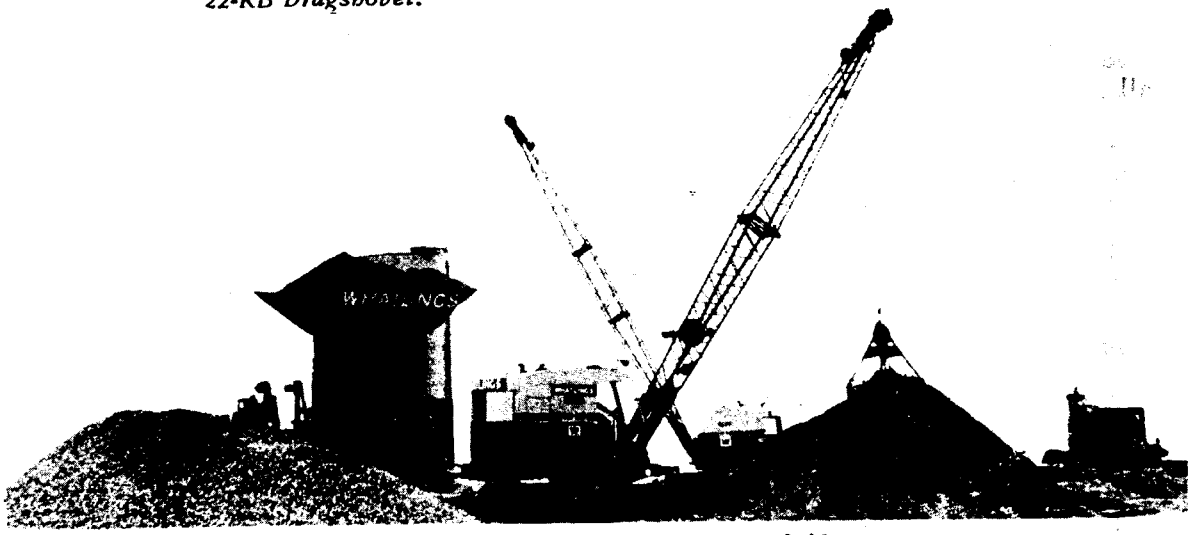
ILLUSTRATIONS



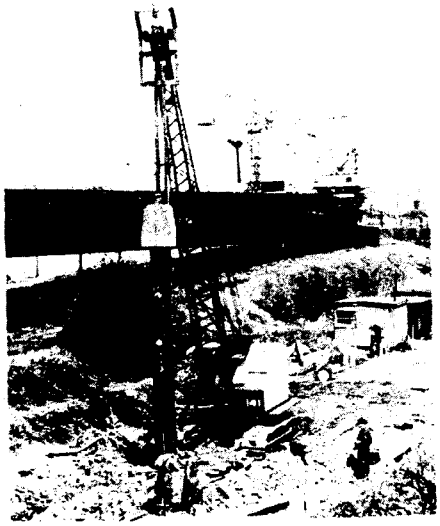
22-RB Dragshovel.



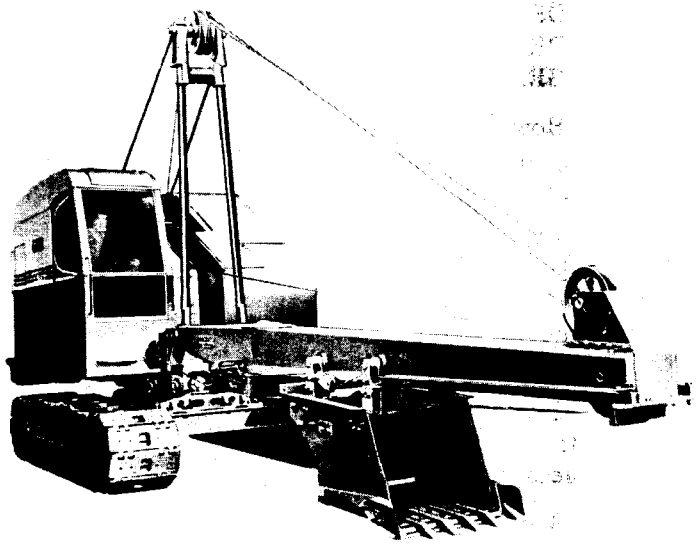
22-RB Heavy Duty Crane



22-RB Grabbing Crane working on sea defences.



22-RB Pile Driver working in a Glasgow dock area.



22-RB Skimmer.

INSTRUCTION MANUAL

This Instruction Manual is intended to help the owners and operators of Ruston-Bucyrus 22-RB Excavators to get the best results from their machines, with the lowest cost of operation.

Before operating the 22-RB, we suggest that even the experienced operator reviews the entire contents of this manual. Although this manual has had to be prepared in sufficient detail and simplicity to be of maximum help to the beginner, the more experienced will also find in it information, illustrations and drawings which are of considerable interest. His familiarity with the contents of this book will make it easier for him to instruct and supervise his associates and assistants in details of 22-RB operation and maintenance.

The useful productive life of the excavator will depend to a great extent on the care given to it by the operator, whilst maintenance men, plant managers and owners also have important parts to play in achieving continuous efficient operation of the machine. It is therefore strongly recommended that this manual be studied carefully by all concerned, and be kept where it is always available for quick reference.

In writing this book, we have tried to first cover the details of construction thoroughly, as an essential preface to fully understanding the points in connection with the care, operation and maintenance of the machine, which follow later on.

The arrangement of the material throughout has been, as far as is possible, kept in similar order for the convenience of locating supplementary information. In general, the machinery is dealt with upwards from the crawler tracks to the revolving frame, then the prime mover, transmission and main machinery, with the front-end equipments at the end of the section.

Initially the reader should understand that the Ruston-Bucyrus 22-RB Excavator is available in several forms. It may have as its prime mover, either diesel engine or a single electric motor, and may be supplied with one or more front-end equipments, including:-

POSITIVE ROPE-CROWD SHOVEL
DRAGLINE
DRAGSHOVEL
GRABBING CRANE
LIFTING CRANE
SKIMMER
PILE-DRIVER

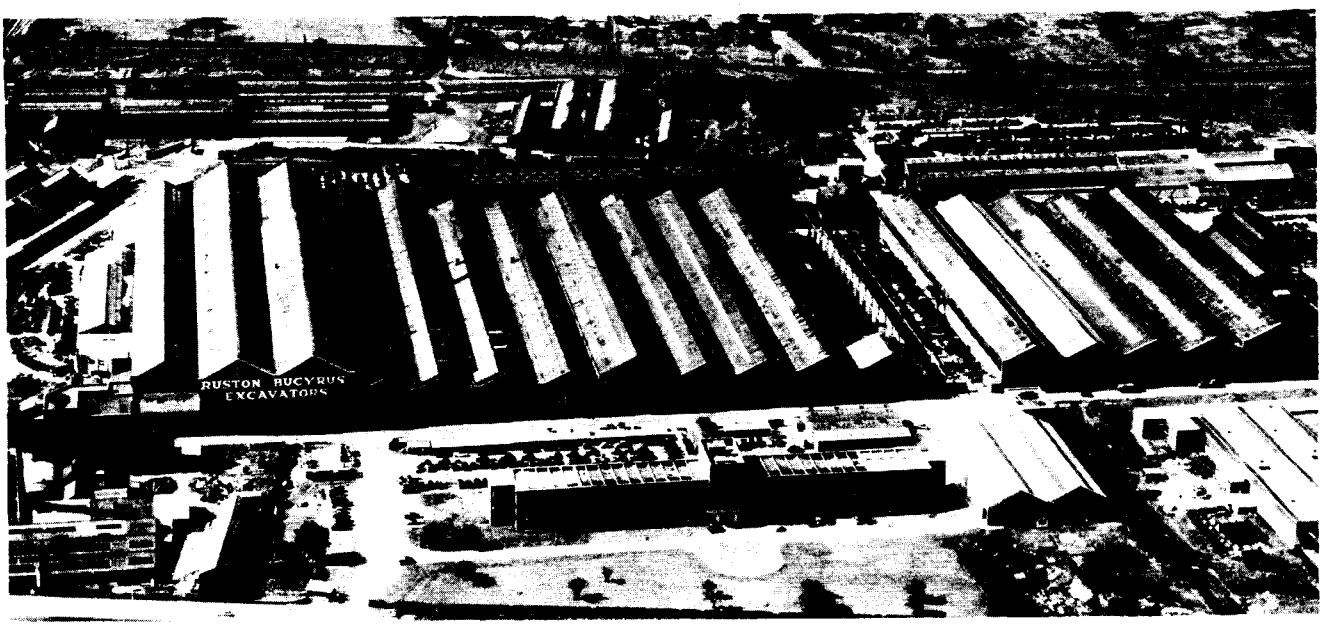
However, as so many component parts and assemblies are common throughout the range, it is expedient to cover all types of machine in one comprehensive Instruction Manual.

Although the 22-RB Excavator is more often supplied as a Crawler Track Mounted Machine, it should be noted that it is also available as a Transit Machine, mounted on a suitable lorry type chassis. For maximum load ratings, counterweight data and other service notes relating to any particular machine, refer to the charts fixed inside the operator's cab of the machine concerned.

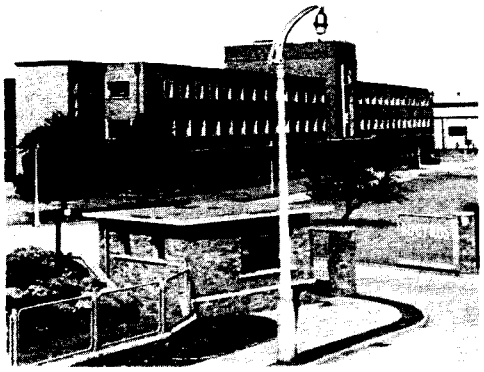
The terms 'Right Hand' and 'Left Hand' used in this book are determined from the position of the operator's seat, when looking towards the boom, and with the track driving tumblers towards the rear.

While every care is taken in the preparation of this book, the text and illustrations may not agree in absolute detail with the actual machine, due to design modifications being made from time to time.

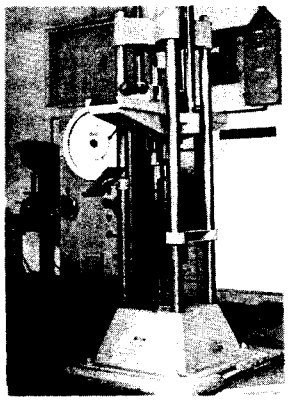
SOME VIEWS OF THE RUSTON-BUCYRUS FACTORY



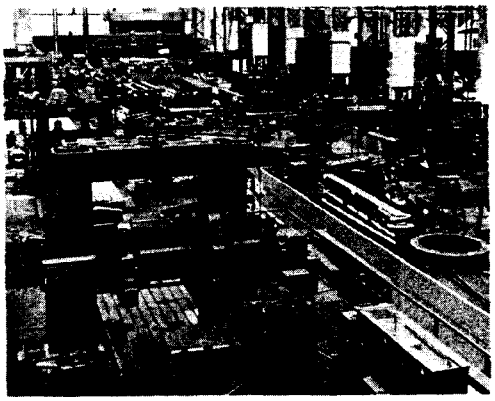
Aerial view of works; most buildings are visible, but test-ground, stock yards, etc., are off the picture.



Entrance to Administration Offices.



Tensile Testing Machine in Physical Laboratory.



Part of No. 2 Heavy Machine Shop.

Continuous assembly - lines for smaller excavators (Erection of upper works).

Continuous assembly - lines for smaller excavators (Final stages of Erection).

THE FACTORY AND ORGANIZATION BEHIND YOUR RUSTON-BUCYRUS EXCAVATOR

For the benefit of those users of Ruston-Bucyrus Excavators, who have not had an opportunity to visit our factory, we feel that some reference should be made to ourselves, so that you will have an idea of the efficiency and magnitude of the organization behind your machine.

Rustons built their first excavator in 1874, and as evidence of an early reputation, it is interesting to note that a total of 71 Ruston Steam Excavators were used in the construction of the Manchester Ship Canal, commenced in 1887. Since those far off days thousands of excavating machines of all types and sizes have been made at Lincoln.

The name 'Ruston-Bucyrus' dates from the beginning of 1930, when the excavating interests of Ruston & Hornsby Limited, Lincoln, were allied to those of the Bucyrus-Erie Company of South Milwaukee, Wisconsin, U.S.A., who constructed their first excavator in 1881.

The wealth of designing, manufacturing and field experience accumulated by Ruston-Bucyrus Limited, and the Bucyrus-Erie Company, during more than eighty years, is available to all excavator users in the machines we build to-day.

The Ruston-Bucyrus Excavator Works at Lincoln, is the largest in Europe, exclusively engaged in the manufacture of Excavating Machinery. The factory, with stock yards, test ground, etc., occupies a site of more than 50 acres, of which over 18 acres are under roof, providing a total floor space of rather more than three quarters of a million square feet.

The factory is modern throughout, and is equipped with machinery of the latest and most efficient design. To keep down machining costs and also to ensure interchangeability of parts, the components are machined with the aid of jigs and fixtures made in our own tool room using special machine tools of microscopic accuracy, that are the envy of many engineers who visit us.

In manufacturing a range of excavators of highest quality, it is necessary to pay special attention to the selection of suitable materials, and to provide strict inspection and careful supervision, coupled with most modern techniques throughout, as shown by the following examples.

All important alloy materials that enter the factory are subject to stringent physical and chemical tests in a well equipped laboratory under the supervision of a highly qualified metallurgic chemist, before being released for machining etc.

Advanced heat treatment and hardening techniques, under laboratory control, make important contributions to the long life of wearing parts.

Modern welding and fabricating methods employing the most up-to-date equipment are used in the manufacture of many components.

Shot blasting is extensively used in removal of rust and mill scale, perparatory to painting, whilst in the case of cab parts, chemical cleansing and pre-treatment lay the foundation for high quality finish.

Final test running of each machine, and necessary adjustments are made by our test-ground staff, personally supervised by our Test Superintendant.

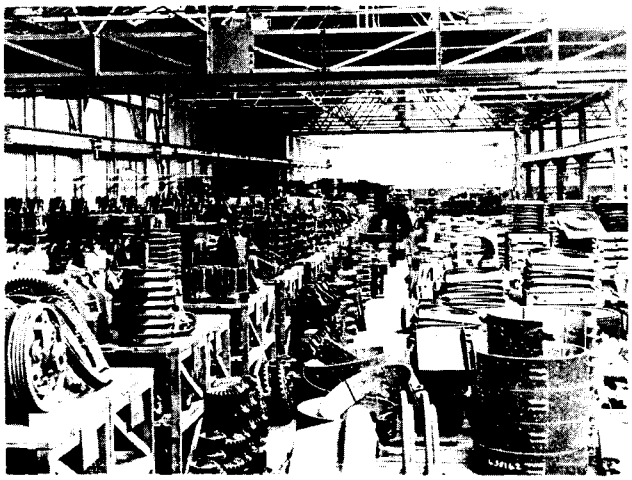
AFTER SALES SERVICE

FIELD SERVICE DEPARTMENT

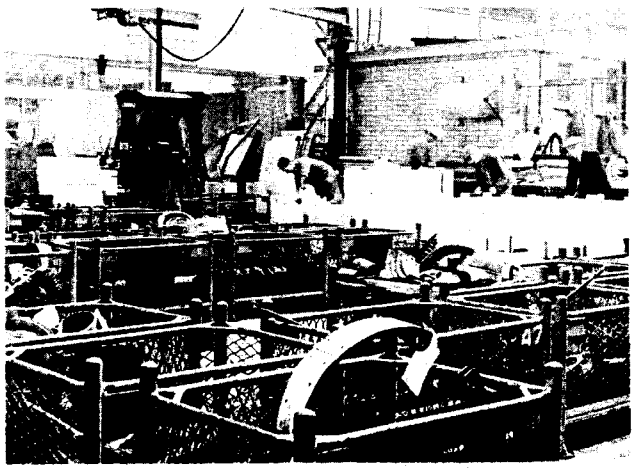
An efficient Field Service Department is in operation at home and abroad, which can when necessary provide the services of skilled field service fitters, erectors and demonstrators, in special cases where erection, emergency repairs etc., cannot be handled by the operator. A moderate charge is made for such services.

The Ruston-Bucyrus Field Service Department also provides and controls a number of Field Service Engineers who each usually work in a district allocated to them. The function of these Service Engineers is to make periodical visits to machines, with a view to ensuring that each machine is working efficiently, and to advise the customer and/or report back to the factory as and when necessary.

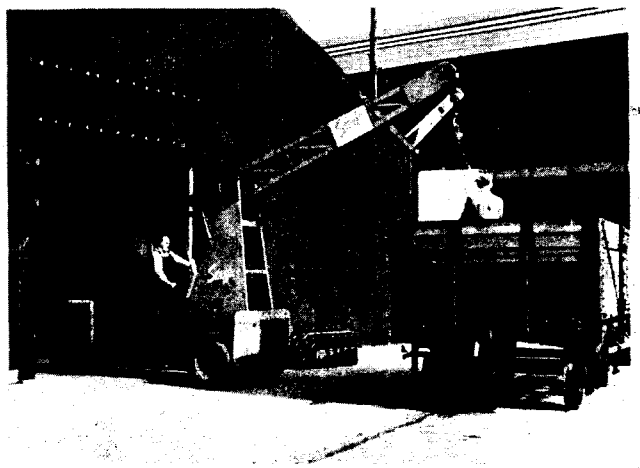
THE SERVICE FITTING SHOP— Here, spare parts receive their final touches at the hands of skilled fitters and spare units are assembled, preparatory to despatch or being placed in stock against customer's future orders.



A CORNER OF ONE OF THE STORES:-
A comprehensive stock of spare parts awaits customer's orders, ranging from the smallest details to complete assemblies, and amounting in total value to well over a million pounds sterling.



PACKING SPARE PARTS FOR SHIPMENT— The mode of packing depends largely on the destination and the means of transport of the shipment concerned. Special preservation and other tropical packing treatments are introduced when desirable.



A SPARES CONSIGNMENT BEING LOADED DIRECT INTO RAIL WAGON
Between one and two-hundred tons of spares leave the factory every week, by post, road, rail, sea and air transport, and destined for nearly every part of the world.

SECTION 2

CONTENTS

DESCRIPTION OF MACHINERY

The following description of the machinery is intended to help the new operator to get to know his machine and to help him in visualizing the flow of power from the power unit to each operating function of the machine.

For convenience the machine can be considered as being made up of three main units:-

A. LOWER WORKS OR MOUNTING
B. UPPER WORKS
C. FRONT END EQUIPMENT

A. LOWER WORKS OR MOUNTING

The Lower Works (See Fig. 1.) is the base or foundation on which the upper works rotates, and consists mainly of a pair of crawler track assemblies, track frame and truck frame, together with associated machinery.

Standard 22-RB Excavators are supplied mounted on crawler tracks having heat treated track links 26" wide, but Long and Wide Mounting is also available, and can be furnished on request. This provides a mounting 13'7" long, 11'0" wide, with 30" track links. For other dimensions see Page 3 , Section 3.

Each crawler track belt runs round a driving tumbler at the rear end and a take-up tumbler at the forward end and is also supported by six lower rollers and two upper rollers spaced out between tumblers.

The crawler track frame is a robust fabricated unit comprised mainly of two side members carrying the crawler tracks and two transverse members to which the truck frame is bolted.

The truck frame is a single steel casting of great strength and incorporates bearings for both horizontal and vertical propelling shafts. The double-flange path for the hook rollers with internal toothed swing gear ring is also an integral part of the truck frame casting, and carries all up and down digging reactions, so that no centre pintle is required. There is however a machined gudgeon to keep the revolving frame correctly centred. The lower part of the truck frame is also arranged to form a gearcase and housing for the propelling bevel gears and steering jaw clutches. (Refer to Figs. 2 & 3.)

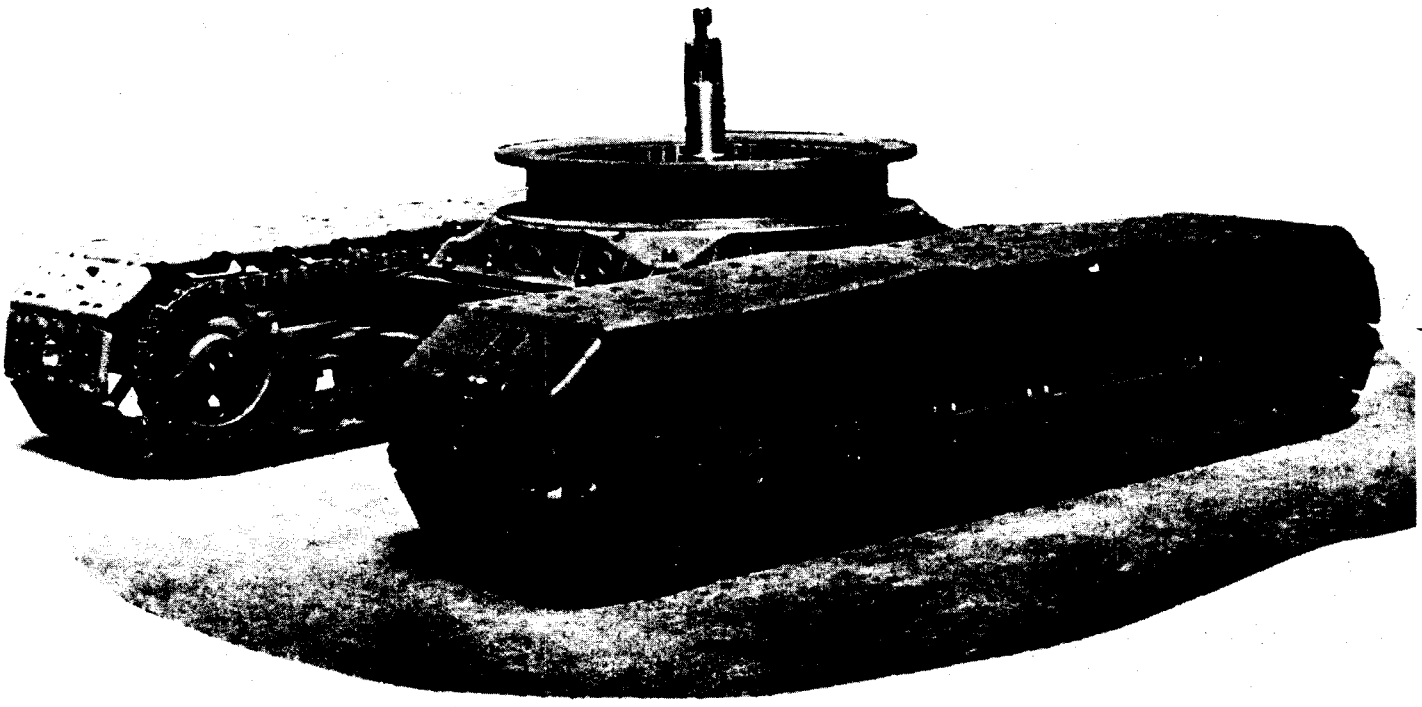


Fig 1. Lower Works - Standard Mounting.
(12'0" long, 9'4" wide, with 26" track shoes.)

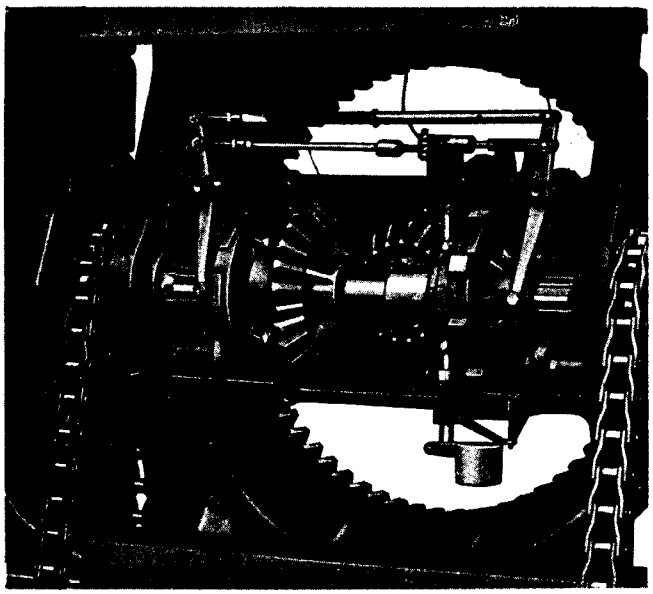


Fig. 2. 'Worm's Eye View' of Truck Frame Machinery, with Gear Case Cover and Clutch Guards removed.

STEERING CLUTCHES (Refer to Figs. 2 & 3)

Power is transmitted from the vertical propelling shaft to the driving chains, by a bevel gear reduction, to the centre section of the three piece horizontal propelling shaft, which is divided by a pair of robust dog-clutches, provided for steering purposes. Each of these dog-clutches may be in full drive, idling, or locked to the truck frame as desired, thus permitting either gradual or sharp turns to be made. The dog-clutch operating levers are interconnected to one handlever at the operator's position; a special safety device being incorporated into the lever system to prevent both dog-clutches becoming disengaged simultaneously.

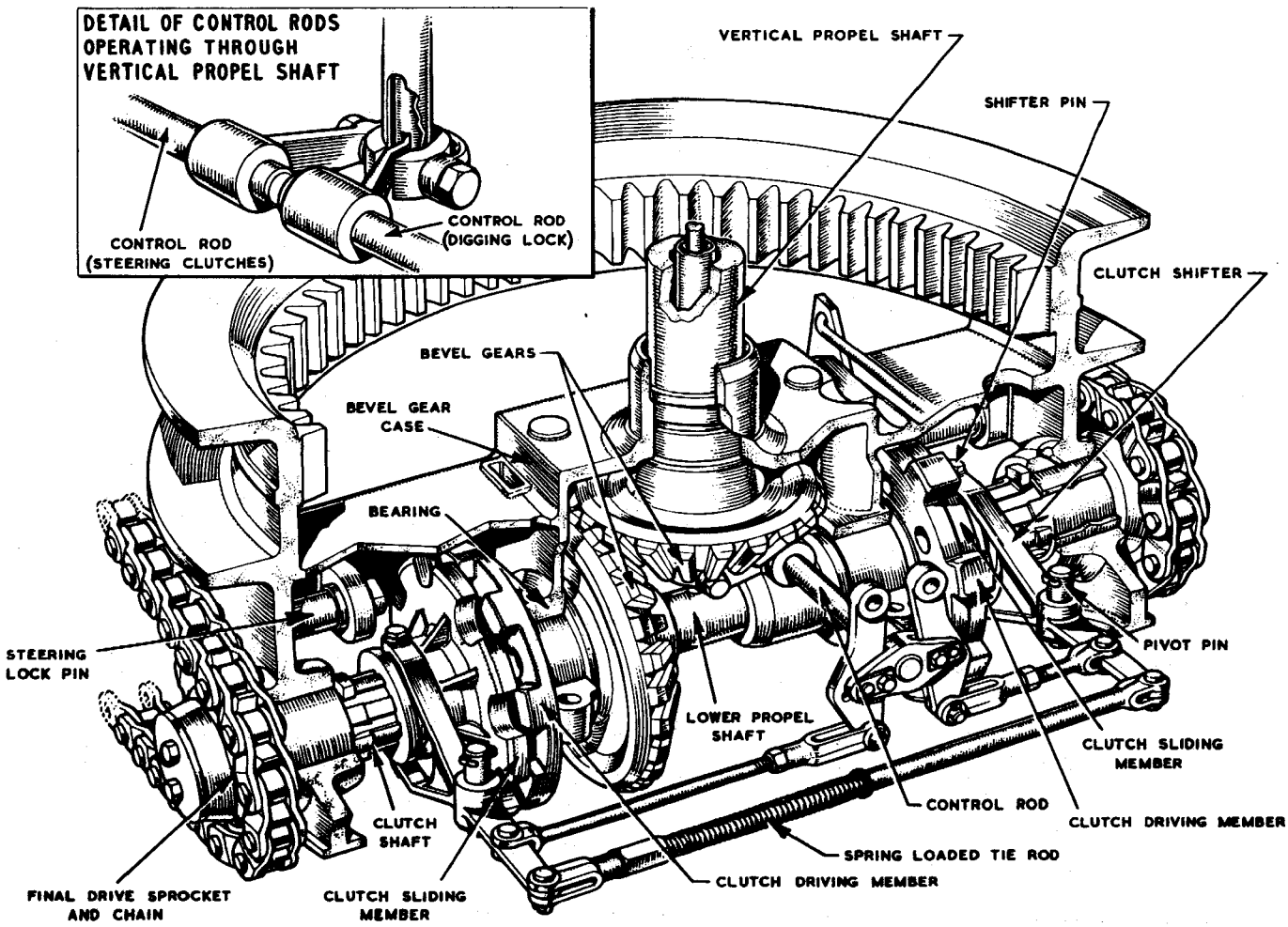


Fig. 3. Part Sectioned Truck Frame showing the Propel Drive.

DIGGING LOCK (Refer to Fig. 4)

Ratchet pawls which engage with solid lugs integrally cast with the left side clutch driving member on the horizontal propelling shaft, permit locking the tracks against movement when digging or travelling on an incline.

The pawls may be selectively engaged to permit:-

(A) Free movement forward and backward.

(B) Locking against movement to rear only.

(C) Locking against movement in either direction.

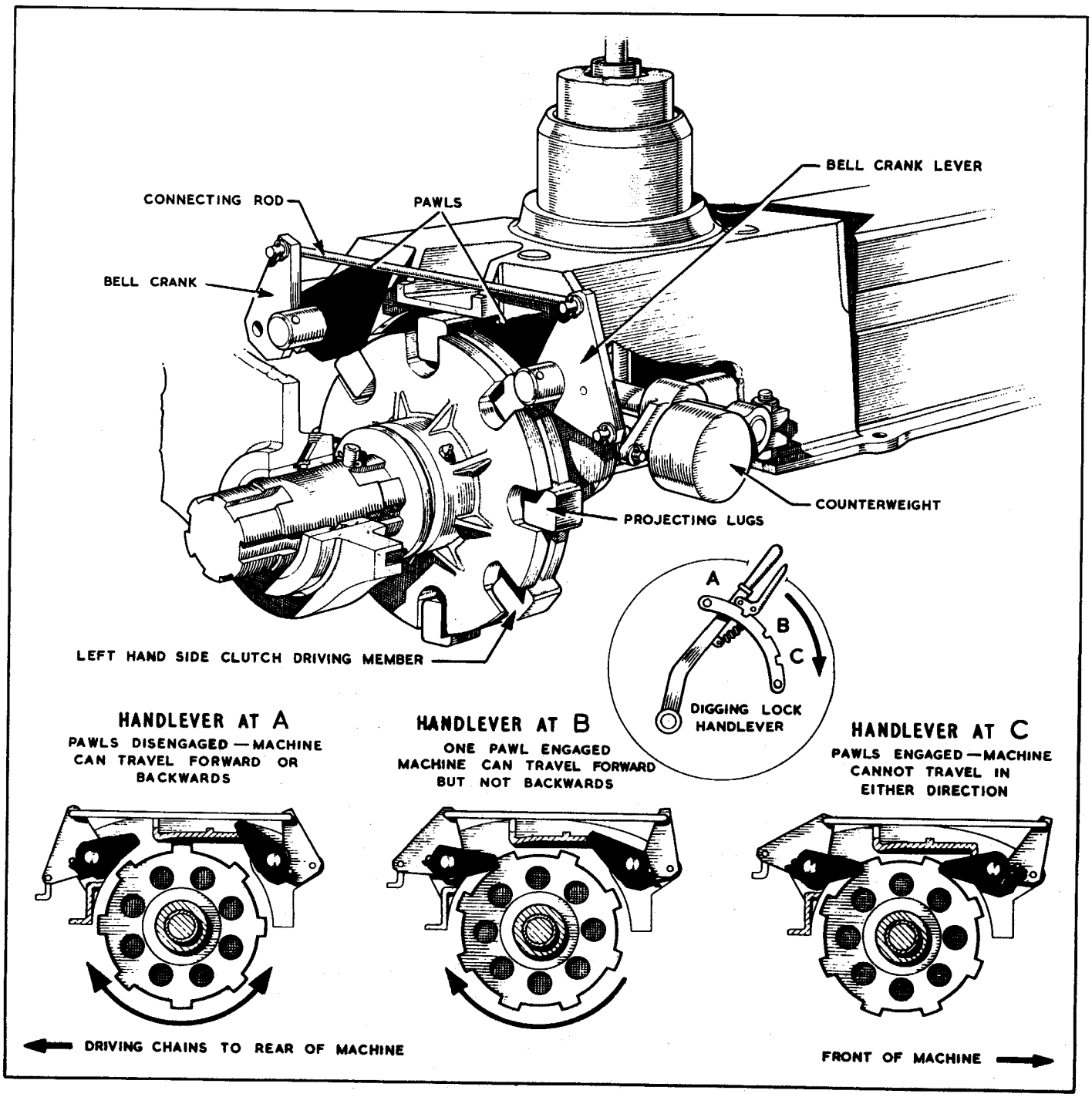


Fig. 4. The Digging Lock Mechanism.

B. UPPER WORKS

The upper works is the most important and most complex of the three main units. It is supported on the lower works by six adjustable conical hook rollers, running between the double flanged roller path of the truck frame. (See Fig. 5.)

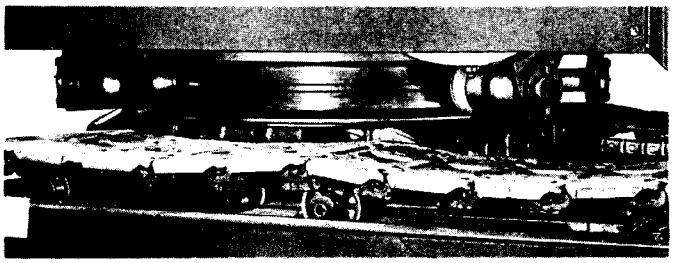


Fig. 5. Conical Hook Rollers running in Double-flanged Roller Path.

The major component part of the upper works is the revolving frame, (See Figs. 6 and 7) this is a steel casting of box section providing a foundation of great strength and rigidity for the machinery and power unit. Integrally cast with the revolving frame casting are the boom foot lugs, hook roller brackets, the main bearing and the bearing for the vertical swing shaft. The upper surface of the revolving frame is recessed to accommodate the swing and propelling gears, which are located at the upper end of the vertical shafts.

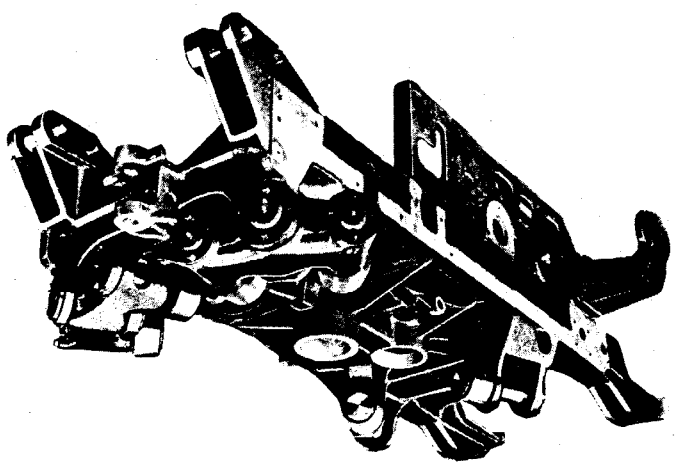


Fig. 6. Bottom view of Revolving Frame showing Centre Gudgeon Bushing, Hook Roller Mountings and integral extending arms which carry the Rear End Casting and Power Unit.

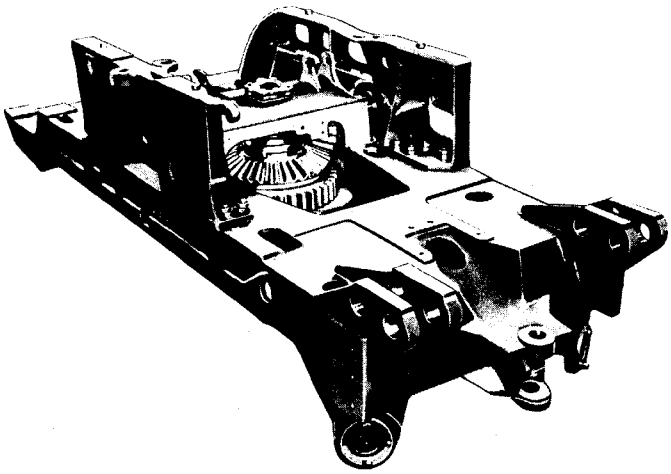


Fig. 7. Top view of Revolving Frame with Machinery Side Frames bolted in position and also showing the Swing Shaft Bevel Gearing.

Arms integral with the revolving frame extend back to support the rear end casting on which the power unit is mounted.

The main machinery side frames are securely bolted to the revolving frame and are held in permanent location by large diameter shear plugs, relieving the bolts of all shear stress.

As a power unit, the 22-RB may have a single electric motor, but more usually it is equipped with a heavy duty Diesel Engine.

DIESEL ENGINE

The standard Diesel engine usually fitted to 22-RB machines is a six cylinder Ruston 6YDAN Air Cooled Engine, developing 75 b.h.p. at 1300 r.p.m. and is provided with 24 Volt Electric Starting Equipment.

The engine, mounted on the rear end casting, is complete in unit form, with electric starter, dynamo, air cleaners, oil filters, engine clutch and similar auxiliary equipment all assembled on a fabricated base.

The engine instruction book, supplied by the Engine Manufacturer, is furnished with this instruction manual. Read it carefully for full instructions on the operation and maintenance of the engine and its auxiliaries.

PRIMARY TRANSMISSION (See Fig. 8.)

Power is transmitted from the power unit to a chain wheel fitted on one end of the transmission shaft by a multiple strand roller chain drive, housed in an oil-bath chain case. Two pinions are fitted at the other end of the transmission shaft; the larger one is known as the high speed pinion it is free on the shaft and can be moved laterally on it, the smaller one is known as the hoist pinion, and is splined to the shaft. The side of the high speed pinion is counter-bored and toothed internally so that it can engage with the teeth on the hoist pinion. The hoist pinion is in constant mesh with the hoist gear on the rear drum shaft and the high speed pinion is in constant mesh with the swing gear on the horizontal swing shaft. When it is desired to propel the machine in forward direction at high speed, the high speed pinion is moved along the transmission shaft so that the internal teeth in the side of it engage with the hoist pinion. Normally the drive for all motions is taken through the hoist pinion engaging with the hoist gear on the rear drum shaft. Two gears are mounted on the left side of each drum shaft, the larger ones are in constant mesh with each other and are known as the hoist gears and they are keyed to their respective shafts. The drive to all motions is common up to this point and is shown in red on Fig. 8 , the smaller pair of gears are known as the swing gears and are described in the following paragraph.

DRIVE TO PROPEL AND SWING MOTIONS

The smaller pair of gears on the drum shafts, known as the swing gears are keyed to sleeves of the swing gear clutch housings, the housings are in turn fitted on ball races on the shafts. The driving members of the clutches are keyed to the shafts and the only method of transmitting the drive from a hoist gear to a swing gear is by engaging one of the clutches. The smaller gears are in constant mesh with the swing gear mounted on the horizontal swing shaft, and a bevel pinion is fitted at the other end of the swing shaft which meshes with a bevel gear mounted on ball races at the top of the vertical swing shaft. The swing pinion that engages with the fixed gear ring in the truck frame is mounted at the bottom of the vertical swing shaft. The top end of the vertical swing shaft is splined and fitted with a jaw clutch member that can be engaged with a similar jaw clutch formed on the upper boss of the bevel gear. Located below the latter bevel gear and cast integral with it is a spur gear which meshes with another gear fitted on a loose bush at the top of the hollow vertical propel shaft. The top of this shaft is also splined and fitted with a jaw clutch member that can be engaged with a similar jaw clutch formed on the upper boss of the spur gear. The drive for swing and propel motions is common up to this point and if for example the main engine clutch and the front shaft swing gear clutch be engaged the whole train of gears so far mentioned will rotate as shown by the blue arrows, Fig. No. 8 Reverse direction of rotation as shown by the yellow arrows is obtained when the rear swing shaft gear clutch is engaged.

NOTE: The front shaft swing clutch is deleted from Fig. 8 for the purpose of clarity.

Both jaw clutches are controlled by one lever and the control is arranged so that one clutch only can be engaged at any particular time thereby ensuring that propel and swing motions cannot be carried out simultaneously. The swing gear friction clutches (used also for propelling) are also controlled by a single lever system arranged so that only one of these clutches can be engaged at any one time.

THE SWING LOCK

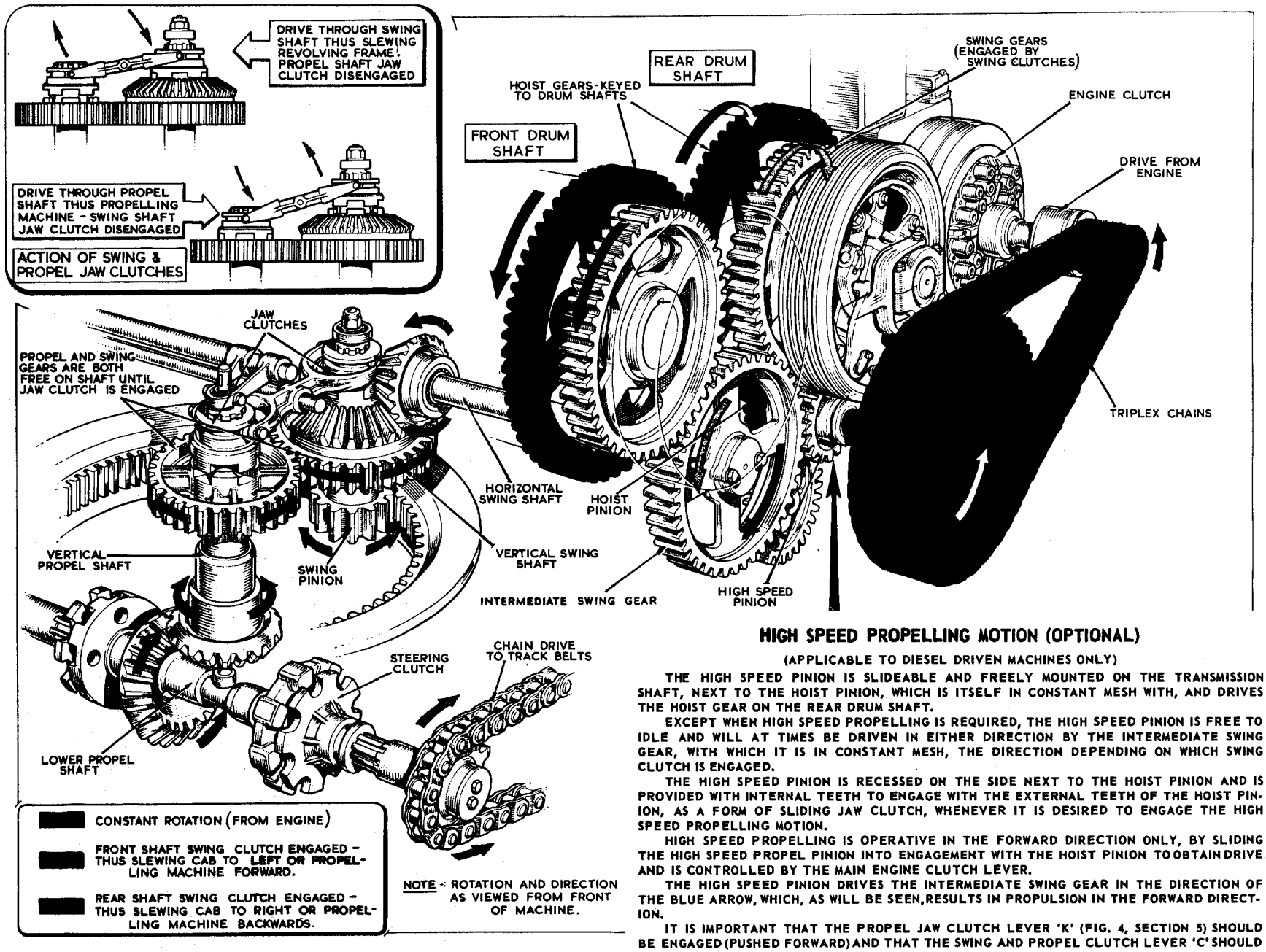
The Swing Lock is a device for preventing the revolving frame from swinging round out of control when the machine is on uneven ground and particularly whilst the machine is being propelled. It is actuated by hand-lever 'M', near the operator's left hand, and consists of a system of levers, a toggle assembly and a locking dog which engages with the internal gear teeth of the swing rack. For illustration of this device refer to Fig. 13 on page 12 of Section 7 and for position of the hand-lever concerned see Fig. 4 on Page 6 of Section 5.

THE REAR DRUM SHAFT (See Fig. 9.)

Apart from the Hoist Gear, Swing Gear and Swing Clutch assembly referred to previously under 'Primary Transmission' and shown on Fig. 8, the following items are also mounted on the Rear Drum Shaft.

Between the bearings of the rear shaft there is a drum which carries the hoist rope. This drum is known as the hoist drum and is controlled by a clutch and brake unit mounted on the left hand side of it.

On the right hand side of the drum there is a chain sprocket, also controlled by a clutch. This sprocket is known as the rear shaft crowd sprocket, and is used only when the machine is being operated



HIGH SPEED PROPELLING MOTION (OPTIONAL)

(APPLICABLE TO DIESEL DRIVEN MACHINES ONLY)

THE HIGH SPEED PINION IS SLIDEABLE AND FREELY MOUNTED ON THE TRANSMISSION SHAFT, NEXT TO THE HOIST PINION, WHICH IS ITSELF IN CONSTANT MESH WITH, AND DRIVES THE HOIST GEAR ON THE REAR DRUM SHAFT.

EXCEPT WHEN HIGH SPEED PROPELLING IS REQUIRED, THE HIGH SPEED PINION IS FREE TO IDLE AND WILL AT TIMES BE DRIVEN IN EITHER DIRECTION BY THE INTERMEDIATE SWING GEAR, WITH WHICH IT IS IN CONSTANT MESH, THE DIRECTION DEPENDING ON WHICH SWING CLUTCH IS ENGAGED.

THE HIGH SPEED PINION IS RECESSED ON THE SIDE NEXT TO THE HOIST PINION AND IS PROVIDED WITH INTERNAL TEETH TO ENGAGE WITH THE EXTERNAL TEETH OF THE HOIST PINION, AS A FORM OF SLIDING JAW CLUTCH, WHENEVER IT IS DESIRED TO ENGAGE THE HIGH SPEED PROPELLING MOTION.

HIGH SPEED PROPELLING IS OPERATIVE IN THE FORWARD DIRECTION ONLY, BY SLIDING THE HIGH SPEED PROPEL PINION INTO ENGAGEMENT WITH THE HOIST PINION TO OBTAIN DRIVE AND IS CONTROLLED BY THE MAIN ENGINE CLUTCH LEVER.

THE HIGH SPEED PINION DRIVES THE INTERMEDIATE SWING GEAR IN THE DIRECTION OF THE BLUE ARROW, WHICH, AS WILL BE SEEN, RESULTS IN PROPULSION IN THE FORWARD DIRECTION.

IT IS IMPORTANT THAT THE PROPEL JAW CLUTCH LEVER 'K' (FIG. 4, SECTION 5) SHOULD BE ENGAGED (PUSHED FORWARD) AND THAT THE SWING AND PROPEL CLUTCH LEVER 'C' SHOULD BE IN THE NEUTRAL MID-WAY POSITION WHILST THE HIGH SPEED PINION IS ENGAGED.

Fig. 8. The Main Power Drives (Diagrammatic)

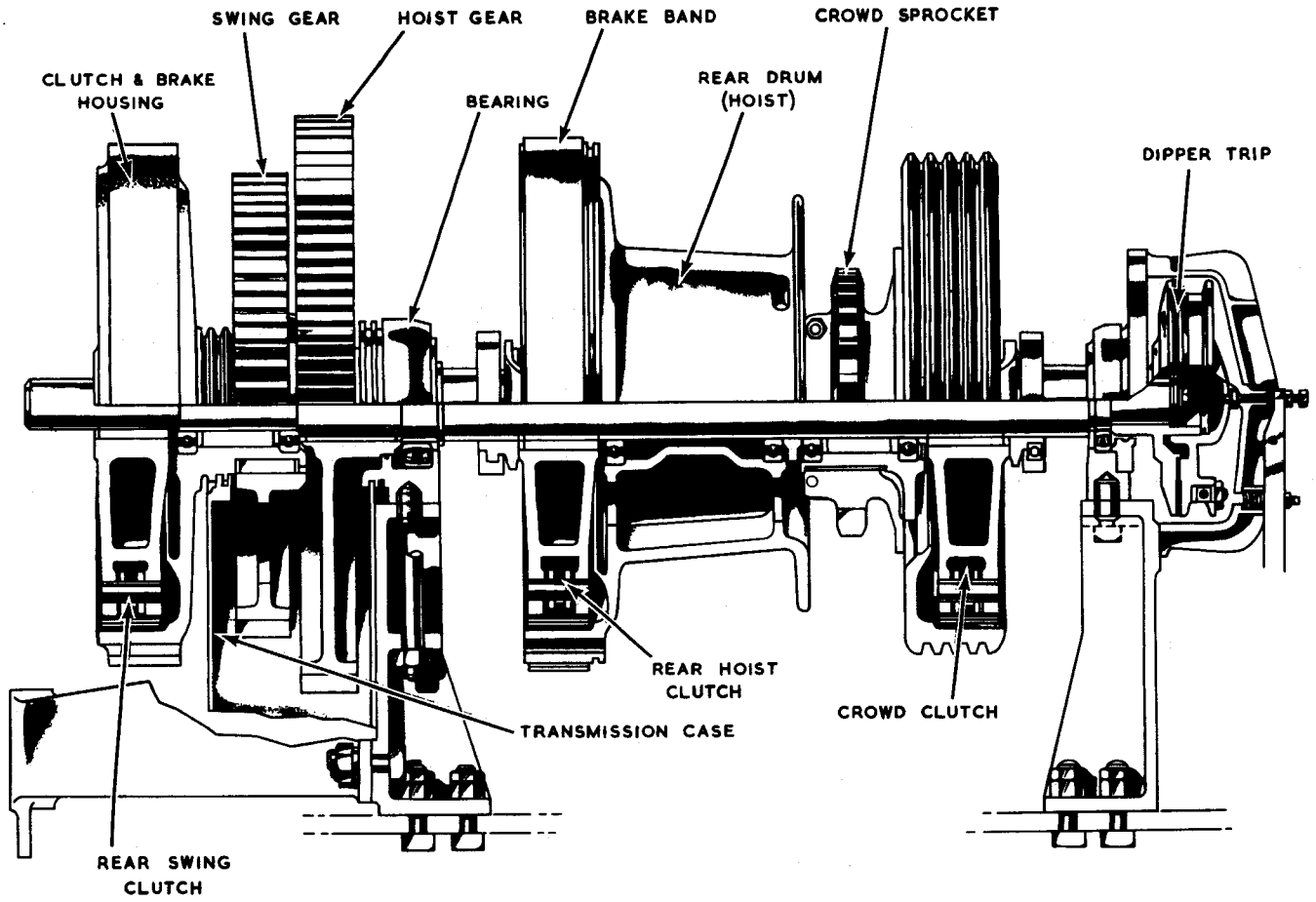


Fig. 9. The Rear Drum Shaft.

with Shovel, Skimmer or Straight Boom Dragshovel equipments. A rather similar though different sprocket is however used in this position for the controlled load lowering device used with Heavy Duty Cranes.

Overhanging at the right hand end of the rear drum shaft there is a friction clutch and a small drum. This assembly is known as a dipper trip; its function is to release the spring loaded latch on the shovel equipment dipper door.

The Hoist Drum is a plain tapered one 17" in diameter, and always takes the Hoist Rope on Shovel, Dragline, Dragshovel and Skimmer Equipments. For Clamshell Equipments it is used for the Holding Rope and on Pile Drivers the Pile Lifting Rope. For occassional use in Crane work, the Hoist Drum may be used for the Main Hoist, but it is more usual to use the Front Drum for this purpose, the Rear Hoist Drum always being used for the Auxiliary Hoist Rope when an offset jib is fitted.

The chain sprocket to the right of the hoist drum is split into two halves, and is clamped and bolted to its associated clutch housing which itself is mounted on two ball races on the shaft. The arrangement is similar to the hoist drum and its clutch, except that a brake band is not fitted. The sprocket is connected by a single roller chain to a similar sprocket in the front shaft drum when the machine is equipped for Shovel, Skimmer, or Straight Boom Dragshovel operation. The front drum sprocket is also controlled by a clutch and both clutches are controlled by a single lever so that one of them only can be engaged at any particular time. As the front and rear shafts rotate in opposite directions the chain connecting the two sprockets can be driven in either direction by engaging one or other of the clutches. The purpose of this arrangement is for instance (in the case of Shovel Equipments) to ensure that the crowd drum at the boom foot can be driven in either direction, in order to provide crowd or retract motion to the dipper handle. As no brake is fitted to the rear shaft crowd sprocket clutch, the brake on the front shaft clutch (Applied by Pedal 'G'), is used to stop the drum irrespective of its direction of rotation.

The dipper trip is only used when the machine is a Shovel, Skimmer or a Dragshovel with front-opening type dipper. It comprises a friction clutch and a small drum to which one end of the trip rope is reeved, the other end being attached to the latch on the dipper door. The clutch is set to 'drag' slightly to keep the trip rope in tension, allowing the rope to be paid out or wound on the drum depending on the movement of the dipper arm and the shovel without tripping the latch. When it is desired to trip the latch to open the dipper door the clutch faces are brought closer to each other by pushing lever 'N' forward. The increased drag on the clutch then puts more tension on the rope and trips the latch. The driving member of the dipper trip clutch is keyed on the drum shaft, and the assembly is held in position by means of a retaining washer secured by a screw on the end of the shaft. The driven clutch member which also comprises the rope drum is freely mounted on an extended hub of the driving member. The clutch is operated by means of an adjustable shifter pin one end of which is fitted with a wearable plug that locates against the centre of the driven clutch member. A lever is secured to the head of the pin by means of a lock nut. The lever is spring loaded so that the wearable plug exerts a slight pressure on the driven clutch member. The spring loading is also adjustable. The lever is moved by a toggle assembly which is connected by reach rods to the control lever 'N'.

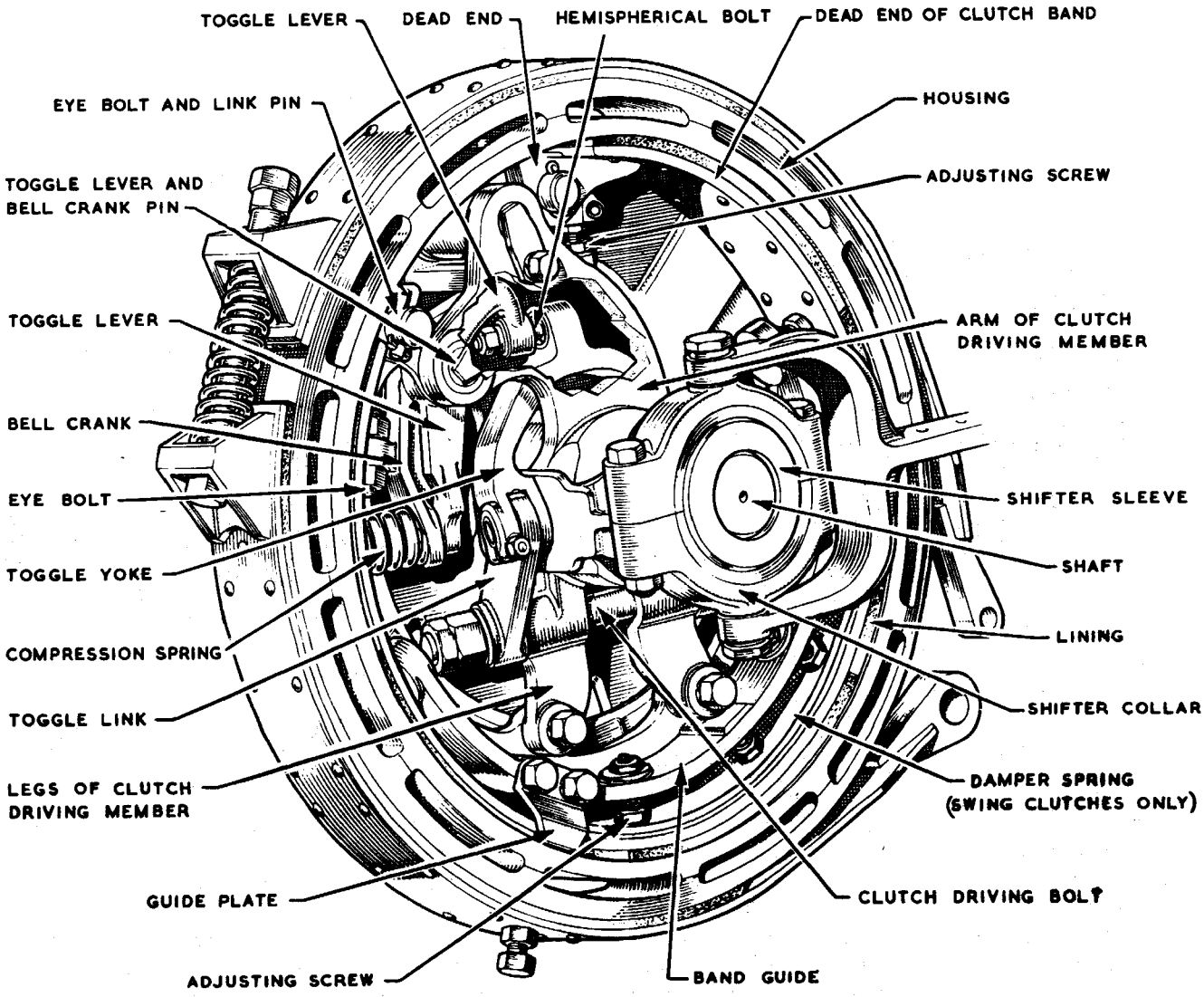


Fig. 10. Driving Clutch Details.

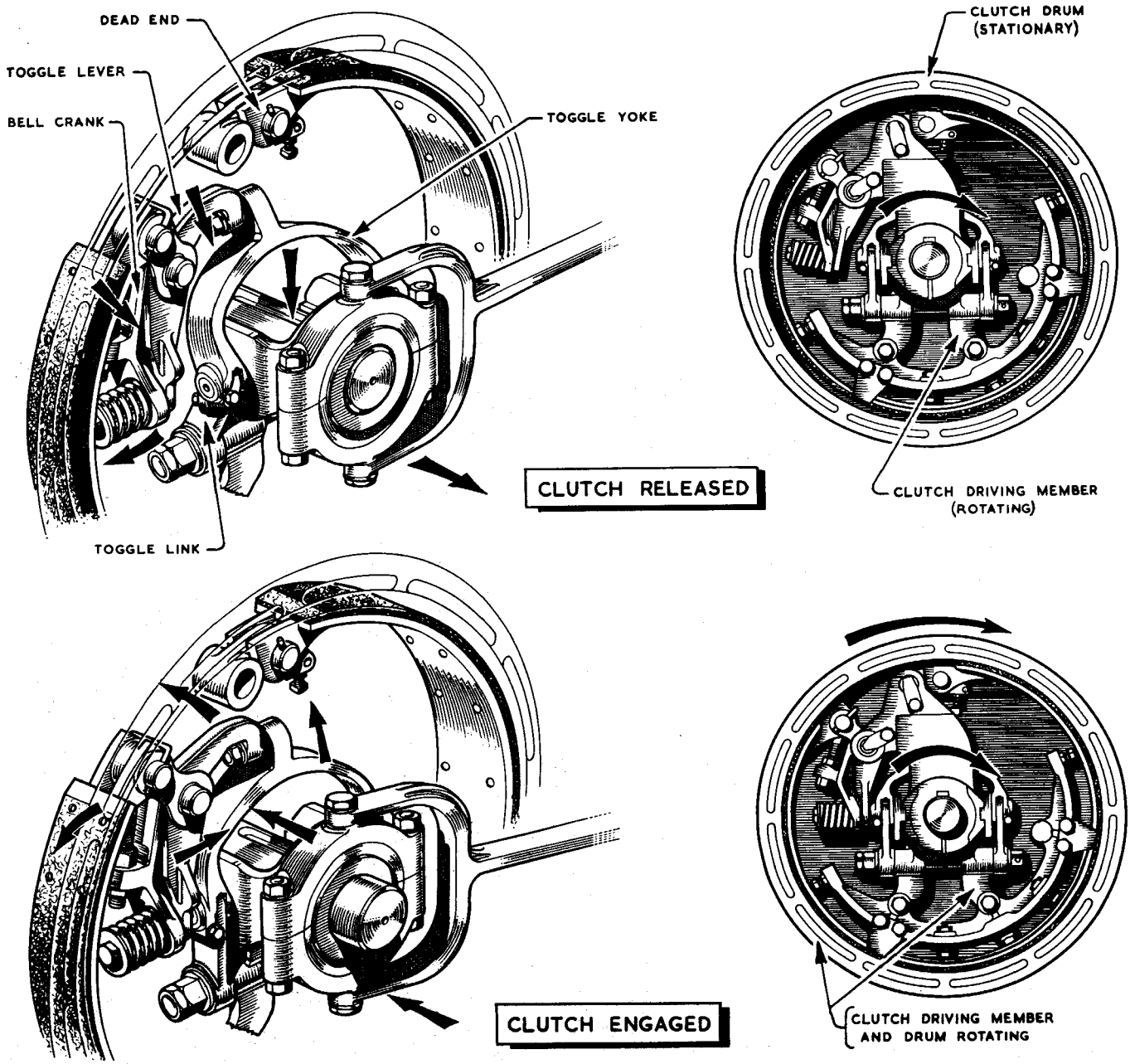


Fig. 11. Operation of Clutch.

THE DRIVING CLUTCHES (Refer to Figs 10 & 11.)

There are three clutches on each of the drum shafts, the general principle and operation of which are similar except in the case of the boom hoist clutch, which incorporates a booster clutch and will be described in more detail later on.

Referring to the construction of the other clutches, it will be found that the driving member of the clutch has a wide boss that is keyed to the shaft; two arms extend from it in one direction and two legs extend from it in the opposite direction. The clutch driving bolt and a toggle link assembly is fitted to the legs. The other ends of the links are connected to the arms of the toggle yoke by means of two toggle pins. A tongue is machined on the end of each toggle pin and these project inward to engage into two slots in the clutch shifter sleeve which is keyed on to the drum shaft. A non-rotating shifter collar is fitted over the sleeve and both parts can be moved laterally on the shaft by operating the control lever.

There is a boss on the top of the toggle yoke which is machined to accept a hemispherical headed

bolt that is secured to the end of the toggle lever. At the other end of the lever is a boss with a tapped hole in it for a spring loaded bolt. The toggle lever and bell crank are fitted between the arms of the clutch driving member and are pivoted on the bell crank fulcrum pin secured to the arms. A compression spring secured under the head of the bolt bears on the other end of the bell crank and is known as the 'Toggle Lever Spring'. The bell crank is connected to the live end of the clutch band by means of an adjusting eye-bolt and a pin. The clutch is adjusted by shortening or lengthening the effective length of the bolt. The toggle lever and bell crank pivot pin is connected by means of two links to the clutch band eyebolt pin. The dead end of the clutch band is also connected to the clutch driving member by means of a link and two pins. Movement of the dead end of the band can be adjusted by means of the dead end link stop adjusting screw.

A clutch band guide is secured to the legs of the driving member. There are four adjusting screws mounted on the periphery of the guide, the heads of which bear against the band when the clutch is disengaged. The screws can be adjusted to take up slight bulging of the band and to ensure that the clearance all round between the clutch lining and housing is uniform. On the Swing Clutches, a flat damper spring held in position by a stud and retaining nut is interposed between the clutch band and clutch band guide.

To prevent the clutch band from moving out of the housing, two guide plates are secured to the rim of the band guide.

In operation all the parts mentioned above rotate with the drum shaft except the clutch shifter collar. When the clutch control lever is moved from the 'neutral' to the 'engaged' position the shifter collar and the sleeve move inward towards the clutch driving member. As the toggle pins are engaged into the slots in the shifter sleeve they also move inwards and in doing so the toggle assembly is straightened, resulting in an upward movement of the boss containing the hemispherical headed bolt. The toggle lever is moved anti-clockwise about its pivot pin and the bell crank

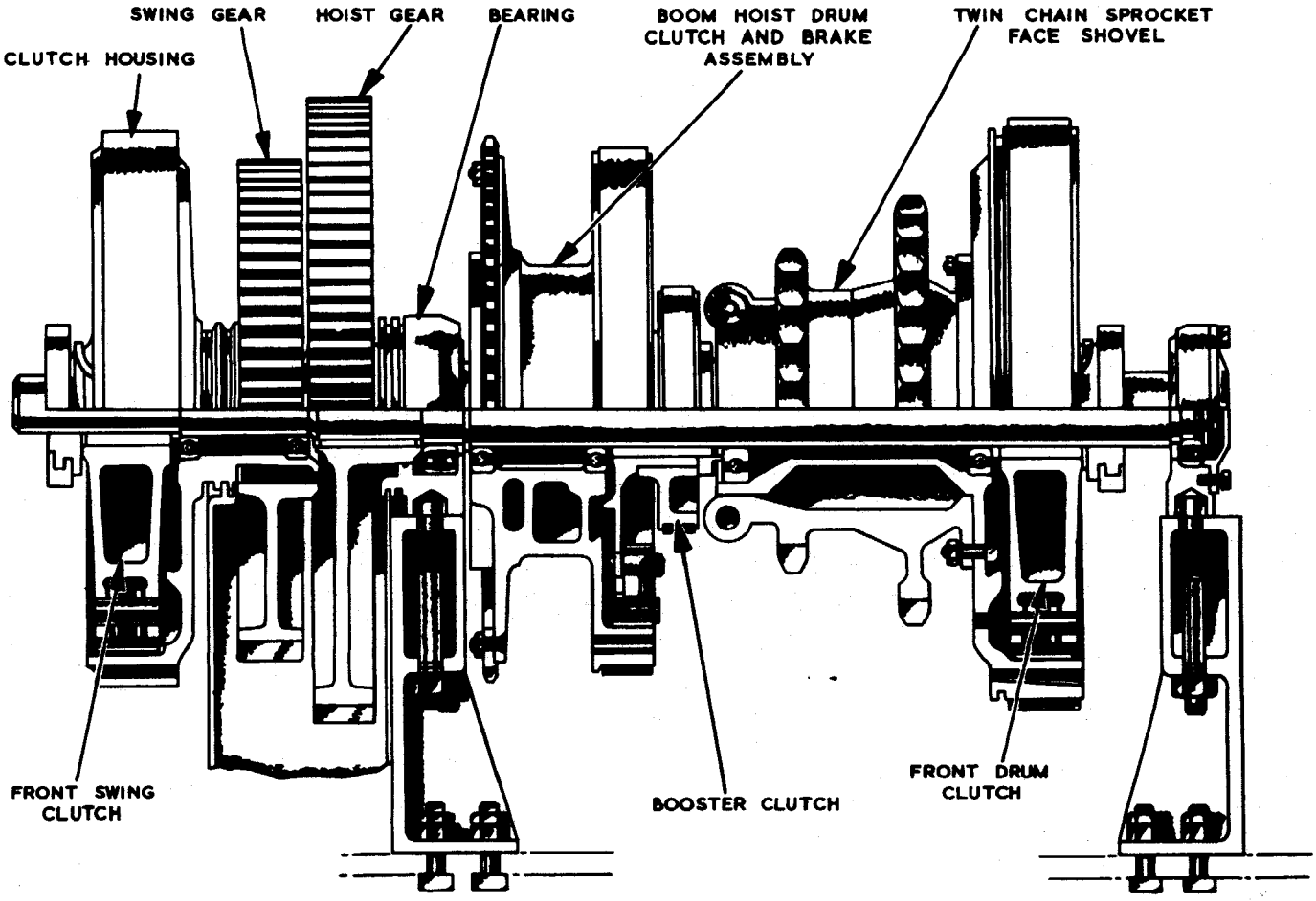


Fig. 12. The Front Drum Shaft

moves in the same direction because of the action of the compression spring. The live end of the clutch band being pivoted on the same pin as the bell crank and connected to the latter by the eye bolt is also moved anti-clockwise, thus expanding the clutch to contact and drive the clutch housing.

When the clutch control lever is returned to neutral position, the shifter collar is drawn away from the clutch driving member and the toggle assembly assumes the released position.

The compression spring is set at the factory and requires no adjustment between major overhauls. When the clutch is in the engaged position there should be 1/8" clearance between the toggle lever and the bell crank, this ensures that the correct force is applied to the clutch band in the working condition.

THE FRONT DRUM SHAFT (Refer to Fig. 12.)

The items mounted on the front drum shaft are the swing clutch; the swing and hoist gears; the boom hoist drum, clutch and brake assembly; the booster clutch; the front drum or lagging, and the clutch and brake assembly associated with it.

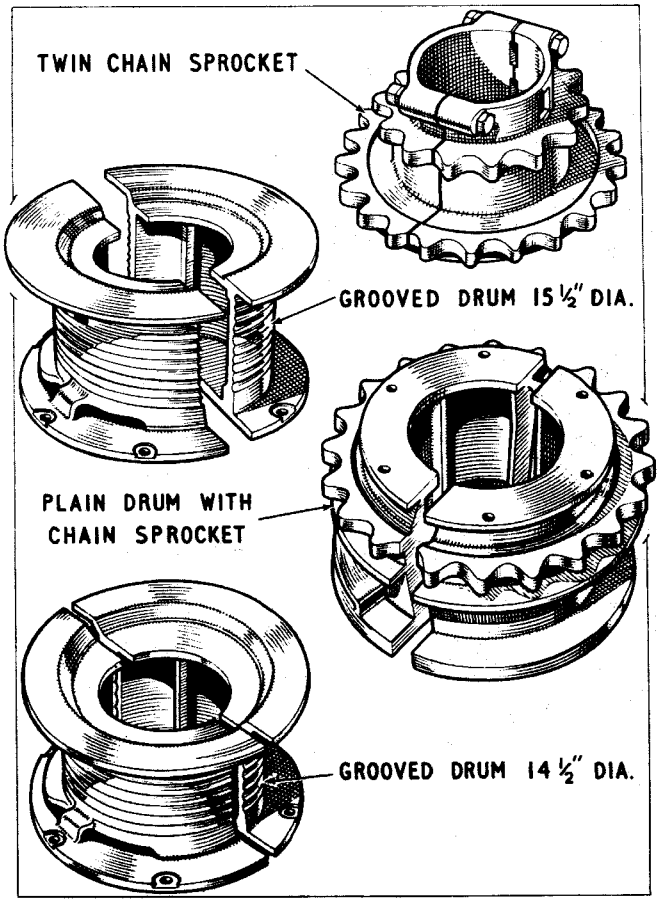


Fig. 13. Laggings (Front Drum).

One of the differences between the front and rear shafts is that provision is made for fixing alternative fittings, or laggings to the front shaft.

THE FRONT SHAFT LAGGINGS (Refer to Fig. 13.)

There are four types of front shaft laggings available as shown in the following table. Each lagging is made in two halves to facilitate assembly on the shaft. Provision of the laggings makes it possible to connect both shafts together, to attach a rope or a chain to the front drum and to regulate the rope speed of the drum.

LAGGINGS (FRONT DRUM)	
EQUIPMENT	TYPE OF LAGGING FITTED ON FRONT SHAFT
Face Shovel	Twin Chain Sprocket
Straight Boom) Dragshovel or) Skimmer)	16" pitch diameter plain tapered drum with chain sprocket.
Dragline or) Cambered Boom) Dragshovel)	15½" pitch diameter grooved drum.
Lifting Crane	14½" pitch diameter grooved drum.
Grabbing Crane	15½" or 14½" pitch dia. grooved drum.
Pile Driver	15½" pitch diameter grooved drum.

FRONT SHAFT CLUTCH, BRAKE AND LAGGING ASSEMBLY.

The clutch housing is integral with a long sleeve mounted on ball races on the shaft and is machined to locate the lagging. Each half of the lagging is bolted to the side of the clutch housing and in addition the two halves of the twin sprocket lagging are secured by two clamping bolts at the opposite end.

The arrangement of the clutch and brake is similar to the hoist clutch and brake fitted on the rear shaft and many of the parts are interchangeable.

When the machine is equipped as a Dragline, Cambered Boom Dragshovel, Crane, or Pile Driver, a grooved drum lagging is fitted to the front shaft.

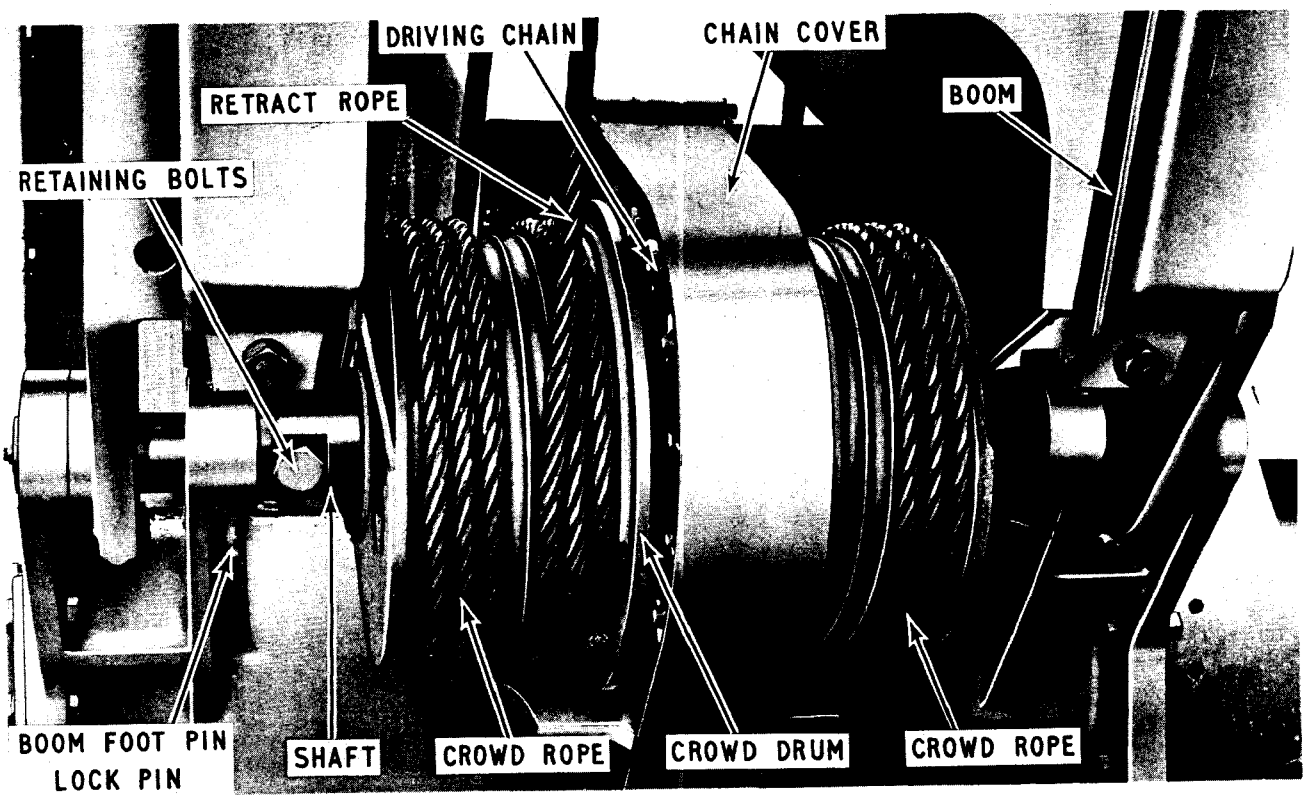


Fig. 14. The Crowd Drum (Faceshovel).

The drum is power driven clockwise by engaging the front shaft clutch, the rear shaft crowd clutch is not used and the front and rear shafts are not connected together by means of the chain.

The combined drum and chain sprocket lagging is fitted when the machine is equipped as a Straight Boom Dragshovel or a Skimmer. In both cases the front and rear shafts are connected together by means of the chain, the lagging is power driven anti-clockwise by the crowd sprocket on the rear shaft and the front drum clutch is not used. It will be seen from the reeving diagrams in Section 8, that in both cases the drag or digging rope is attached to the lagging and that anti-clockwise rotation of it is the direction for digging. When the machine is equipped as a Face Shovel, a twin chain sprocket lagging is fitted to the front shaft. The purpose of the twin sprocket is to provide a means for driving the crowd drum at the boom foot. (See Fig. 14). The front and rear shafts are connected and both the front drum clutch and crowd clutch are used so that the crowd drum can be power driven in either direction. Both clutches are controlled by one lever. The Face Shovel and Lifting Crane (with Power Controlled Load Lowering) are the only equipments requiring the front lagging to be power driven in both directions.

THE INDEPENDENT BOOM-HOIST AND CONTROLLED LOWERING UNIT.

In crane or clamshell work it is often desirable to change the boom angle as a regular part of the operating cycle, and these machines are equipped with an Independent Boom-Hoist Unit which permits either raising or lowering the boom under the control of a single hand lever, entirely independent of the other functions of the machine (hoisting, swinging etc.).

The Independent Boom-Hoist Unit (See Fig. 15) is mounted on anti-friction bearings on the forward drum shaft, and consists mainly of a drum, inside which is an internal-expanding clutch band set by a booster clutch. The boom-hoist brake band on the outside of the clutch housing is set by a powerful brake spring. Control of the clutch and brake is combined in a single lever (Lever 'J', Fig. 4, Section 5) just to the left of the operator. When the Boom Hoist Clutch Lever is in the middle notch of its quadrant the booster clutch is released and the brake holds the drum from turning.

The Boom-Hoist Drum is also held from turning (in the lowering direction) by a drum ratchet pawl engaging with the hoist drum ratchet wheel fitted to the left hand side of the boom hoist drum (See

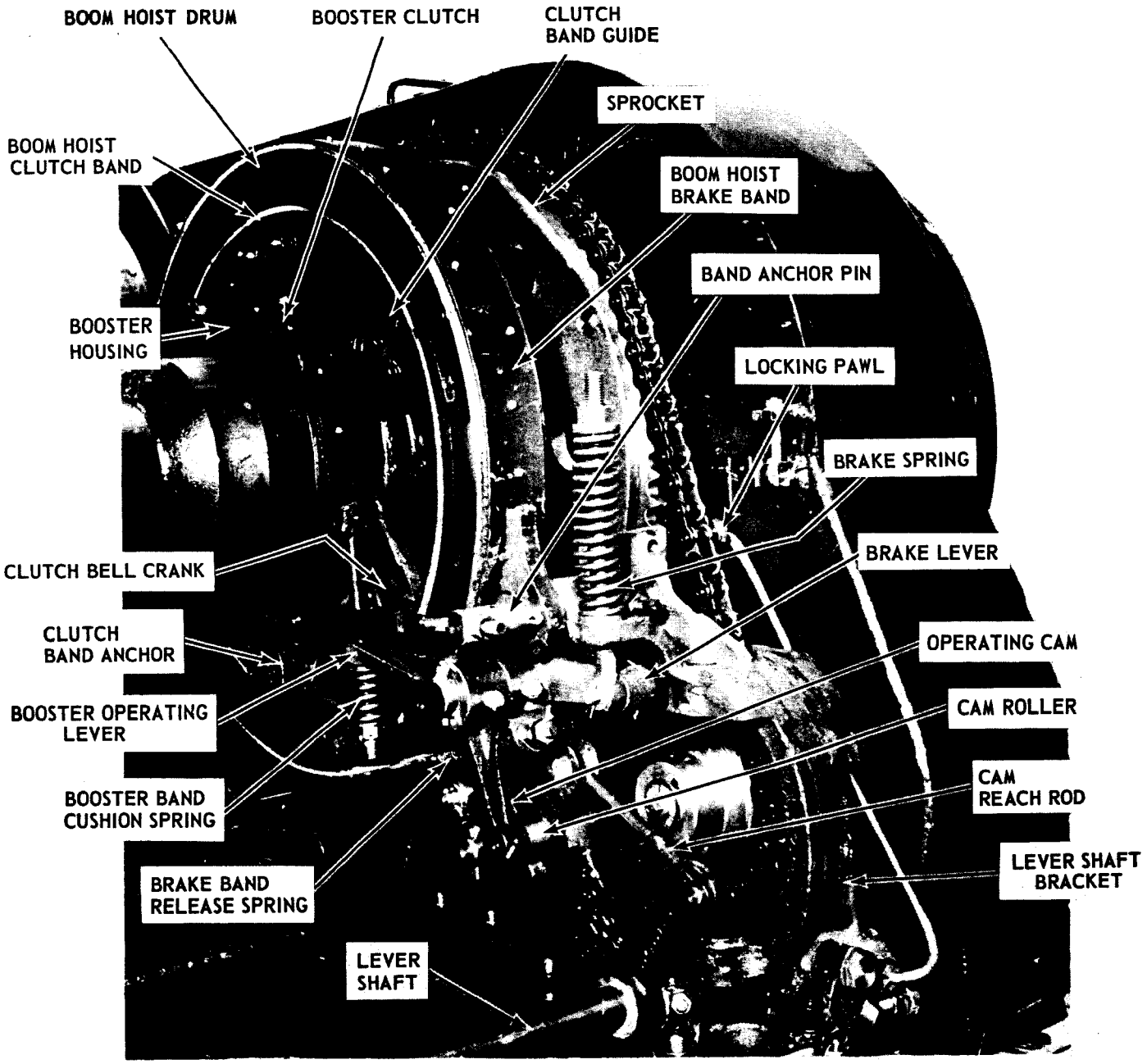


Fig. 15. The Boom Hoist and Booster Clutch Assembly

Fig. 16.). This ratchet pawl (or locking pawl) is controlled by the Boom-Hoist Safety Pawl Lever (Lever 'P', Fig. 4. Section 5), just in front of the Boom Hoist Clutch and Brake Lever.

In raising the boom by pulling back the Boom-Hoist Clutch and Brake Lever 'J', it is not necessary to release the locking pawl. The action of the operating cam (See Fig. 15.) sets the booster band which in turn engages the clutch inside the boom-hoist drum and rotates the drum in direction for raising the boom. When the boom has reached the desired position, the boom-hoist clutch and brake lever is returned to neutral. The spring-set brake will then stop the drum turning and hold it. It is a good plan to release the brake momentarily and allow the drum to turn until the locking pawl engages with one of the ratchet teeth.

Before lowering the boom it is necessary to raise it slightly and release the locking pawl by pulling up on the boom-hoist lock lever 'P', then release the brake by moving the Boom-Hoist Clutch and Brake Lever 'J' forward. Returning

Lever 'J' to the neutral position permits the spring to set the brake and stop the boom lowering. If the boom has a tendency to continue lowering after the lever has been returned to neutral, the lever is then pulled back past neutral. This sets the clutch for raising the boom and will quickly bring the boom to a stop. As soon as the boom has stopped lowering the locking pawl should be engaged by pulling up the boom-hoist lock lever. The locking pawl will then hold the drum from turning until proper brake adjustment can be made.

To limit the speed at which the boom lowers, a safety pawl device is mounted on a countershaft inside the gear case on the left hand side of the machine. (See Fig. 16.) The pawl housing runs on anti-friction bearings on the countershaft and is driven by a pinion meshing with the forward drum shaft gear. The pawls are pivoted on a pawl arm which is keyed to the countershaft. The pawl housing turns at all times when the main engine clutch is engaged, whereas the countershaft is driven by a roller chain from the boom-hoist drum sprocket and turns only when the boom-hoist drum is turning. In the boom hoisting direction the pawl housing and pawl arm are turning in opposite directions and the safety pawls are held out of engagement with the ratchet teeth in the pawl housing by two small friction shoes. When lowering, the pawl arm rotates in the same direction as the pawl housing and if the pawl arm tends to rotate faster than the pawl housing, then one of the friction shoes moves the most suitably placed safety pawl into engagement with the ratchet teeth and the speed of rotation is limited to that of the pawl housing. By regulating the speed of the engine (and consequently the speed of the pawl housing) the operator may lower the boom at any desired speed.

After the boom is lowered to the desired position the drum ratchet pawl should be engaged **by pushing** lever **'P' downwards,** at the same time gently releasing the brake to allow the drum to turn until the pawl is up against one tooth of the boom-hoist drum ratchet wheel.

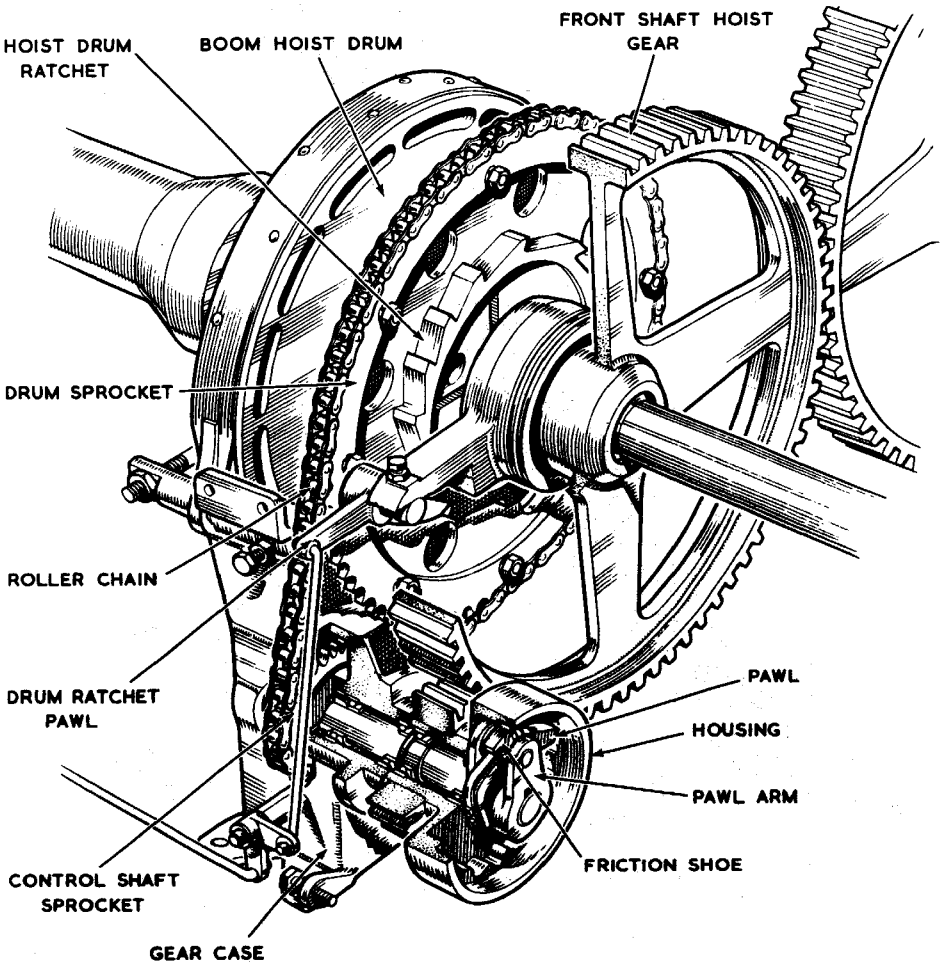


Fig. 16. The Boom Controlled Lowering Unit

FRONT END EQUIPMENTS

Reference to the photographs on Pages 2 and 4 in Section 1 of this book and the General Arrangement Drawings in Section 4 will help the reader to obtain a basic idea of the types of Front End Equipments available for this machine. This initial study can later be broadened into more useful working knowledge by perusal of the other sections of this book, such as 'Operating', 'Reeving', 'Conversions etc. The following notes and illustrations are also intended to provide some assistance in getting to know the various front end equipments.

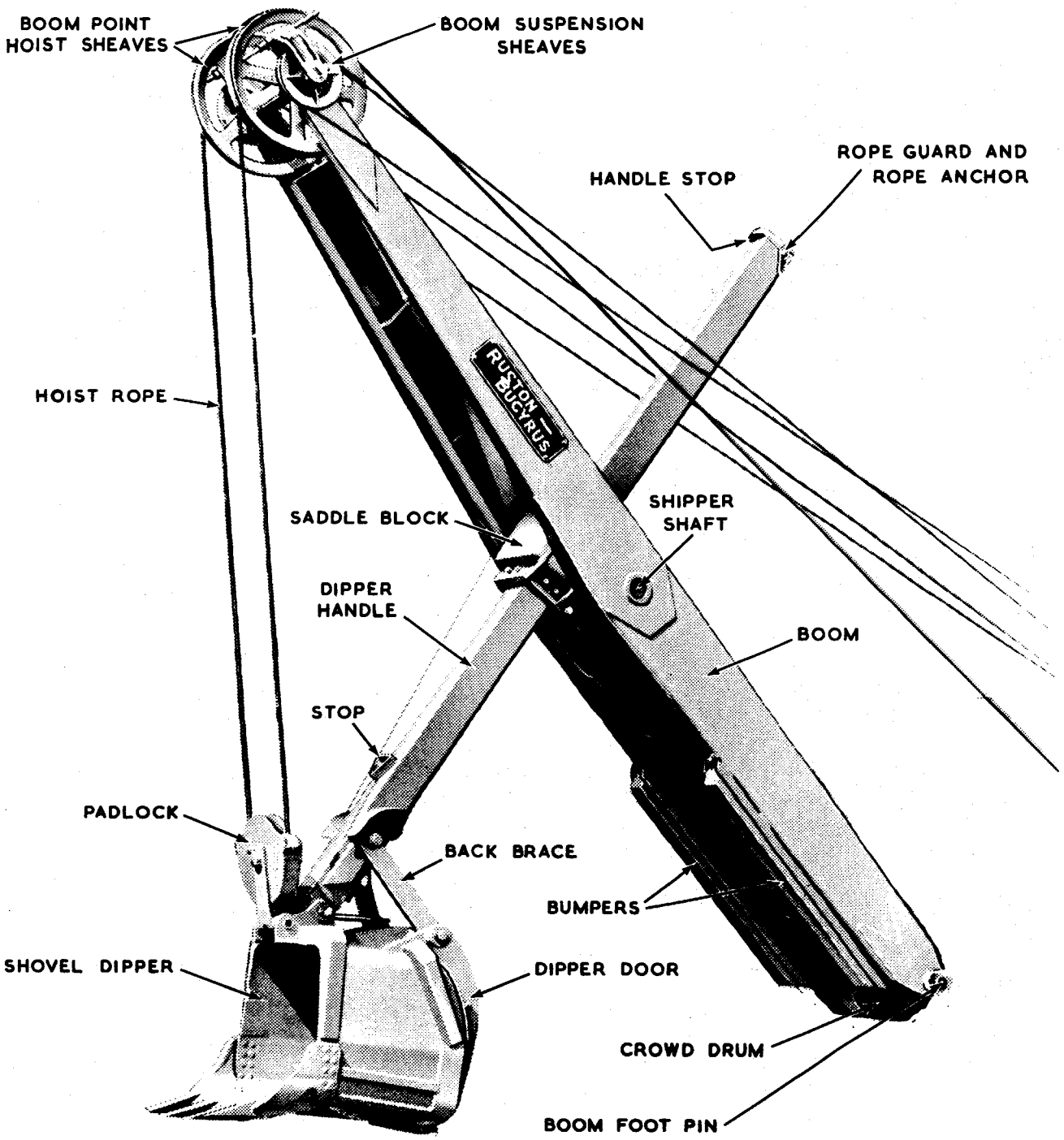


Fig. 17. The Shovel Equipment

SHOVEL

The Shovel Equipment shown on Fig. 17, is of advanced engineering design, combining great strength and light weight for greatest output.

The Shovel is one of the most widely used front end equipments; unlike most other front ends, it has no major parts that are common to them.

When giving this equipment its full title, it is referred to as a Positive Twin Crowd Shovel, because the shovel can be forced outwards (Crowd out) into the face to be excavated by tensioning a rope known as the crowd rope. The middle of this rope is anchored to the top of the dipper handle and the two ends are anchored to the crowd drum. The Shovel Dipper is attached to the lower end of the Dipper Handle. Crowding Out as it is known, is accomplished by rotating the crowd drum at the boom foot (See Fig. 14) under engine power and spooling rope on the drum, therefore shortening its ffective length and forcing the dipper handle outwards. The dipper handle is retracted by a retract rope connected between the crowd drum and the lower end of the dipper handle. The crowd drum is chain driven by the twin crowd sprocket lagging fitted to the Front Drum Shaft (See Fig. 12), and the other sprocket of the lagging is connected by chain to the crowd clutch on the Rear Drum Shaft (See Fig. 9).

THE BOOM

The Boom is a robust fabricated component of large box section at the lower end, having twin side members extending to form an arch at the boom foot. The upper part of the boom, extending from the box section consists of two side members of tapering reinforced channel section, terminating in a forked end, designed to carry the boom point hoist and suspension sheaves.

Twin live boom point hoist sheaves 24" in diameter ensure long hoist-rope life. The sheave for the anchored rope follows the flexing of the rope during digging and does not force the rope to slide and wear as over a fixed surface.

The crowd drum shaft is bolted to the inner side members at the lower end of the boom, and the outer members are secured between lugs integral with the revolving frame by means of the boom foot pins. Handholes are cut in the arch and in the

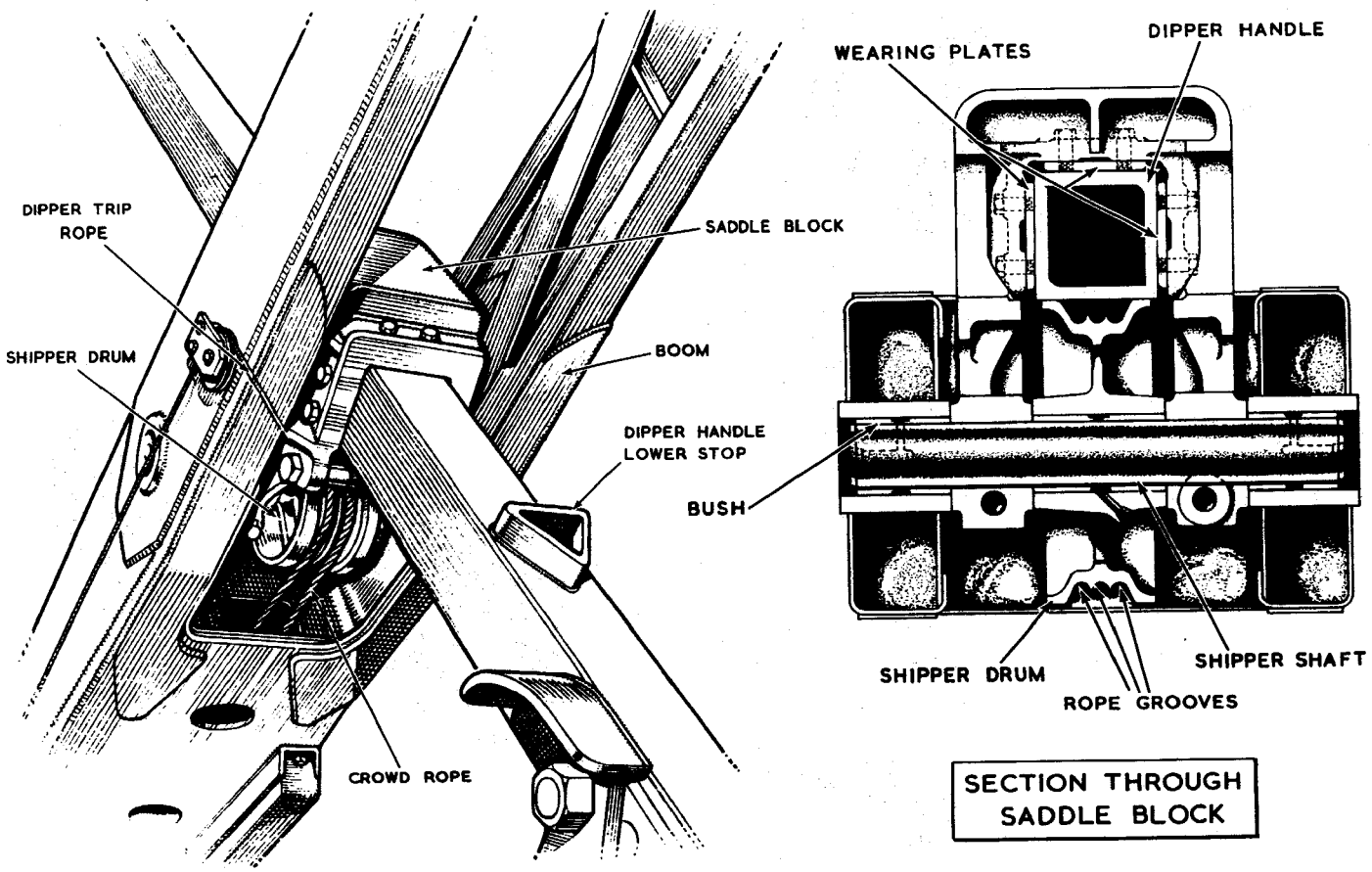


Fig. 18. The Saddle Block and Shipper Shaft Drum

underside of the boom to facilitate reeving the crowd and retract ropes.

Two metal face hard wood bumpers are bolted to the underside of the boom to prevent the shovel dipper from damaging the boom.

Near to half-way up the boom is located the shipper shaft on which the saddle block and shipper shaft drum are mounted. (See Fig. 18).

THE DIPPER HANDLE

The dipper handle which carries the shovel dipper at its lower end, has box section strength augumented by internal reinforcing diaphragms, and is fitted through the saddle block at the centre of the boom. The handle bears on two roller-like surfaces formed on the periphery of the shipper shaft drum, and derives its in and out movement from the crowd and retract ropes. Stops are fitted at the top and the bottom of the handle to limit its movement.

SADDLE BLOCK AND SHIPPER SHAFT DRUM

This assembly shown on Fig. 18, is mounted between the side members of the boom and is carried on the shipper shaft.

The Saddle Block is a 'U' shaped casting secured to the shaft by means of clamping bolts and two dowels. Bronze wearing plates (Adjusted by shimming) are fitted to the sides and front of the aperture in the block through which the dipper handle slides.

The Shipper Shaft Drum is mounted on the shaft between the arms of the saddle block. There are three rope grooves machined in the middle of it and a parallel roller surface at each end. The centre rope groove is for the retract rope and the outer ones are for the twin crowd rope. The dipper handle bears on the roller surfaces of the drum which rotates when the handle is moved out and in under control of the crowd an retract ropes respectively.

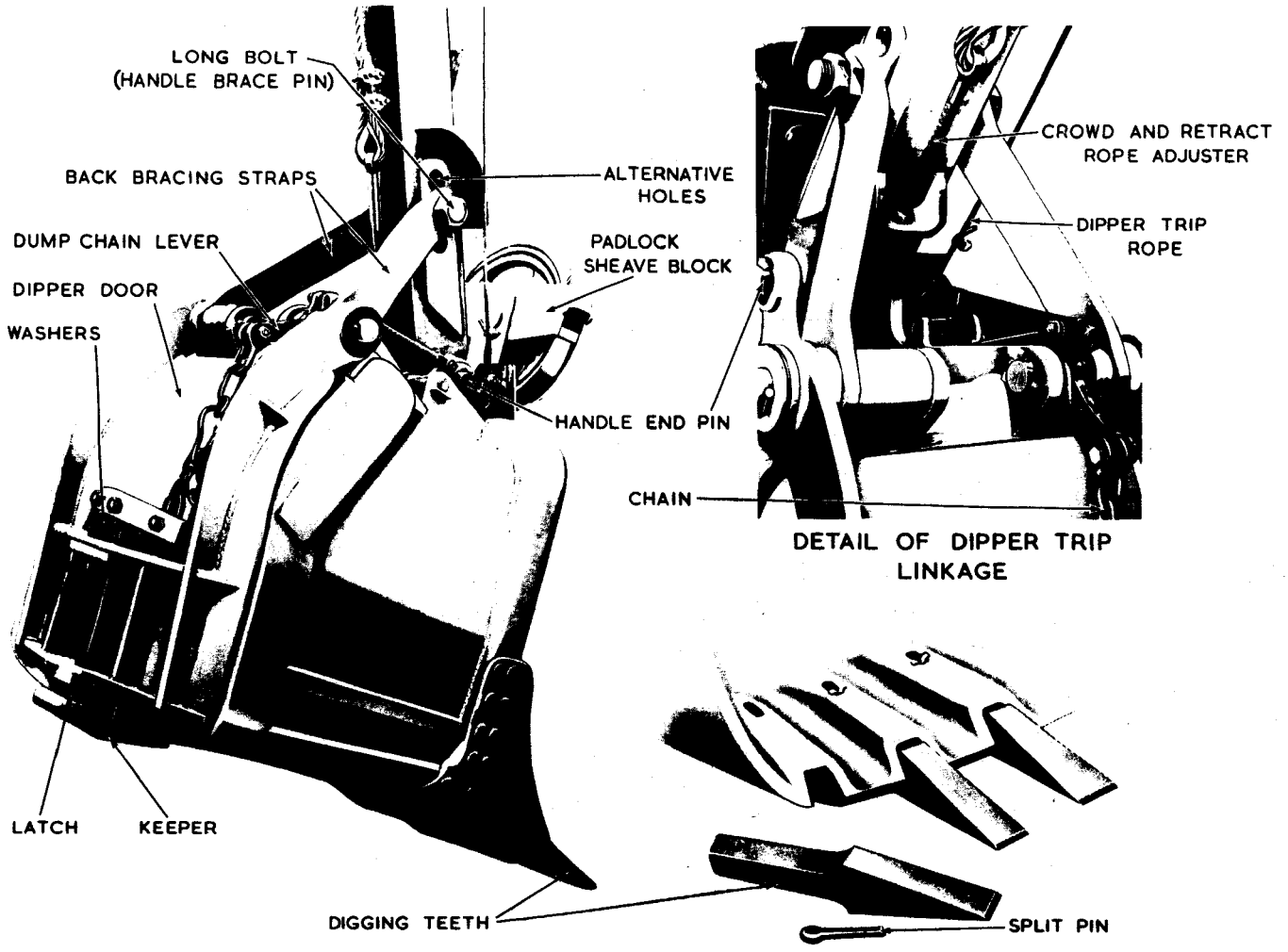


Fig. 19. The Shovel Dipper and Trip Mechanism

SHOVEL DIPPER AND TRIP MECHANISM (See Fig. 19.)

The Dipper is attached to the lower end of the dipper handle by means of a pin and two adjustable bracing straps. The straps are secured in position by means of pins and a long bolt which can be fitted into any one of three holes in the dipper handle, to provide means for adjusting the digging angle of the dipper. When digging against a face or rising ground, it is advisable to secure the bolt in the upper hole, when digging loose material with the fall of the ground the bolt should be secured in the lower hole.

The padlock which carries the padlock sheave and the hoist rope is attached to the front bridle of the shovel dipper by means of a pin. The dipper door and part of the dipper trip mechanism are pivoted on the pins securing the bracing straps. The door opens automatically by gravity when the shovel is hoisted and the latch is withdrawn by pushing lever 'N' forward. (See Fig. 4, Section 5.) The door closes when the shovel is lowered and the brake pedal 'F' is depressed. The door latch engages into a keeper provided with renewable wearing plate and welded to the base of the dipper.

The dipper trip operates the latch through a system of levers and a chain on the shovel dipper. The chain is in two parts and its effective length can be adjusted by threading the links from the latch pin end through a pinch link in the other part of the chain. The lever to which the latch pin and the chain is attached is pivoted on a bolt secured to a rib on the dump door. There are a number of spacing washers at either side of the rib that are held in position on the bolt by means of two nuts. Final adjustment of the depth of engagement of the latch into the keeper is effected by transposing washers from the top or bottom of the bolt. Removing a washer from the top and putting it underneath the rib increases the depth of the latch in the keeper.

The digging teeth of the shovel dipper can be reversed (turned upside down) or they can be replaced. They are secured in the socket by means of split pins. When reversing a tooth it may be necessary to add shims at either side of it to eliminate side play of the tooth in the socket.

DRAGLINE

A photograph on Page 2 Section 2, shows an Excavator at work that is fitted with a Dragline Equipment, and a general arrangement drawing covering this combination will be found in Section 4.

The dragline principle is similar to the old-fashioned horse-drawn scraper pan. The pan or drag-bucket, is drawn towards the machine and usually digs below the level on which it stands. The bucket is suspended by wire rope from a long lattice-type boom, which can also be used for crane, clamshell and pile driver equipments. The dragline can be used for under water excavation and in consequence is much used for land drainage work, other types of dredging and excavation of under-water gravel etc. The longer reach of the dragline excavator provided by the long boom and the ability to swing the bucket out beyond the boom point, makes it possible to have digging and dumping points further apart than is feasible with other types of equipment. This is often of particular advantage in such operations as stripping overburden etc., when it is desired to remove the spoil to a point well away from the cut.

THE BOOM

The boom is of all-welded, lattice box-section construction designed to stand up to the compression and swing stresses of fast dragline work. To enable the boom length to be adjusted to suit the job in hand, the boom has butt-flange joints, which make it easy to insert or exchange extra boom sections. Big boom point sheaves are mounted on large bronze bushings and are well guarded to relieve sheaves of off-lead pull.

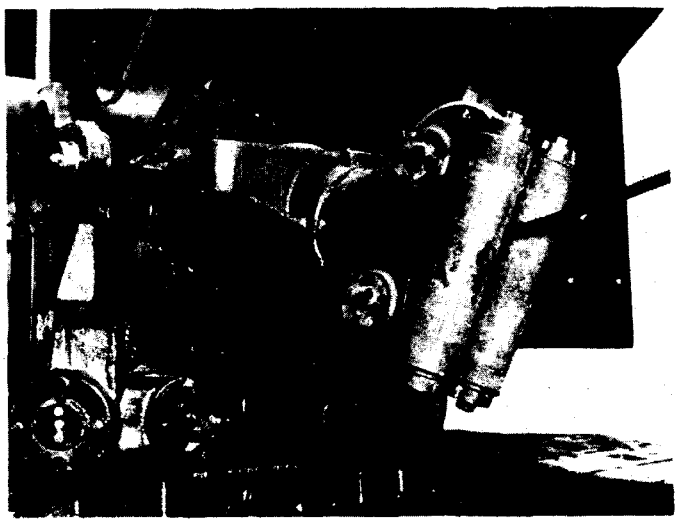


Fig. 20. The Dragline Fairlead.

THE FAIRLEAD (See Fig. 20.)

Low friction and instant response are features of the dragline fairlead.

The compact rotating-type fairlead is set well forward to provide a long lead direct to the grooving on the drag drum. The fairlead is symmetrical and carries two identical, ball-bearing mounted guide sheaves. The barrel carrying the sheaves can rotate through 360° and being mounted on taper roller bearings, moves instantly into the plane of the drag-rope pull with the slightest off-lead of the drag-rope. This design minimizes rubbing and chafing with consequent reductions in rope and sheave wear.

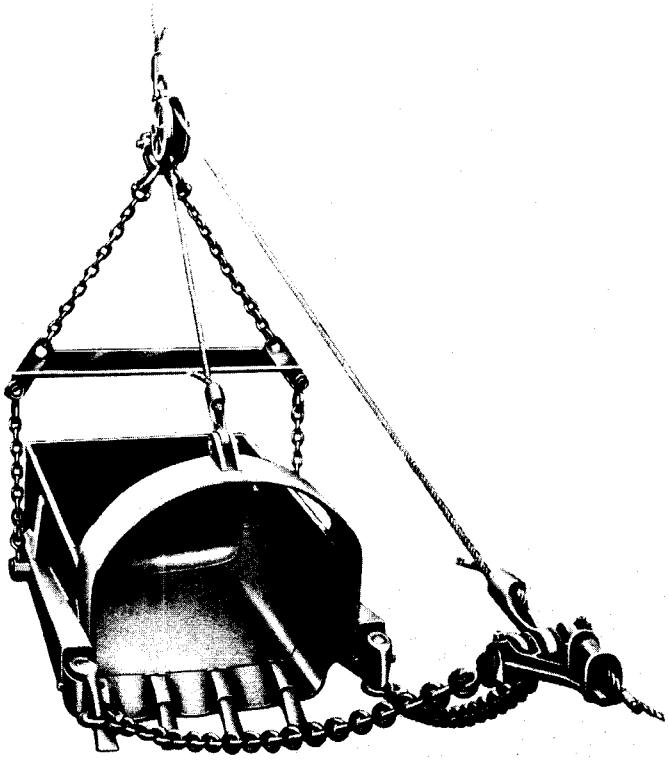


Fig. 21. A 'BAX' Dragline Bucket.

THE DRAGLINE BUCKET (See Fig. 21.)

The modern design of the 'BAX' buckets is based on a unique background of practical experience, providing high efficiency, long wearing qualities and low-cost service. The body and single-plate arch are of high tensile steel and are reinforced at the points of the greatest stress and wear. Quick filling and clean dumping are ensured by the high arch and smooth interior. These buckets are well balanced and carry a heaped load smoothly to the dumping point even with a fast swing. These features, together with the cast nickel-chrome steel lip and inserted, easily renewable teeth ensure long satisfactory service.

DRAGSHOVEL

The Dragshovel is always used for digging below ground level and its principal use is for digging trenches for pipe lines and cables or for excavating foundations, basements etc. When used for trenching the machine straddles the area in front of the trench and as the excavation proceeds the machine travels forward leaving a clean sided trench. It can also be used for lowering heavy pipes into the trench and for back-filling it when the pipe laying is finished.

Straight Boom and Cambered Boom Dragshovel Equipments (See Fig. Nos. 22 and 23) are available, enabling the user to choose the most effective for his particular requirements. The straight boom, to which a skimmer bucket can be applied, incorporates runners for this function. Greater reach and digging depths are obtained with the cambered-boom dragshovel equipment, and it is also able to deal with some-what heavier materials. Booms and handles are of welded structural-steel box-section construction.

A strut-braced forward A-frame is standard with the straight boom. With the cambered-boom equipment a rope-suspended type is employed which can also be made available for straight-boom equipments. By this means the entire front-end, including dipper handle, boom and forward A-frame may be readily folded so that all parts of it are below cab height – a most useful feature if restricted headroom is encountered during moves on or between sites.

A further degree of selection is afforded by the two types of dragshovel dipper which are available to take advantage of the characteristics of proper proportioning of speed and power; both are equally robust; able to dig heavy materials easily; fill to capacity at each digging stroke, and dump rapidly and cleanly.

HOE-TYPE DIPPER

A Hoe-type Dipper is offered for use with the straight or cambered boom. This dipper has no door; other characteristics being an open top and rounded heel. A single casting forms the channel arch and lip, providing rigid strength at the most necessary points. Fast filling is made easy by the high arch and by the rounded heel which also provides the needed clearance for digging vertical walls in basement work. The particularly robust construction of this dipper makes it highly suitable for digging in hard or stratified materials.

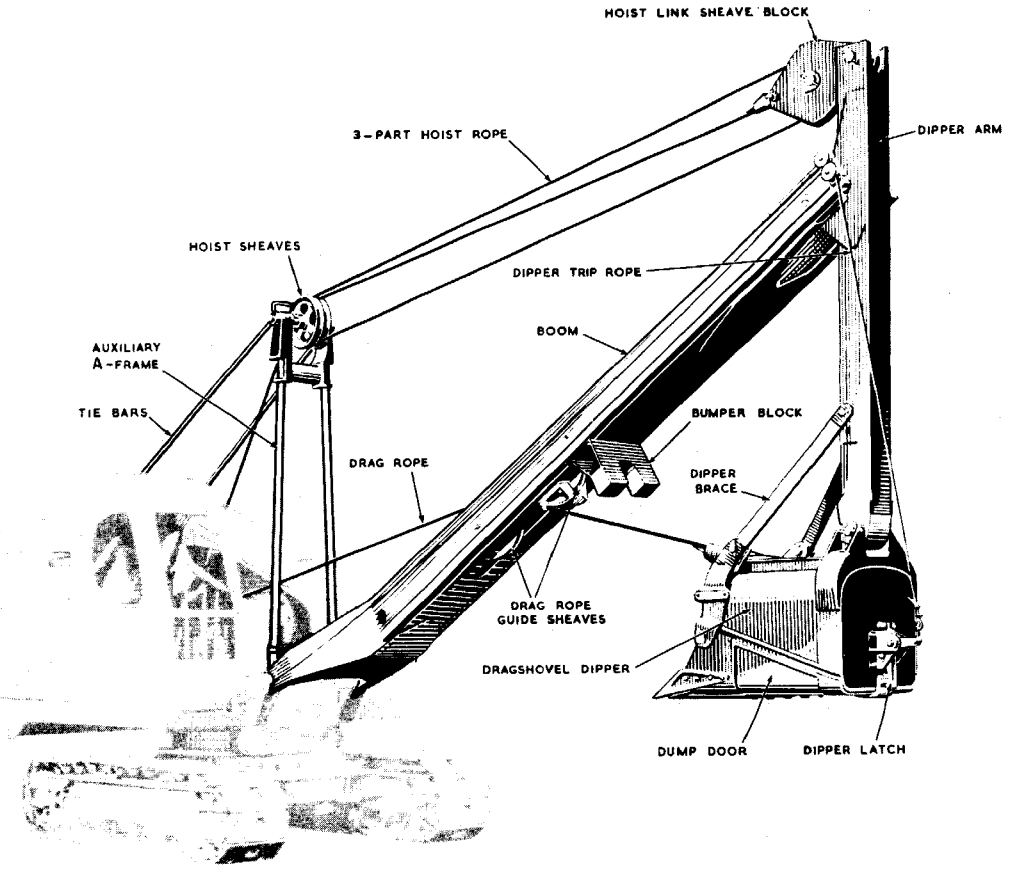


Fig. 22. Straight-Boom Dragshovel with Front-Opening Type Dipper.

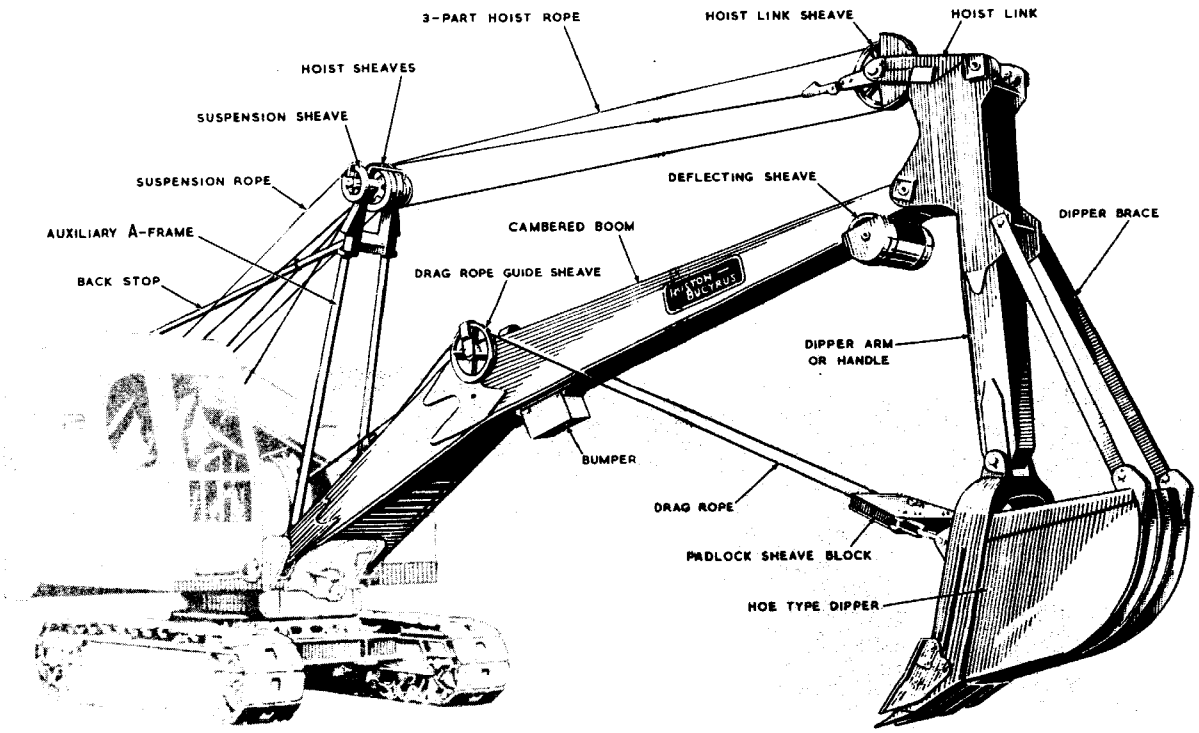


Fig. 23. Cambered-Boom Dragshovel with Hoe-Type Dipper.

This type of dipper is normally fitted with pick-pointed side cutters, but when really accurate trimming is required, blade-type cutters can be supplied.

FRONT-OPENING TYPE DIPPER

The Front-opening type Dipper, available as an alternative with the straight boom is of composite cast and welded construction; can be supplied in various widths, and is fitted with special cast-steel side cutters. This dipper is particularly suitable for trenching work. Accurate dumping into wagons or lorries at short radius is made easy by the hinged door and power operated dipper trip which is quick in action and simple to operate.

SKIMMER

The boom and auxiliary 'A' frame used for Straight-Boom Dragshovel operation are also used when the machine is fitted with a Skimmer Equipment (See Fig. 24). Four roller assemblies are attached to the dipper frame and these run along the lower flange of the boom. Outward travel of the dipper along the boom is controlled by the drag rope reeved round the drag rope sheave at the boom point and back to the front shaft drum, the other end of the rope being attached to the dipper. The boom can be raised or lowered by means of a three-part hoist tackle reeved between the boom point and the auxiliary A-frame and thence down to the rear shaft drum. Backward movement of the dipper and lowering the boom is by gravity and both movements are controlled by the brakes fitted on the drum shafts.

The skimmer dipper is of all-welded steel construction with a hinged door to which two side cutters and four chisel-type teeth are attached. It has a cutting stroke of 11 ft. 9 in. and is carried rigidly on its path when excavating by the four roller assemblies referred to above. Possessing the useful dumping height of 17 ft. 3 in., the dipper dumps cleanly throughout its radius of operation by means of the hinged door, which is fitted with a power operated latch.

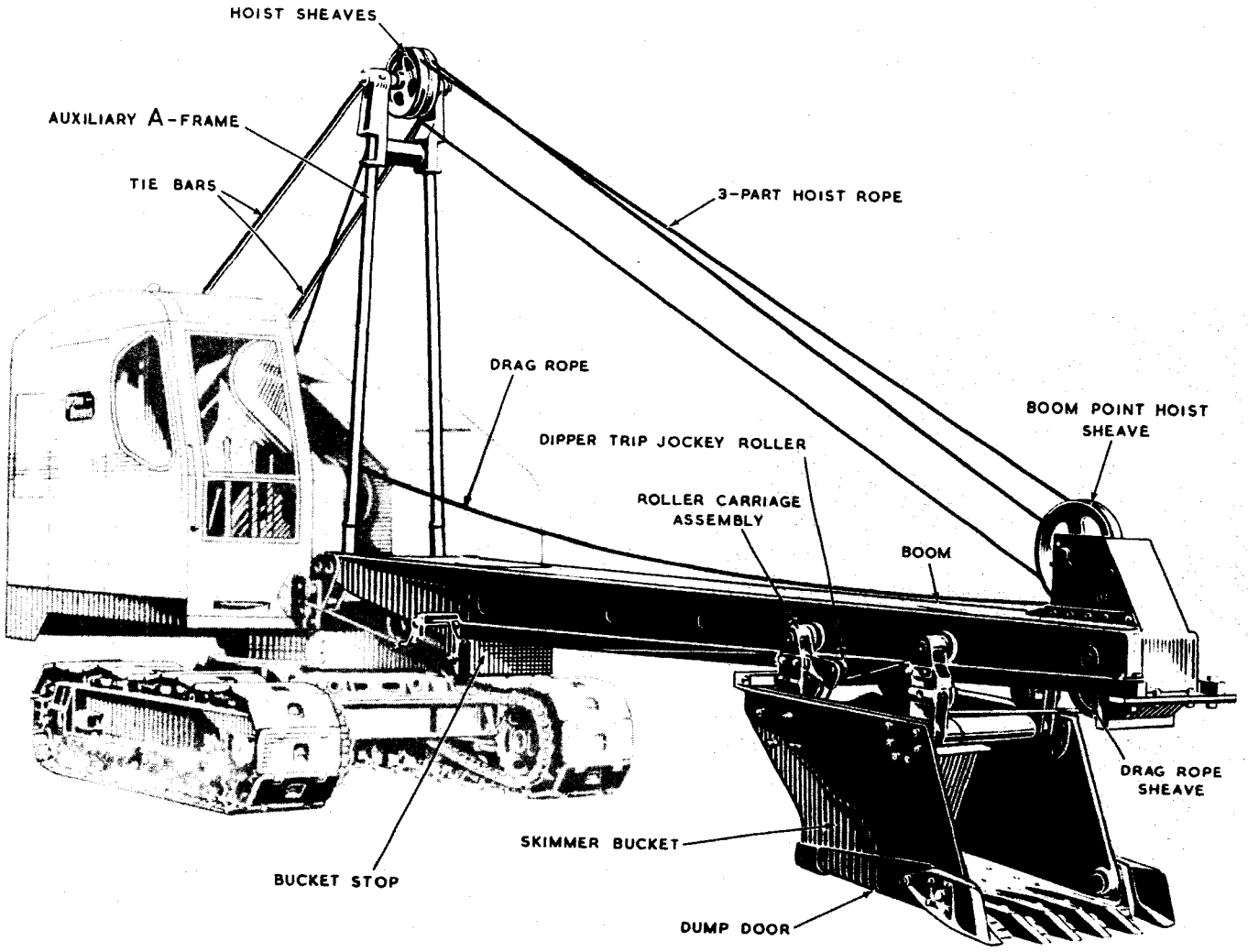


Fig. 24. Skimmer Equipment.

The skimmer can dig from the level of its tracks up to a height of about five feet. Its principle use is for skimming off layers of soil from a site, for skimming off gently sloping mounds or any similar duty where reasonable level finish surface is required.

It is particularly useful for grading road foundation surfaces, and for removing old macadam etc., after preliminary ripping, in road reconstruction operations.

CLAMSHELL (GRABBING CRANE)

The equipment (See Fig. 25.) uses the same boom as the Dragline, and is similar to the Lifting Crane, except that two hoist sheaves are fitted at the boom point, and there is also a jockey sheave fitted on the boom upper section to act as a guide for the closing rope.

A tagline device is provided to prevent the Clamshell Bucket (or Grab) from spinning and twisting together the two ropes by which the bucket is suspended from the boom point hoist sheaves.

The rope from the front drum is known as the Closing and Hoist Rope, because when it is spooled in, it closes and hoists the bucket. The rope from the rear drum is known as the Holding and Lowering Rope; it holds the bucket in the open position whilst it is lowered for the next load. Thus, the clamshell or grab can be opened or closed by transferring the weight from one rope to the other.

The Clamshell Bucket or Grab consists of two half-scoops hinged together at the top so that they can be closed to pick up material between the two halves. A clamshell is sometimes confused with a grab; the difference between them is that teeth are fitted in the jaws of a clamshell, whereas the jaws of a grab are often rubber nosed to prevent free running material spilling through the joint when hoisting the grab.

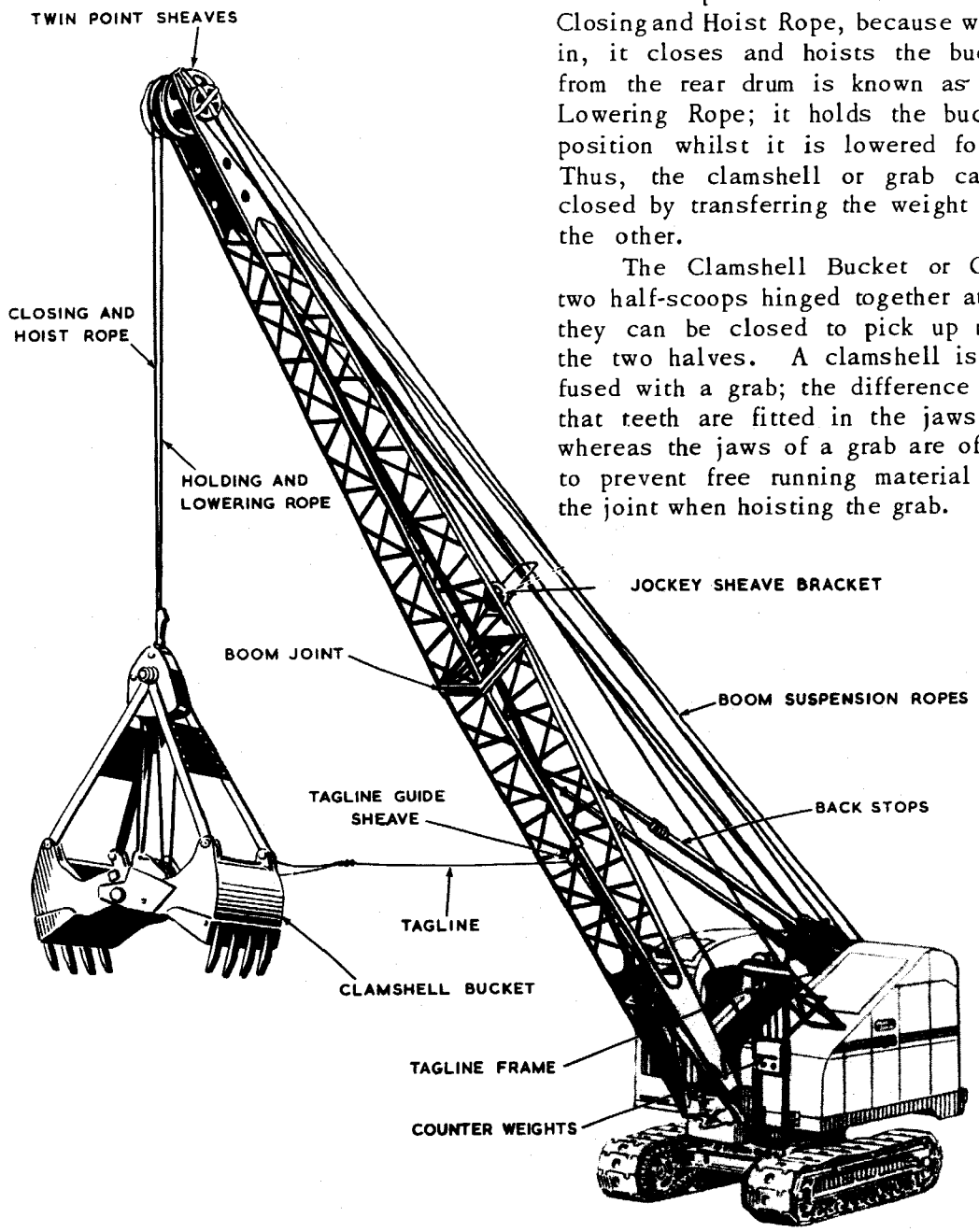


Fig. 25. The Clamshell or Grabbing Crane Equipment

The digging action of the Clamshell (or Grabbing Crane) is entirely vertical; it does not have either the 'out' motion of the shovel or the 'in' motion of the dragline or dragshovel.

The use of the Grab does not extend to real excavating, and this type of bucket is mainly useful for transferring loose materials from stockpiles to hoppers, or un-loading material from trucks or boats and placing it in hoppers or stockpiles. On the other hand the clamshell is quite capable of excavating fairly soft and loose materials, at a point above, below, or on the same level as that on which the machine is standing and is particularly useful where the digging point is readily accessible only to a vertical operating bucket. Another advantage of this type of equipment is the ability to dump accurately into a relatively small hopper or opening, especially where the dumping point is at considerable height above the machine.

LIFTING CRANE

This front-end equipment (See Fig. 26.) is for lifting instead of excavating. A simple hook-block replaces the clamshell bucket on the hoist line running over a sheave at the point of the same lattice boom used for dragline or clamshell. For long reach jobs, special long booms using pendant suspension are available with or without offset jibs.

Accurate control of all functions and outstanding stability provide high lifting capacity and make the machine ideal for mobile crane service; whilst exceptional manoeuvrability enabling it to work in confined places and the fact that it lays its own tracks are often other points in its favour.

Another and important advantage of this type of crane lies in its accurate and reliable boom control. The boom hoist is independent of all other functions: the boom angle can be changed while the machine is swinging or propelling; while the load is being hoisted or lowered. One lever controls both raising and lowering the boom.. Activated by a booster-set friction clutch on the front drum shaft, raising is smooth, its speed controlled by the engine governor. The clutch band is self-adjusting. Lowering control is so accurate that loads can be inched into position. A hand-controlled holding pawl relieves the brake of all responsibility when the boom is kept at a fixed angle, and should be kept engaged whenever operations do not require frequent boom angle changes. With the safety pawl disengaged, releasing the band brake starts the boom lowering. The instant

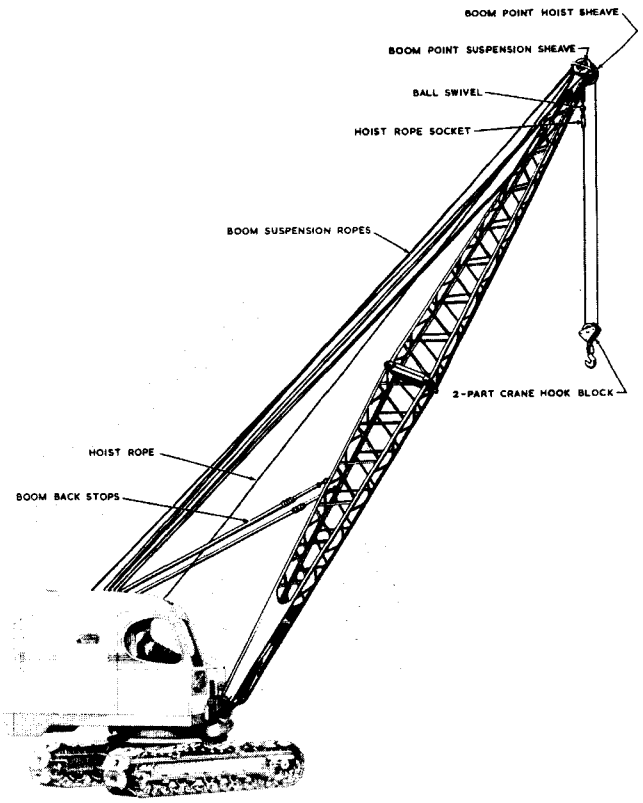


Fig. 26. Crane Equipment (2-Part Reeving to Hook.)

that lowering speed overhauls the speed at which the front shaft is turning, an automatic, silent ratchet pawl engages and positively limits lowering speed at shaft speed, taking advantage of machinery inertia and engine compression as the braking means. This relieves the brake, in a most effective way, of the functions it must normally handle on most machines. As a consequence, the brake remains cool and ready to stop lowering at the desired instant, permitting maximum boom angle changes without the loss of efficiency which usually comes at the end of a change because of a hot brake.

The single lever controlling the boom-hoist unit has a central neutral position. Movement forward releases the brake whilst movement to the rear actuates the hoisting mechanism. Rapid reversal of motion is simply obtained by moving the lever through neutral.

The above two paragraphs to a great extent form a supplementary explaination of the practical application of the boom hoist unit, as already described in some detail and illustrated on pages 14 and 15 of this section.

When derricking out a suspended load care must be taken not to exceed the specified rating for the machine. When in any doubt it is essential

to play safe and consult the load chart and also the boom angle or radius indicator fitted to the boom. A visible and audible safe-load indicator of approved make is also available and is supplied and fitted on request.

For Lifting Crane Ratings etc., refer to Section 3 of this book, and refer to other sections for information regarding Operation, Conversions etc.

POWER CONTROLLED LOAD LOWERING

Controlled lowering of the load on the hoist line is available and recommended for machines equiped as lifting cranes. It gives increased ease, efficiency and safety of operation when engaged on such jobs as the erection of steelwork.

This controlled lowering is accomplished by providing a roller chain connexion between the right-hand clutch on the rear drumshaft, normally inoperative for lifting crane service, and the hoist drum on the forward shaft. This chain drive reverses the direction of rotation of the hoist drum and by this means powered control of the hoist line is obtained when lowering the load.

The drive sprocket attached to the rear clutch housing and the driven sprocket on the hoist drum have a ratio of 2 to 1 so that the load may be lowered at half the hoisting speed. Further adjustment can be made by means of the engine governor control. Both chain sprockets are split for easy installation in the field.

NOTE:-

The hoist line for the offset jib may be reeved from the rear drum and used independently of the controlled lowering main hoist.

PILE DRIVER

The pile driver (See Fig. 27.) comprises the crane boom having a frame secured to the boom point shaft and two channel section uprights the lower ends of which are secured to the revolving frame by means of two adjustable braces. The channel section uprights are known as 'leaders' The hoist rope from the front drum is reeved over the boom point sheave and attached to a hammer, sometimes referred to as a 'monkey'.

The top of the frame is off-set outwards so that the pile lifting rope from the rear drum which is reeved round a sheave at the top of the frame, does not foul the hammer. (Refer to Fig. 28.)

The boom can be raised or lowered to plumb the leaders and the pile when the complete equipment is assembled to the machine.

The hammer can be held near the top of the leaders by means of a spring loaded latch which is controlled by a lever near the bottom of the leaders.

The free end of the pile lifting rope is fitted with a swivel hook so that the piles can be lifted into position.

A ladder is fitted behind the leaders so that the pile guide steady fittings and the pile lifting sling are ready accessible.

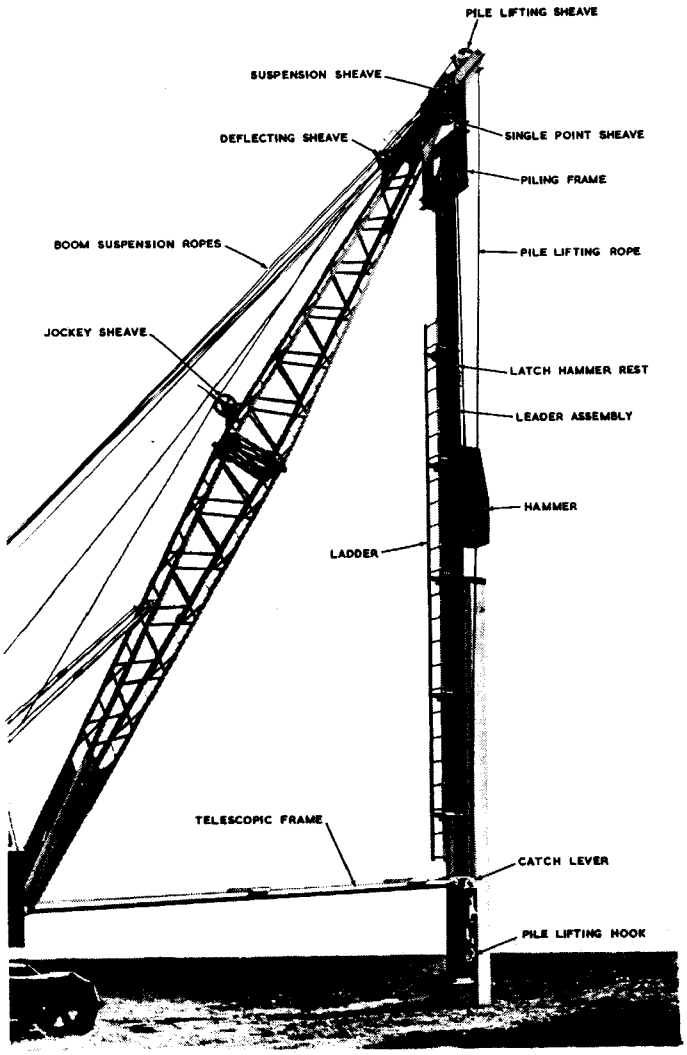


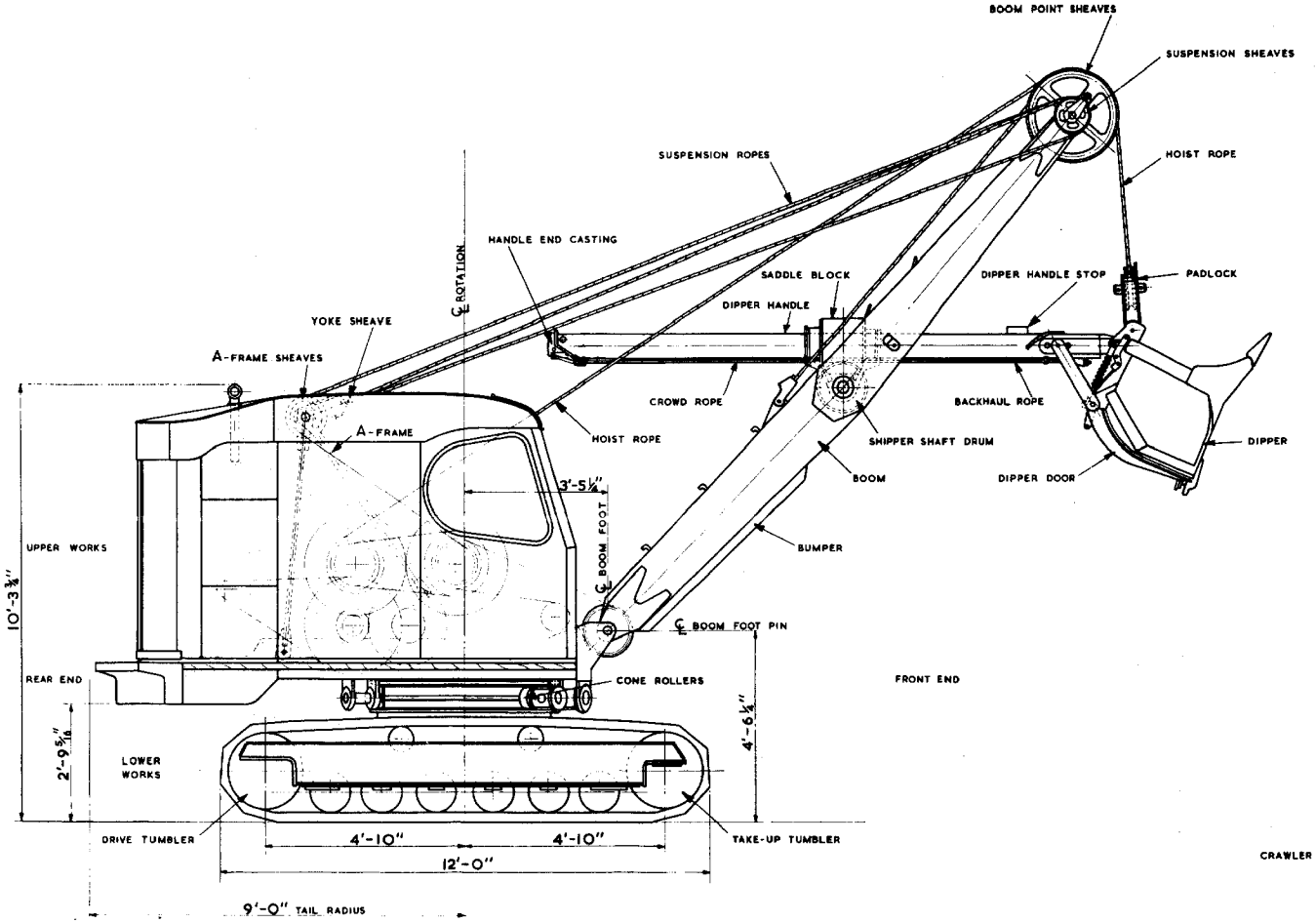
Fig. 27. The Pile Driving Rig.

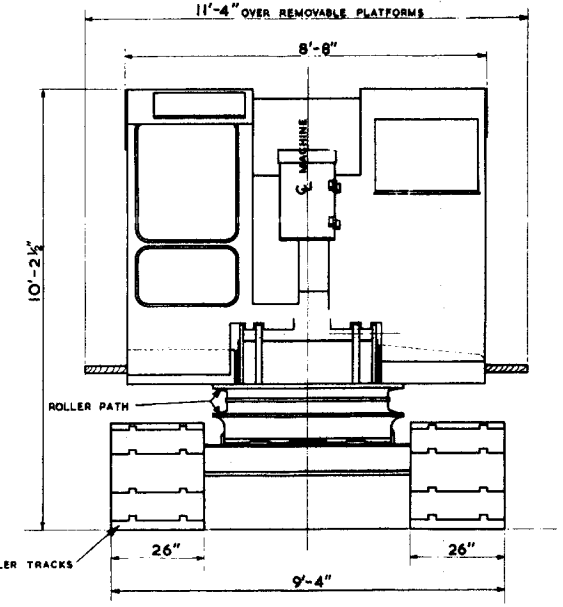
INDEX TO ILLUSTRATIONS IN SECTION 2.

SECTION 4 — 4 DRAWINGS

CONTENTS

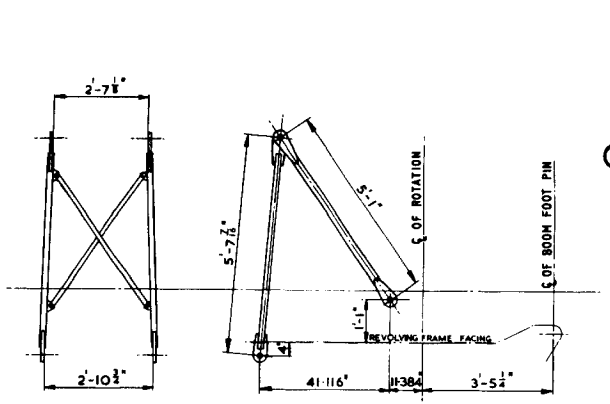
22-RB GENERAL ARRANGEMENT DRAWINGS, as follows:-



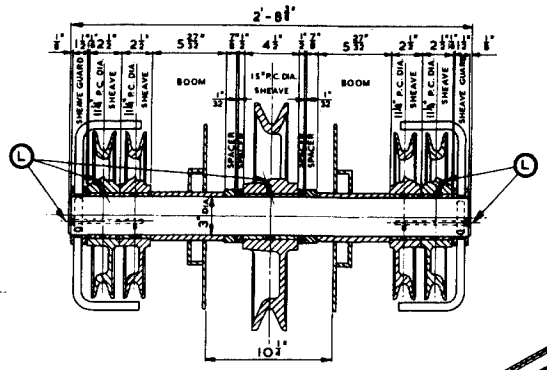


GENERAL ARRANGEMENT OF THE 22-RB SHOVEL

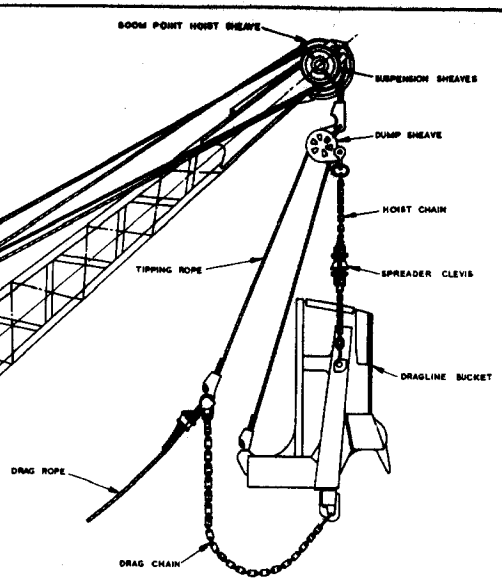
IMD-50

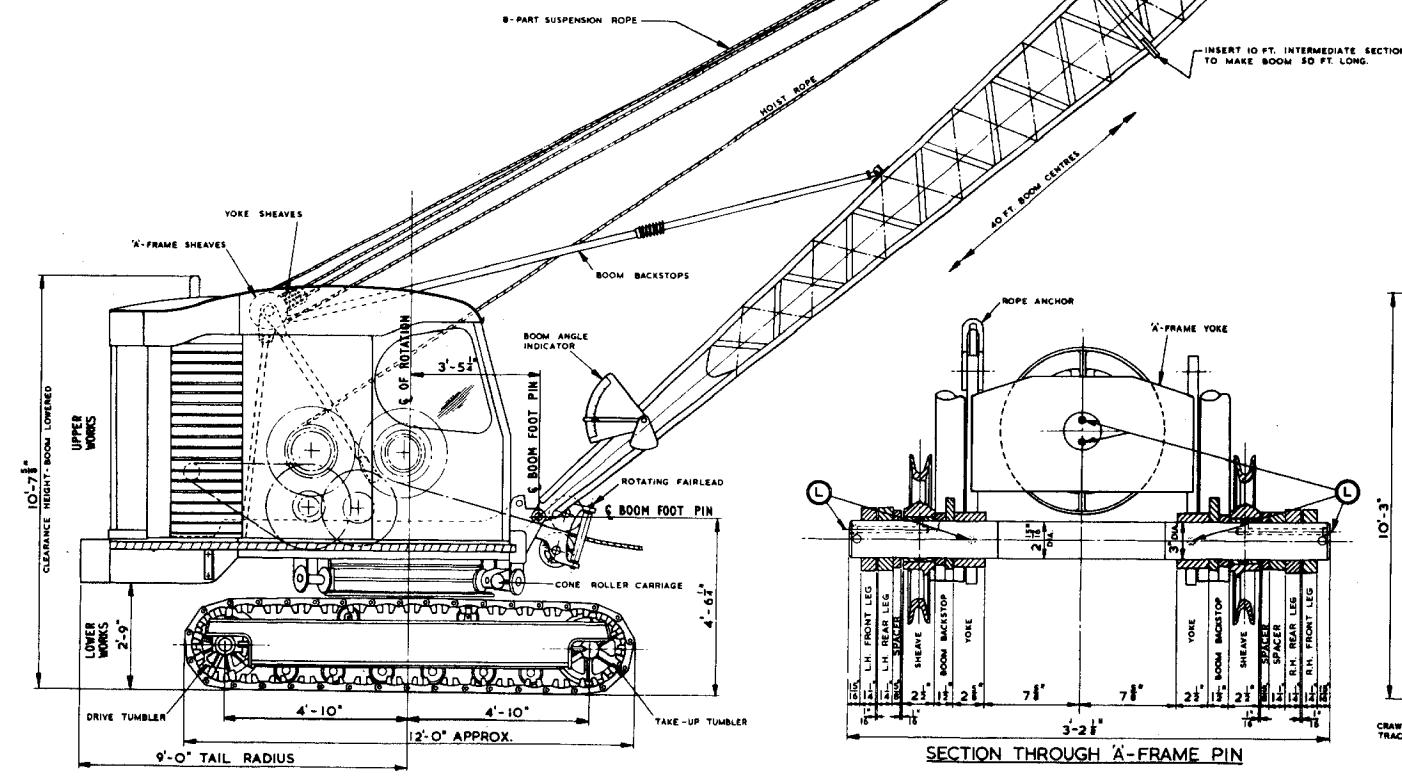


'A'-FRAME DIMENSIONS

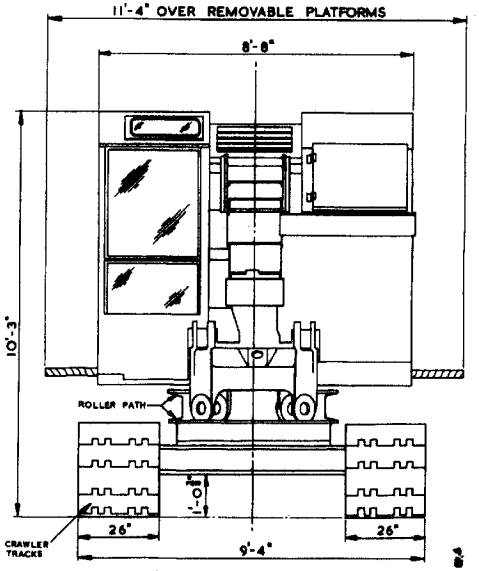


SECTION THROUGH BOOM POINT PIN





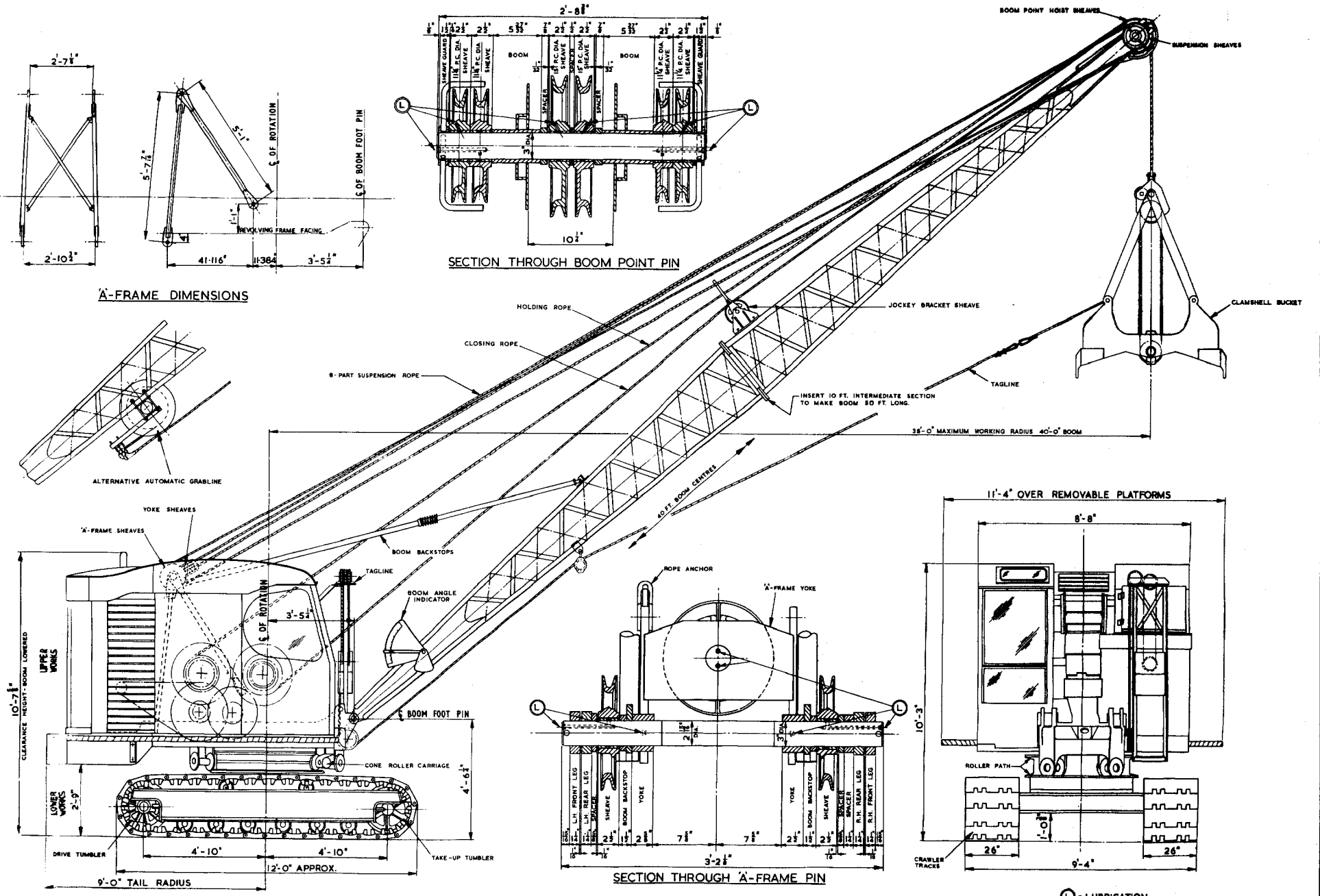
SECTION THROUGH 'A'-FRAME PIN



Ⓛ LUBRICATION

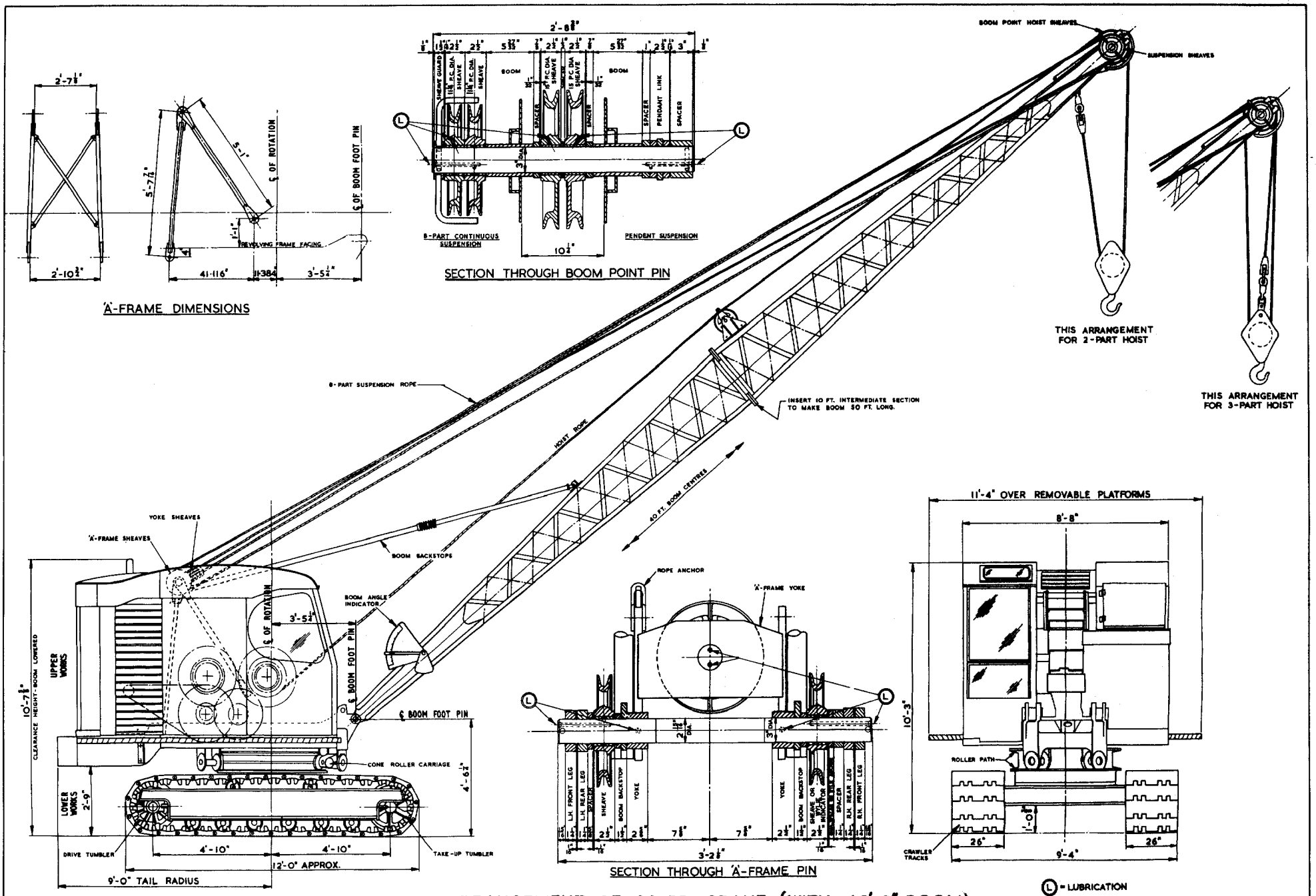
GENERAL ARRANGEMENT OF 22-RB DRAGLINE

IMD 64/R2



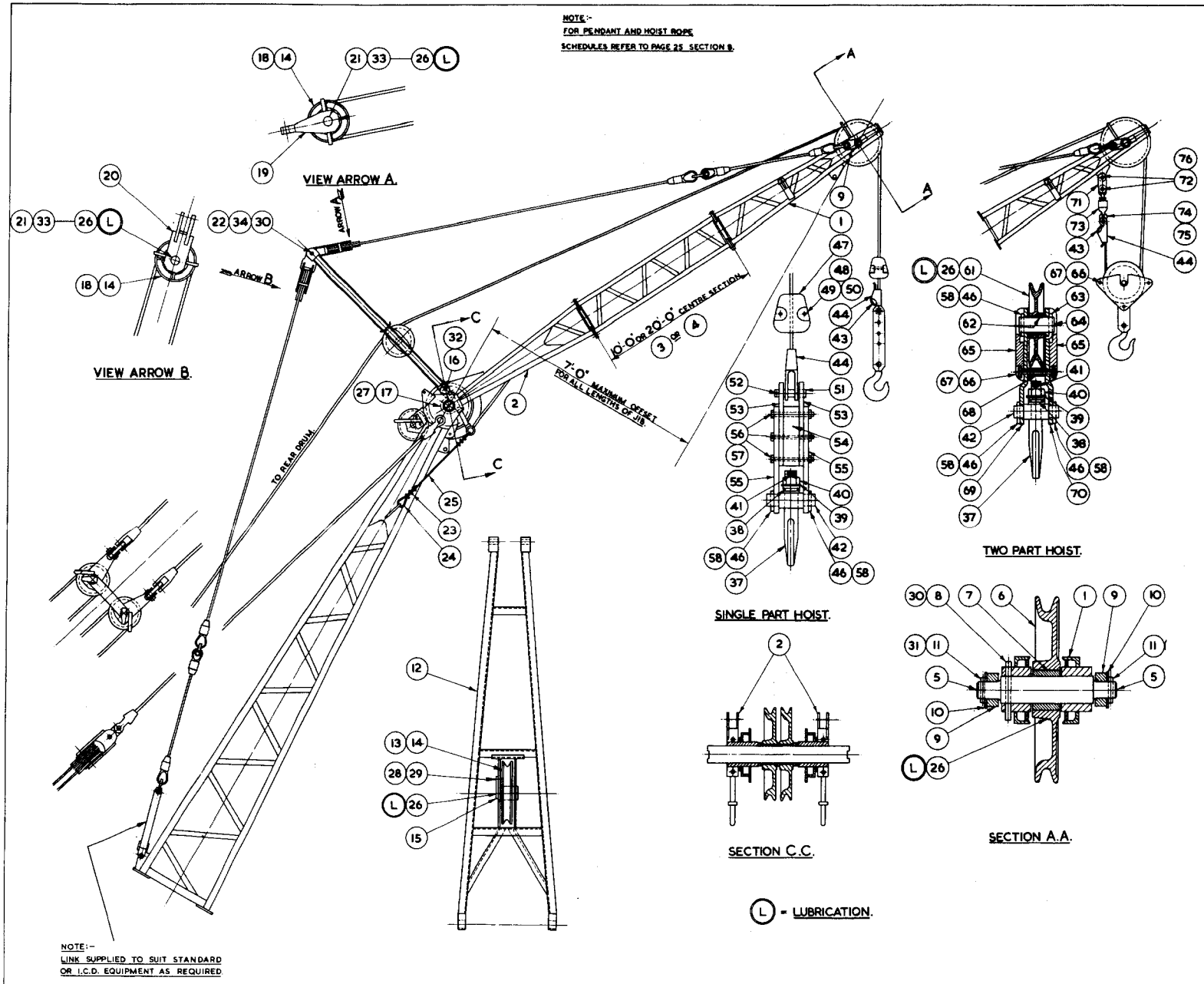
GENERAL ARRANGEMENT OF 22-RB CLAMSHELL

IMD 67/R2



GENERAL ARRANGEMENT OF 22-RB CRANE (WITH 40'-0" BOOM)

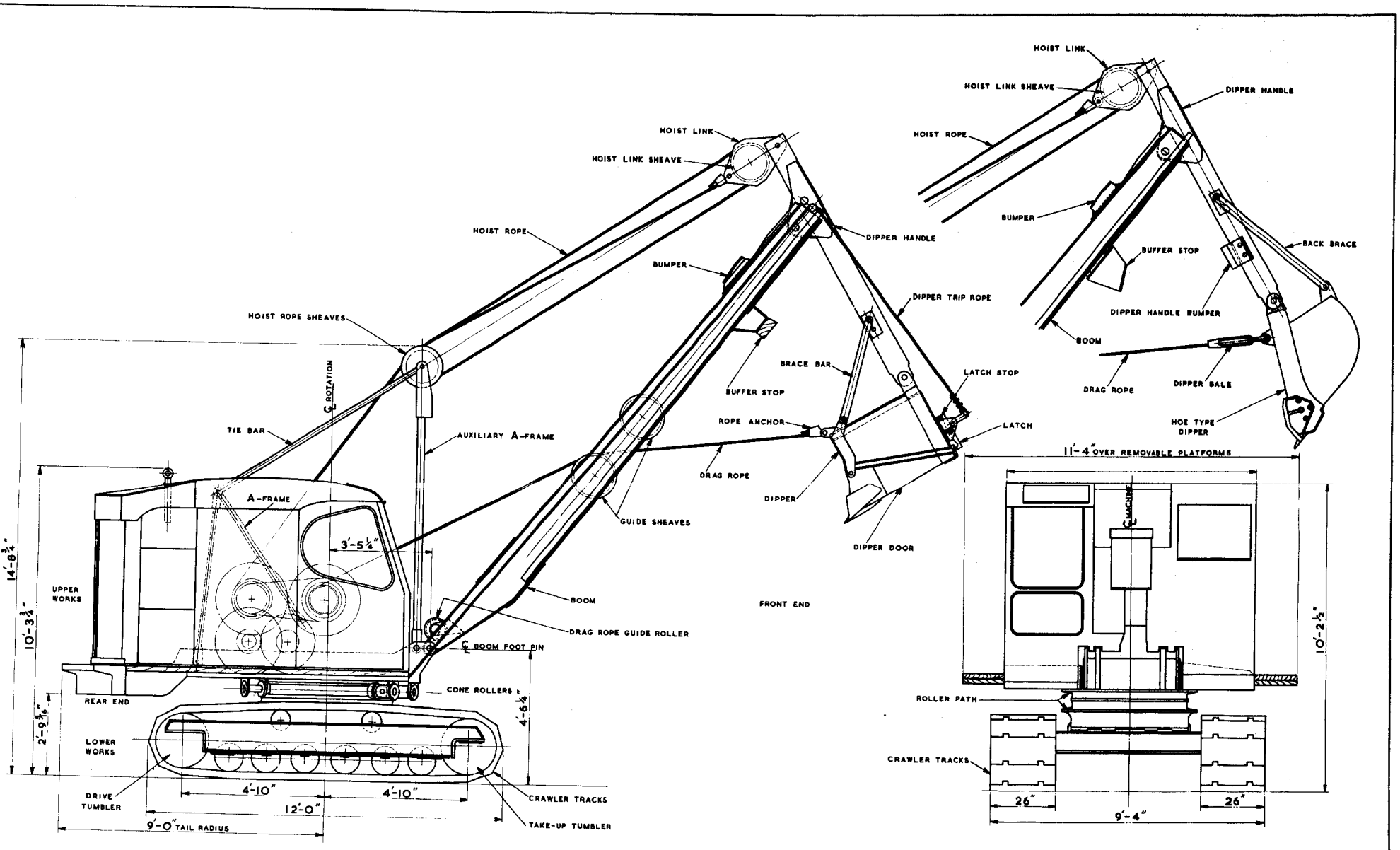
IMD 109/R2



	REF No	DESCRIPTION.
PARTS TO COMPLETE OFFSET JIB ASSEMBLY.	1	OFFSET JIB UPPER SECTION (5'-0")
	2	OFFSET JIB LOWER SECTION (5'-0")
	3	OFFSET JIB CENTRE SECTION (10'-0")
	4	OFFSET JIB CENTRE SECTION (20'-0")
	5	JIB POINT PIN.
	6	JIB POINT SHEAVE.
	7	JIB POINT SHEAVE BUSHING.
	8	JIB POINT PIN LOCK.
	9	PENDANT ANCHOR LINK.
	10	ANCHOR LINK RETAINER.
	11	ANCHOR LINK RETAINER LOCK.
	12	OFFSET JIB MAST.
	13	MAST DEFLECTING SHEAVE.
	14	MAST DEFLECTING SHEAVE BUSHING.
	15	MAST DEFLECTING SHEAVE PIN.
	16	MAST FOOT PIN.
	17	'U'-BOLT.
	18	PENDANT EQUALISER SHEAVE.
	19	EQUALISER SHEAVE SUPPORT.
	20	EQUALISER SHEAVE SUPPORT.
	21	EQUALISER SHEAVE PIN.
	22	MAST HEAD PIN.
	23	JIB SAFETY ROPE CLIP.
	24	JIB SAFETY ROPE THIMBLE.
	25	JIB SAFETY ROPE.
	26	GREASE NIPPLE.
	27	'U'-BOLT NUTS.
	28	DEFLECTING SHEAVE PIN SETSCREWS.
	29	LOCKNUTS.
	30	SPLIT PIN.
	31	SPLIT PIN.
	32	SPLIT PIN.
	33	SPLIT PIN.
	34	'U'-BOLT.
COMMON TO SINGLE AND TWO PART HOIST.	37	CRANE HOOK (8 TON)
	38	HOOK THRUST BEARING.
	39	HOOK WASHER.
	40	HOOK NUT.
	41	SPLIT PIN.
	42	HOOK TRUNNION
	43	ROPE SOCKET WEDGE.
	44	ROPE SOCKET.
PARTS TO COMPLETE SINGLE LINE HOIST.	46	LOCKING PINS.
	47	BOB WEIGHT. (2-HALVES)
	48	BOB WEIGHT BOLTS.
	49	LOCKWASHERS.
	50	WASHERS.
	51	HOIST ROPE SOCKET PIN.
	52	SPLIT PIN.
	53	INNER SUSPENSION BAR.
	54	DISTANCE PIECE.
	55	OUTER SUSPENSION BAR.
	56	SUSPENSION BAR BOLTS.
	57	LOCKWASHER.
	58	SPLIT PIN.
PARTS TO COMPLETE TWO PART HOIST.	26	GREASE NIPPLE.
	46	LOCKING PINS.
	58	SPLIT PIN.
	61	HOOK BLOCK SHEAVE.
	62	HOOK BLOCK SHEAVE BUSHING.
	63	SHEAVE PIN DOWEL.
	64	HOOK BLOCK SHEAVE PIN.
	65	CHEEK WEIGHTS.
	66	CHEEK WEIGHT BOLTS.
	67	LOCKWASHER.
	68	CHEEK WEIGHT BOLT SEPARATORS.
	69	SUSPENSION BAR.
	70	SUSPENSION BAR.
	71	HOIST ROPE ANCHOR LINK.
	72	HOIST ROPE ANCHOR LINK.
	73	BALL BEARING SWIVEL.
	74	HEADED PIN.
	75	SPLIT PIN.
	76	SPLIT PIN.

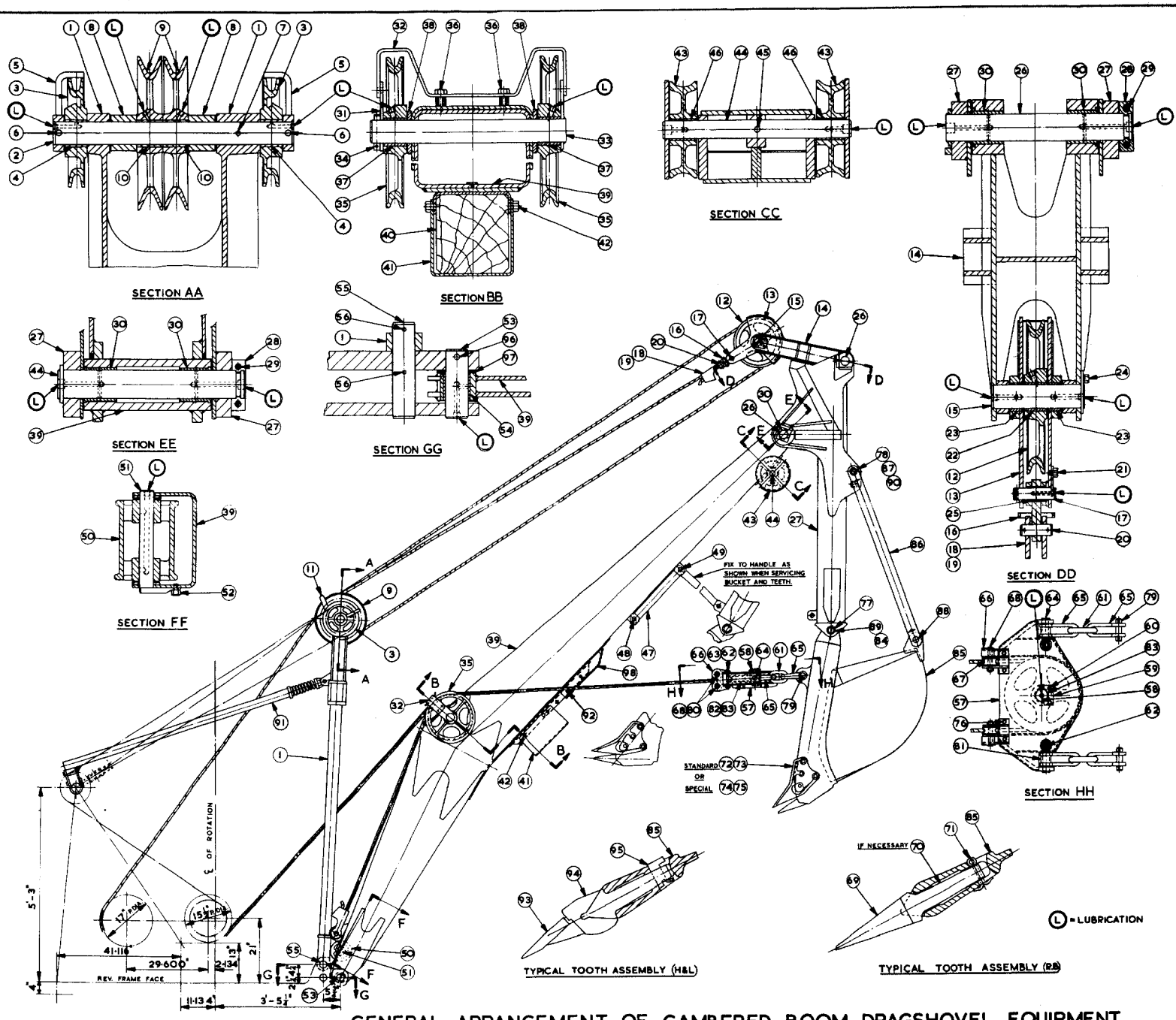
GENERAL ARRANGEMENT OF OFFSET JIB FOR 22-RB.

IMD. 961



GENERAL ARRANGEMENT OF 22-RB DRAGSHOVEL

IMD-70

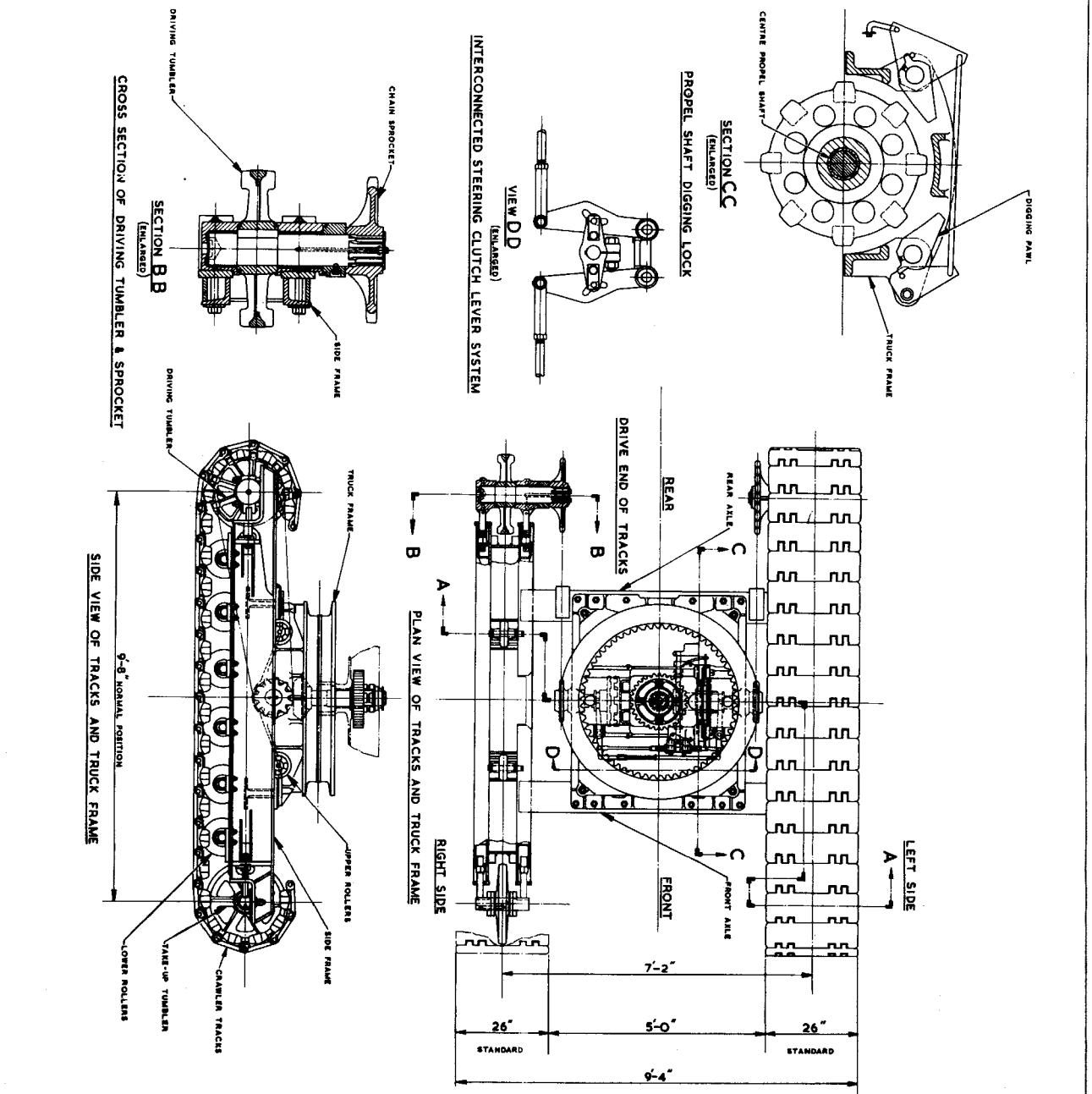


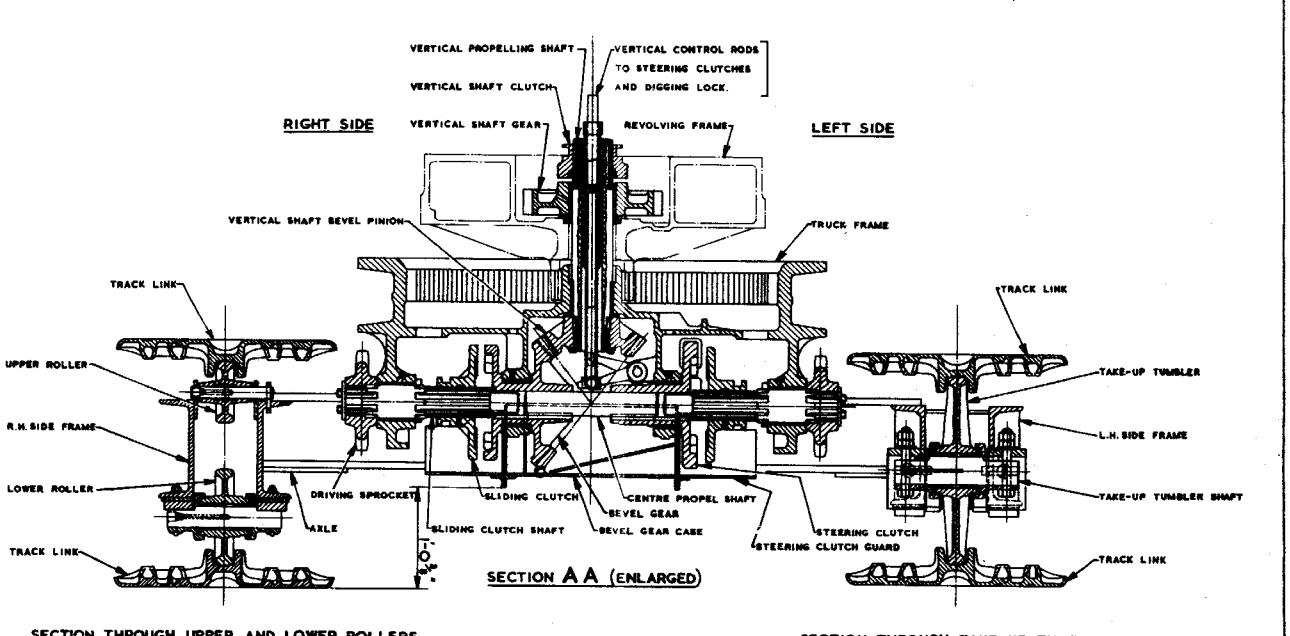
REF	DESCRIPTION
1	AUXILIARY 'A' FRAME
2	AUXILIARY 'A' FRAME HEAD PIN
3	AUXILIARY 'A' FRAME SUSPENSION SHEAVES
4	SUSPENSION SHEAVE BUSHING
5	SUSPENSION SHEAVE GUARD
6	SUSPENSION SHEAVE GUARD RETAINER
7	HEAD PIN LOCKING SCREW
8	HEAD PIN SEPARATOR
9	HOIST SHEAVE
10	HOIST SHEAVE BUSHING
11	HOIST SHEAVE ROPE GUARD
12	HOIST LINK SHEAVE
13	HOIST LINK SHEAVE GUARD
14	COMPLETE HOIST LINK
15	HOIST LINK SHEAVE PIN
16	HOIST ANCHOR BAR
17	HOIST ANCHOR BAR PIN
18	ROPE SOCKET
19	ROPE WEDGE
20	ROPE SOCKET PIN
21	ANCHOR BAR PIN LOCK SETSCREW
22	HOIST LINK SHEAVE BUSHING
23	HOIST LINK SHEAVE GUARD BUSHING
24	SHEAVE PIN LOCK SETSCREW
25	HOIST ANCHOR BAR PIN BUSHING
26	HOIST LINK PIN
27	DRAGSHOVEL DIPPER HANDLE COMPLETE
28	HOIST LINK CLAMP COLLAR
29	CLAMP COLLAR BOLTS
30	HANDLE HINGE PIN BUSHING
31	GUIDE SHEAVE RETAINING PLATE
32	GUIDE SHEAVE ROPE GUARD
33	GUIDE SHEAVE PIN
34	GUIDE SHEAVE PIN LOCK PIN
35	DRAG ROPE GUIDE SHEAVE
36	ROPE GUARD SETSCREW
37	DRAG ROPE GUIDE SHEAVE BUSHING
38	GUIDE SHEAVE THRUST WASHER
39	CAMBERED DRAGSHOVEL BOOM
40	BUMPER BLOCK
41	BUMPER PLATE
42	BUMPER PLATE BOLT
43	DEFLECTING SHEAVE
44	DEFLECTING SHEAVE PIN
45	DEFLECTING SHEAVE PIN LOCK BOLT
46	DEFLECTING SHEAVE BUSHING
47	SAFETY STAY
48	SAFETY STAY LOWER PIN
49	SAFETY STAY UPPER PIN
50	GUIDE ROLLER
51	GUIDE ROLLER PIN
52	GUIDE ROLLER PIN LOCKSCREW
53	BOOM FOOT PIN
54	BOOM FOOT PIN BUSHING
55	AUXILIARY 'A' FRAME FOOT PIN
56	AUXILIARY 'A' FRAME FOOT PIN LOCK PIN
57	PADLOCK FRAME
58	PADLOCK SHEAVE PIN
59	PADLOCK SHEAVE PIN LOCK PLATE
60	SHEAVE PIN LOCK PLATE SETSCREW
61	PADLOCK LINK
62	BOLT
63	NYLOC NUT
64	SHACKLE PIN
65	SHACKLE
66	ROPE GUIDE ROLLER BRACKET
67	ROPE GUIDE ROLLER
68	ROPE GUIDE ROLLER PIN
69	TOOTH
70	SHIM
71	SPLIT PIN
72	SIDE CUTTER R.H.
73	SIDE CUTTER L.H.
74	SIDE CUTTER R.H. FLARED
75	SIDE CUTTER L.H. FLARED
76	ROPE GUIDE ROLLER BRACKET BOLT
77	HANDLE END PIN BUSHING
78	BRACE BAR BUSHING
79	BUCKET TO SHACKLE PIN
80	ROPE GUIDE ROLLER BUSHING
81	PADLOCK SHACKLE SPACER
82	PADLOCK SHEAVE
83	PADLOCK SHEAVE BUSHING
84	HANDLE END PIN LOCK
85	HOE TYPE DIPPER
86	BRACE BAR
87	BRACE BAR PIN HANDLE END
88	BRACE BAR PIN DIPPER END
89	HANDLE END PIN
90	BRACE BAR PIN LOCK
91	BACKSTOP FOR AUXILIARY 'A' FRAME
92	DEFLECTOR PLATE BOLT
93	TOOTH POINT
94	TOOTH SHANK
95	TOOTH KEY
96	BOOM FOOT PIN LOCK BOLT
97	BOOM FOOT PIN WASHERS
98	DEFLECTOR PLATE

GENERAL ARRANGEMENT OF CAMBERED BOOM DRAGSHOVEL EQUIPMENT

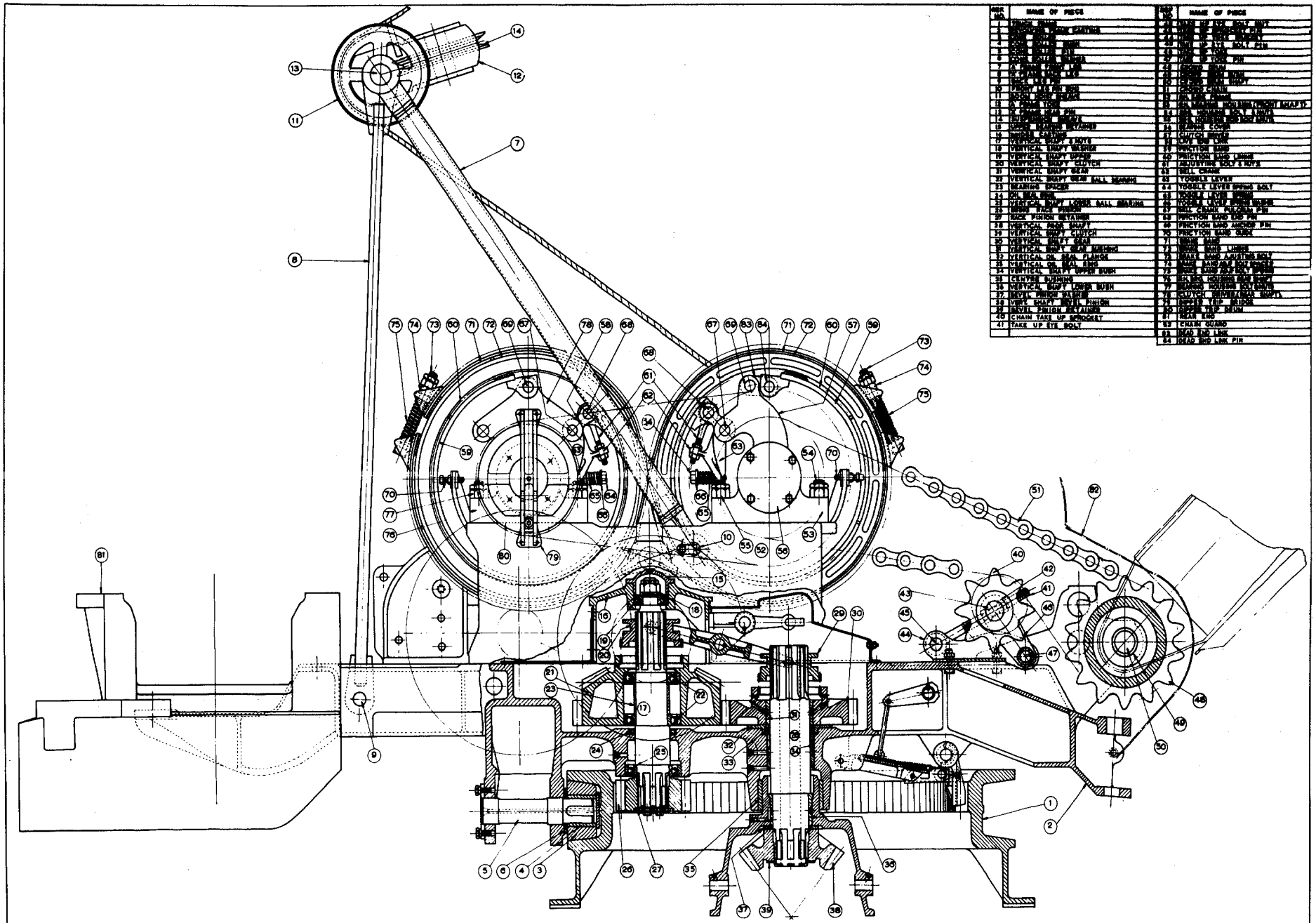
IMD 71/R2.

GENERAL ARRANGEMENT OF 22-RB LOWER WORKS

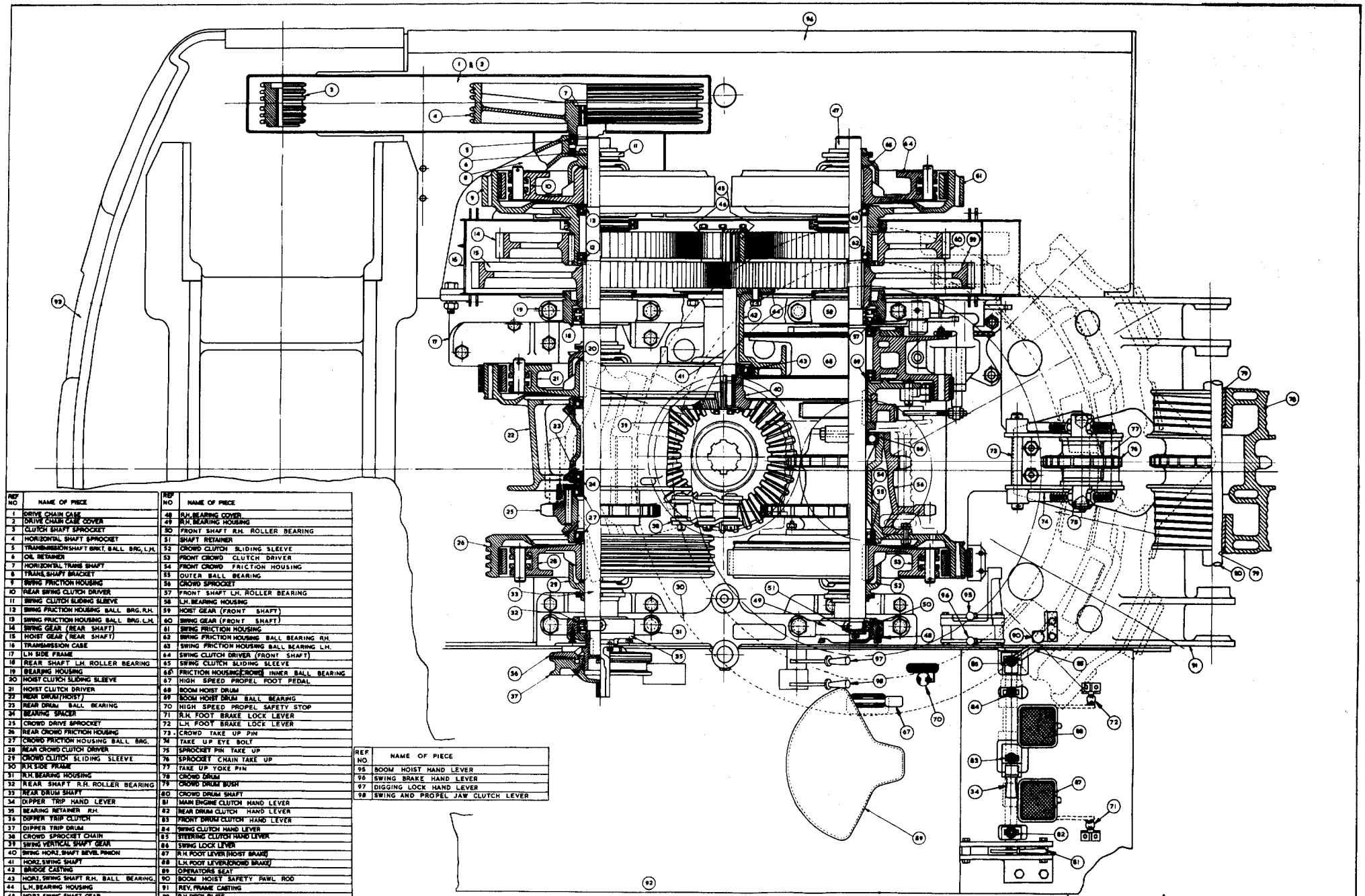




IMD-65



GENERAL ARRANGEMENT OF SHOVEL MACHINERY (SIDE ELEVATION)



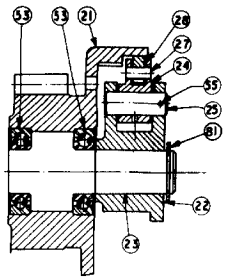
REF NO	NAME OF PIECE
1	DRIVE CHAIN CASE
2	DRIVE CHAIN CASE COVER
3	CLUTCH SHAFT SPROCKET
4	HORIZONTAL SHAFT SPROCKET
5	TRANSMISSION SHAFT BRKT. BALL BRG. L.H.
6	OIL RETAINER
7	HORIZONTAL TRANS SHAFT
8	TRANS. SHAFT BRACKET
9	SWING FRICTION HOUSING
10	REAR SWING CLUTCH DRIVER
11	SWING CLUTCH SLIDING SLEEVE
12	SWING FRICTION HOUSING BALL BRG. R.H.
13	SWING FRICTION HOUSING BALL BRG. L.H.
14	SWING GEAR (REAR SHAFT)
15	HOIST GEAR (REAR SHAFT)
16	TRANSMISSION CASE
17	L.H. SIDE FRAME
18	REAR SHAFT L.H. ROLLER BEARING
19	BEARING HOUSING
20	HOIST CLUTCH SLIDING SLEEVE
21	HOIST CLUTCH DRIVER
22	REAR DRUM (HOIST)
23	REAR DRUM BALL BEARING
24	BEARING SPACER
25	CROWD DRIVE SPROCKET
26	REAR CROWD FRICTION HOUSING
27	CROWD FRICTION HOUSING BALL BRG.
28	REAR CROWD CLUTCH DRIVER
29	CROWD CLUTCH SLIDING SLEEVE
30	R.H. SIDE FRAME
31	R.H. BEARING HOUSING
32	REAR SHAFT R.H. ROLLER BEARING
33	REAR DRUM SHAFT
34	DIPPER TRIP HAND LEVER
35	BEARING RETAINER R.H.
36	DIPPER TRIP CLUTCH
37	DIPPER TRIP DRUM
38	CROWD SPROCKET CHAIN
39	SWING VERTICAL SHAFT GEAR
40	SWING HORZ. SHAFT BEVEL PINION
41	HORZ. SWING SHAFT
42	BRIDGE CASTING
43	HORZ. SWING SHAFT R.H. BALL BEARING
44	L.H. BEARING HOUSING
45	HORZ. SWING SHAFT GEAR
46	RETAINER
47	FORWARD DRUM SHAFT

REF NO	NAME OF PIECE
48	R.H. BEARING COVER
49	R.H. BEARING HOUSING
50	FRONT SHAFT R.H. ROLLER BEARING
51	SHAFT RETAINER
52	CROWD CLUTCH SLIDING SLEEVE
53	FRONT CROWD CLUTCH DRIVER
54	FRONT CROWD FRICTION HOUSING
55	OUTER BALL BEARING
56	CROWD SPROCKET
57	FRONT SHAFT L.H. ROLLER BEARING
58	L.H. BEARING HOUSING
59	HOIST GEAR (FRONT SHAFT)
60	SWING GEAR (FRONT SHAFT)
61	SWING FRICTION HOUSING
62	SWING FRICTION HOUSING BALL BEARING R.H.
63	SWING FRICTION HOUSING BALL BEARING L.H.
64	SWING CLUTCH DRIVER (FRONT SHAFT)
65	SWING CLUTCH SLIDING SLEEVE
66	FRICTION HOUSING (CROWD) INNER BALL BEARING
67	HIGH SPEED PROPEL FOOT PEDAL
68	BOOM HOIST DRUM
69	BOOM HOIST DRUM BALL BEARING
70	HIGH SPEED PROPEL SAFETY STOP
71	R.H. FOOT BRAKE LOCK LEVER
72	L.H. FOOT BRAKE LOCK LEVER
73	CROWD TAKE UP PIN
74	TAKE UP EYE BOLT
75	SPROCKET PIN TAKE UP
76	SPROCKET CHAIN TAKE UP
77	TAKE UP YOKE PIN
78	CROWD DRUM
79	CROWD DRUM BUSH
80	CROWD DRUM SHAFT
81	MAIN ENGINE CLUTCH HAND LEVER
82	REAR DRUM CLUTCH HAND LEVER
83	FRONT DRUM CLUTCH HAND LEVER
84	SWING CLUTCH HAND LEVER
85	STEERING CLUTCH HAND LEVER
86	SWING LOCK LEVER
87	R.H. FOOT LEVER (HOIST BRAKE)
88	L.H. FOOT LEVER (CROWD BRAKE)
89	OPERATORS SEAT
90	BOOM HOIST SAFETY PAWL ROD
91	REV. FRAME CASTING
92	R.H. DECK PLATE
93	REAR END
94	L.H. DECK PLATE

REF NO.	NAME OF PIECE
95	BOOM HOIST HAND LEVER
96	SWING BRAKE HAND LEVER
97	DIGGING LOCK HAND LEVER
98	SWING AND PROPEL JAW CLUTCH LEVER

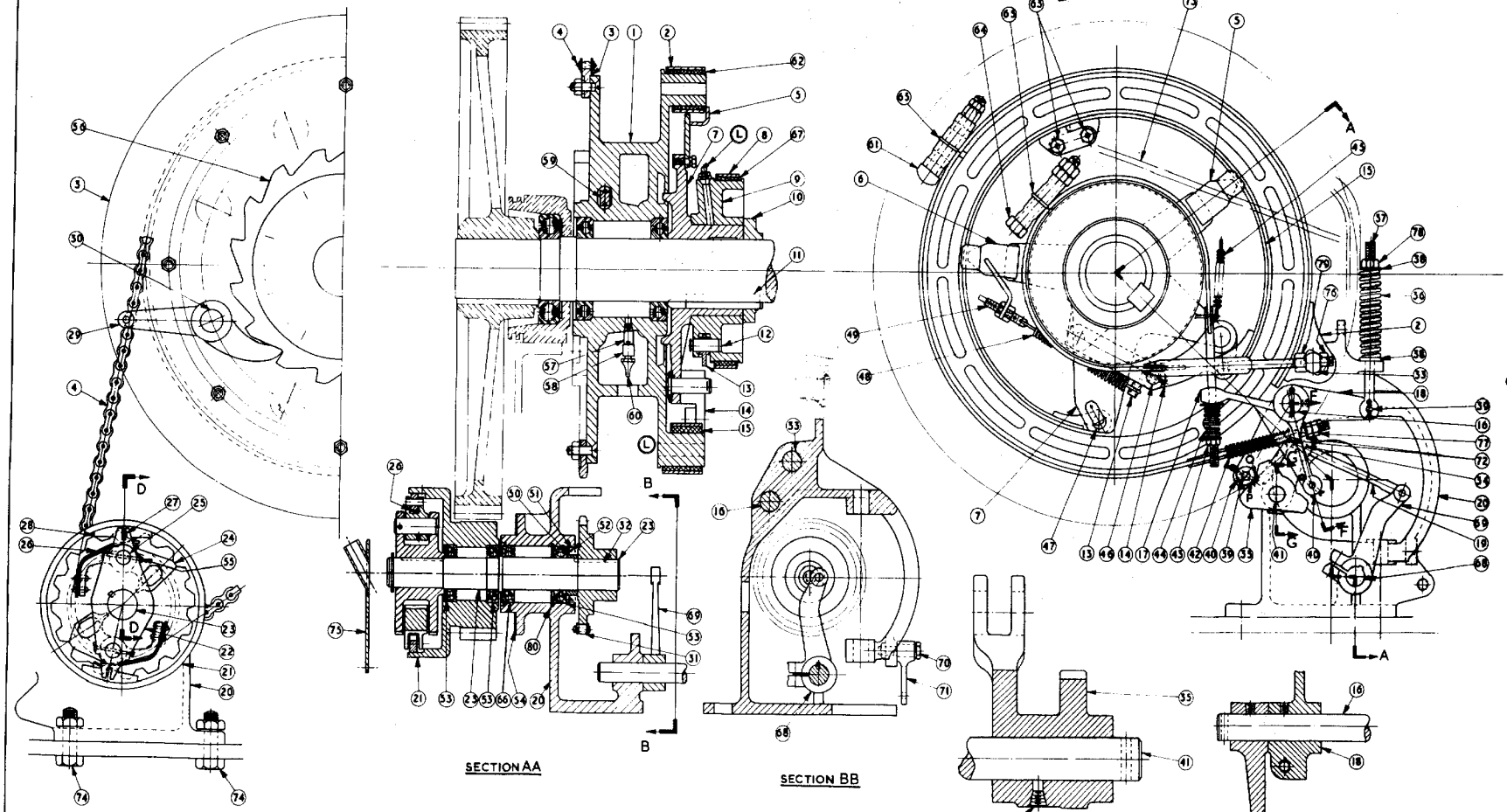
GENERAL ARRANGEMENT OF 22 RB DIESEL SHOVEL MACHINERY (PLAN VIEW)

IMD74/R



SECTION DD

REF	NAME OF PART	REF	NAME OF PART	REF	NAME OF PART	REF	NAME OF PART
1	BOOM HOIST DRUM	21	PINION AND RATCHET HOUSING	41	CAM PIN	61	BRAKE BAND JOINT BOLT
2	BOOM HOIST BRAKE BAND	22	LOWERING PAWL ARM	42	BRAKE BAND RELEASE SPRING	62	BRAKE BAND LINING
3	BOOM HOIST DRUM SPROCKET	23	LOWERING CONTROL SHAFT	43	BOOSTER CUSHION SPRING ADJUSTING NUT	63	CLUTCH BAND JOINT BOLT
4	BOOM HOIST DRIVE CHAIN	24	LOWERING PAWL	44	BOOSTER BAND CUSHION SPRING	64	BOOSTER BAND JOINT BOLT
5	CLUTCH BAND GUIDE	25	LOWERING PAWL PIN	45	BOOSTER BAND RELEASE SPRING	65	WASHER
6	CLUTCH BAND GUIDE AND SPRING BRACKET	26	LOWERING PAWL SPRING	46	BELL CRANK LINK PIN	66	CONTROL SHAFT BEARING
7	CLUTCH DRIVER	27	FRICTION SHOE PIN	47	CLUTCH BAND ANCHOR PIN	67	BOOSTER BAND LINING
8	CLUTCH BAND	28	PAWL FRICTION SHOE	48	BOOSTER SPRING	68	BOOM HOIST OPERATING SHAFT
9	BOOSTER HOUSING	29	DRUM RATCHET PAWL	49	SPRING TAKE-UP BOLT	69	BOOM HOIST OPERATING LEVER
10	BOOSTER HOUSING SPACER	30	PAWL PIN	50	OIL SEAL COLLAR	70	BELL CRANK FULCRUM PIN
11	CLUTCH DRIVER KEY	31	CONTROL SHAFT SPROCKET	51	OIL SEAL SPACER	71	BELL CRANK
12	BOOSTER DRIVING PIN	32	SPROCKET KEY	52	CONTROL SHAFT OIL SEAL	72	SPECIAL WASHER
13	BOOSTER LINK	33	BAND ANCHOR PIN	53	CONTROL SHAFT BEARINGS	73	COVER
14	CLUTCH BELL CRANK	34	CAM REACH ROD PIN	54	TRANSMISSION CASE GASKET	74	BRACKET BOLT
15	CLUTCH BAND	35	OPERATING CAM	55	PAWL ARM LOCKPIN	75	COVER
16	BELL CRANK AND BRAKE LEVER PIN	36	BRAKE SPRING	56	HOIST DRUM RATCHET	76	BOOSTER BAND ADJUSTING NUT
17	BOOSTER LEVER	37	BRAKE SPRING ADJUSTING ROD	57	CLOSE NIPPLE	77	BRAKE BAND ADJUSTING NUT
18	BRAKE LEVER	38	SPRING SEAT	58	STANDARD PIPE COUPLING	78	BRAKE SPRING ADJUSTING ROD NUT
19	CAM REACH ROD	39	CAM ROLLER AND SPRING ROD PIN	59	ROPE ANCHOR WEDGE	79	BOOSTER BAND ADJUSTING NUT
20	LEVER SHAFT BRACKET	40	CAM ROLLER	60	GREASE NIPPLE	80	BEARING RETAINER
						81	SHAFT RETAINER



SECTION AA

SECTION BB

SECTION GG

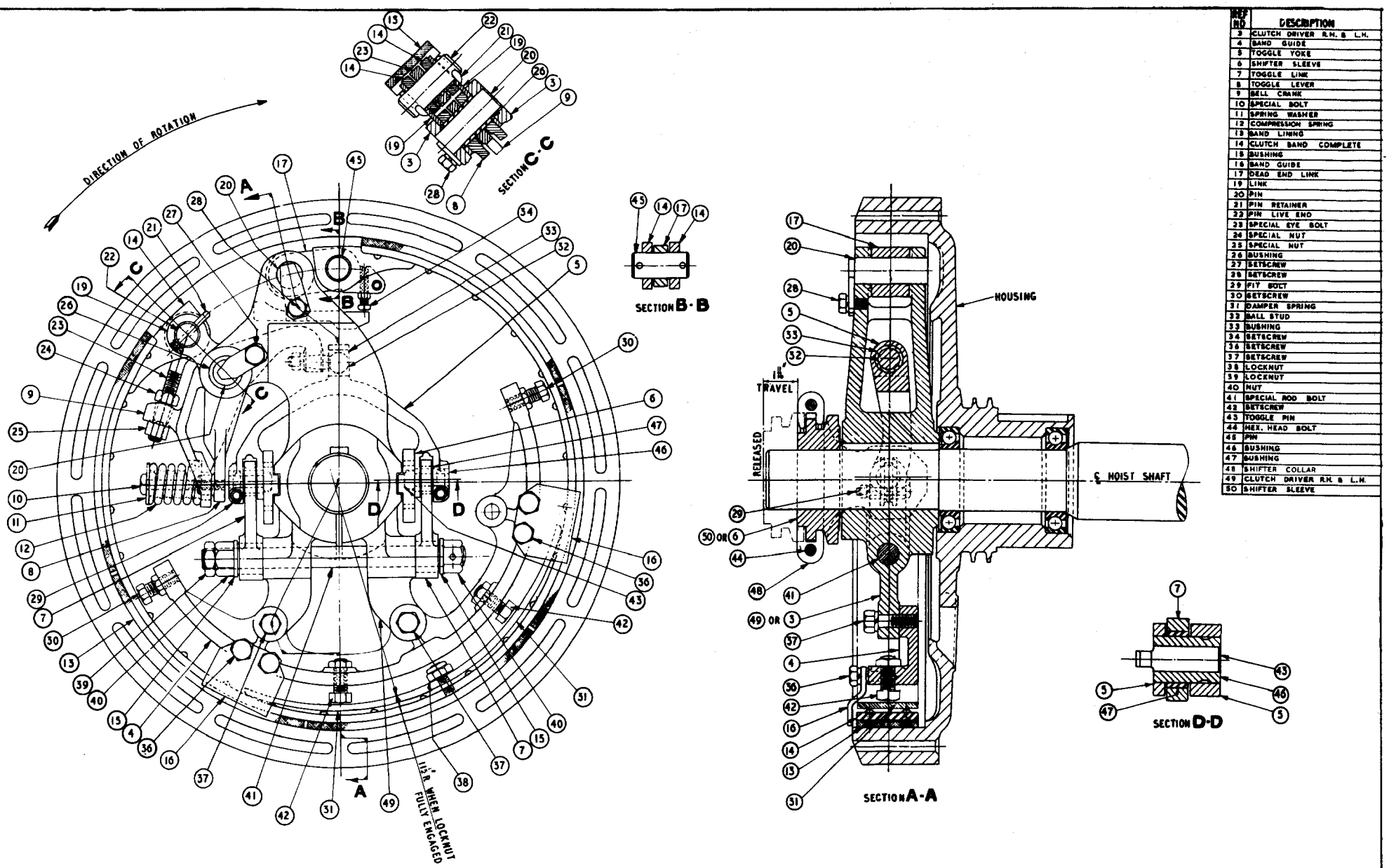
SECTION FF

INSTRUCTIONS FOR INITIAL ADJUSTMENT

1. SET THE BOOM HOIST HANDLEVER IN THE NEUTRAL NOTCH ON THE QUADRANT.
2. BACK OFF NUT (45) AT LIVE END OF THE BOOSTER BAND & NUT (76) ABOVE THE BRAKE COMPRESSION SPRING AGAINST THEIR SPLIT PINS.
3. SLACKEN NUTS (77) AT THE LIVE END OF THE BRAKE BAND UNTIL ROLLER (40) ON BELL CRANK (16) CONTACTS CAM (35).
4. ROTATE CAM (35) BY ADJUSTING THE LENGTH OF REACH ROD (19) UNTIL ROLLER CONTACTS CAM AT POINT 'P'. ADJUST REACH ROD FURTHER UNTIL AN 1/8" GAP IS OBTAINED AT POINT 'Q'.
5. TIGHTEN NUTS (77) UNTIL 1/8" GAP IS OBTAINED AT POINT 'P'.
6. OBTAIN 1/8" GAP BETWEEN CAM (35) AND ROLLER (40) ON BELL CRANK (17) BY ADJUSTING NUT (76) AT ANCHOR END OF BOOSTER BAND, AT THE SAME TIME PULLING LIGHTLY ON ROLLER TO OVERCOME BOOSTER TAKE OFF SPRING (45). TIGHTEN LOCKNUT (79).

GENERAL ARRANGEMENT OF INDEPENDENT BOOM HOIST

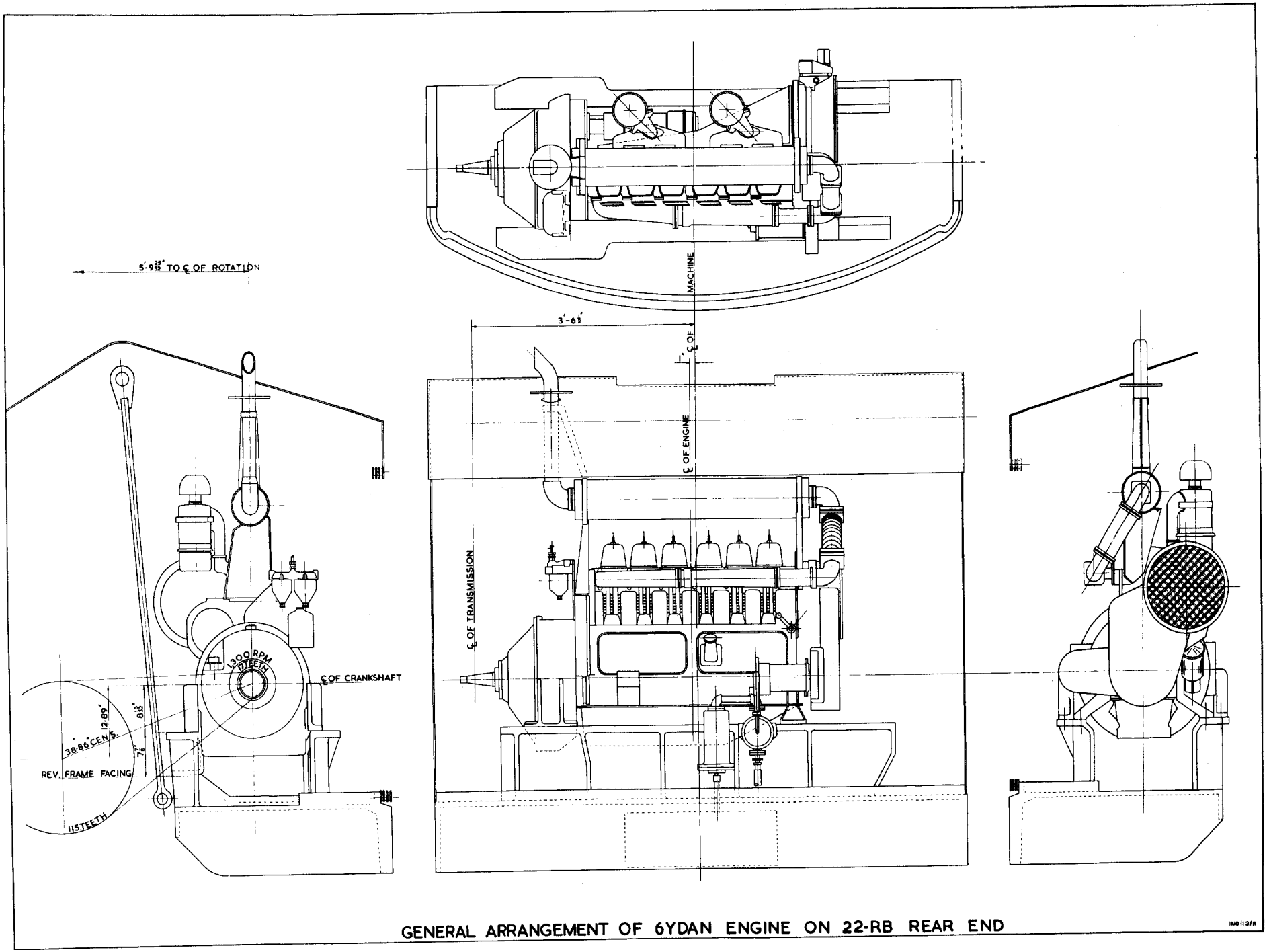
IMD 210/R2



REF NO	DESCRIPTION
3	CLUTCH DRIVER R.H. & L.H.
4	BAND GUIDE
5	TOGGLE YOKE
6	SHIFTER SLEEVE
7	TOGGLE LINK
8	TOGGLE LEVER
9	BELL CRANK
10	SPECIAL BOLT
11	SPRING WASHER
12	COMPRESSION SPRING
13	BAND LINING
14	CLUTCH BAND COMPLETE
15	BUSHING
16	BAND GUIDE
17	DEAD END LINK
19	LINK
20	PIN
21	PIN RETAINER
22	PIN LIVE END
23	SPECIAL EYE BOLT
24	SPECIAL NUT
25	SPECIAL NUT
26	BUSHING
27	SETSCREW
28	SETSCREW
29	FIT BOLT
30	SETSCREW
31	DAMPER SPRING
33	BALL STUD
34	BUSHING
36	SETSCREW
37	SETSCREW
38	LOCKNUT
39	LOCKNUT
40	NUT
41	SPECIAL ROD BOLT
42	SETSCREW
43	TOGGLE PIN
44	HEX. HEAD BOLT
45	PIN
46	BUSHING
47	BUSHING
48	SHIFTER COLLAR
49	CLUTCH DRIVER R.H. & L.H.
50	SHIFTER SLEEVE

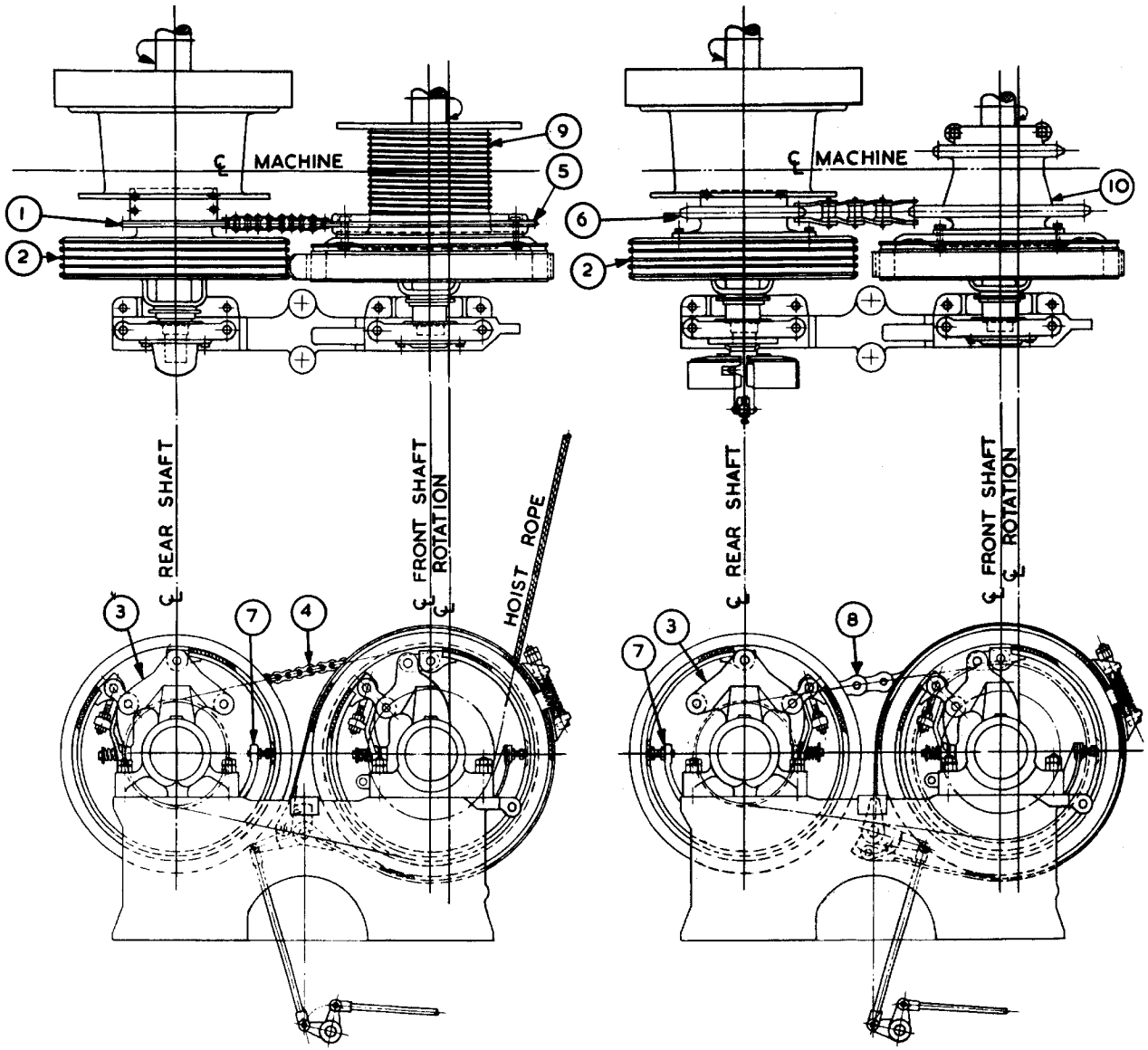
GENERAL ARRANGEMENT OF MAIN CLUTCHES

IMD.115.



GENERAL ARRANGEMENT OF 6YDAN ENGINE ON 22-RB REAR END

IMB 112/R



REF No	DESCRIPTION
1	SPLIT SPROCKET. 30 TEETH.
2	CLUTCH HOUSING
3	CLUTCH DRIVER
4	ROLLER CHAIN 1¼" PITCH. 94 LINKS
5	SPLIT SPROCKET. 61 TEETH.
6	SPLIT SPROCKET. 13 TEETH.
7	BAND GUIDE
8	ROLLER CHAIN 3·067" PITCH 36 LINKS
9	HOIST DRUM
10	CROWD SPROCKET

ARRANGEMENT FOR CRANE WHEN EQUIPPED FOR POWER CONTROLLED LOAD LOWERING.

ARRANGEMENT FOR SHOVEL, SKIMMER, OR STRAIGHT BOOM DRAGSHOVEL.

GENERAL ARRANGEMENT OF DRUM SHAFT CONNECTING CHAINS.

IMD.157.

SECTION 5

5 OPERATING

CONTENTS

ALWAYS PUT SAFETY FIRST

Fig. 1. The operator's position. Take an easy and relaxed position, but keep alert. Remember that you have 66 horse-power and more than 20 tons weight under your control.

TO THE NEW OPERATOR

How to operate an excavator efficiently must be learned in much the same way as any skilled trade. No one is a 'born' operator. Regardless of previous experience, the new operator must use care to operate the machine safely so as not to endanger men or equipment.

At first glance the large number of operating levers may give the impression that operating the machine might be complicated, but most of the levers control some auxiliary function of the machine such as steering, swing lock, etc., and are not used in the regular operating cycle. The three tall levers and the two pedals in front of the operator are the principal controls used in the regular operating cycle, their use will be described in detail further on in these instructions The first thing the new operator must do is to familiarize himself with the purpose of each of these levers.

The best way to learn to drive an excavator is to first go over the levers a few times with the engine dead, to become familiar with their position and names.

Then try moving the levers, remembering that you probably can't move the dog-clutch controls with the shafts stationary.

When you begin to feel acquainted with the arrangement, try starting the engine, engaging the engine clutch, and stopping the engine.

Next you are ready to undertake handling the various motions of the machine. For example, take the hoist (rear-drum clutch and brake) and practice raising and lowering the dipper or bucket in the air a few times. Do it slowly and experiment with this motion and the brake until you are sure of yourself. Set the governor control lever at slow speed while you become familiar with the actual motions.

Then try the crowd or drag (front-drum clutch and brake) and work this combination until you get the feel of it.

Now, after making sure that the machine has plenty of clearance for swinging, experiment with the swing controls. Next work with the boom hoist until that is clear in your mind.

Finally, do a bit of propelling backward and forward (with dipper in the air) and then add steering, until you know how to move the machine safely.

Take your time, move the levers slowly and easily, and make short slow motions backwards and forwards until you really know the controls.

When you have had sufficient practice to be sure of the levers, start going through the motions in proper sequence to dig an imaginary bank. Don't try to combine the individual motions, just go through the cycles slowly, checking your ability to put the dipper where you want it when you want it.

Now move into the bank and try digging dirt. Don't attempt to load into a truck yet, just overcast to a spoil pile against the bank. Take your time and be sure not to swing before retracting the shovel dipper or hoisting it clear of the digging. Increase engine speed gradually to normal as you become familiar with the cycle.

After a few hours of these preliminary exercises, you should be ready to try real digging.

TAKE YOUR TIME and put SAFETY FIRST

GENERAL OPERATING HINTS

(FOR SAFETY AND EFFICIENCY)

When taking over the controls from another operator, adjust the seat to suit your arm and leg movements. (Refer to Fig. 2). A comfortable position will result in less fatigue at the end of the day.

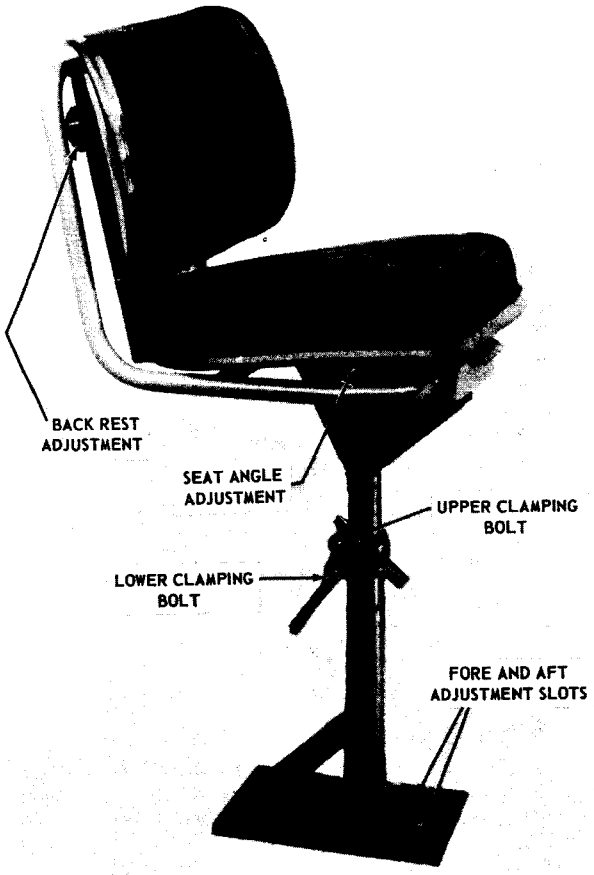


Fig. 2. The Operator's Seat.

Keep the machine neat and clean. Keep all walk-ways clear of obstructions and grease patches etc. This may save you falling over or off the machine. Remember also to keep cab windows clean for good visibility.

When servicing the machine, stop the engine and disengage the main clutch as a precaution against someone else deciding to operate the machine.

Ensure that your clutches and brakes are properly adjusted.

Keep machinery guards securely in place unless servicing the machine.

Do not run the engine with the machine on slopes greater than 1 in 4 in any direction, as this could lead to engine damage arising from inadequate lubrication.

Do not operate the machine with a second person in the operator's compartment.

Do not disengage main engine clutch prior to or during lowering the load, bucket or boom.

Do not mount or dismount from machine whilst it is in motion. Always engage the swing brake or lock before leaving the operator's seat, propelling or transporting the machine.

At all times make sure that you are well clear of overhead wires and if in proximity of power cables make sure that the current is switched off.

NEVER leave your cab with bucket or load suspended and held by the brake. The cooling off of the brake drum may partially release the brake and cause the bucket or load to drop.

OPERATING - GENERAL INSTRUCTIONS

STARTING UP

Before the operator can commence to operate the machine, he must first start up the power unit, whether it be a single electric motor or a diesel engine.

If the source of power is an electric motor then he should carefully read Section 10 covering Electrical Equipment.

More usually it will be a diesel engine that needs to be started, and the operator should refer to the engine instruction book, supplied by the Engine Manufacturer, and which is furnished to users along with this instruction manual. Read it carefully for full instructions on the operation and maintenance of the engine and its auxiliaries.

ENGINE CONTROLS

DIESEL ENGINE CLUTCH (Lever 'D', Fig. 4).

Lever 'D' operates the Diesel Engine Clutch, used on Diesel machines only. It has no regular function in machine operation, but must be disengaged when starting the engine. Use it also to disconnect the machinery in an emergency.

The main engine clutch should not be left in the disengaged position with the engine running for long periods, and should be engaged as soon as the engine is started. Running the engine for long periods with the clutch disengaged will put excessive load on the crankshaft thrust bearing in the engine, which may result in damage to the bearing, or to clutch parts. If it is desired to stop the main machinery for more than three or four minutes, the engine also should be stopped.

To engage engine clutch, push Lever 'D' forward.

To disengage engine clutch, pull Lever 'D' back.

GOVERNOR CONTROL AND ENGINE STOPPING (Fig. 4).

The standard engine for the 22-RB Excavator is a Ruston type 6YDAN Air Cooled Diesel Engine, which develops 75 h.p. at 1300 r.p.m.

The engine is controlled from the operator's position by the Governor Control Lever 'T' and Engine Stopping Pull-Button 'U' shown in Fig. 4. The Governor Control adjusts the governor on the engine to hold any desired engine speed, whilst the Engine Stopping Pull-Button is used only when it is desired to stop the engine.

The governor is set at the factory for the correct engine speed and no further adjustment should be required. However, it is a good plan to check the speed occasionally to be sure the governor is functioning properly.

If no tachometer is available to take the speed of the engine direct, a close check may be made by counting the r.p.m. of the drum shaft.

Put a chalk mark on the front drum clutch spider, and putting the gear in motion, count the number of revolutions in a minute against a stopwatch or centre second hand of a wrist watch. The correct front drum speed of the 22-RB is 37.05 r.p.m.

If the speed is too high it will be injurious to the engine. If it is too low the machine will not operate satisfactorily.

To set the governor at idling speed, push the governor control lever forward as far as it will go.

To set the governor at full speed, pull the governor control lever back.

To stop the engine, pull Engine Stopping Pull-Button upwards. This will move the fuel bar to the no fuel position. Hold in this position until the engine has stopped.

Whenever possible the engine should be run 'light' for a few minutes before stopping.

If the engine has been operated at a low speed for a lengthy period, it should be momentarily speeded up to clear the injector nozzles before closing down.

In all cases the engine speed should be reduced to 'idling' before stopping.

For adjustment of the Engine Controls travel limiting stops refer to Page 16, Section 4.

AIR COOLED ENGINE – IMPORTANT NOTE

In order to maintain free air circulation round the engine the rear doors should be kept open.

This instruction does not apply when experience with the duty of the machine shows engine operating temperatures are below normal.

The operator should maintain the engine temperatures within the band of 212°F (100°C) – 365°F (185°C) on the gauge which is situated on the panel

KEY TO ACCESSORY CONTROLS AND INSTRUMENT REFERENCE NUMBERS ON FIG. 4. (NEXT PAGE)

REF.	DESCRIPTION
1	ENGINE OIL PRESSURE GAUGE
2	WARNING HORN PUSH BUTTON
3	ENGINE COOLING WATER TEMPERATURE GAUGE
4	ENGINE GLOW PLUG PUSH BUTTON
5	EXTERIOR LIGHTING SWITCH
6	INTERIOR LIGHTING SWITCH
7	STARTER BATTERY CHARGING AMMETER
8	ENGINE STARTER BUTTON

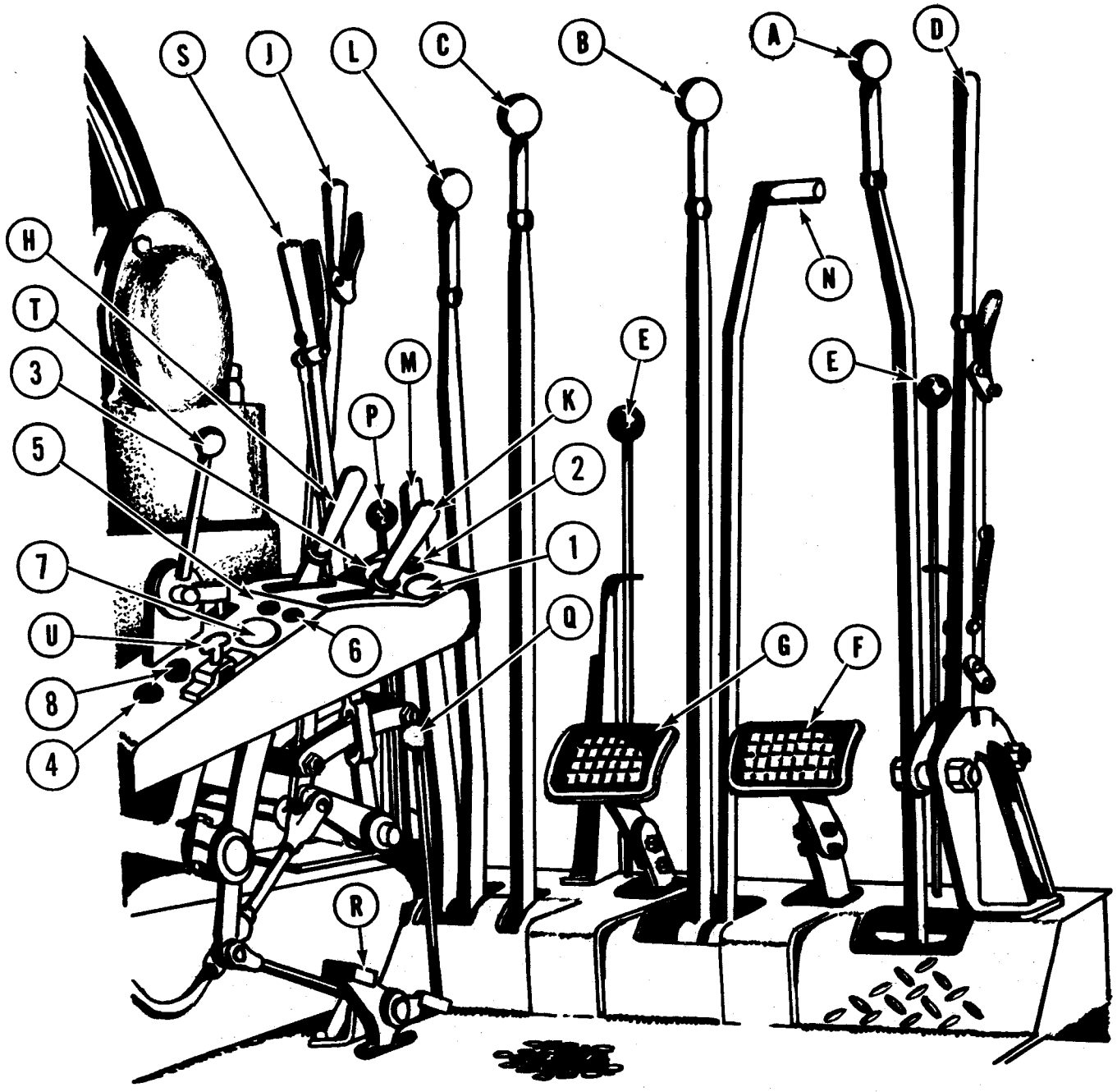


Fig. 4. The Operating Levers at the Operator's Position.

SUMMARY OF CONTROL LEVERS (SEE FIG. 4)

LEVERS CONTROLLING MAIN OPERATING FUNCTIONS

	LEVER CONTROL		PUSH FORWARD	MID POSITION	PULL BACK
COMMON TO ALL FRONT END EQUIPMENTS	C	Swing and Propel Clutches	To Swing Left or Propel Forward from Drive Chain	For Neutral	To Swing Right or Propel Backwards towards Drive Chain
	F	Hoist Brake	To Brake Hoist Drum		Spring Released unless Locked
	G	Second Drum Brake	To Brake Second Drum		Spring Released unless Locked
	E	Foot Brake Locks	Push down to lock Brake Hard-on		Pull up to Release (Normal Position)
SHOVEL	A	Hoist - Rear Drum	To Hoist Dipper		To Release to Lower
	B	Crowd - Front Drum	To Crowd Out	For Neutral	To Retract
	N	Dipper Trip	To Trip		Spring Released
DRAGLINE	A	Hoist - Rear Drum	To Hoist Bucket		To Release to Lower
	B	Drag - Front Drum	To Drag		To Release to Swing Bucket out under Boom Point
CLAMSHELL	A	Hoist - Closing (Front Drum)	To Close and Hoist Loaded Bucket		To Release to Dump
	B	Holding - Lowering (Rear Drum)	To Hoist Empty Bucket Hold with Foot Brake to Dump		To Release to Lower Open Bucket
CRANE	A	Auxiliary Hoist (Rear Drum)	To Hoist		To Release to Lower
	B	Main Hoist (Front Drum)	To Hoist		To Release to Lower
DRAGSHOVELS	A	Hoist - Rear Drum	To Hoist		To Release to Lower
	B	Drag - Front Drum	To Drag		To Release to Run Dipper Out
SKIMMER	A	Hoist - Rear Drum	To Hoist		To Release to Lower
	B	Drag - Front Drum	To Drag (or Dig)		To Release to allow Bucket to Run to bottom of Boom
PILE DRIVER	A	Pile Handling (Rear Drum)	To Hoist Pile		To Release to Lower Pile
	B	Hoist - Hammer (Front Drum)	To Hoist		To Release to Drop

LEVERS CONTROLLING AUXILIARY FUNCTIONS

	LEVER CONTROL		PUSH FORWARD	MID POSITION	PULL BACK
COMMON TO ALL FRONT END EQUIPMENTS	K	Swing and Propel Jaw Clutches	For Propel Position	Neutral-Both Clutches Out	For Swing Position
	D	Main Engine Clutch	To Engage		To Release
	H	Digging Lock	To Lock against movement either way	To Lock against Backward Motion only	To Disengage Pawls for movement either way
	J	Boom Hoist Clutch and Brake	To Lower Boom Safety Pawl Released	To Hold Boom	To Raise Boom
	L	Steering Clutch	All the way to turn sharp right chain to rear / Part way to turn right gradually	To Steer Straight Ahead	Part way to turn left gradually / All the way to turn sharp left chain to rear
	M	Swing Lock	To Release		To Lock
	P	Boom Hoist Safety Pawl	Push Down to Lock		Pull Up to Release
	Q	Safety Device against Accidental Engagement of High Speed Treadle 'R'.	To Release before Moving Treadle Lever 'R' to 'HI' Speed Position		To Engage Safety Lock
	R	High Speed Travel Treadle	Push Down Rear End to Engage		Push Down Front End to Disengage
	T	Governor Control	For Idling Speed	To Select Intermediate Speeds	For Full Governed Engine Speed
	U	Engine Stopping Lever	Lift and Hold until Engine has Stopped		Release for Running Position
CRANE	S	Swing Brake	Apply Brake		Release Brake

THE FUNCTIONS OF THE CONTROL LEVERS

CONTROL LEVERS (Refer to Fig. 4).

The regular operation of the 22-RB machine with all equipments except crane is controlled by three main levers and two foot brakes. Machines equipped as cranes require two main levers and one foot brake.

All machines have auxiliary levers for selective control, which are brought in use when special action is required, such as propelling, raising or lowering the boom, etc.

The function of each lever and its direction of movement etc. are as follows:-

LEVER 'A'.

This lever is pushed forward to set the clutch and controls the rear drum. This drum takes the luffing rope on Skimmers and Dragshovels, also the hoist rope on Shovels and Draglines. In regard to Clamshells, the re-arrangement of levers described in Section 9, under 'Clamshell Conversions' means that lever 'A' sets the forward drum clutch, which controls the closing drum.

LEVER 'B'.

This lever is pushed forward to set the clutch and controls the forward drum. This drum takes the drag rope on Draglines and Dragshovels, the digging rope on Skimmers, the crowd on Positive Crowd Shovels, and the hoist rope on Cranes. In regard to Clamshells, the re-arrangement of levers described in Section 9, under 'Clamshell Conversion' means that lever 'B' sets the rear drum clutch which controls the clamshell holding line.

The linkage of the lever must be altered when converting from Dragline, Clamshell or Crane, to Shovel, Straight Boom Dragshovel or Skimmer, as explained in Section 9.

LEVER 'C'.

This lever controls the slewing and travelling clutches no matter what front end equipment is in use.

With lever 'K' in the rear notch of its quadrant pull lever 'C' to swing to the right and push to swing to the left.

With lever 'K' in the forward notch of its quadrant and the track driving chains to the rear, push lever 'C' to propel forward and pull to propel backwards.

LEVER 'D'.

This lever operates the main engine clutch and moves forward to engage. The main engine clutch should not be left in the disengaged position with the engine running for long periods. If it is desired to stop the machinery for more than three or four minutes, the engine should also be stopped.

FOOT BRAKE LOCK RODS 'E'.

These controls operate the locking devices for Foot Brake Pedals 'F' and 'G'. When either brake pedal is depressed to the limit of its travel, and the appropriate Lock Rod is pushed down, the brake will be locked 'Hard On'. To release, apply foot pressure to the brake pedal, pull the Lock Rod upward and allow the brake pedal to return to its normal 'OFF' position.

RIGHT-FOOT BRAKE PEDAL 'F'.

This pedal normally operates the brake on the rear drum, but for Clamshell operation the linkage is changed over to ensure that the hoist brake on the front drum is controlled by the operator's right foot. (See Section 9 – Conversions).

LEFT-FOOT BRAKE PEDAL 'G'.

This pedal normally operates the brake on the front drum, but the linkage of the two foot pedals is changed over for Clamshell operation. (See 'Pedal F', above).

LEVER 'H'.

This lever operates the digging lock, which is comprised of two pawls engaging with lugs on one of the steering clutches.

THE THREE POSITIONS OF LEVER 'H' ARE SHOWN ON FIG. 6 BUT IT IS IMPORTANT TO NOTE THAT IN ADDITION TO THE INSTRUCTIONS GIVEN ON FIG. 6, LEVER 'H' SHOULD BE SECURELY LOCKED IN ITS QUADRANT BEFORE ENGAGING THE PROPELLING JAW CLUTCH.

LEVER 'J'.

This lever operates the controlled lowering boom hoist brake and clutch. When the lever is in notch on quadrant (NEUTRAL) the booster clutch is released and the spring set brake keeps the drum from turning. PULL BACK TO RAISE THE BOOM. PUSH FORWARD TO LOWER THE BOOM. Stop the boom lowering by returning lever to Neutral position. USE IN CONJUNCTION WITH LEVER 'P'.

LEVER 'K'.

This lever operates the swing and propelling jaw clutches. Moving this lever forward from the neutral position engages the propelling jaw clutch and moving it to the rear of the neutral position engages the swing jaw clutch.

LEVER 'L'. (See Fig. 7).

This lever operates the sliding clutches on the propelling shaft in the truck frame. When this lever is in the middle or neutral position both clutches are engaged.

To turn to the right (track driving chains to rear) push lever forward until the right clutch is disengaged. To turn more sharply, push the lever further forward until the clutch engages with the renewable lock pin, thus locking the right track belt against movement.

Moving the lever to the rear operates the left clutch in a similar manner for steering the machine to the left.

Do not move lever 'L' with the machine in motion, but engage lever 'C' lightly if necessary to relieve the load on the clutches.

LEVER 'M'.

This lever operates the swing lock, which prevents rotation of the revolving frame when travelling. This lever should be pulled to engage the lock. (See Fig. 13, in Section 7).

LEVER 'N'.

This lever operates the dipper trip drum clutch, and should be pushed forward to operate the dipper latch.

LEVER 'P'.

This lever operates the ratchet pawl of the boom hoist drum. The lever should be pulled up to release the pawl, raising the boom slightly if necessary, to release the load. This lever is only used when lowering the boom and should be pressed down to re-engage after the boom has been lowered to the desired position.

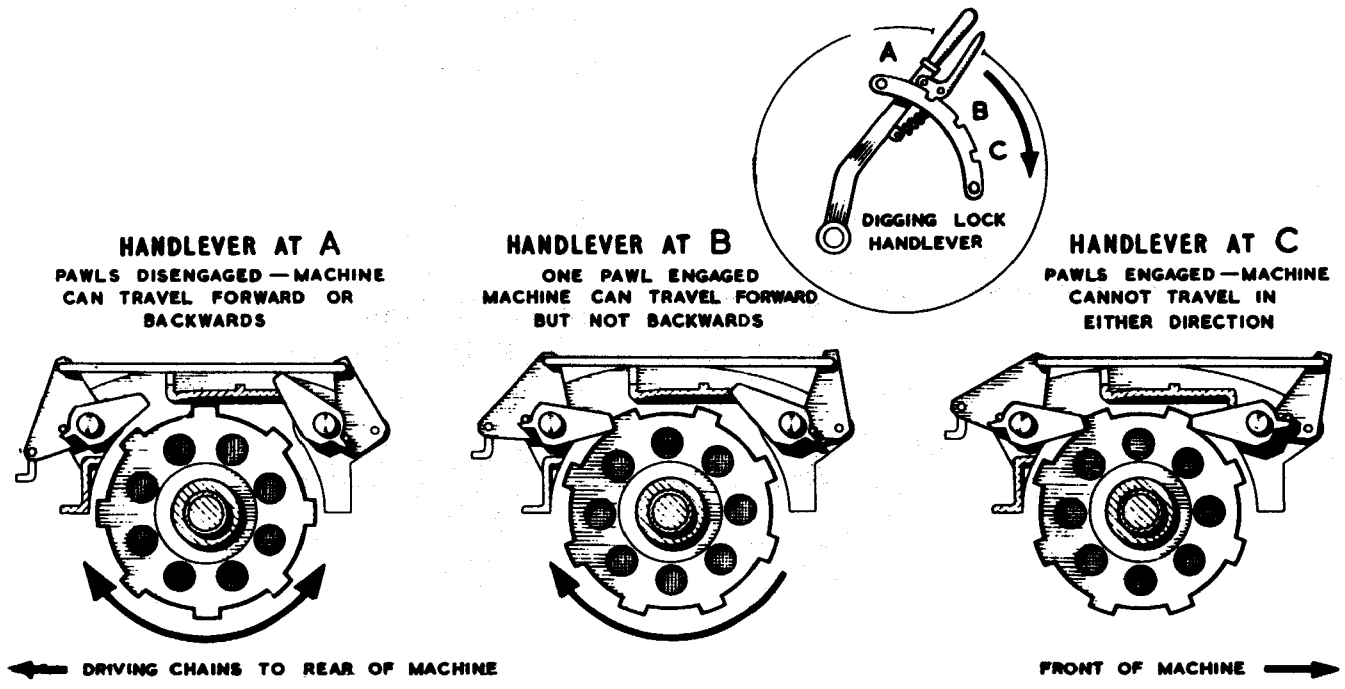


Fig. 6. Digging Lock Handlever Positions.

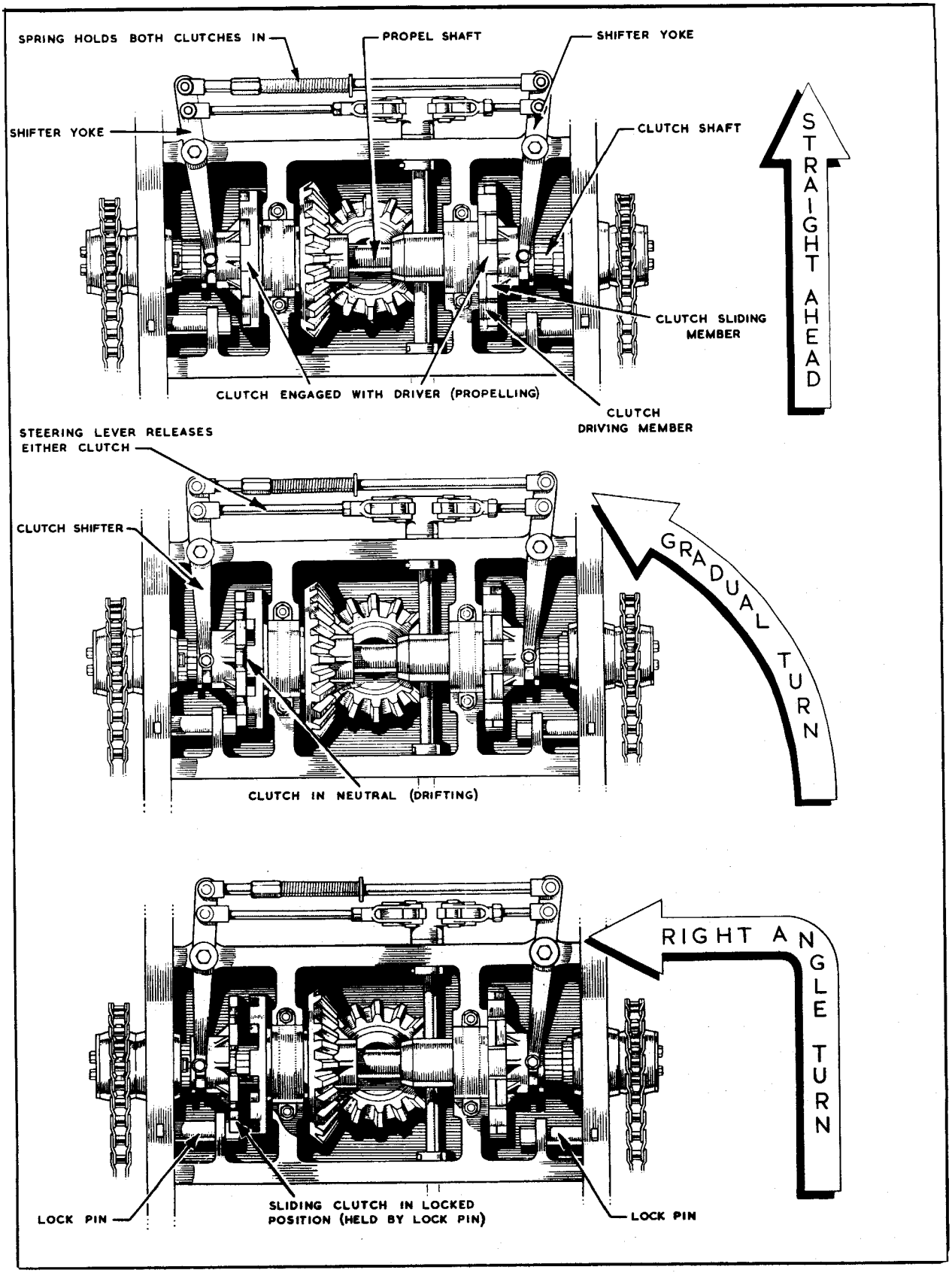


Fig. 7. Operation of the Steering Clutches.

LEVER 'Q'.

This lever operates a safety device to avoid accidental engagement of the High Speed Treadle, and should be pushed forward before moving lever 'R' into the 'High Speed Propel' position.

LEVER 'R'.

This foot treadle lever engages the high speed propel gears when the foot is pressed on the 'HI' notation end.

LEVER 'S'.

This l lever (Fitted as standard on I.C.D. Cranes) operates a brake on the periphery of the rear swing clutch housing.

The brake serves as a slewing brake when the jaw clutch lever 'K' is in the rear notch on the quadrant and it can also be used as a propel brake when lever 'K' is in the forward position.

Push forward lever 'S' to apply brake and pull back to release.

5

FUNCTIONS COMMON TO ALL FRONT END EQUIPMENTS

PROPELLING OPERATION

The normal propelling drive is through the swing machinery so that the machine may be moved in either direction by means of the swing clutches when the swing and propel jaw clutch lever 'K' is in the forward notch of its quadrant.

Before propelling, lock the upper revolving frame by moving the swing lock lever 'M' to the rear. This engages the swing locking dog to hold the revolving frame against rotation. With the track driving chains to the rear, push hand lever 'C' to propel forward, and pull to propel backwards.

HIGH SPEED PROPELLING OPERATION

On diesel powered machines the high speed propelling is obtained (in the forward direction only) by a separate drive independent of the swing clutches. This drive is engaged or disengaged by a foot treadle below and to the left of the operator's seat. To propel at high speed, engage the propelling jaw clutch previously described, push on lever 'Q' to release the safety device on lever 'R'. Then move the high speed propelling gear on the transmission shaft into mesh with the propelling drive by depressing the rear end of the treadle and feeling the pinion into mesh by partially engaging the engine clutch. To propel, engage the engine clutch.

IT IS ABSOLUTELY ESSENTIAL THAT THE SWING AND PROPELLING CLUTCHES SHOULD NOT BE OPERATED WHILST THE HIGH SPEED PROPELLING IS IN USE, OTHERWISE SERIOUS DAMAGE MAY RESULT.

High speed propelling is not provided on electrically operated machines.

STEERING

Steering is controlled with the revolving frame in any position by Lever 'L' and has to a great extent already been dealt with under the sub-heading 'Lever 'L'', on Page 9 with much of the mechanism illustrated in Figure 7 on Page 10.

The Lever 'L' operates the sliding clutches on the horizontal propelling shaft in the truck frame by linkage through the centre of rotation.

When travelling with the drive chains at the rear, and the operator facing the direction of travel, the steering lever operates as follows:-

Push Lever 'L' part way forward for gradual turn to right.

Push Lever 'L' all way forward for sharp turn to right.

Pull Lever 'L' back to centre to steer straight ahead.

Pull Lever 'L' part way back for gradual turn to left.

Pull Lever 'L' all way back for sharp turn to left.

When the drive chain is leading, the steering operation will be reversed, and moving Lever 'L' forward will steer left instead of right.

If propelling for any great distance, always have the driving chain at the rear. Travel in this direction provides a tight crawler track belt on the bottom and reduces wear of the tumbler lugs.

It is necessary to **STOP PROPELLING TO RELEASE OR ENGAGE STEERING JAW-CLUTCHES** for changing direction. If steering control lever 'L' does not release easily, engage friction clutch lever 'C' lightly for reverse direction, to relieve pressure on jaw engagement.

From the above notes and reference to Fig. 7, it will be seen that under no circumstances can both clutches be out of engagement at the same time, which ensures that the machine could not normally run back, out of control, down a steep gradient

As a precaution against an unforeseen mechanical failure occuring in any part of the propel drive or operating mechanism, when negotiating steep gradients it is advisable to have a groundsman available so that a block of hard wood could be placed in the track belts behind one of the tumblers to prevent the machine running down the gradient out of control.

When standing on a gradient, the swing and propel changeover jaw clutches must never be taken from the propel to swing position without both propelling and steering clutches being engaged in the propel drive position and the digging lock set.

When digging on a gradient, should it be required to travel down the gradient, the change over from swing jaw clutch engagement to propel jaw clutch engagement must be made before the digging lock preventing the machine moving down the gradient is released.

IF PROPELLING DOWN A STEEP GRADIENT, ANY TENDENCY FOR THE MACHINE TO 'RUN AWAY' MAY BE ARRESTED BY ENGAGING THE REVERSE PROPEL CLUTCH.

WHERE THE MACHINE IS FITTED WITH A SWING BRAKE, THIS SHOULD BE USED AS A PROPEL BRAKE TO ASSIST IN SLOWING THE MACHINE.

IF IT IS NECESSARY TO CHANGE DIRECTION WHEN TRAVELLING DOWN STEEP GRADIENTS, STEER BY LOCKING THE TRACK OPPOSITE TO THE DIRECTION OF TURN AND REVERSING ON OTHER TRACK UNTIL REQUIRED CHANGE OF DIRECTION IS ACHIEVED.

SWINGING (OR SLEWING) OPERATION

When you wish to 'swing', always make sure that the Digging Lock Lever 'H' is in a suitable position; preferably in the forward notch, locking the tracks against movement in either direction, but certainly NOT in the rear position, when the machine would be free to run away in either direction out of control.

When the Lever 'K' is pulled back into the rear position, the 'swing' jaw-clutch is engaged, and the function of Lever 'C' will be to control the swing motion. Be sure that the swing-lock lever (Lever 'M') is in the released position (Pushed forward) before engaging the clutches.

To swing to the right, pull Lever 'C' back.

To swing to the left, push Lever 'C' forward.

To stop the 'Swing' momentarily engage the clutch for 'swing' in the opposite direction. On machines that are fitted with a band type brake on the rear swing clutch housing, more sensitive control can be obtained by operating this brake. Pull Lever 'S' back to apply brake. Push forward to release.

NOTES:

DON'T attempt to engage either the swing or propel jaw-clutches, (Lever 'K') without being sure to disengage the main swing and propel friction clutches by placing Lever 'C' in the neutral position. If the jaws do not engage readily, rotate them slightly by using friction clutch. Also on diesel machines it will make for easier engagement of the jaw-clutches if the engine is slowed down to tick-over speed by means of the governor control lever (Fig. 3).

DON'T try to swing the machine when the swing lock (Lever 'M') is engaged.

DON'T attempt to engage the swing lock when the revolving frame is in motion.

DON'T swing the machine into the bank or other obstruction.

When digging, keep Lever 'K' back in swing position continuously.

When moving either forward or backward, keep Lever 'K' forward in propelling position.

The intermediate or neutral position disengages both swing and propel jaw-clutches and is

only used where desirable for maintenance jobs, such as lubricating the gear teeth on swing and propel gears.

DIGGING LOCK (Lever 'H', Fig. 4.)

This control has already been referred to under the heading 'Swinging', and the device is illustrated and described on Fig. 6, page 9, but the following points should be carefully noted.

In practice it is usual to use the intermediate position of the lever, to lock the machine against digging reaction yet permitting working movement of the machine without changing the position of the digging lock lever. For Shovel operation it is usual to operate with the drive chains to the rear. For dragline it is usual to operate with the drive chains forward. This arrangement tends to keep the top side of the drive chains and the lower ground contacting sections of the track belts in tension, making for more efficient drive, and preventing any tendency for the track to bunch up.

The forward notch position, (Handlever at 'C', Fig. 6) which is actually the safest and locks against movement in either direction, is seldom used when digging, except when working as a shovel on a down grade, when it is necessary to prevent the machine moving from gravity as well as digging reaction. Keep the lever in this position whenever you can reasonably avoid using either of the other positions.

Use the rear notch position when it is desired to move the machine in both directions for Crane and Clamshell work on level ground, and when there is no digging reaction.

It may be necessary to turn the steering clutch driver slightly to relieve load on the pawls before the digging lock lever can be shifted.

DO NOT

Engage digging lock when the machine is in motion, except in extreme emergency.

Park the machine on a slope without engaging digging lock.

Ship the machine on a trailer or truck without engaging digging lock to prevent movement in either direction.

BOOM HOIST OPERATION

The raising and lowering of the boom is controlled by lever 'J' in conjunction with lever 'P'. Before attempting to lower the boom it is vitally important that the adjustment of the brake should be checked.

TO LOWER BOOM

Raise boom slightly to ensure release of locking pawl. Lift up boom hoist lock lever 'P'. Release brake by moving boom hoist clutch and brake handlever 'J' forward. Stop the boom lowering by returning the boom hoist clutch and brake handlever to neutral. If boom has a tendency to continue lowering after handlever has been returned to neutral pull the handlever back past neutral. This sets the clutch for raising the boom and quickly brings the boom to a stop.

As soon as boom has stopped lowering, immediately engage the locking pawl by pressing down the boom hoist lock lever 'P'.

The speed of lowering can be regulated to any desired speed by controlling the speed of the main engine.

TO RAISE BOOM

Pull back on boom hoist clutch and brake handlever (it is not necessary to release the locking pawl). When the boom has reached the desired position return the boom hoist clutch and brake hand lever to neutral. The spring set brake will stop the drum turning and hold same. To ensure that the locking pawl is engaged in one of the ratchet teeth, release the brake momentarily.

CAUTION

WHEN OPERATING A CRANE EQUIPMENT WHICH IS FITTED WITH A 'WYLIE' AUTOMATIC SAFE LOAD INDICATOR AND IT IS NECESSARY TO LOWER THE BOOM TO CHANGE THE BOOM LENGTH ETC., IT IS IMPORTANT TO AVOID POSSIBLE DAMAGE TO THE 'WYLIE' INDICATOR CAM ROD. IF THE BOOM IS TO BE LOWERED BEYOND HORIZONTAL, IT IS RECOMMENDED THAT THE CAM ROD BE TEMPORARILY DISCONNECTED. IF LEFT CONNECTED IT IS POSSIBLE FOR THE CAM ROD AND LEVER TO PULL INTO LINE AND DROP PAST TOGGLE POINT; THEN WHEN THE BOOM IS RAISED THE LEVER CANNOT RETURN AND THE CAM ROD MAY BE BADLY BENT.
WHEN CHANGING FROM CRANE TO EXCAVATING DUTY OR BACK AGAIN, THE INDICATOR LOCK-OUT DEVICE MUST BE SET IN ACCORDANCE WITH INSTRUCTIONS ON PAGE 9, SECTION 9.

IMPORTANT

WHEN OPERATING AS SHOVEL, DRAGLINE, CLAMSHELL OR CRANE, THE MAIN ENGINE CLUTCH MUST NOT BE DISENGAGED PRIOR TO OR DURING LOWERING THE DIPPER, BUCKET OR LOAD.
THE OPERATOR SHOULD NEVER DISMOUNT FROM HIS MACHINE LEAVING THE BUCKET OFF THE GROUND AND HELD ON THE BRAKE. NORMAL OPERATION TENDS TO WARM UP AND EXPAND THE BRAKE HOUSINGS, AND IF THE MACHINE IS LEFT WITH THE BUCKET HELD ON THE BRAKE, THE HOUSING MAY COOL OFF AND CONTRACT, THUS ALLOWING THE BRAKE TO SLIP AND THE BUCKET TO LOWER OFF.

ALWAYS LOWER THE BUCKET TO THE GROUND BEFORE LEAVING THE MACHINE.

OPERATING – FRONT END EQUIPMENTS

ROPE CROWD SHOVEL OPERATION

The operating cycle of the Shovel (Fig. 8) is made up of four basic motions:-

1. Hoist - raising and lowering the dipper.
2. Crowd - thrusting and retracting the dipper.
3. Swing - swinging dipper between digging and dumping points.
4. Dump - opening door in dipper-bottom to discharge load.

A skilled operator combines these motions into a smooth fast cycle. He hoists and crowds simultaneously and in just the right proportions to fill the dipper in the shortest time. He starts to swing as soon as the dipper is out of the bank, hoists and crowds the dipper into dumping position as he swings, starts to dump before the swing is quite finished, and lowers the dipper as he swings it back to the digging point. The machine is so designed and built that the operator can combine motions smoothly and without undue strain or fatigue.

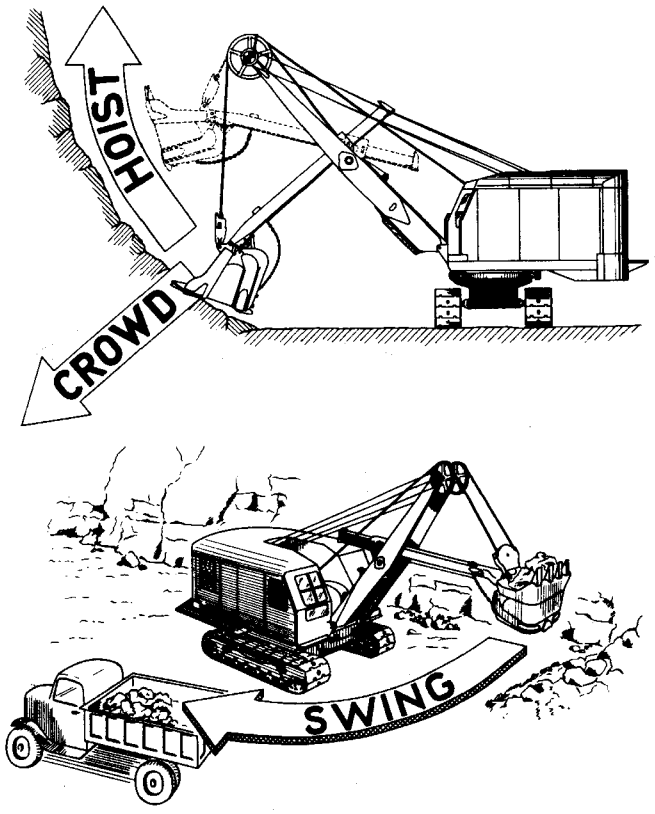


Fig. 8. The Basic Motions of a Shovel.

WHERE TO USE THE SHOVEL

The shovel has the shortest cycle of any of the front end equipments, consequently it will produce the greatest output where conditions permit the 'out-and-up' digging motion.

In contrast to other front-ends, the shovel can be used to greatest relative advantage where:-

1. Material to be dug is relatively hard.
2. Digging and dumping points can be close together.
3. Accurate dumping is required.
4. Dumping point is above but not too far above machine level.
5. Excavation is large enough to allow machine to be worked in it.

Rule of thumb: Use shovel front-end whenever you can.

OPERATING CONTROL

Digging with a rope crowd shovel equipment is controlled by levers 'A', 'B' and 'C', and brake pedals 'G' and 'F'. Lever 'B' controls operation to the dipper handle.

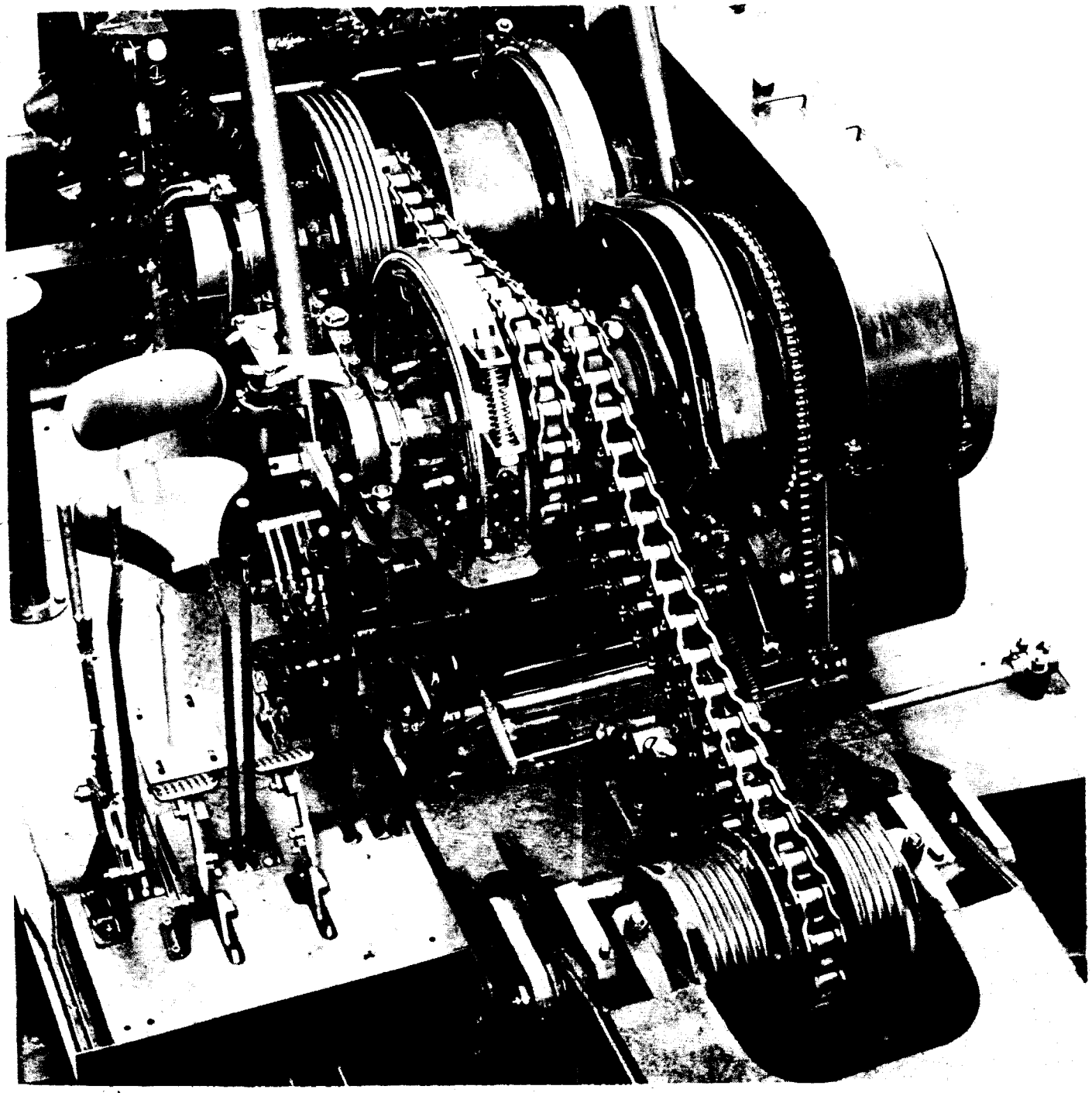


Fig. 9. Deck Machinery arranged for Shovel Operation.

With the machine equipped as a rope crowd shovel, lever 'B' operates two clutches, namely the clutch on the forward drum and the right hand clutch on the rear drum shaft. A study of the rope crowd reeving diagram in Section 8 of this book will show that the twin crowd rope and single retract rope are reeved on to the crowd drum at the boom foot.

Reverse operation of the dipper handle is obtained by connecting both the right hand rear clutch and crowd drum to the front main drum by means of two roller chains as shown in Fig. 9. Lever 'B' then operates the same as the swing lever, i.e. it operates the forward drum clutch when pulled backwards and the right hand clutch on the rear shaft when pushed forward to the 'crowd

out' position. This provides for reverse operation of the forward drum, thus giving reverse motion to the dipper handle.

Lever 'A' controls the rear drum and the hoisting of the dipper.

Lever 'C' controls the slewing (or swing) motion.

Brake Pedal 'G' controls the brake on the forward drum.

Brake Pedal 'F' controls the brake on the rear or hoist drum.

To commence digging, and assuming that the dipper is at the toe of the face, push on lever 'A' to commence hoisting, and push on lever 'B' to thrust the dipper into the face.

The depth of cut is controlled by lever 'B', and the dipper should be withdrawn from the face if the cut is too heavy and tends to stall the engine. When the dipper is full, withdraw it from the face by means of lever 'B' releasing the crowd clutch and applying the crowd brake when the dipper is clear of the face; stop the hoist and apply the hoist brake, and operate on lever 'C' to swing to the dumping position. After dumping the material, swing back to the face and at the same time lowering the dipper on the foot brake so that by the time the return swing is completed the dipper is down ready to take another cut.

The lowering of the dipper on the brake should be done steadily and the dipper must not be allowed to strike the ground heavily, or strike any portion of the crawler tracks. When the return swing is completed, the dipper may be forced into the face once more and the digging cycle repeated.

For dumping the material a power operated dipper trip is provided, and this is operated by lever 'N'. When the dipper has been swung round to the dump or truck a slight push on lever 'N' will open the dipper door and the material will be discharged.

When digging in a high face, and unless for special reasons a cut the whole depth of the face is required, the operator should commence by digging half way up the face and clearing the upper half before digging at the toe. There is no advantage in forcing a full dipper through a high face, and by taking off the upper layer first, the operation is quicker and the machine is not unnecessarily overloaded.

Whenever levers 'A' and 'B' are operated to stop the hoisting or thrusting, the respective brake pedals should be simultaneously applied to prevent the dipper dropping or running out.

When swinging, the clutch should be released before arrival at the dump, thus allowing the momentum of the revolving frame to carry the machine to the dumping position, and making unnecessary excessive braking with the clutches to stop the swing. Practice will indicate at what period of the swing the friction should be released.

Facilities are provided for altering the rake or pitch of the dipper for various kinds of digging. Generally speaking, if the digging is hard or it is desired to dig down hill, the dipper should be adjusted for the forward dip; if in easy digging and a level floor is required, the front of the dipper should be tilted towards the dipper handle.

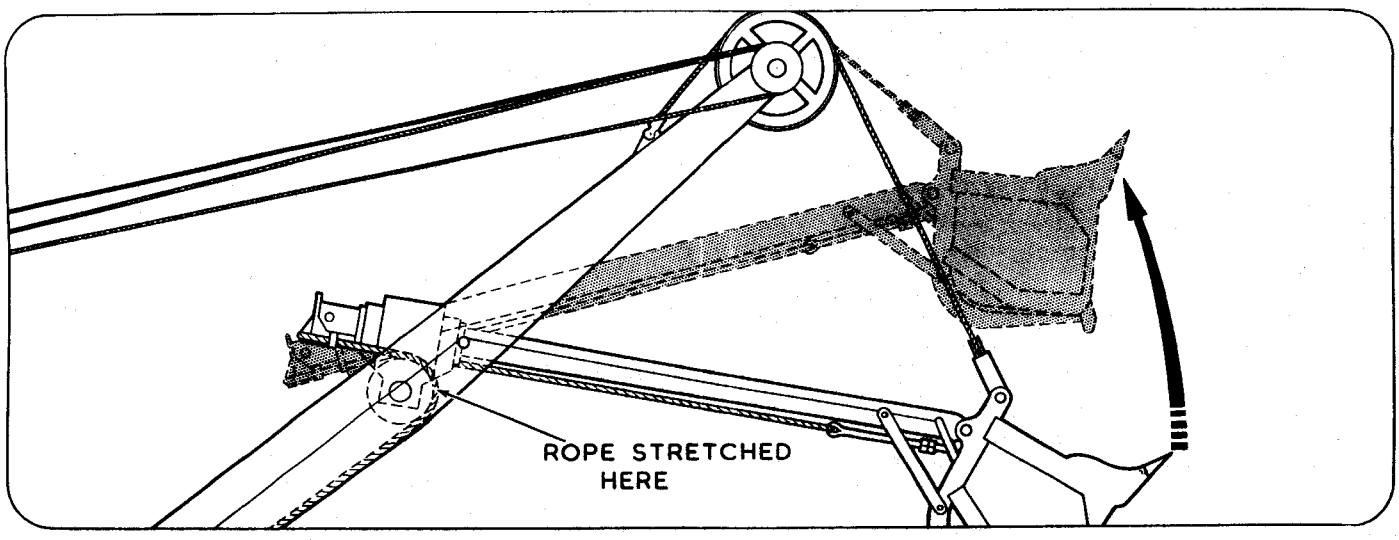


Fig. 10. Effect of Hoisting Fully Extended Dipper Arm.

NOTE: (See Fig. 10.)

WITH THIS EQUIPMENT, THE DIPPER HANDLE SHOULD NOT BE HOISTED WHEN IT IS FULLY EXTENDED. THIS ACTION TENDS TO STRETCH THE CROWD ROPES, OR DAMAGE THE REVERSING CHAIN BETWEEN THE DRUMS. IF THE FULL EXTENT OF THE DIPPER HANDLE IS REQUIRED FOR DISCHARGING PURPOSES, THE HOISTING MOTION SHOULD FIRST BE COMPLETED, AND THEN THE CROWD OUT UTILISED.

WHILST DIGGING, IT SHOULD NOT BE NECESSARY TO USE THE FULL EXTENT OF THE CROWD OUT MOTION, AND THE MACHINE SHOULD BE MOVED UP BEFORE THIS IS REQUIRED.

WHEN HOISTING THE DIPPER, THE END STOP ON THE HANDLE SHOULD BE AT LEAST NINE INCHES FROM THE SADDLE BLOCK.

SHOVEL OPERATING HINTS.

Actual digging operations with a Shovel require combining the Hoist, Crowd and Swing motions into a fast, smooth operating cycle which cannot be described in any step by step procedure, as actual movement of the levers depends on individual digging conditions.

There are many little operating tricks which will come from experience and some of these are included in the following list of points to remember in operating the Shovel

1. Keep dipper teeth sharp.
2. Heap the dipper! Get a full load every time you dig.
3. Take a relatively thin slice at a cut so that the dipper hoists through the bank fast and easily. Overcrowding slows down the hoist and does not increase speed of filling.
4. It is NOT necessary to pull the dipper through full depth of the bank to fill. Take just enough out to fill your dipper and pull out. For high banks take top passes first.
5. See that the dipper pitch braces are adjusted to give dipper the most efficient digging angle. Maximum 'rake' for hard digging, high banks and grading. Minimum 'rake' for easy digging low cuts.
6. Save loading time with two-truck spotting. Have truck spotted in as close to digging as is safe, always the same distance from centre of rotation, and lined up with the arc of swing. (See Fig. 11.)
7. Keep the Shovel as near the face of the bank as safety will permit and always move up before it is necessary to reach out with the dipper to dig the material.

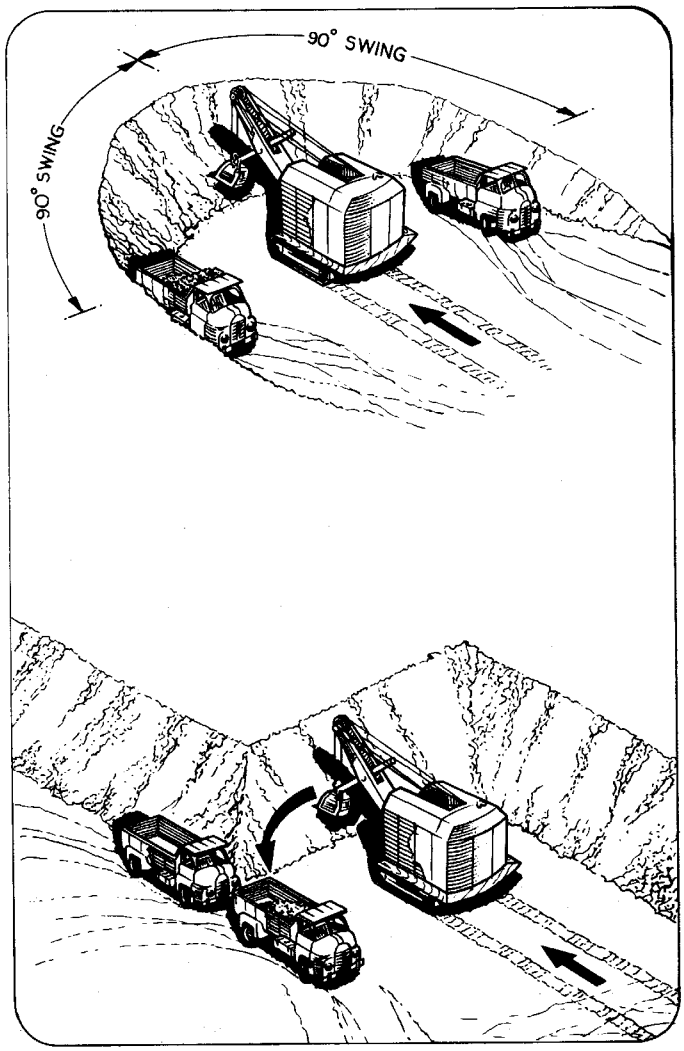


Fig. 11. Positioning Trucks for Excavator Loading.

8. Take cut out in layers across the entire face. Start digging next to spotted truck and work in toward centre of cut.
9. Move up while waiting for trucks whenever possible.
10. Help trucks coming in for loading in an even, cycle, by getting first truck or two out especially fast, if they begin to jam up. Avoid that 'Convention' of Trucks, it indicates poor planning.

11. Avoid excessive crowding and hoisting. Hoist the dipper only just high enough to provide clearance for the dipper door when swung down in dumping. Don't continue hoisting if the dipper handle is fully extended against the saddle block stop. Retract the handle a few inches by releasing the crowd brake slightly, then finish hoisting.

12. When lowering back into the pit, allow the dipper handle to run in by gravity while the handle is above the horizontal and run out when the handle is below horizontal.

13. Keep the dipper under control. Don't permit dipper handle to retract too rapidly, and avoid striking bumper on boom with dipper or hitting crawler tracks with dipper. A little care will save maintenance costs.

14. Be careful not to ride the crowd brake when either crowd clutch is engaged. Stop movement of the dipper handle by engaging the opposing clutch and use the crowd brake only when it is necessary to hold the handle in position with the crowd lever in neutral. (As when swinging and hoisting at the same time, which requires the use of both hands).

15. Never strike spoil bank with dipper to stop swing of boom, or attempt to level off ahead of machine by swinging the dipper back and forth like a broom. Such practices cause undue loads. Use the proper functions of the machine, if you want to avoid trouble.

16. Keep the machine working with the full length of both tracks on a solid footing. Concentrated loads invite trouble. If there is a hump, dig it out or move round it.

17. Shovel booms usually are worked 45° to 50° for general digging. Lowering the boom permits a longer cut in a shallow bank at better hoist rope angle and also gives you extra reach. Raising increases dumping height and improves stability for heavy digging.

18. Spot trucks so that they can be loaded from the rear. Never swing over cab of truck. In unloading dangerous materials, have the driver get out of the truck and stay on the safe side.

19. Men should be kept out of the pit as much as possible. Have them watch out for caving banks and rolling stones -- and be ready to run. The shift in bank stresses before a cave-in usually is indicated by a trickle of loose material. Never swing the dipper over the ground crew, and be sure that everyone is clear before backing up.

20. Don't overload trucks. Load evenly, and don't drop the load into the truck from a height and bang the body to pieces.

21. In sticky material try to save any dry or coarse material to spread in the bottom of the truck to act as a cushion and help to ease dumping.

22. Never leave the machine overnight, or for the weekend, against a high bank, or in a hollow where a caving bank or flash floods might endanger the machine.

DRAGLINE OPERATION

The operating cycle of the Dragline (Fig. 12) is made up of four basic motions:-

1. Drag - pulling bucket through material to fill and controlling dump.
2. Hoist - lifting bucket from digging to dumping height and helping to control filling.
3. Swing - swinging bucket between digging and dumping points.
4. Dump - slacking drag-rope tips bucket vertically.

A good operator will combine the motions into a smooth cycle. Since control of the bucket is not through a rigid handle as with the shovel, even greater skill is required to put the bucket where it is desired for digging and dumping. The digging teeth in the bucket are set at such an angle that they tend to penetrate the ground when pull is applied through the drag-rope. However, the only digging force that can be applied is the weight of the bucket and the pull of the drag-rope. Consequently, the dragline cannot dig as hard material as the shovel.

WHERE TO USE THE DRAGLINE

In general, the dragline is ideally fitted for digging where:-

1. Material to be dug is soft to medium hard.
2. Digging is at or below machine level.
3. Digging and dumping points are relatively far apart, both horizontally and vertically.

4. Material need not be dumped accurately within a small space.

The dragline can be used for underwater digging, although the action of the water will decrease output.

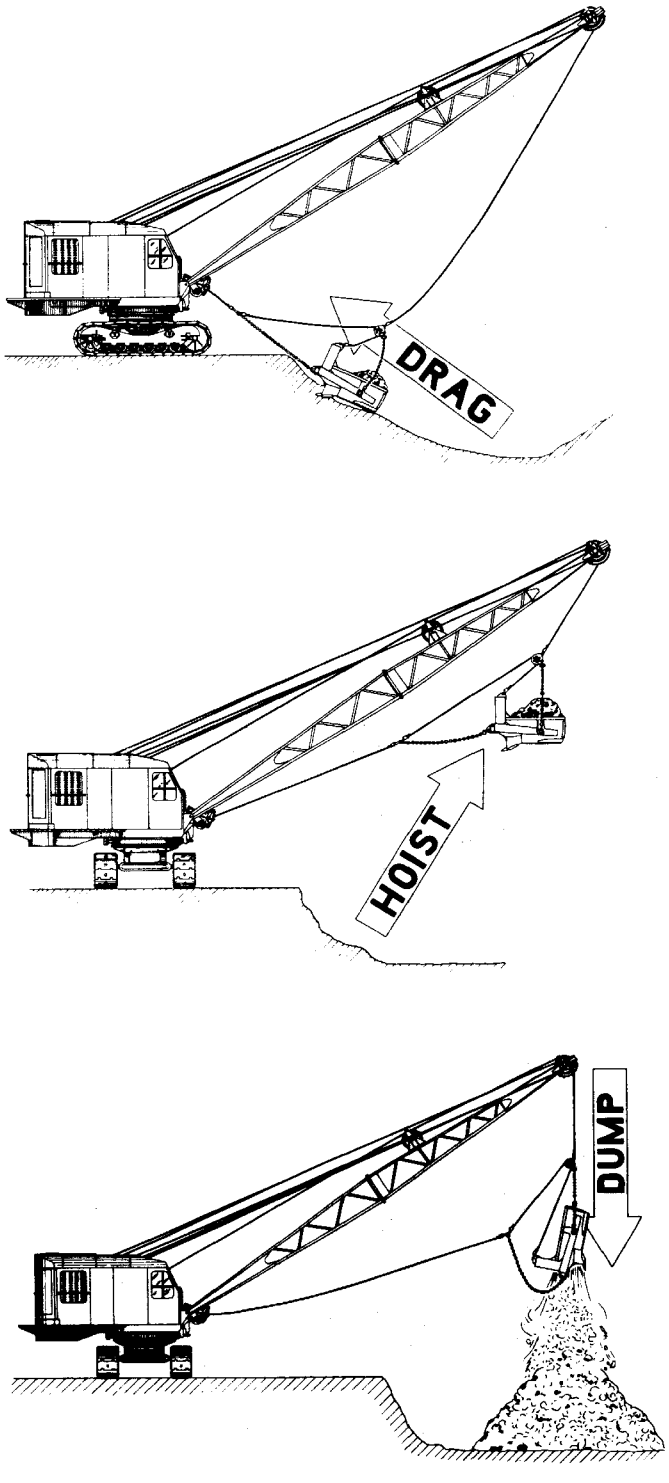


Fig. 12. The Basic Motions of a Dragline.

DRAGLINE OPERATING CONTROL

The right hand clutch on the rear drum shaft is not used when the machine is fitted with dragline equipment.

The forward drum takes the drag rope, and the rear drum takes the hoist rope, therefore lever 'B' controls the drag, and lever 'A' the hoist.

To commence digging, lower out the bucket to the point where the cut is to commence, and apply lever 'B' to drag in the bucket. The weight of the bucket should be allowed to penetrate the material, but if the bucket bites in too deeply, the cut may be controlled by applying the hoist brake. The bucket should be withdrawn from the cut as soon as it is full by applying the hoist clutch, and at the same time releasing the drag clutch and applying the drag brake. As soon as the bucket is clear of the cut, swing to the right or left as desired. Whilst swinging to the dumping point, allow the bucket to creep out on the drag brake whilst hoisting and swinging, so that the bucket is in a position to dump as soon as the dumping point is reached.

Dumping is accomplished by releasing the drag brake which causes the bucket to assume a vertical position, thus discharging its contents. It is important to remember that when releasing clutches the respective brakes should be immediately applied to prevent the bucket dropping or running out, also to keep the ropes taut.

THERE IS A DANGER THAT THE ROPES MAY BECOME CROSS COILED, OR EVEN REVERSED COILED IF PROPER CONTROL IS NOT KEPT WITH THE RESULT THAT ROPES BECOME DAMAGED AND BREAK BEFORE A USEFUL LIFE HAS BEEN SERVED.

The bucket should be raised from the cut as soon as it is full, AND CARE SHOULD BE TAKEN TO AVOID PULLING THE DRAG ROPE ANCHOR INTO THE FAIRLEAD. It is bad practice to pile up dirt in front of the machine, and the easiest way to avoid this is to hoist the bucket as soon as it is full. The depth of cut is regulated by means of the hoist brake, and the bucket may be prevented from biting too deeply by the application of this brake.

If it is desired to make a cut beyond the end of the boom, pull in the bucket with the drag clutch whilst swinging to the cut, and at the end of the swing release the drag clutch and brake, allowing the bucket to run out. When the bucket has reached the furthest point of its run out, drop the bucket to the ground with the hoist brake.

Some practice is required to get the maximum reach with the bucket, and in any case it must be remembered that the drag drum should be checked as soon as the bucket has finished its outward throw.

It is important that the angle assumed by the full bucket when hoisting out of the material ready for swinging should be of such a degree as to enable the bucket to carry the material round without spillage. A full bucket held in the air on the drag rope should hang with the bucket teeth pointing slightly upwards and the amount of upward tilt required to avoid spillage will vary slightly with different materials. A heavy, sticky material will remain in the bucket in an almost horizontal position, whereas a wet free running material will require considerable upward tilt of the bucket.

Fig. 13 shows the correct angle of the bucket when digging in sticky materials and Fig. 14. shows the correct angle when digging in loose or very wet materials.

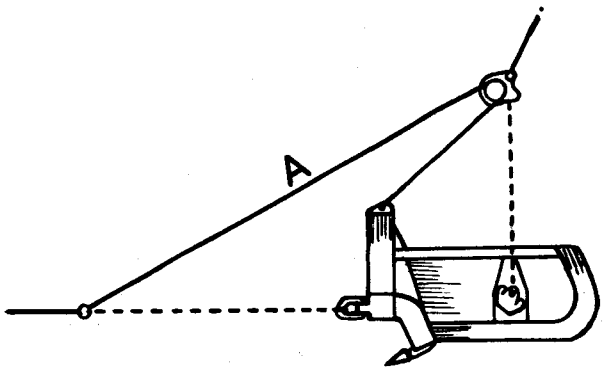


Fig. 13. Angle of Bucket for sticky materials.

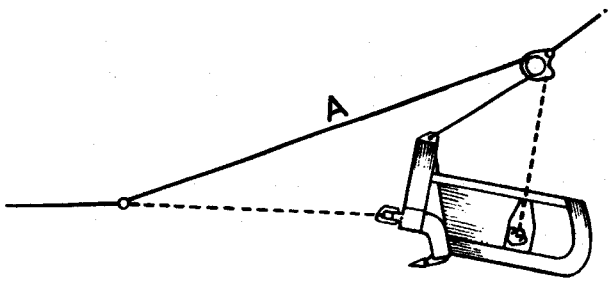


Fig. 14. Angle of Bucket for loose or very wet materials.

Adjustment of the carrying angle is effected by lengthening or shortening the dumping rope 'A', by shortening this rope the mouth of the bucket is tilted upwards; lengthening the rope tends to bring the bucket horizontal.

Fig. 15 shows the normal position of the drag clevis 'A' when digging in easy or moderately hard material. In hard digging or where difficulty is found in making the teeth penetrate the material, the drag clevis should be reversed, to the position shown in Fig. 16. The drag chains will then have a tendency to pull the bucket mouth down into the material and improve penetration.

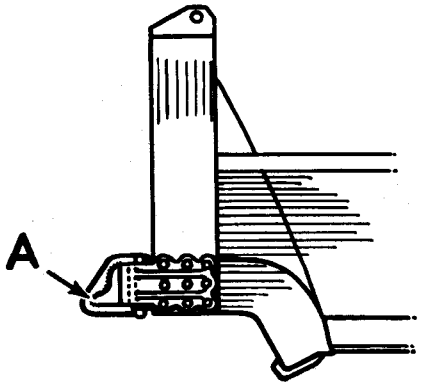


Fig. 15. Normal position of Drag Clevis when digging easy or moderately hard material.

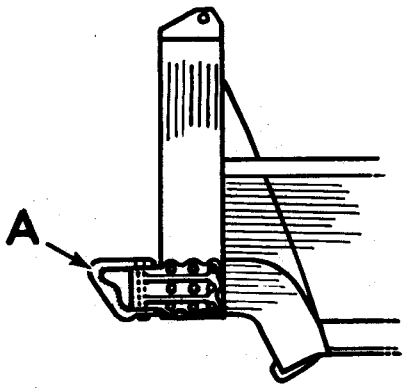


Fig. 16. Drag Clevis reversed to help penetration in hard material.

'Spotting' wagons with a dragline is rather a difficult operation, unless the wagons are of ample capacity, and the best method for loading into wagons is to use a hopper of large mouth area, under which wagons may pass to be loaded.

DRAGLINE OPERATING HINTS

Actual digging operations with the Dragline require co-ordination between the Hoist and Drag motions which may at first be a little difficult to attain.

Attention to the following suggestions and a little practice will soon give the operator the knack of filling the dragline bucket smoothly and quickly and permit accurate dumping:-

1. Be sure that the bucket teeth are kept sharp and built up to proper size. This increases digging speed and protects the lip from un-necessary wear.

2. Work with boom at highest angle that will allow the reach and accuracy needed for the particular job. With a low boom (30° to 40°), you have longer reach and better control of the throw of the bucket, along with more accurate grading and dumping. A high boom (40° to 50°), increases stability, decreases swing loads and swing power requirements

3. Do not use bucket of larger capacity than recommended for normal rapid operation. The gain of more per pass is usually offset by less passes per hour and, in addition, over-loading always results in extra maintenance and delay. Do not exceed figures given in the Table of Maximum Allowable Lifting Loads (See Capacity Charts in Operators Cab.)

4. Take an even cut and fill the bucket, being sure to fill the back corners. Don't gouge. Keep the drag hitch adjusted for the best penetration of materials. And heap that bucket.

5. The machine should be kept in an efficient position with relation to the work, to eliminate digging beyond the point of the Boom as much as possible, as well as to reduce un-necessary casting and hoisting, which all takes extra time. Many operators get into the habit of pulling the Bucket a greater distance than is necessary to fill it, thus wearing out the Bucket and Drag Cable un-necessarily. Use as short haul as you can get by with. After the Bucket is full no more material can be loaded no matter how far you drag it.

6. Save your Drag Cable -- Move back and dig off top edges that might wear or cut your Drag Rope. Avoid piling dirt on your 'door step'. Hoist the Bucket as soon as it is full. Piling dirt under the boom foot wastes time and power and makes a 'wearing' trap for Drag Rope.

7. It is important to use the proper length of dump-cable so that the bucket can be picked up at a considerable distance ahead of the machine without spilling the dirt. If dump line is too long it becomes necessary to pull the loaded bucket close up to the fairlead to keep it level. Too long a dump line also causes bucket to dump before it gets out under the boom-point for maximum reach.

8. Avoid pulling the Drag Rope Socket into the Fairlead, and keep all dirt and mud cleaned off Fairlead to save wear on cable and Fair-lead.

9. Start and stop the swing motion slowly so as not to place un-necessary strain on the boom. When the boom is in motion, the bucket is lagging behind so do not drop the bucket to stop the swing of the machine. Don't bang the bucket against banks or trucks to knock out sticky mud. Do not get into the habit of dropping the bucket in a heap, because the cable and chains may become tangled and considerable time will be lost on each bucket load. When dropping the bucket back into the pit, be careful to check the hoist and drag drums with the brakes, so that the cables do not run off the drums.

10. Release the drag brakes gradually when dump-ing the bucket to avoid jerking the boom.

11. Regulate the depth of cut by taking in or paying out the hoist line.

12. Use timber mats, old rail-track sleepers etc., on the ground below the tracks if footing is soft.

DRAGSHOVEL OPERATION

GENERAL NOTES

The normal operating cycle of the Dragshovel (Fig. 17) is made up of four basic motions:-

1. Drag – After lowering dipper into cut and releasing hoist, haul in on drag rope to pull dipper through material to fill.

2. Hoist – Holding full bucket in raised position with drag rope, raise boom and dipper clear of cut and to suitable height for swinging and dumping.

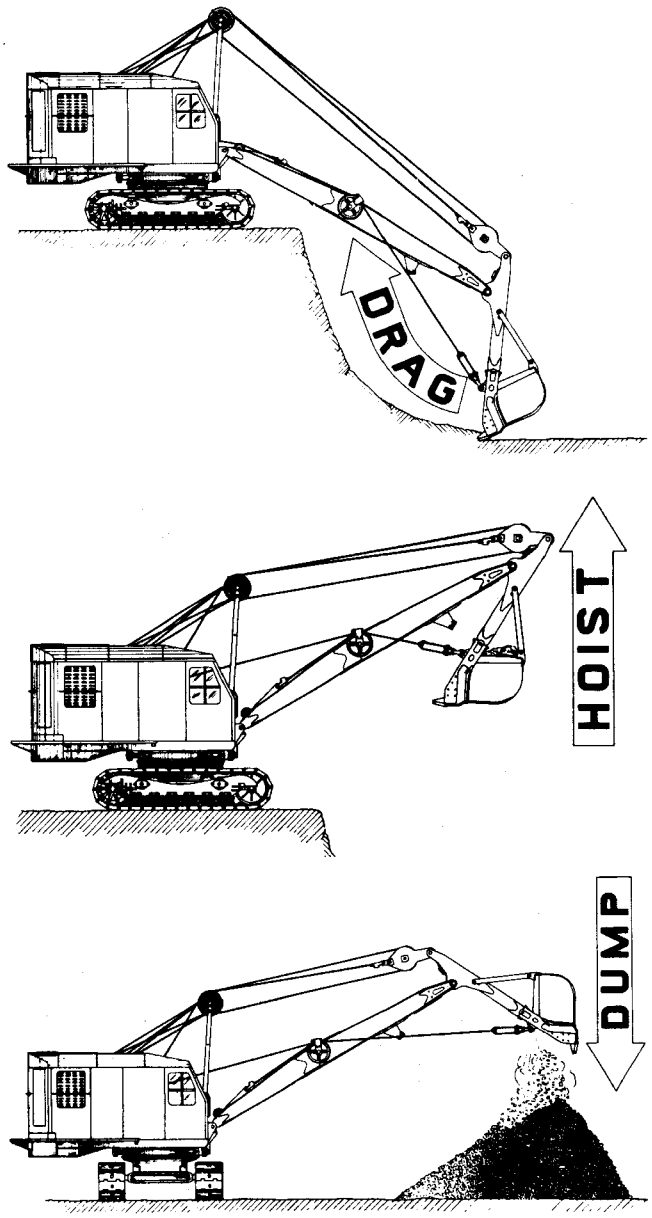


Fig. 17. Basic Motions of a Dragshovel.

3. Swing – Swinging bucket between digging and dumping points.
4. Dump – Dumping the spoil from the dipper in either of two ways:-
   (a) By opening the dipper door to give bottom discharging, or
   (b) By allowing the dipper to run out by releasing the digging drum brake, and discharging from the front (or mouth) of the dipper.

The latter is the only method with hoe type dippers.

A skilled operator will combine these operations into a smooth, fast cycle. He lowers the dipper and commences to pull it in simultaneously, then, once that he has raised the boom and bucket clear of the cut, he will commence to swing as he continues to hoist to dumping height. He starts to dump just before he finishes his swing to the dumping point, and commences to lower his bucket again on the return swing.

WHERE TO USE THE DRAGSHOVEL

The dragshovel is eminently suitable for digging trenches for pipes, foundations etc., and for digging pits for basements, tank installations and the like. In general it is suitable for conditions where:-

1. Material to be dug is from medium soft to relatively hard.
2. Digging is at or below machine level.
3. Excavation is not large enough for machine to work inside.
4. Digging and dumping points can be fairly close together.

IMPORTANT NOTES

It is essential to remember that the dragshovel boom is not directly controlled by the suspension rope as in the case of other front end equipments; a high degree of operator skill is required to avoid overloading the machine and to ensure good workmanship. To avoid the possibility of a serious accident release both brakes gradually. There is also the possibility of snatching and twisting the hoist rope if the dipper is allowed to run out too quickly. Fig. 18 shows the laden dipper ready for dumping, but in order to do so it is necessary to allow the dipper to run out. If the dipper is allowed to run out simply by releasing the brake pedal 'G' (left foot), the boom will fall slightly and may cause the dipper to strike the transport vehicle; the hoist rope will be snatched and may become twisted. To counteract this tendency it is necessary to simultaneously engage the hoist by pushing lever 'A' forward.

You cannot practice the dragshovel operating cycle satisfactorily unless the mouth of the dipper is rested on the ground. Dragging in the dipper will damage the surface on which the machine is standing, it is therefore advisable to drive the machine to a piece of waste land or to the site.

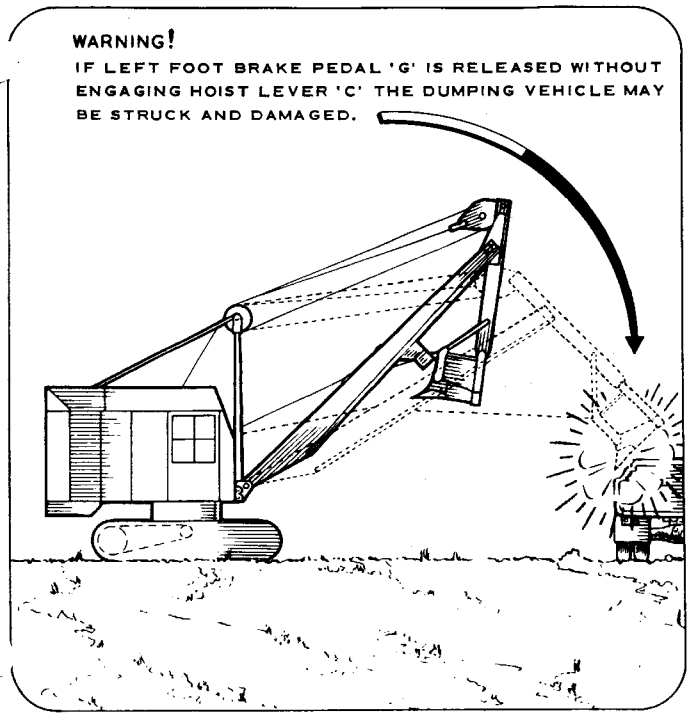


Fig. 18. Effect of releasing drag brake without engaging hoist clutch.

ALWAYS REMEMBER

1. When dumping the spoil through the mouth of the dipper, it is only necessary to run out the dipper arm until the spoil is discharged.
2. When running out the dipper arm remember NOT to release the brake pedals until you are actually pushing the hoist lever forward.

STRAIGHT BOOM DRAGSHOVEL OPERATION

Levers 'A', 'B', and 'C', and foot pedals 'F' and 'G' control digging with straight boom dragshovel equipment.

The forward drum takes the drag rope and is driven and controlled in the same manner as on the skimmer equipment i.e. through the chain, right hand clutch on the rear shaft, and lever 'B'. The front drum clutch is not used.

The rear drum takes the hoist rope and is controlled by lever 'A' and foot pedal 'F' through the rear drum clutch.

To commence digging, raise the boom by applying the lever 'A', and regulate the distance from the machine at which it is desired to commence the cut, but releasing the digging brake and allowing the dipper to run out. The depth of cut is regulated by the hoist brake, but if the dipper tends to dig too deep, thereby stalling the engine, the cut should be eased by raising the boom, which is done by applying the rear drum clutch.

If it is desired to dig to the maximum depth it is advisable to run the machine back and take off the first few cuts as near as possible to the machine and then run the machine to the edge of the cut to get the deeper digging. After filling the dipper, apply lever 'A' to raise the dipper from the cut, but do not attempt to swing until the dipper is well clear.

Dumping is accomplished in two ways, either by opening the dipper door to give bottom discharging, or allowing the dipper to run out by releasing the digging drum brake, and discharging from the front of the dipper. The latter is the only method with hoe type dippers.

Generally speaking, dumping from the front of the dipper is the better method when side casting, but dumping by opening the door is the better method when discharging into wagons or motor lorries.

The tilt of the dipper is adjustable by means of dipper braces, and digging in hard material calls for the dipper to be tilted forward to the maximum whereas digging on soft materials, the dipper should be tilted back.

CAMBERED BOOM DRAGSHOVEL OPERATION

The forward drum takes the drag rope and is controlled in the same manner as the Dragline equipment, by lever 'B'. No chain is used between the drum shafts, but all digging instructions are identical with those for straight boom dragshovel.

DRAGSHOVEL OPERATING HINTS

Digging operations with the Dragshovel bear some resemblance to those for the Dragline, and require the same sort of co-ordination between the Hoist and Drag motions that may at first be somewhat difficult to master.

A little practice will however soon give the operator that feeling of confidence and knack of filling the dipper smoothly and quickly and will also permit accurate digging and dumping.

1. Be sure that the dipper teeth are kept sharp and built up to proper size. This will increase speed and protect the bucket lip from un-necessary wear.
2. Use the best position for best digging. Start loading the dipper with the dipper handle in a nearly vertical position. The dipper digs best at this point. The dipper tends to ride out of the material with the dipper out past the vertical position.

3. Don't swing into trench walls. Be sure to clear bank or trench wall when hoisting out of the cut, before attempting to swing. Again, on returning to the digging position, stop the swing before lowering the dipper back into the cut.

4. To avoid making steps in the trench, regulate the depth of cut so that the dipper is filled when it is clearing the trench and when it is fairly close in towards the boom foot. The depth of cut can be regulated by hoisting the boom slightly or by taking the weight of the boom on the hoist rope. If the ground is soft the dipper arm should only be run out slightly past the vertical. The boom can be hoisted during the digging operation by pushing lever 'A' and releasing the right foot brake. When the dipper is full, stop the drag motion by releasing lever 'B' and applying the left foot brake.

5. When commencing to dig a trench in hard ground, i.e. compacted hardcore etc., the dipper arm should be run out to about three quarters of its extended length so that the digging teeth will contact the ground at about the same angle as would a pickaxe if the trench was being excavated by hand. When breaking up the surface do not allow the dipper to fall from a height of more than 2ft. and if the teeth make no impression on the surface use a concrete ripper to break it up. Don't use the dragshovel as a pick. While the dragshovel will dig fairly hard materials, it will sometimes be cheaper to loosen the material with a pneumatic drill or blasting than trying to pull the dipper through hardcore or rock strata. Compressed air or power is cheaper than repairs. When dragging in the dipper release the hoist brake so that the weight of the boom assists in forcing the dipper into the material. When commencing to dig in soft ground run out the dipper arm to a point less than three quarters of its fully extended length and lower the dipper to the ground. When dragging in the dipper keep a slight pressure on the hoist brake, this will ensure that the weight of the boom is not transferred to the dipper, see Fig. 19.

6. Stock the spoil at one side of the trench, keeping it well clear of the edge.

7. Do not travel the machine back over a partly excavated trench.

8. When digging a trench more than about 4 ft. deep it is advisable to have an assistant on the bank to advise you, this is a necessity when digging at the maximum depth and in all cases where the sides are likely to cave in.

9. Ensure that the correct bumpers are fitted to the boom.

10. Do not allow the machine to stand at the end of the trench or near the edge of other excavation during the shut-down-hours.

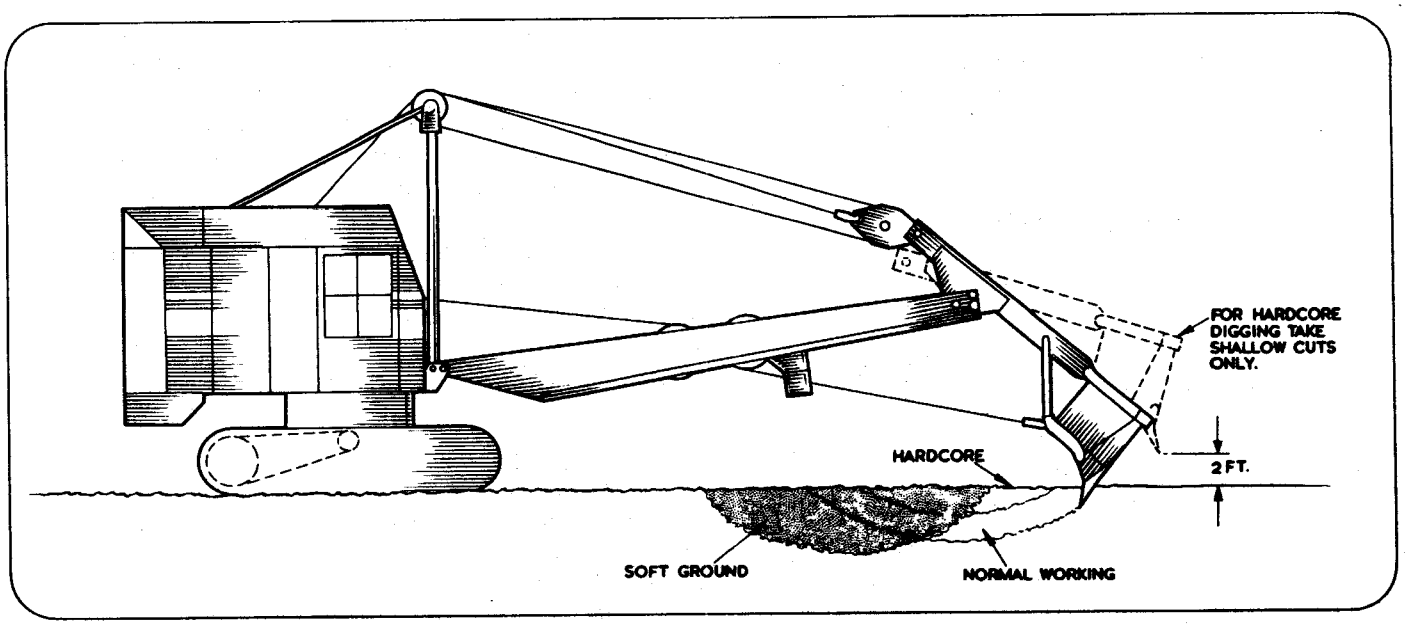


Fig. 19. Digging a Trench.

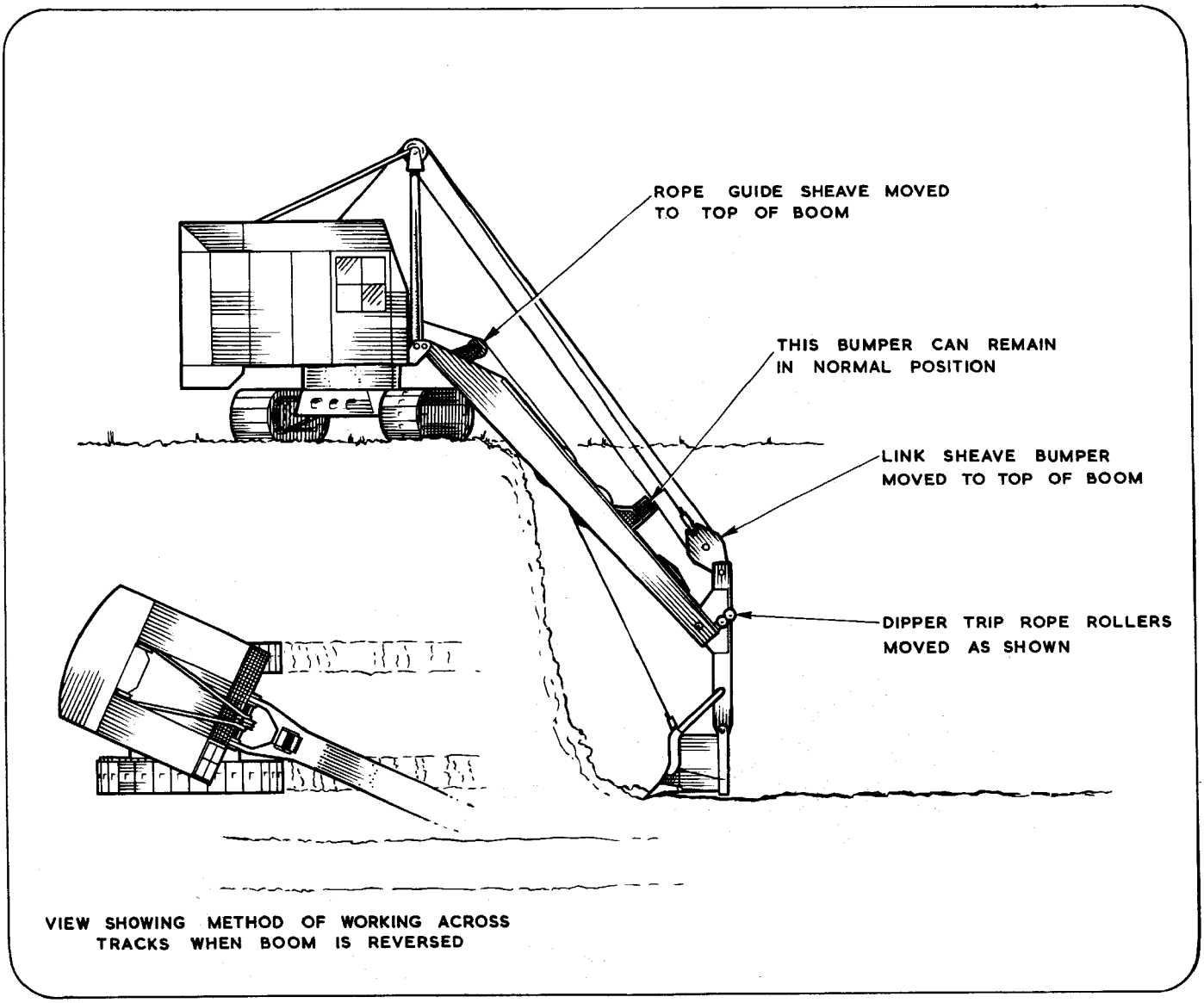


Fig. 20. Reversing the Boom (Applicable to Straight-Boom Dragshovels only).

11. Rest the dipper on the ground and secure the brakes in the locked position before leaving the cab.

12. See that the dipper brace straps are adjusted to the type of spoil being excavated, hard material requires maximum forward tilt of the dipper, the straps should be secured in the bottom holes of the dipper arm in the case of opening-door type dippers or the top holes with hoe type dippers.

13. In some cases it may not be possible to straddle the machine across the centre line of the trench and digging 'over the side' or corner of the tracks must be resorted to. Be very careful because this method of working often results in damage to the boom or to the tracks, due to careless operation.

14. When digging a trench in excess of 11ft. deep in the above manner with a straight boom dragshovel, the boom can be reversed, so that the belly of it is upwards, thereby reducing the risk of hitting the track belt. (See Fig. 20). Greater depths with less danger can be accomplished with the cambered boom.

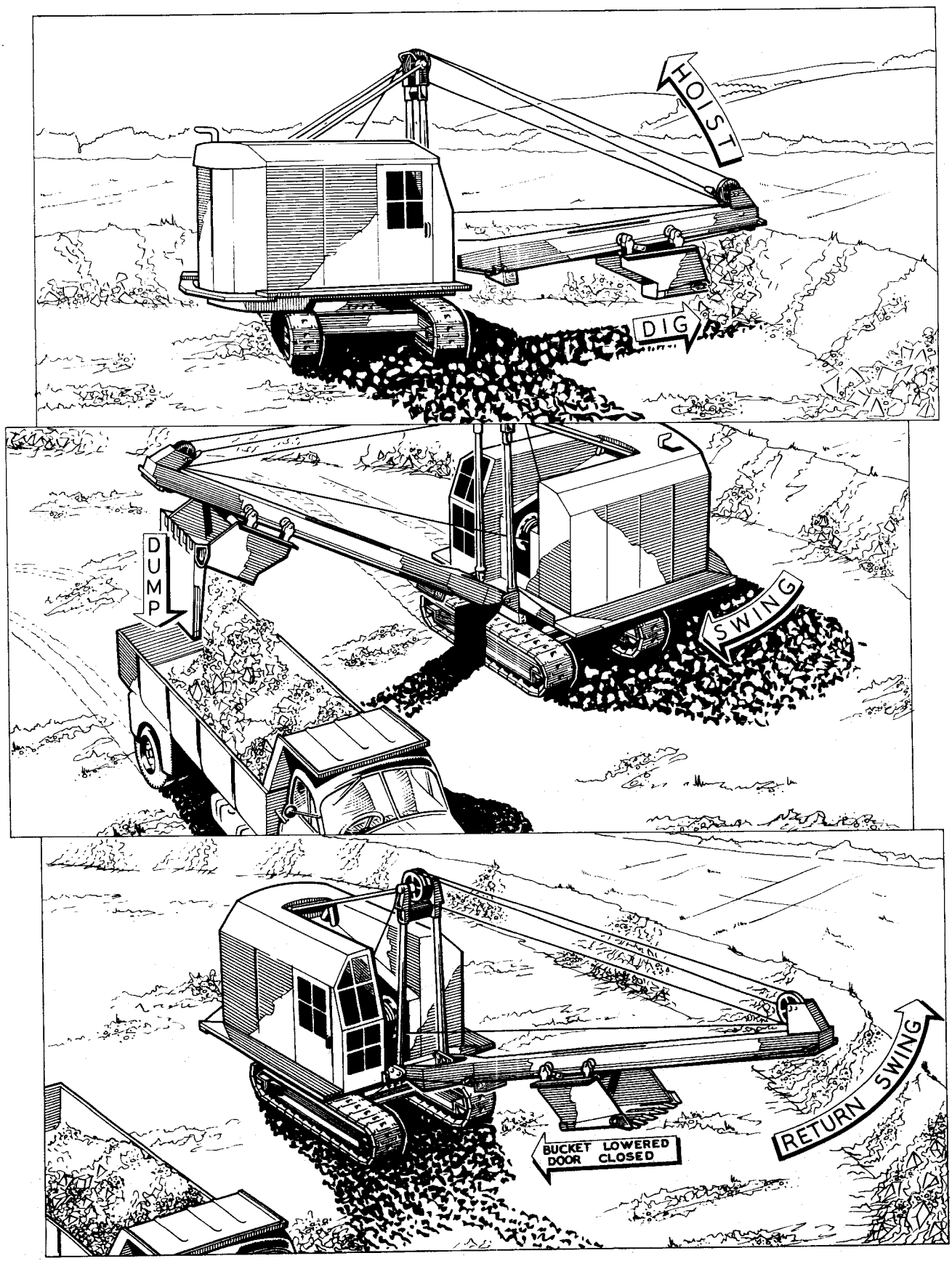


Fig. 21. The Basic Motions of a Skimmer.

SKIMMER OPERATION

The normal operating cycle of the Skimmer is made up of the following basic motions, which will be easily understood by reference to Fig. 21.

1. Lowering the boom and digging.
2. Hoisting the boom and swinging to dumping position.
3. Dumping the spoil.
4. Lowering the shovel and closing the door.
5. Swinging back to the cut.

Operating the Skimmer equipment is no more difficult than operating any of the other equipments described, in fact it is probably more simple in many respects. A little practice under actual digging conditions will soon produce that co-ordination of movements that makes for a fast smooth operating cycle.

WHERE TO USE THE SKIMMER

The Skimmer equipment is particularly useful for many types of levelling work, road foundation grading etc., in conditions where:-

1. Material to be dug is soft to relatively hard.
2. Digging is from the level of the tracks up to a height of about 5ft.
3. Digging and dumping points can be fairly close together.
4. Accurate dumping is required.
5. Excavation is large enough to allow machine to work in it.

SKIMMER OPERATING CONTROL

Levers 'A', 'B' and 'C', and foot pedals 'F' and 'G' control digging with Skimmer front end equipment. On this equipment the bucket digs by travelling along the boom, AND BUMPING THE BUCKET VIOLENTLY AGAINST THE STOPS AT EITHER END OF THE BOOM MUST BE AVOIDED.

The front drum which is driven by the chain from the rear shaft, takes the drag rope and is controlled by lever 'B' connected to the right hand clutch on the rear shaft. The front drum clutch is not used. The rear drum takes the hoist rope and is controlled by lever 'A' connected to the left hand clutch. Lever 'C' controls the swing in the same manner as on other equipments.

To commence digging, swing the machine to the digging position with the boom raised, allowing the bucket to run to the bottom of the boom, but checking with the brake before the bucket makes violent contact with the buffer. Next lower the boom until the bucket rests on the ground, and then applying lever 'B' the bucket is pushed through the material to the end of the boom, filling itself en route.

When the bucket is full raise the boom by operating the rear drum clutch, lever 'A', and swing to dumping position by operating lever 'C'. Discharge the material by tripping the bucket latch by means of the lever 'N'. The bucket should be allowed to run to the bottom of the boom whilst the return swing is being made, and the boom lowered to the ground ready for the next cut. THE BUCKET SHOULD BE ALLOWED TO RUN, AND THE BOOM LOWERED STEADILY, AND ON NO ACCOUNT MUST THE BUCKET BE DROPPED HEAVILY ON THE GROUND AS THIS WOULD DAMAGE BOTH BUCKET AND BOOM.

THE BUCKET SHOULD NOT BE USED FOR TAMPING OR SWEEPING, AS THESE OPERATIONS PUT EXCESSIVE STRAIN ON THE BOOM. AN EXPERIENCED OPERATOR WILL REGULATE HIS CUT SO THAT NEITHER TAMPING OR SWEEPING ARE NECESSARY.

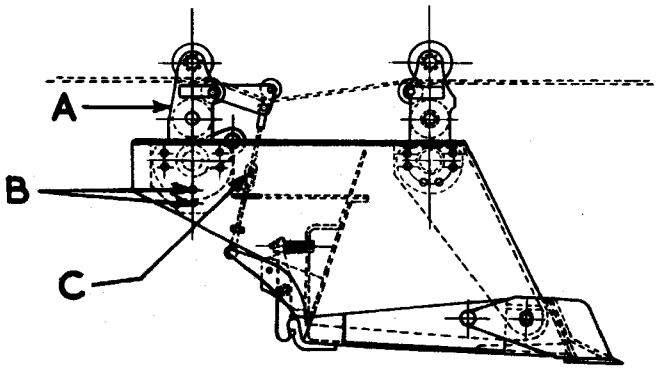


Fig. 22. Adjusting angle of Skimmer Bucket.

The depth of cut is regulated by the hoist brake 'F' and the bucket should not be allowed to dig in so deeply as to stall the engine. Adjustment of the digging angle for skimmer buckets is accomplished by raising or lowering the rear bucket hanger 'A', and extra holes are provided in the sides of the bucket for this purpose as shown at 'B' Fig. 22. When any alteration is made to the digging angle as previously explained it is also necessary to re-adjust the bucket trip rope by means of the turn buckle 'C'. Generally speaking the rear hanger of the

bucket should be adjusted to the top holes when digging in easy material or making an up grade. When digging in heavy materials or making a down grade the bucket hanger should be adjusted to the bottom holes.

SKIMMER OPERATING HINTS

The following operating hints will help the operator towards achieving maximum output:-

1. Be sure that bucket teeth are kept sharp and built up to proper size, or replaced when necessary. This increases the digging speed and protects the lip from un-necessary wear.
2. Take a relatively thin slice at a cut so that the bucket pulls through the material fast and easily without overloading and slowing down the engine, but aim to get a full bucket each time.

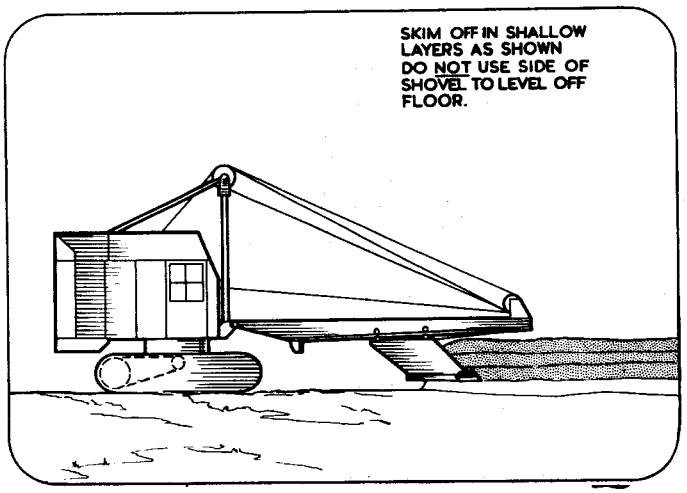


Fig. 23. Skimming.

3. Take the cut down in layers across the entire surface of the work, so that there is always adequate clearance for the digging rope and the boom point machinery. (See Fig. 23).
4. Make sure that the bucket angle is adjusted correctly for the best output in the material that is being dealt with.
5. Don't drop the bucket heavily on the ground or use the bucket for tamping or sweeping from side to side. Such action can cause damage and result in lost time and costly repairs.
6. Always release both brakes gradually, you may cause serious damage to the machine by allowing the bucket to strike the ground or the boom bucket stop. The depth of cut is regulated by the hoist brake, pedal 'F', right foot. For example when commencing to dig hard material release the pedal and allow the weight of the boom to force the shovel into the material. When digging soft ground, the weight of the boom should be taken by the hoist rope and if a thicker cut is required the hoist brake should be released slightly. If the cut is too deep and causes the engine to labour stop the digging motion and hoist the boom slightly.
7. Do not leave the cab when the boom is raised and the bucket is travelled out towards the boom point, you should lower the bucket to the ground and lock the brakes before leaving the cab.
8. Save loading time when ever possible by two-truck spotting, similar to that suggested for the shovel equipment. Have trucks spotted in as close to digging as is safe, always the same distance from centre of rotation, and lined up with the arc of swing.
9. Move up while waiting for trucks whenever possible.
10. Help trucks coming in for loading in an even cycle, by getting the first truck or two out especially fast, if they begin to jam up. Avoid a crowd of waiting trucks, it indicates poor planning.
11. Spot trucks so that they can be loaded from the rear. Never swing over cab of truck. In handling dangerous materials, have the driver get out of the truck and stay on the safe side.
12. Men should be kept away from the working area as much as possible. Never swing the bucket over the ground crew, and be sure that everyone is clear before backing up.
13. Don't overload trucks. Load evenly, and don't drop the load into the truck from a height and knock the body to pieces.
14. In sticky material try to save any dry or coarse material to spread in the bottom of the truck to act as a cushion and help to ease dumping.
15. Never leave the machine overnight, or for the week-end, against a high bank or near an edge where caving-in might occur, or in a hollow which might flood after a heavy rain storm and endanger the machine.

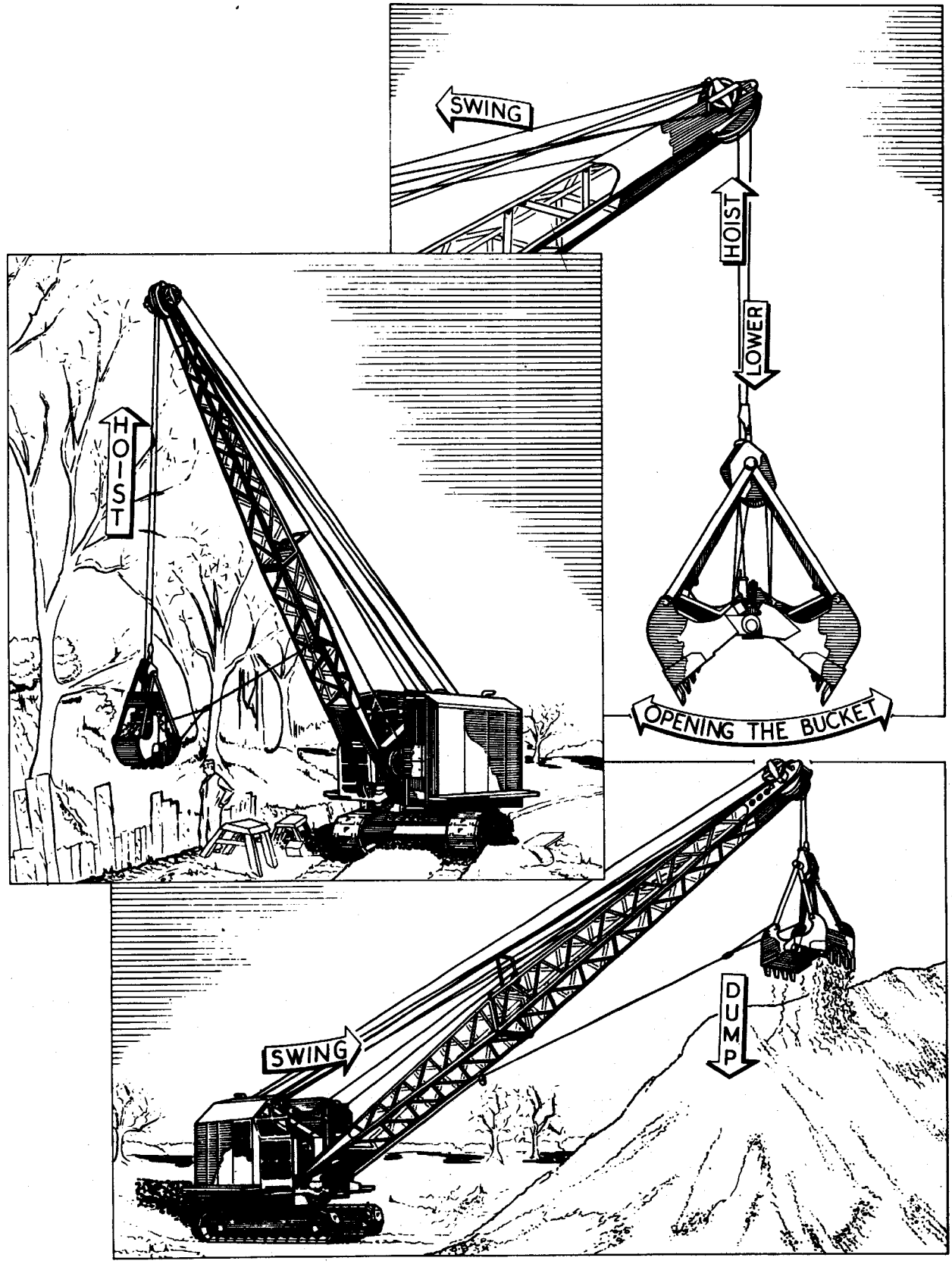


Fig. 24. Basic Motions of a Clamshell.

CLAMSHELL (GRABBING CRANE) OPERATION

Fig. 24. illustrates basic motions in the normal operation of a Clamshell or Grabbing Crane.

Assuming that the bucket is closed and resting on the ground, the cycle of operations is:-

Hoisting the bucket clear of the ground.

Transferring the weight to the holding rope and lowering the open bucket on to the material to be dug.

Closing, filling and hoisting the bucket.

Swinging to dumping point.

Discharging the spoil by transferring the weight from the hoist rope to the holding rope.

Swinging back to the digging point.

Since the only digging force available is the closing action and the weight of the bucket, the clamshell cannot dig as hard a material as the other equipments already dealt with in this section. A tagline operating a counterweight arrangement is attached to the bucket to retard any tendency for the bucket to spin and twist the two main operating ropes together.

WHERE TO USE THE CLAMSHELL

The clamshell can dig and dump below, at, or above the level on which the machine stands. This makes it ideal for such jobs as digging pits and shafts, transferring materials from stockpiles to hoppers; unloading material from railway wagons or boats, and placing it in hoppers or stockpiles. In general the clamshell should be used where:-

1. Material is soft or loose.
2. Digging point is readily accessible only to a vertical operating bucket.
3. Dumping must be accurately controlled into a relatively small hopper or opening, especially where this dumping point is at considerable height above the machine.

CLAMSHELL OPERATING CONTROL

The Clamshell or Grabbing Crane Equipment is normally controlled by levers 'A', 'B' and 'C' and brake pedals 'F' and 'G'. In this instance lever 'A' controls the front drum which carries the 'Closing - Hoisting Rope', and lever 'B' controls the rear drum which takes the 'Holding - Lowering Rope'.

The linkage of the brake pedals is also reversed so that the Right Foot Pedal 'F' still acts on the hoist drum although this is now the front drum instead of the more usual rear drum. In a similar manner the Left Foot Pedal 'G' will now control the rear drum instead of the front drum. The change over of the linkage for the levers and foot pedals is described under 'Conversions' in Section 9 of this book.

In normal Clamshell operation, lever 'B' is not used because the rear drum clutch is partially engaged by means of a spring connected to the bell crank below the right hand deck plate as shown in Fig. 25. This spring should be so adjusted that sufficient pressure is put on the rear drum clutch to cause the band to drag slightly, thus winding up the holding rope and keeping it taut whilst the bucket is being hoisted.

To open the bucket apply the rear drum brake and release the front drum brake, both clutches being disengaged.

IT IS ABSOLUTELY ESSENTIAL THAT THE FOOT BRAKES DO NOT BIND OR DRAG IN THE OFF POSITION, OTHERWISE THE BUCKET WILL TEND TO CLOSE WHILST LOWERING.

To commence digging, lower the open bucket on the holding rope and when the bucket has dropped to the material apply lever 'A'. This will close and fill the bucket and hoist it when full. Keep the clutch engaged and commence swinging to the dump. Release lever 'A' and apply the brake when sufficient height has been reached.

To discharge, release the front drum brake and apply the rear drum brake. If for any reason it is desired to lift the open bucket, push lever 'B' and keep the closing line taut by pushing lightly on lever 'A'. For normal operation lever 'B' is not used.

CLAMSHELL OPERATING HINTS

The Clamshell is an easy machine to operate as there is little overlapping of the motions but reasonable care must be used and the following points should be carefully noted:-

1. Be sure that the machine is on a solid footing so that it will not 'Nose Down' when hoisting the loaded bucket.
2. Keep the boom as high as conditions will permit, but be careful not to let the bucket swing against the underside of the boom.

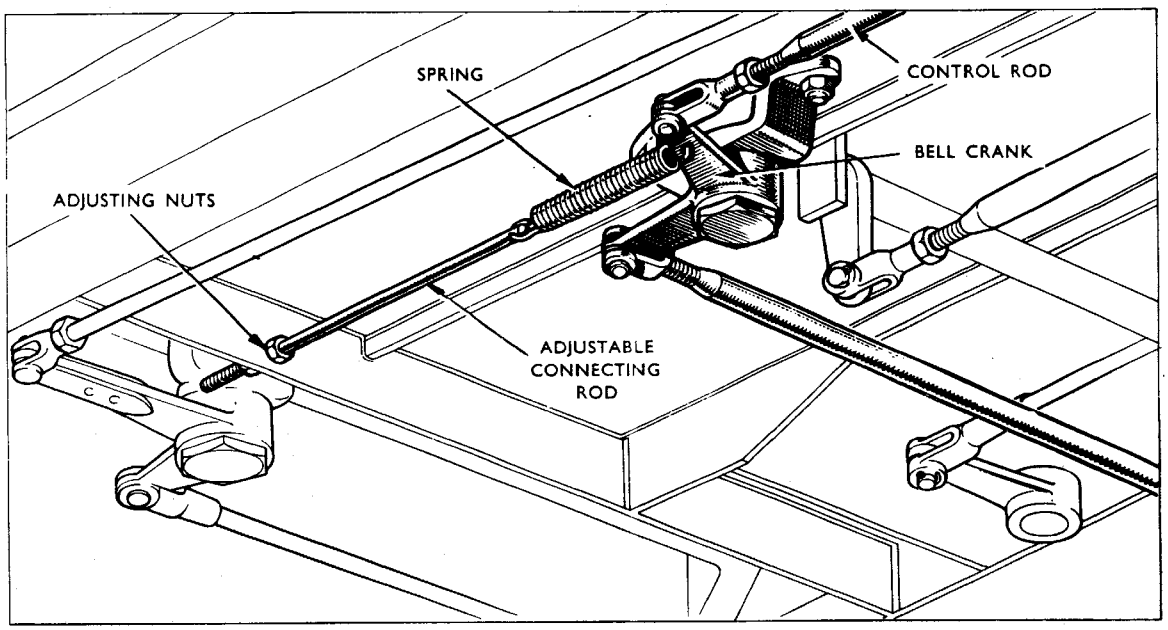


Fig. 25. Spring maintaining partial engagement of Rear Drum Clutch. (Applicable to Clamshell or Grabbing Crane machines only).

3. If you are excavating soft, heavy material, i.e. wet clay at maximum radius you may overload the machine. Clamshell buckets as well as material to be handled vary a great deal in weight, therefore it is important to be sure that the combination of the boom angle, bucket and material comes within the limits of the Table of Allowable Working Loads for Grabbing Crane operation. (See 'Specifications' - Section 3, in this book).
4. Keep sufficient tension on the bucket tagline so that the bucket will not spin and foul the cables.
5. Start and stop the swing motion slowly so that the loaded bucket will not swing excessively. If it swings out beyond the boom point the stability may be exceeded.
6. When raising or lowering the bucket into deep sheathed trenches, where you can't see the bucket, use a signal man to advise you of the bucket's position so as to avoid hanging it up on cross bracing or tearing out sheathing. Lowering the bucket closed and opening it on a signal is sometimes advisable when working blind. This gives greater clearance when lowering.
7. Don't bang the bucket against the bank, truck or hopper to release sticky material. Instead close bucket and release closing line quickly to 'shake' material loose.
8. When transferring material from a stockpile always excavate the centre of it so that the material falls inwards, and helps to ensure a full bucket every time.
9. Do not disengage the main clutch or leave the cab when the bucket or grab is off the ground.

CRANE OPERATION

The normal crane operating cycle consists of:-

1. Hoisting the load.
2. Swinging and/or travelling to the off-loading position.
3. Depositing the load.

When performing work where accurate placing of the load is especially important such as setting up structural steel-work, etc., it is also often convenient to utilize the Boom Hoist with its Controlled Lowering Unit. Engine speed control of both hoisting and lowering the boom permits accurate spotting of the load in horizontal as well as the vertical plane. (Lowering the boom will move the load out, raising the boom will bring it in).

WHERE TO USE THE CRANE

In general, use the crane for lifting jobs, where material can be attached to a hook, and providing of course that the weight to be lifted is within the

capacity of the crane. (Refer to Section 3 of this book for ratings etc.)

CRANE OPERATING CONTROL

For crane operation the main hoist rope is taken off the forward drum, controlled by hand lever 'B' and foot pedal 'G'.

When an offset jib and auxiliary hoist are fitted, the auxiliary hoist rope is taken off the rear drum and is controlled by hand lever 'A' and foot pedal 'F'.

When using the machine as a crane the operator should be careful not to snatch at loads, but to operate slowly until the weight has been taken, when the clutch may be fully applied.

The lowering of the load should be done with care, full control being kept with the brake. On no account must the load be allowed to run out and be caught up on the brake.

NEVER LEAVE THE MACHINE WITH A LOAD SUSPENDED ON THE BRAKE AS THE COOLING OF THE HOUSING MAY PARTIALLY RELEASE THE BRAKE AND CAUSE THE LOAD TO DROP.

For occasional crane use on a Dragline or Crowd Shovel Machine not equipped with a front crane lagging, the hoist rope may be taken off the rear drum and be operated with hand lever 'A' and foot pedal 'F'.

POWER CONTROLLED LOAD LOWERING

Operation of the machine when fitted with controlled lowering equipment does not differ greatly from ordinary crane operation previously described. The following steps are descriptive of the procedure when handling a heavy load with the controlled lowering equipment:-

1. Raise the load by pushing forward on the centre lever 'B' to engage the hoist clutch, at the same time releasing the left foot brake pedal 'G'.
2. Hold the load by applying the left foot brake pedal 'G' and disengaging the hoist clutch by returning lever 'B' to the neutral mid-way position.
3. To lower the load under the control of the engine, pull back on the centre lever 'B' to engage the lowering clutch, then release the hoist brake pedal 'G'. Control speed of lowering by adjusting the speed of the engine with the governor control lever (Fig. 3 or 5.) reducing the speed if necessary to idling speed.
4. To stop lowering apply left foot brake pedal 'G' and disengage the lowering clutch by pushing lever 'B' forward to the mid-way neutral position.

CRANE OPERATING HINTS

Crane work usually requires lifting heavy loads, placing them accurately and at times may require travelling with the load suspended for short distances. The crane operator must use extra caution and good judgment to avoid accidents or damage to the equipment.

1. Be sure the footing is solid. A little extra time spent preparing a good footing will be more than repaid by increased speed, steadiness and safety of operation. Remember to keep the tracks high on the load side.
2. Be certain that you know how much you are lifting, and be sure the boom length and boom angle are such that the load to be lifted comes within the limit given in the Table of Maximum Lifting Loads. (See 'Specifications'--Section 3, in this book.) Crane ratings are based on a firm foundation for the Crane and if the footing is so soft that the Crane will sink in to any extent, due allowance must be made. When figuring the total weight of the lift, be sure to include hook block and any sling or other lifting device between hook and load.
3. Swing the boom directly in line with the load before picking up the load.
4. Accurate control leads to safety and speed. Keep brakes and clutches in proper adjustment. Pick up the load gradually and do not catch it suddenly on the brake when lowering, as such practice places un-necessary strain on the boom.
5. To obtain maximum lifting capacities, the Hook Block must be reeved with sufficient parts of line. (See 'Lifting Crane Service Notes' in 'Specifications'--Section 3 in this book.) In general, it will be found that the fewer the parts of line used, the faster the hoisting speed and the less capacity; increasing the parts of line reeved, increases the load capacity but reduces the hoisting speed and therefore improves accuracy when spotting loads.
6. If it is necessary to propel with the load suspended, the load should be snubbed to the machine to prevent it swaying. Keep

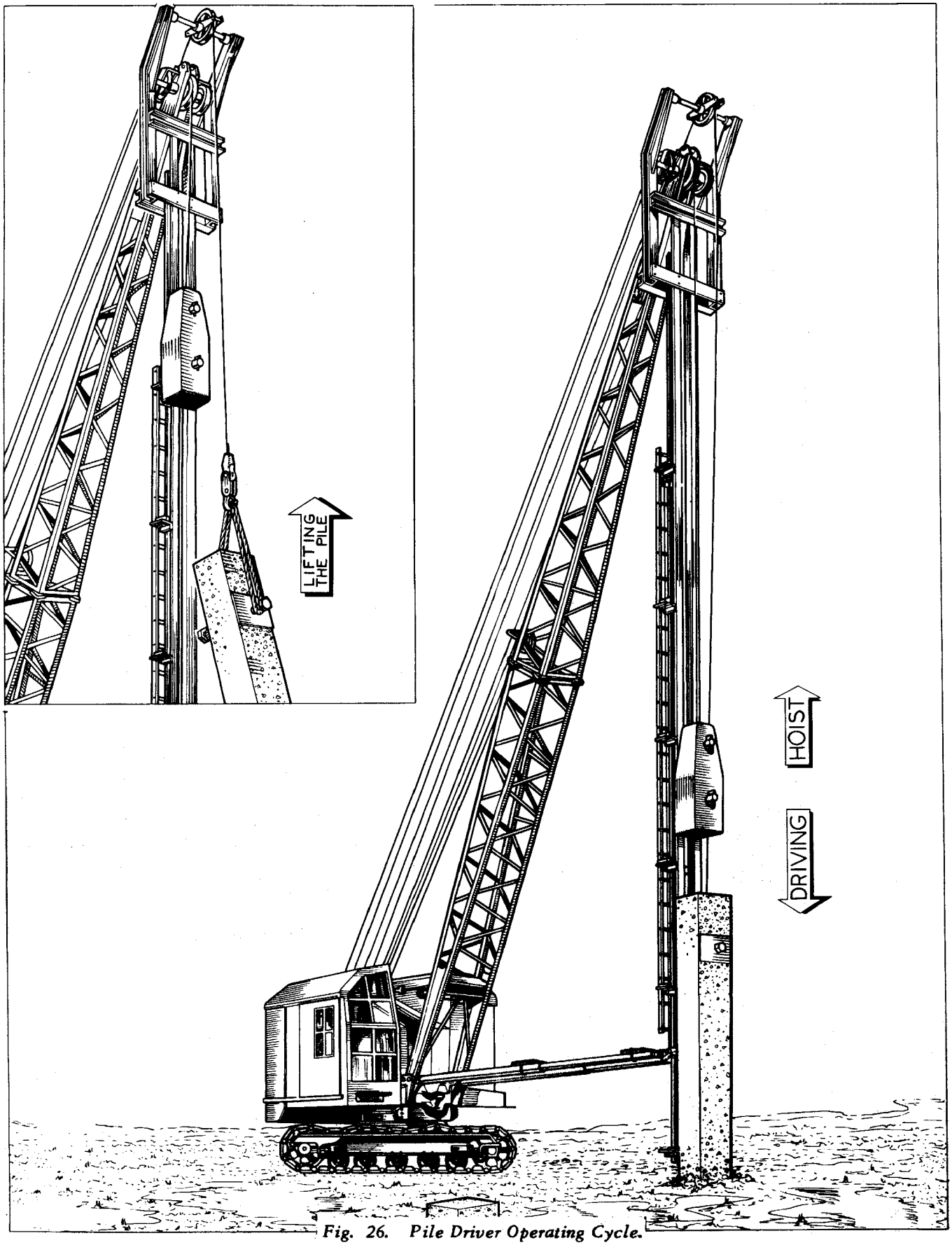


Fig. 26. Pile Driver Operating Cycle.

the load as low as possible. Use extreme care and avoid travelling with a high boom. If you have to move with a load in soft going, the tracks will 'climb' better if you move with the load behind.

7. Use the auxiliary hoist line for light loads only.

8. For maximum lifting capacity and greater safety use the shortest boom that will do the job. Longer booms call for additional care in accelerating and decelerating the swing motion and thus slow down the operating cycle and increase clutch wear.

9. Check your 'slinger' to make sure loads are well secured before lifting. If he is careless either in attaching or keeping out from under loads he is endangering his own and other lives and risking damage.

10. Use proper rope length for each job. A rope that is too long means excessive overwinding and that increases wear greatly. Rope life can often be increased by reversing ropes end for end.

11. Watch the lines carefully! Inspect all ropes, including boom suspension, daily -- and replace promptly those that show any consider able number of broken wires. The safety of valuable machinery is at stake, to say nothing of the crew and what is being lifted. DON'T TAKE CHANCES.

12. Swing the Crane slowly enough to avoid any outward throw of the load due to centrifugal force and any over-swinging when the machine is stopped. A tagline device, similar to that used with Clamshell Buckets, can be used to control outward swing, and hand lines will be found useful for guiding the load.

PILE DRIVER OPERATION

The pile driver operating cycle (See Fig. 26.) is as follows:-

(1) Hoisting the hammer and locking it.

(2) Lifting the pile and steadying it to the leader assembly.

(3) Driving the pile.

PILE DRIVER OPERATING CONTROL

The pile driver is controlled by levers 'A' and 'B' and both brake pedals. The pile lifting rope is reeved on the rear drum and is controlled by hand lever 'A' and right foot pedal 'F'. The hammer rope is under wound on the front drum and it is controlled by hand lever 'B' and left foot pedal 'G'. The swing, propel, and boom hoist motions are controlled as previously described.

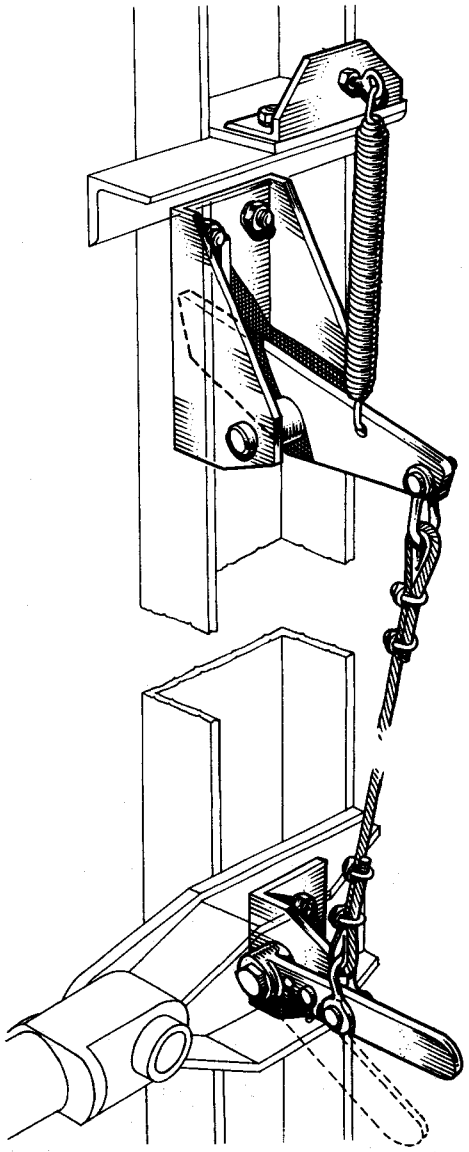


Fig. 27. Latch Lever Assembly.

SITING THE MACHINE

Propel the machine to the site and park it on firm ground. When travelling the machine with the piling rig, ensure that the toe of the leader assembly is well clear of the ground. It is advisable to have the hammer located at the foot of the leader when travelling the machine. If it is required to drive a row of piles, position the machine so that

the track belts are at one side of and parallel to the centre line of the row of piles. Set the boom to an angle of 65° approximately by operating lever 'J' after temporarily releasing the boom hoist safety pawl by means of lever 'P'. Swing the revolving frame and manouvre the machine so that the toe of the leader is located directly behind the location of the first pile. Get an assistant to plumb the leader assembly if necessary to adjust the length of the telescopic frame and lower or raise the boom slightly.

OPERATING PROCEDURE

Put both feet on the pedals and release the foot brake lock.

Raise the hammer; Push lever 'B' with left hand, and release left foot pedal 'G'.

When the base of the hammer is above the latch near the top of the leader member, release lever 'B' and apply the brake smartly. Get an assistant to ensure that the hammer release lever is engaged and lower the hammer on to the latch gently. (See Fig. 27.)

Raising the Pile; If necessary swing the revolving frame so that the lifting rope is directly above the head of the pile.

To lower the rope; Release right foot pedal 'F'.

To hoist the pile; Engage lever 'A' with right hand and release right foot pedal 'F'.

When the pile is clear of the ground secure the base of it loosly to the leader assembly by means of a fibre rope. Secure the head of the pile to the leader by means of the rod-bolt, the guide block and two backplates. (See Fig. 28.)

Swing the revolving frame and locate the toot on the mark. Lower the pile gradually to the ground, release right foot pedal 'F' and then plumb pile, adjusting the boom radius if necessary. Stow the hook of the pile lifting rope at the back of the ladder so that it does not foul the hammer rope.

Driving the pile; Hoist the hammer slightly so that an assistant can move the hammer release lever to trip the latch, then lower the hammer gently under control of brake pedal 'G' on to the head of the pile. The force necessary to drive the pile satisfactorily will be determined by the site engineer. To drive it, push lever 'B', hoist the hammer the required distance and then release lever 'B'. You should maintain slight pressure on the left foot brake as the hammer decends to prevent the rope being spooled off the drum when the hammer contacts the head of the pile.

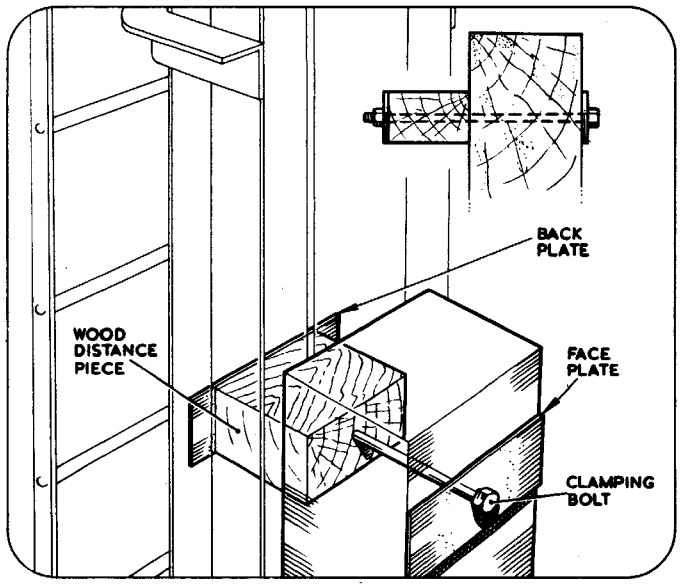


Fig. 28. Securing the Pile.

PILE DRIVER OPERATING HINTS

1. Do not allow the leader assembly to take the weight of the boom, this may cause damage to the boom point shaft or it may result in the boom suspension ropes becoming twisted.
2. If the machine is to be propelled over rough ground, it is advisable to locate the hammer near the foot of the leader assembly. Ensure that the brakes are locked in the hard-on position.
3. Do not allow anyone to work on the rig above the head of the pile.
4. Check the fall of the hammer slightly with the left foot brake to prevent spooling off an unnecessary length of rope and do not re-engage lever 'B' until you have stopped the drum rotating.
5. Get an assistant to check that the guide block is of sufficient thickness to prevent friction between the pile and the leader.
6. The longest pile that can be driven by this machine is approx. 27ft.
7. Use the hammer rope for withdrawing piles that are partly driven.
8. Ensure that the swing lock is engaged when the pile is positioned.

INDEX TO ILLUSTRATIONS IN SECTION 5.

SECTION 6

6 LUBRICATION

CONTENTS

ILLUSTRATIONS

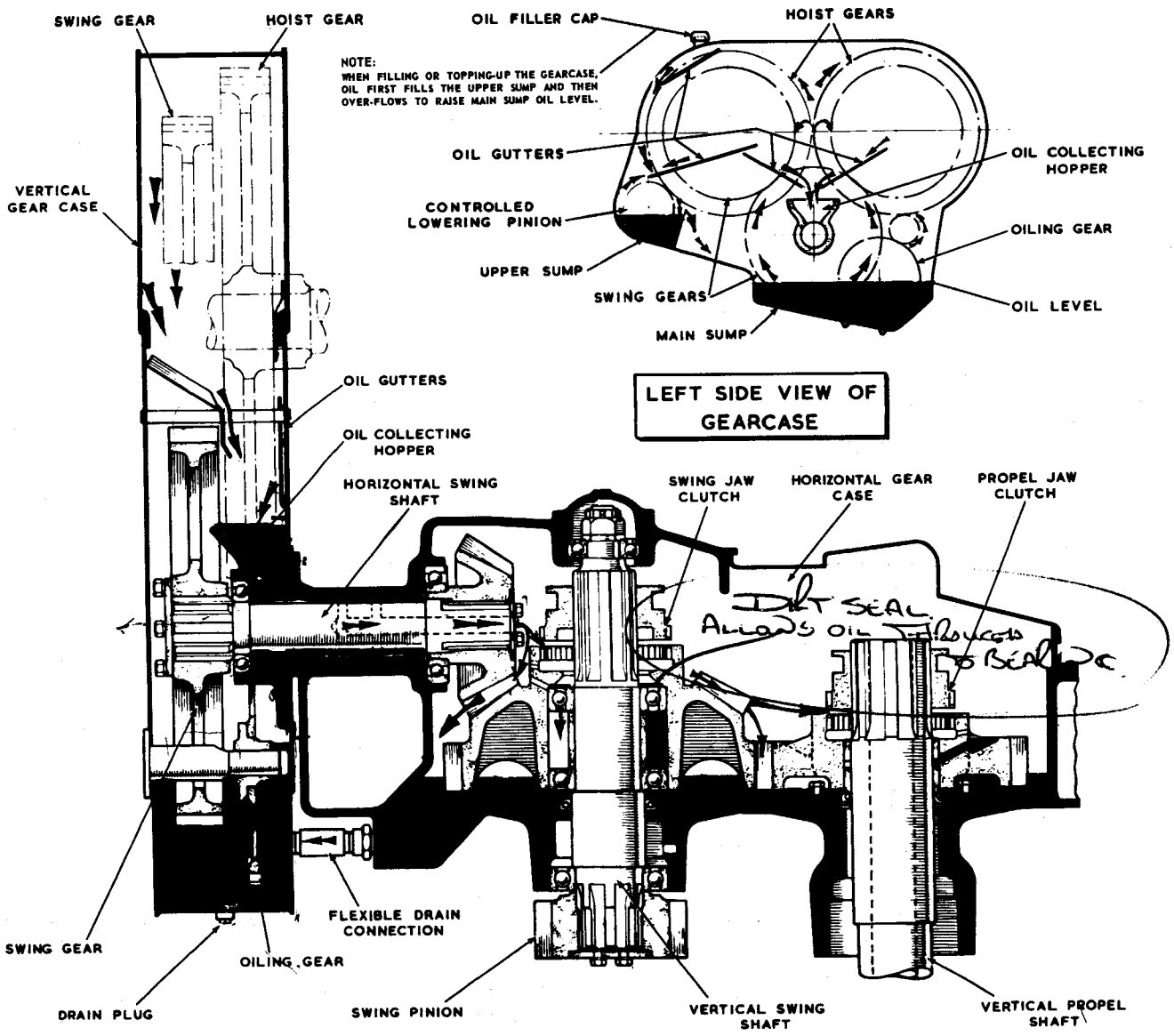


Fig. 1. Main Machinery - Lubrication System

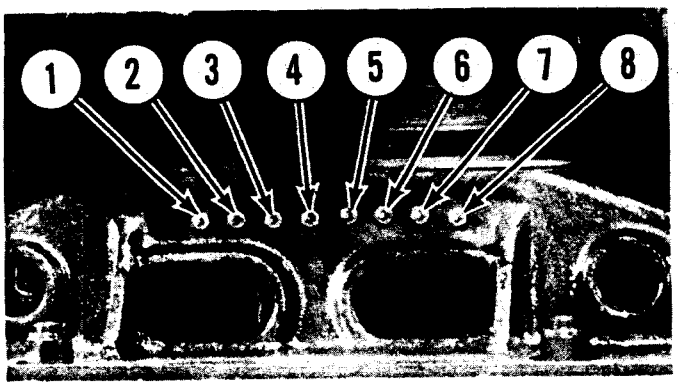


Fig. 2. Grouped Grease Nipples on Truck Frame.

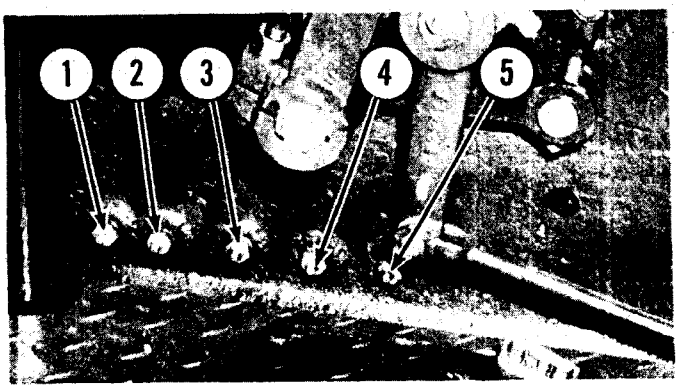


Fig. 3. Grouped Grease Nipples near Operator.

KEY TO RECOMMENDED LUBRICANTS FOR 22-RB EXCAVATORS

REF.	CLIMATIC CONDITIONS	GRADE OF 'SHELL' LUBRICANT RECOMMENDED
A	ENGINE (6YCN or 6YDAN), TRANSMISSION CHAIN CASE AND ALL OIL-CAN LUBRICATION POINTS.	
	TEMPERATE CONDITIONS	REFER TO ENGINE MANUFACTURER'S INSTRUCTION BOOK AND BE SURE TO USE THE RECOMMENDED LUBRICANT, OR AN EXACT EQUIVALENT WHEN AN ALTERNATIVE MAKE IS DESIRED.
	TROPICAL CONDITIONS	
	ARCTIC CONDITIONS	
B	MAIN MACHINERY TRANSMISSION GEAR CASE	
	TEMPERATE & TROPICAL (Above - 32°F)	MACOMA OIL 72
	ARCTIC CONDITIONS (Below - 32°F)	MACOMA OIL 68
C	PROPEL BEVEL GEAR CASE, EXPOSED ROLLER CHAIN DRIVES. Also use for WIRE ROPES, when a heavy oil is preferred instead of compound.	
	TEMPERATE & TROPICAL (Above - 32°F)	MACOMA OIL 82
	ARCTIC CONDITIONS (Below - 32°F)	MACOMA OIL 275
D	HOOK ROLLER PATH, WIRE ROPES and DIPPER HANDLE.	
	TEMPERATE & TROPICAL (Above - 32°F)	CARDIUM COMPOUND D
	ARCTIC CONDITIONS (Below - 32°F)	CARDIUM COMPOUND A
E	ELECTRIC MOTORS & GENERATORS (When applicable)	
	ALL TEMPERATURES	ALVANIA GREASE 3
F	EXPOSED GEARS, SWING RACK & PINION TEETH	
	TEMPERATE & TROPICAL (Above - 32°F)	CARDIUM COMPOUND F
	ARCTIC CONDITIONS (Below - 32°F)	CARDIUM COMPOUND D
G	GREASE NIPPLES (Generally - Except Electrical and other equipment requiring separately specified lubricants.)	
	ALL TEMPERATURES	ALVANIA GREASE EP2
H	AIR LINE LUBRICATION	
	ALL TEMPERATURES	TELLUS OIL 27

LUBRICATING YOUR MACHINE

IMPORTANT NOTES

GENERAL NOTES

Regular and correct Lubrication is one of the most important factors in obtaining low upkeep and maintenance costs. The importance of efficient lubrication cannot be too often emphasized, especially in regard to excavating machinery, which is exposed to the elements and subjected to sudden shocks and high stresses.

Correct lubrication means, not only the application of oil and grease, but the application at the proper time, of the proper quantity of the lubricant best adapted to the particular duty.

Cheap lubricants are by no means cheap in the long run, and it has been definitely proved that it is a paying proposition to use the correct grades of lubricants.

Operators and owners are earnestly requested to use only the oils and greases recommended, so as to cut down to a minimum, repair and maintenance costs.

SELECTION OF LUBRICANTS

On page 3 of this section is a Key List showing the lubricants recommended by a well known oil company, for various applications. This list is intended as a guide, and if a substitution by other makes of lubricant is made, then the corresponding products should be equivalent to those listed.

OPERATORS RESPONSIBILITY

The operator should always be responsible for proper lubrication even where an oiler is assigned to the machine to do the actual work. The operator should see that the oiler is properly instructed and that he does his lubricating regularly, cleanly and correctly.

A good operator never neglects lubrication of his machine. It may require a little study on his part to find out just how much lubricant should be added at each servicing, but such a study will be repaid by a smooth running machine and long wearing parts.

With greater use made of anti-friction bearings the number of points requiring frequent lubrication has been greatly reduced. It is necessary, however to keep track of just when lubrication is required at any particular point. It is suggested therefore a proper record be kept of all lubrication, by regularly maintaining a form of log sheet or log book for this purpose. If this recording is carried out efficiently, the operator taking over on the next shift, or a different operator taking over in an emergency will always be able to see at a glance, just how lubrication matters stand. The Plant Manager will also have a ready reference when he wishes to check up on any matter connected with frequency of lubrication.

THE IMPORTANCE OF CLEANLINESS

Dirt and grit applied in or with the lubricant helps to make up a 'grinding paste', that will destroy the machine that you are trying to protect.

Always keep grease and oil clean, taking care of the following points:-

1. Be sure oil and grease comes to you clean and properly sealed, and is not contaminated during delivery, when delivered from bulk.
2. Keep lubricants properly covered and stored neatly in a clean place.
3. Clean outside of grease-gun before using.
4. Clean grease fittings so that you do not force grit in with the grease.
5. Remember that the grease or oil is intended for inside the bearing, and not the outside where it may start the first stages of a filthy machine, and/or may cause trouble by getting on to a brake or clutch lining. Wipe away surplus grease squeezed out from bearings and remaining around grease fittings.
6. Wipe oil filler caps and the area round them before removing for filling or topping-up with clean oil. Also wipe round the position where the oil level dip-stick is inserted into the oil enclosure, in order to avoid accidentally poking dirt down the dip-stick hole when replacing the dip-stick.
7. Keep funnels, oil measures, oil cans and grease guns stored in a clean place, and always make quite sure that they are clean, before using.
8. Drain oil enclosures when hot, so that the draining oil carries off sludge, and the draining is more complete.

9. When making regular inspection of machinery, watch for signs of incorrect lubrication such as an accumulation of excess grease. Be sure that the grease has not come from a broken or disconnected grease pipe. If a grease line or fitting is found damaged or blocked have it repaired, replaced or cleared at once so that proper lubrication can be restored. Also watch out for oil leaks due to worn or damaged oil seals, gaskets, etc., and replace without delay.

SMALL QUANTITIES AND OFTEN

As a general rule, lubrication should be applied in small quantities often and regularly rather than in large quantities at infrequent intervals.

When large quantities are applied at one time, most of the lubricant is wasted without performing useful work. When long periods occur between oiling, the parts wear and may be seriously damaged from lack of lubricant.

Applying a lot of grease or oil is of little help in getting into the space between two bearing surfaces where it is needed. Apply a small amount, then rotate or move the part to change the contact. Where possible, lubricate bearings when not under load. On the track rollers and tumblers, where grease does not seem to enter freely, it may be easier to get it to work into the bearing as the machine is moving and rotating the part.

DANGEROUS LUBRICANTS

Both oil and grease for ball or roller bearings should be free from acid, uncombined alkali or sulphur; any of these will pit or etch the highly polished surfaces.

Do not use for anti-friction bearings oils or greases that are apt to gum, become rancid, or develop acid, nor which contain graphite, talc or pumice. Overheating of fast moving bearings is also sometimes due to the use of long-fibre greases that do not dissipate heat freely.

If a grease gun has been used for graphite or other unsuitable grease, be sure it is cleaned thoroughly before loading with the correct grease.

DOUBLE OR TRIPLE SHIFT OPERATION

When the machine is operated for more than one shift each day, all operators must co-operate so that the proper lubrication schedule is maintained, and that no lubrication point is overlooked or overlubricated. It is usually best to take care of most of the lubrication at the beginning of the shift, while the engine is being warmed up. A few points that need lubrication more than once a shift can usually be taken care of during a short wait for a truck or some other such delay.

REMEMBER

Never forget that the frequency of lubrication indicated by the Lubrication Charts is based on normal working conditions. When abnormal conditions are encountered adjust the frequency and amounts to ensure adequate lubrication at all times.

Remember also that when a machine has been entirely or partly dismantled for repair or transport, it is of great importance to ensure that all bearings, grease and oil enclosures are properly replenished with lubricant during re-assembly.

For instance when assembling or re-assembling the upper works on to the truck frame always make sure that the centre post bearings and adjacent cavities are well packed with grease. As normal lubrication to these bearings is piped for some distance, it may be a long time before the bearings receive adequate lubrication if the precaution of applying plenty of grease during assembly is neglected.

Proper lubrication pays dividends in minimum delays in output, and provides a smooth running machine having long wearing parts.

Lubrication that cannot be handled safely while the machine is operating can usually be taken care of during periods when the machine is waiting for trucks, etc. However, when the machine is engaged on a more continuous type of operation, such as digging over-burden etc., it may be necessary to delay the machine's work to lubricate moving parts. Lubrication is essential. Do not hesitate to take this delay if and when necessary, but plan your lubricating work to make the shut-down time as short as possible.

Do not omit to make a full study of the additional Lubrication Instructions contained in the separate Engine Instruction Manual, and also in the Instruction Manuals provided for the Lighting Set or any other auxiliary equipment that may have been installed on your machine.

IMPORTANT

THE CARDIUM COMPOUNDS WHICH WE RECOMMEND CUSTOMERS TO USE WHEN LUBRICATING CERTAIN SPECIFIED PARTS OF THE MACHINE, MAY REQUIRE PRELIMINARY WARMING, TO MAKE APPLICATION EASIER WITH A BRUSH.

ALTERNATIVELY, MACHINE OPERATORS SOMETIMES USE COMPOUNDS OBTAINED IN FLUID CONDITION. SUCH COMPOUNDS ARE PRE-MIXED WITH EVAPORATING TYPE DILUTING FLUIDS AND IN APPLICATION A DRYING TIME IS NECESSARY FOR EVAPORATION OF THE LIGHTER ELEMENTS. IT SHOULD BE NOTED THAT EXCESSIVE QUANTITIES INCREASE THE DRYING TIME.

LOWER WORKS LUBRICATION

SPECIAL INSTRUCTIONS

All bearings in the truck frame are sleeve bearings, grease lubricated through pressure fittings. The fittings for the propelling machinery in the truck frame are piped out to a lubrication header at the front end of the truck frame (See Fig. 2.) This group of lubrication fittings feed lubricant to the following points:-

1. R.H. Propel Shaft Outer Bearing.
2. R.H. Propel Shaft Inner Bearing.
3. Vertical Propel Shaft Lower Bearing.
4. R.H. Propel Clutch Shifter Pin.
5. L.H. Propel Clutch Shifter Pin.
6. Steering Shaft Bearing.
7. L.H. Propel Shaft Inner Bearing.
8. L.H. Propel Shaft Outer Bearing.

The drive and take-up tumbler shafts and also the top and bottom idler roller shafts have individual grease fittings.

An oil filler pipe for the propel gear case is accessible from below the truck frame. An oil level plug is provided for checking the gear case oil level and there is also a drain plug located below the gear case in a central position. Watch under the machine for oil puddles which indicate loss of oil from the gear case.

For crawler track mounting add grease to each bearing until some old grease is forced out. This will tend to flush out any dirt or grit which may have worked into the bearing.

Frequency of lubrication as given on the lubrication chart is based on normal operating service. When travelling on long moves, service the Lower Works grease fittings every two hours. Watch all bearings closely and if there is any excessive heating force in extra grease until the bearing starts to run cooler. Also give extra attention to the track pins and propelling chains to prevent running with insufficient lubrication. In addition to the fittings on the Lower Works, there is one fitting on the Upper Works that should also be serviced every two hours when travelling on long moves, this is the fitting feeding the vertical propel shaft upper bearing, shown as Ref. No. 5 on Fig. 3, depicting the grouped lubrication fitting on the R.H. side of the revolving frame and near to the operating position.

Remember that even though the machine is not propelled very much, there is considerable back and forth movement while the machine is working. This movement tends to squeeze the grease out of the bearing and cutting will start if lubrication of the tumbler shafts and idler rollers is neglected.

REFERENCE NOTES FOR LOWER WORKS LUBRICATION CHART

NOTE:

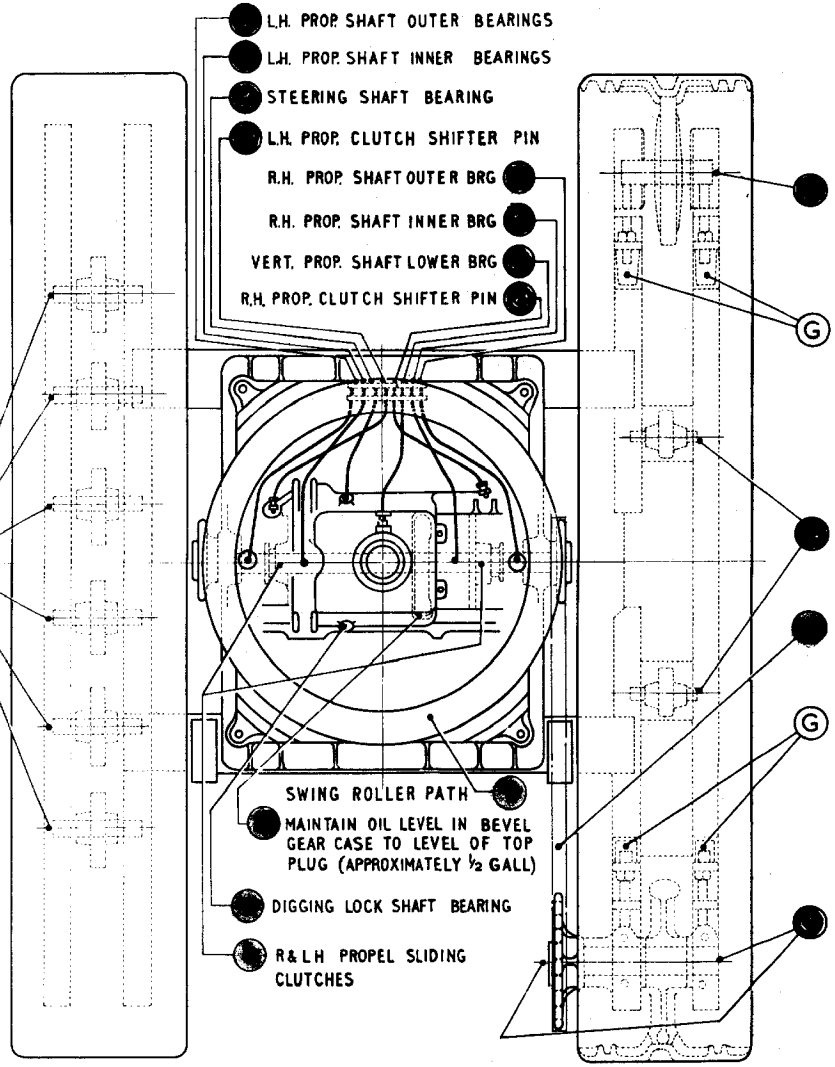
1. Clean fittings before applying grease gun. Propel the machine back and forth for a short distance after greasing to ensure the distribution of lubricant all the way round the bearings.
2. Fittings for lubricating the front tumbler bushing may be on inside end of the shaft or on outer end of shaft.
3. Track link pins - Some operators prefer to run these dry but field tests indicate that in most cases better service can be obtained if a small quantity of drained crankcase oil is poured onto the track pins at least each time when the engine crankcase is drained. Lubricate the track link pins once each shift when the machine is being propelled long distances.
4. Propel Gear Case - Every five 8-hour shifts check oil level with machine standing on level ground and add lubricant if necessary. When machine has operated in deep water or following heavy rain remove drain plug and allow any accumulation of water to drain off. Twice a year, drain the propel gear case immediately after propelling, and refill with approximately half a gallon of the correct lubricant. If the drained oil is reasonably clean, then for the sake of economy it may be desirable to retain it for application to exposed roller chains such as the Propel Chains etc.
5. Swing Roller Path - Cone Roller Paths are best lubricated to suit the site conditions. A thin coating of Compound 'D' is satisfactory for clean dry conditions, but for dirty conditions, wipe the roller path at least once each shift, using a rag soaked in diesel oil.
6. Steering Clutches - Do not omit to lubricate the grease fittings in the sliding clutches. Also grease or oil the shifter grooves and sliding splines once every five shifts.
   Occasionally remove the clutch covers and clean off any dirt which may have accumulated on the clutch splines.

22-RB LOWER WORKS LUBRICATION CHART

NOTES:- 1. THE LETTERS IN THE CIRCLES INDICATE THE CORRECT GRADE OF LUBRICANT FOR EACH POINT: — SEE KEY TO RECOMMENDED LUBRICANTS.

2. THE COLOUR OF THE CIRCLES AND LEAD LINES INDICATES THE FREQUENCY OF LUBRICATION; VIZ:- RED DENOTES ONCE EVERY 8-HOUR SHIFT, AND GREEN DENOTES ONCE EVERY FIVE 8-HOUR SHIFTS.

3. FOR DETAIL REFERENCE NOTES SEE OPPOSITE PAGE.



L.H. PROP. SHAFT OUTER BEARINGS
L.H. PROP. SHAFT INNER BEARINGS
STEERING SHAFT BEARING
L.H. PROP. CLUTCH SHIFTER PIN
R.H. PROP. SHAFT OUTER BRG
R.H. PROP. SHAFT INNER BRG
VERT. PROP. SHAFT LOWER BRG
R.H. PROP. CLUTCH SHIFTER PIN
TAKE UP TUMBLER BEARINGS
(G) TAKE UP TUMBLER ADJUSTING SCREWS
OIL CAN POINTS
ONCE EVERY 8-HOUR SHIFT, OIL ALL BELL CRANK, AND LEVER PINS, OF THE STEERING CLUTCH, AND DIGGING LOCK LEVER ASSEMBLY.
LOWER TRACK ROLLERS
UPPER ROLLERS
PROTECT SCREW THREADS OF ADJUSTING SCREWS BY MAINTAINING COATING OF GREASE OR COMPOUND 'D'
PROPEL CHAINS
(G) DRIVING TUMBLER ADJUSTING SCREWS
ADDITIONAL LUBRICATION POINT (NOT SHOWN ON CHART)
ONCE EVERY TWENTY SHIFTS, LUBRICATE GREASE NIPPLES IN DIGGING LOCK PAWLS, REACH FROM BELOW TRUCK FRAME. FOR POSITION OF PAWLS, SEE FIG.4. ON PAGE.4. SECTION.2.
SWING ROLLER PATH
MAINTAIN OIL LEVEL IN BEVEL GEAR CASE TO LEVEL OF TOP PLUG (APPROXIMATELY ½ GALL)
DIGGING LOCK SHAFT BEARING
R&L H PROPEL SLIDING CLUTCHES
DRIVING TUMBLER BEARINGS

IMD.80.

UPPER WORKS LUBRICATION

REVOLVING FRAME AND DECK MACHINERY

SPECIAL INSTRUCTIONS

The revolving frame rotates on cone rollers and is centred on the truck frame by a bronze-bushed gudgeon. The grease fittings for the cone rollers are in the outer ends of the pins. The fitting for the centre bushing is piped out to a point near the operator (See Ref. 4, Fig. 3). Additional fittings for the swing and propel shaft bearings are also piped out to the same group of nipples, which are all shown on the Upper Works Lubrication Chart.

REFERENCE NOTES FOR UPPER WORKS LUBRICATION CHART

NOTE:

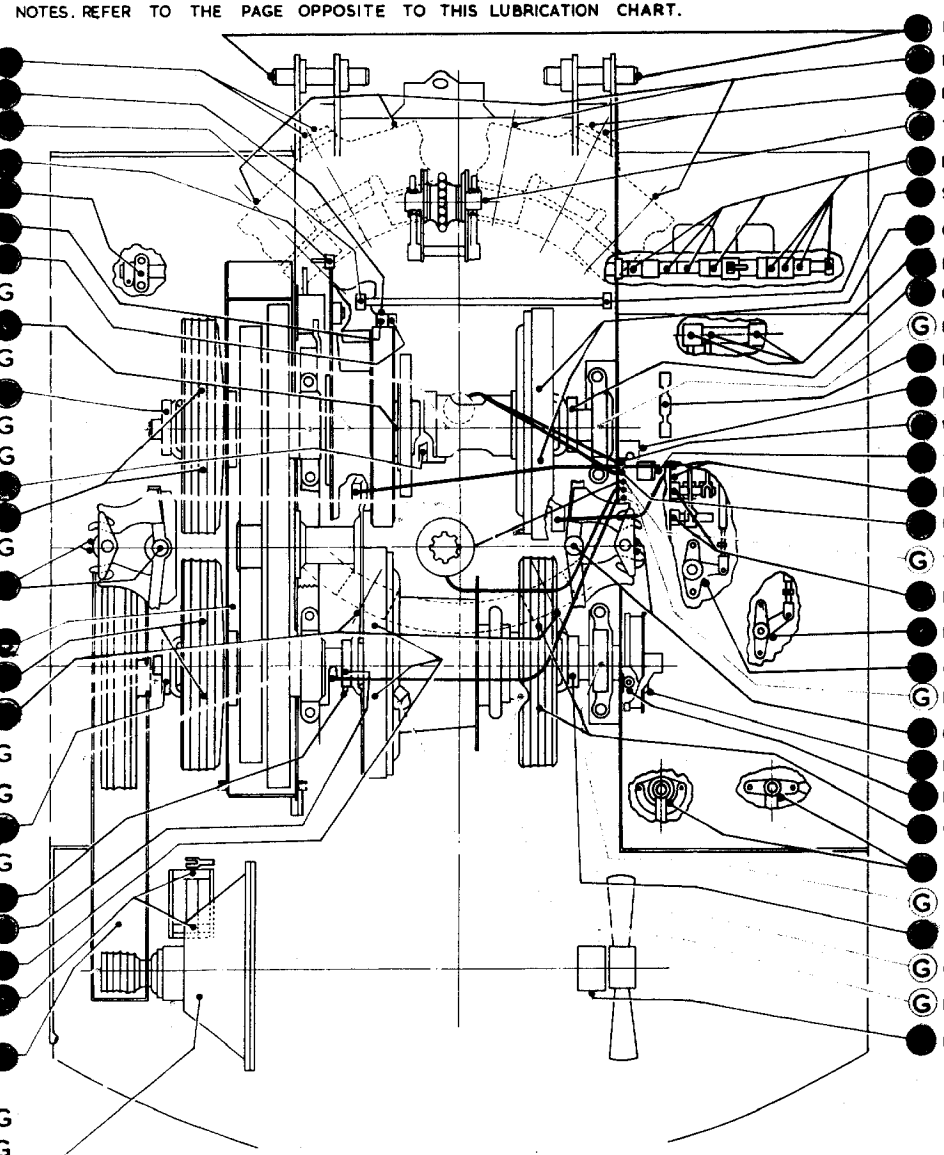
1. Clean fittings before applying lubricant.
2. Once per 8-hour shift, inspect the swing rack on the truck frame from below. If there are any bright spots, coat teeth with gear compound (Ref. 'F' on Key to Recommended Lubricants). Remove cover plate in R.H. deck plate, just rear of centre line of rotation and apply lubricant by brush to swing rack. Swing the machine a little at a time to reach points needing lubrication.
3. Once every five 8-hour shifts, with the machine standing on level ground, check the oil levels in the transmission chain case and the main machinery gear case. If necessary add sufficient appropriate lubricant until the level of the oil level plug is reached. Twice a year or when temperature changes make it necessary, drain these gear cases (immediately after operation while the oil is still warm) and refill with the correct grade of oil. The transmission chain case requires approx. 6 pints of oil and the machinery gear case needs approx. 5½ gallons.
4. Swing and Propel Jaw Clutches - Every twenty 8-hour shifts, remove the centre cover just below the front drum shaft, and pour engine oil over the splines of the vertical propel shaft and oil the splines at the top of the vertical swing shaft by means of the plunger type oil can. Also pour oil into the top of the vertical propel shaft to lubricate the vertical control rods to steering clutches and digging lock etc.
5. In addition to servicing all pressure grease fittings, be sure to oil regularly all bell cranks, levers and pins of the operating lever linkages.
6. The lubrication of engine clutch shaft and clutch shifter bearings varies with the type of power unit installed.
   Refer to Engine Manufacturer's Instruction Book, if no grease nipples are evident. Avoid over lubrication as this leads to excessive leakage when running at operating temperatures, and may result in the clutch slipping.
7. Exposed Roller Chain Drives - Such as Boom Hoist Drive Chain and also Drum Connecting Chains and Crowd Chains (When fitted) - Keep well lubricated by using a brush to apply oil Ref. 'B' or 'C', every three or four shifts, or more often if the chain tends to run dry.
8. DIESEL ENGINE - Once every 8-hour shift with the machine standing on level ground, check engine lubricating oil levels of the main sump and injection pump(s) by means of the dipsticks and top up with oil of the recommended grade (Ref. 'A' on Key to Recommended Lubricants). For full instructions regarding engine lubrication, draining and re-filling etc., refer to the separate Engine Instruction Manual furnished with your machine.

22 UPPER WORKS LUBRICATION CHART

NOTES:-THE LETTERS IN THE SMALL CIRCLES INDICATE THE CORRECT GRADE OF LUBRICANT FOR EACH POINT. SEE KEY TO RECOMMENDED LUBRICANTS.

THE COLOUR OF THE SMALL CIRCLES AND LEAD LINES INDICATE THE FREQUENCY OF LUBRICATION. VIZ.-BLUE DENOTES TWICE PER 8-HOUR SHIFT, RED DENOTES ONCE EVERY 8-HOUR SHIFT, GREEN DENOTES ONCE EVERY FIVE SHIFTS, AND YELLOW DENOTES ONCE EVERY TWENTY SHIFTS.

FOR DETAIL REFERENCE NOTES. REFER TO THE PAGE OPPOSITE TO THIS LUBRICATION CHART.



L.H. CONICAL ROLLER CARRIAGE PINS
BOOM HOIST CAM
SHIFTER SHAFT L.H. BEARING
BOOM HOIST LEVER LOCK
SWING CLUTCH SHAFT
BOOM HOIST BRAKE LEVER
BOOM HOIST BOOSTER LEVER
CROWD CLUTCH HOUSING BEARING G
BOOM HOIST BOOSTER HOUSING
BOOM HOIST DRUM BEARINGS G
SWING CLUTCH SHIFTER COLLAR
SWING CLUTCH HOUSING BEARINGS G
FORWARD SHAFT L.H. MAIN BEARING G
STEERING SHAFT BRACKET
(OIL SPARINGLY) SWING CLUTCH TOGGLE LINKS
BRAKE ANCHOR PINS G
SWING CLUTCH SHIFTER LEVERS
(SEE NOTE.3) MAINTAIN OIL IN GEAR CASE AND MAIN SUMP TO OIL PLUG LEVEL IN SIDE OF CASE APPROX 5½ GALLS
(OIL SPARINGLY) SWING CLUTCH TOGGLE LINKS
REAR CONICAL ROLLERS
SWING CLUTCH HOUSING BEARINGS G
HORIZONTAL TRANSMISSION SHAFT L.H. BEARING G
SWING CLUTCH SHIFTER COLLAR
REAR SHAFT L.H. MAIN BEARING G
HOIST CLUTCH SHIFTER LEVER
HOIST CLUTCH SHIFTER COLLAR
(OIL SPARINGLY) HOIST CLUTCH TOGGLE LINKS
ENGINE CLUTCH OPERATING BRACKET
(SEE NOTE.3) MAINTAIN OIL IN CHAIN CASE TO LEVEL OF PLUG IN SIDE OF CASE APPROX 6 PINTS
(SEE NOTE.6) ENGINE CLUTCH SHAFT INNER BEARING G
ENGINE CLUTCH SHAFT OUTER BEARING G
ENGINE CLUTCH SHIFTER BEARING

BOOM FOOT PINS
R.& L.H. FRONT CONICAL ROLLERS
R.H. CONICAL ROLLER CARRIAGE PINS
TAKE UP SPROCKET SHAFT (SHOVEL)
HAND LEVER ASSEMBLY (REACH FROM BELOW)
SHIFTER SHAFT R.H. BEARING
CROWD CLUTCH TOGGLE LINKS (OIL SPARINGLY)
R.& L.H. FOOT BRAKE LEVERS
CROWD CLUTCH SHIFTER COLLAR
G FORWARD SHAFT R.H. MAIN BEARING
HIGH SPEED PROPEL PEDAL
DIGGING LOCK SLEEVE
VERTICAL PROPEL SHAFT UPPER BEARING
SWING JAW CLUTCH SHAFT (SEE NOTE.4)
BRAKE SHAFT L.H. BEARING
CENTRE PINTLE BEARING
G VERTICAL SWING SHAFT BEARINGS
BRAKE SHAFTS R.H. BEARING
HOIST CLUTCH LEVER
CROWD CLUTCH LEVER
G HORIZONTAL TRANSMISSION SHAFT R.H. BEARING
CROWD CLUTCH SHIFTER LEVERS
DIPPER TRIP DRUM (SHOVEL SKIMMER AND DRAGSHOVEL)
HIGH SPEED PROPEL BEARING
CROWD CLUTCH TOGGLE LINKS (OIL SPARINGLY)
ENGINE CLUTCH LEVERS
G REAR SHAFT R.H. MAIN BEARING
CROWD CLUTCH SHIFTER COLLAR
G CROWD CLUTCH HOUSING BEARINGS
G HOIST DRUM BEARINGS
RADIATOR FAN HUB

IMD 84/R2

SHOVEL EQUIPMENT LUBRICATION

When lubricating your machine, never neglect the Front End Equipment, which is working under dirt and moisture conditions.

If the machine is fitted with a Shovel Equipment, carry out your lubrication schedule with the aid of the Lubrication Chart on page 11 (Facing these notes) and referring to the Key to Recommended Lubricants given on page 3.

When greasing, be sure to add sufficient grease so that a portion of the old grease is forced out of the bearings, each time the fittings are serviced. This will help to keep dirt out of the bearings.

REFERENCE NOTES FOR SHOVEL EQUIPMENT LUBRICATION CHART

NOTE: 1. Clean all fittings before applying the lubricant gun.

NOTE: 2. Once every five shifts lubricate all Boom Suspension Sheaves at Boom Point, head of 'A' Frame, and 'A' Frame Yoke. Even when the Boom Hoist is seldom in use, there will be sufficient movement between the sheaves and pins to make it necessary to replace the film of lubricant regularly. Also remember that adequate lubrication provides protection against the elements and helps to keep out dirt.
The 'A' Frame Head Pin has grease nipples fitted at each end. The horizontal Sheave in the 'A' Frame Yoke is lubricated through a grease nipple in the Sheave Pin.

NOTE: 3. Dipper Latch Bar – Every 8-hour shift, lubricate all wearing surfaces of the latch, by pouring on a little oil with the Oil Can. Also oil latch release linkage and trip rope sheaves.

NOTE: 4. Wire Ropes – Keep all Shovel Equipment Wire Ropes coated with lubricant 'D' or 'C' (See Key to Recommended Lubricants on Page 3), particularly where the rope passes over sheaves or winds on drums.

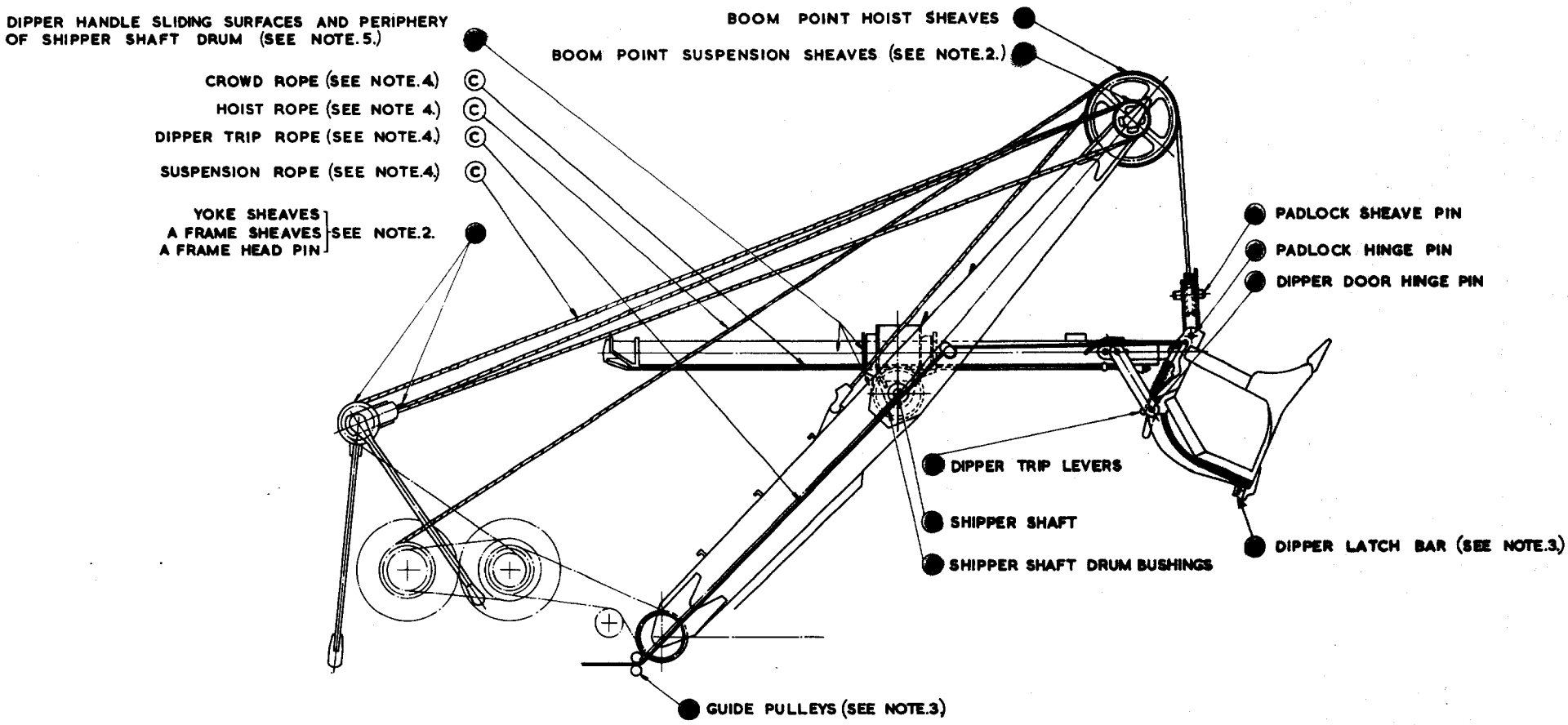
NOTE: 5. Twice per shift (or more often when necessary in order to maintain lubricating film), grease the sliding surfaces of the Dipper Handle, Saddle Block Wearing Plates and periphery of the Shipper Shaft Drum with Lubricant Ref. 'D'.

SHOVEL EQUIPMENT LUBRICATION CHART

NOTES:- 1. THE LETTERS IN THE SMALL CIRCLES INDICATE THE CORRECT GRADE OF LUBRICANT FOR EACH POINT. SEE KEY TO RECOMMENDED LUBRICANTS

2. THE COLOUR OF THE SMALL CIRCLES AND LEAD LINES INDICATE THE FREQUENCY OF LUBRICATION. VIZ:- BLUE DENOTES TWICE PER 8 HOUR SHIFT. RED DENOTES ONCE EVERY 8 HOUR SHIFT. GREEN DENOTES ONCE EVERY FIVE SHIFTS.

3. FOR DETAIL REFERENCE NOTES REFER TO THE PAGE OPPOSITE TO THIS LUBRICATION CHART.



IMD.116

DRAGLINE, CRANE & GRABBING CRANE EQUIPMENT LUBRICATION

When lubricating your machine, never neglect the Front End Equipment, which is working under dirt and moisture conditions.

If the machine is fitted with any of the above equipment, carry out your lubrication schedule with the aid of the Lubrication Chart on page 13 (Facing these notes) and referring to the Key to Recommended Lubricants given on page 3.

When greasing, be sure to add sufficient grease so that a portion of the old grease is forced out of the bearings, each time that the fittings are serviced. This will help to keep dirt out of the bearings.

REFERENCE NOTES FOR DRAGLINE, CRANE AND GRABBING CRANE LUBRICATION CHART

NOTE: 1. Clean all fittings before applying the lubricant gun.

NOTE: 2. Once every five shifts, lubricate all Boom Suspension Sheaves at head of 'A' Frame, 'A' Frame Yoke, and Boom Point or Pendant Yoke in the case of Pendant Type Suspensions.
Even when the Boom Hoist is seldom in use, there will be sufficient movement between the sheaves and pins to make it necessary to replace the film of lubricant regularly, and remember always that adequate lubrication affords protection against the elements and helps to keep out dirt.
When the boom hoist machinery is in more regular use, as for instance when using the machine on some type of crane operation, then it is advisable to increase the frequency of lubricating the suspension sheaves and pins to once per shift.
Be careful not to miss adequate lubrication of any sheave, some are lubricated through grease nipples fitted in the sheave pin and others are lubricated direct through nipples fitted in the boss of the sheave concerned.

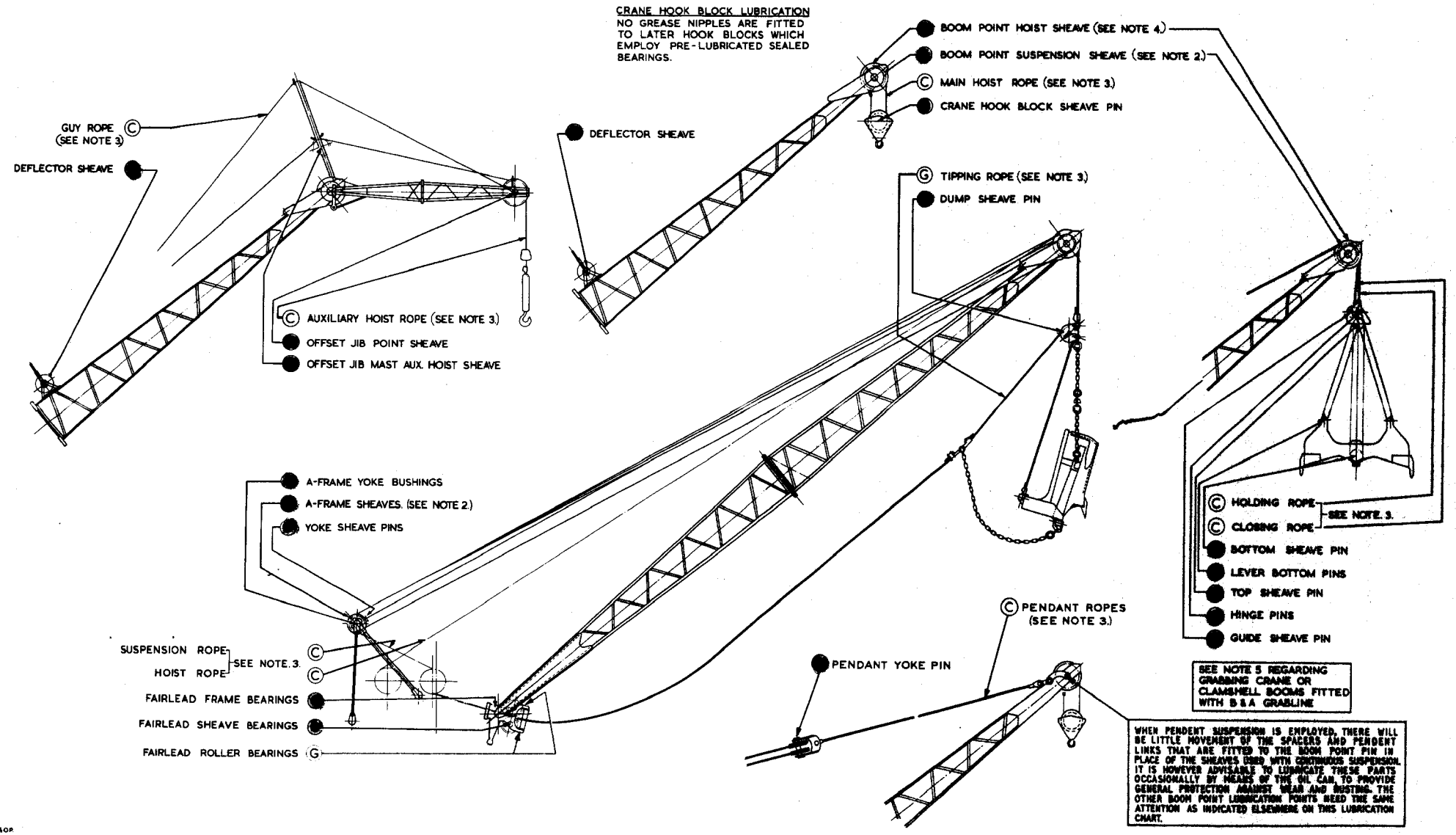
NOTE: 3. Wire Ropes – Keep all wire ropes except Dragline Drag Rope, coated with Lubricant 'D' or 'C' (See Key to Recommended Lubricants) particularly where the rope passes over sheaves or winds on a drum. Even when a wire rope does not make such contact and has little movement in its service, it is as well to remember that the lubricant will extend the life of the rope by providing protection against the elements.

NOTE: 4. The Boom Point Hoist Sheaves are lubricated through grease nipples fitted in the ends of the boom point pin.

NOTE: 5. In connection with Grabbing Cranes or Clamshells fitted with the No. 2. B and A Automatic Grabline device, note that it is important to ensure that the barrel is filled with Gear Oil 'C' (See Key to Recommended Lubricants on Page 3) An oil filling plug is provided at the end of the barrel and the oil capacity is 11 pints. Avoid the use of too thin oil or overfilling, as it will result in seepage along the drum shaft.

DRAGLINE, CRANE & GRABBING CRANE EQUIPMENT – LUBRICATION CHART

NOTES:- 1. THE LETTERS IN THE SMALL CIRCLES INDICATE THE CORRECT GRADE OF LUBRICANT FOR EACH POINT. SEE KEY TO RECOMMENDED LUBRICANTS.
2. THE COLOUR OF THE SMALL CIRCLES AND LEAD LINES INDICATES THE FREQUENCY OF LUBRICATION VIZ:- BLUE DENOTES TWICE PER 8 HOUR SHIFT, RED DENOTES ONCE EVERY 8 HOUR SHIFT, GREEN DENOTES ONCE EVERY FIVE SHIFTS AND YELLOW DENOTES ONCE EVERY TWENTY SHIFTS.
3. FOR DETAIL REFERENCE NOTES REFER TO THE PAGE OPPOSITE TO THIS LUBRICATION CHART.



I.M.D. 118/R6

DRAGSHOVEL EQUIPMENT LUBRICATION

When lubricating your machine, never neglect the Front End Equipment, which is working under dirt and moisture conditions.

If the machine is fitted with a Dragshovel Equipment, carry out your lubrication schedule with the aid of the Lubrication Chart on page 15 (Facing these notes) and referring to the Key to Recommended Lubricants given on page 3.

When greasing, be sure to add sufficient grease so that a portion of the old grease is forced out of the bearings each time the fittings are serviced. This will help to keep dirt out of the bearings.

REFERENCE NOTES FOR DRAGSHOVEL EQUIPMENT LUBRICATION CHART

NOTE: 1. Clean all fittings before applying the lubricant gun.

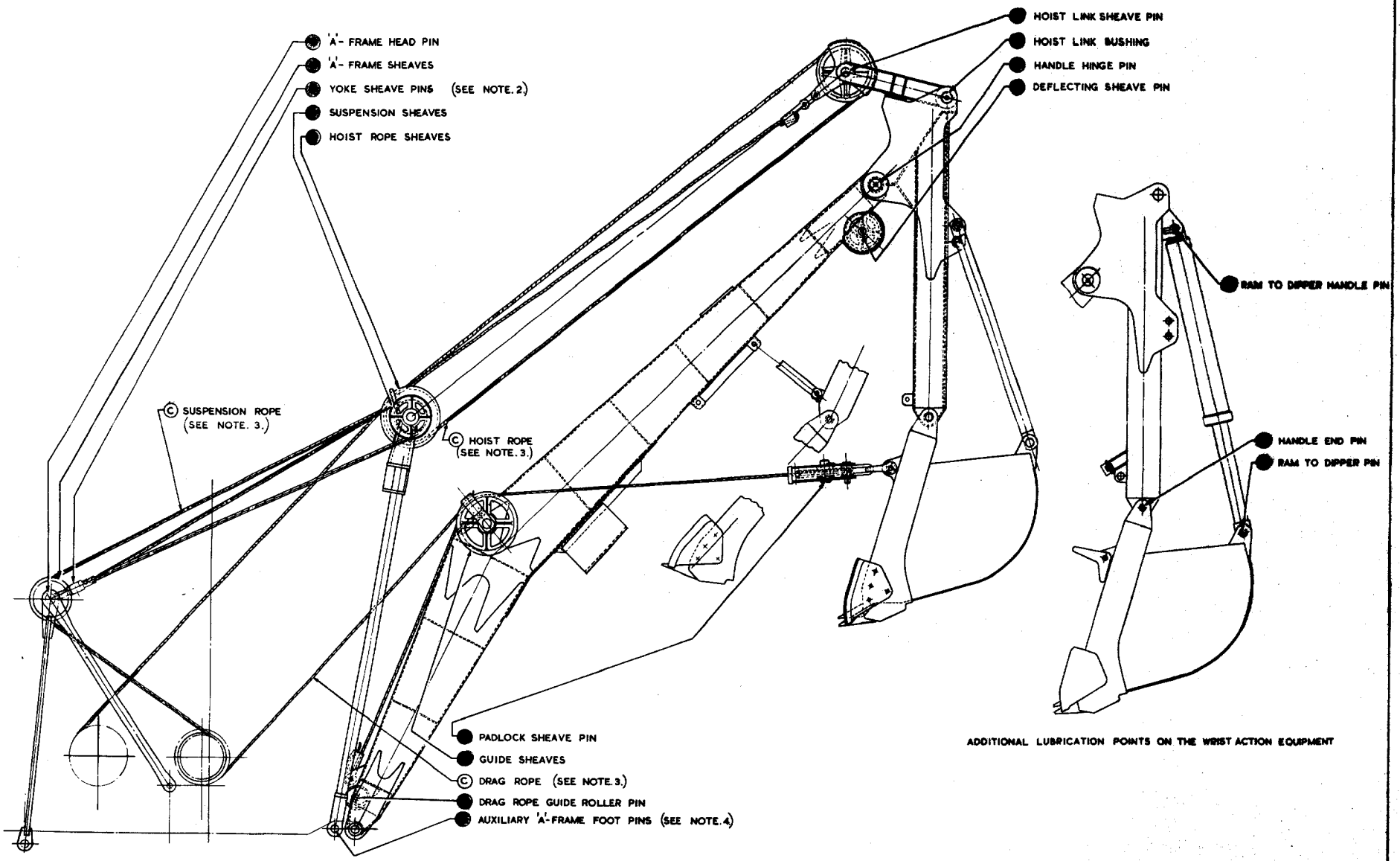
NOTE: 2. Once every five shifts lubricate all Boom Suspension Sheaves at head of 'A' Frame, 'A' Frame Yoke and also head of Auxiliary 'A' Frame. Even when adjustments to the suspension are seldom made, there will be sufficient movement between the sheaves and pins to make it necessary to replace the film of lubricant regularly, and remember always that adequate lubrication affords protection against the elements and helps to keep out dirt. The 'A' Frame Suspension Sheaves are lubricated through fittings in the ends of 'A' Frame Pin, and the Yoke Sheave is lubricated through the Yoke Sheave Pin. The Auxiliary 'A' Frame Suspension Sheaves are lubricated through fittings in the ends of the Auxiliary 'A' Frame Head Pin.

NOTE: 3. Wire Ropes – Keep all wire ropes coated with lubricant 'D' or 'C' (See Key to Recommended Lubricants) particularly where the rope passes over sheaves or winds on a drum. Even when a wire rope does not make such contact and has little movement in its service, it is as well to remember that the lubricant will extend the life of the rope by providing protection against the elements.

NOTE: 4. The Auxiliary 'A' Frame Foot Pins and Bearings are not fitted with grease nipples and require little lubrication. There is however slight movement at this point in working conditions and when adjusting the suspension of the Auxiliary 'A' Frame by means of the boom hoist machinery. Once every five shifts pour a little engine oil (With the Oil Can) between the faces of the Auxiliary 'A' Frame Foot and Bearing Castings so that it will run down on to the Foot Pins.

DRAGSHOVEL EQUIPMENT LUBRICATION CHART

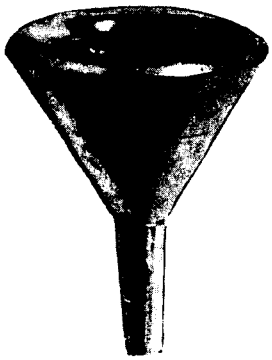
NOTES:- 1. THE LETTERS IN THE SMALL CIRCLES INDICATE THE CORRECT GRADE OF LUBRICANT FOR EACH POINT. SEE KEY TO RECOMMENDED LUBRICANTS.
2. THE COLOUR OF THE SMALL CIRCLES AND LEAD LINES INDICATES THE FREQUENCY OF LUBRICATION. VIZ: BLUE DENOTES TWICE PER 8 HOUR SHIFT, RED DENOTES ONCE EVERY 8 HOUR SHIFT, AND GREEN DENOTES ONCE EVERY FIVE SHIFTS.
3. FOR DETAIL REFERENCE NOTES REFER TO THE PAGE OPPOSITE TO THIS LUBRICATION CHART.



ADDITIONAL LUBRICATION POINTS ON THE WRIST ACTION EQUIPMENT

S. O.P.

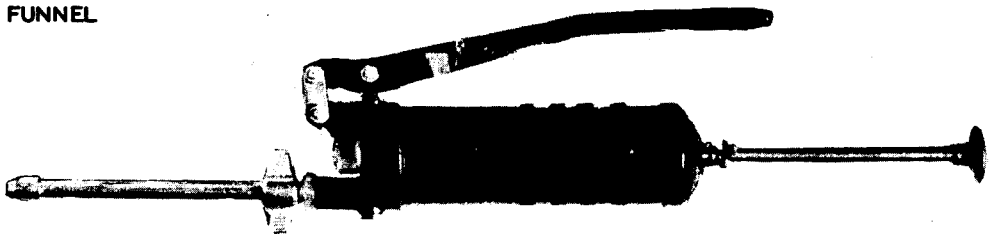
LUBRICATION EQUIPMENT



OIL FUNNEL

NOTE:
USE THE SMALL GREASE GUN FURNISHED WITH THE ENGINE TOOL KIT, FOR APPLICATIONS WHERE THE JUNIOR HAND COMPRESSOR IS TOO BULKY.

PLUNGER TYPE OIL CAN



TECALEMIT GREASE GUN—JUNIOR HAND COMPRESSOR
TYPE JCT.906 — CAPACITY 12½OZ.

LUBRICATION EQUIPMENT SUPPLIED WITH TOOL KIT.

Fig. 4.

OPERATING AND MAINTENANCE INSTRUCTIONS

1. THE TYPE JCT.906 JUNIOR HAND COMPRESSOR

LUBRICANT

Use only recommended grease listed on the Key to Recommended Lubricants given on Page 3, or a grease of equivalent specification. These guns are not intended for use with oil lubricants.

METHODS OF FILLING

(1) By hand.

(2) By means of a Tecalemit gun filler attachment.

(3) By means of a Tecalemit easy filler container.

FILLING WITH LUBRICANT

(1) Filling by hand, by suction - See Fig. 5.

(a) Make sure gun is clean, unscrew and remove head. Ensure that follower piston is adjacent to open end of barrel if gun is empty, otherwise remaining content of grease to be flush with end of barrel.

(b) Place open end of barrel into grease in container and, whilst forcing the barrel downwards into the grease with the left hand (the left thumb holding down firmly the ram rod lock), hold the ram rod stationary with the right hand. The barrel is full when the ram rod is fully withdrawn.

(c) Grasp the ram rod in the right hand, and withdraw the gun barrel from the lubricant through the fingers of the left hand held stationary to remove grease from outside of barrel.

Screw on head tightly and wipe barrel dry.

(2) Filling by gun filler attachment - See Fig. 6.

(a) Remove filler plug from head and place aside on clean surface. Remove cap from vertical filling nozzle on gun filler attachment, clean nozzle and gun.

(b) Holding gun barrel vertical, filling orifice downwards, insert filling nozzle into orifice.

(c) Hold down ram rod lock with forefinger or thumb of left hand whilst rotating gun filler attachment handle with right hand. When ram rod is fully extended the gun is full. Replace filler plug in head tightly.

(3) Filling by means of easy filler container See Fig. 7.

(a) Unscrew gun head from barrel, and ensure that follower piston is adjacent to open end of barrel if gun is empty, or that remaining grease content is flush with end of barrel.

(b) Place open end of barrel flush over centre opening in easy filler plate and whilst holding the ram rod lock out of engagement and grasping the barrel with the left hand, push the barrel downwards, at the same time holding the ram rod stationary with the right hand to facilitate the action. The gun is full when the ram rod is fully extended.

PRIMING - See Fig. 8.

To assist priming whether guns are new or have been used until lubricant is completely exhausted proceed as follows:

(a) Open air release valve in gun head one or two turns, tap ram rod button on bench with gun barrel held vertically (piston downwards, do not touch ram rod lock). Operate gun lever scissorwise, occasionally tapping ram rod button on bench, until air free lubricant emerges from orifice in head.

Tighten release valve home firmly by hand.

(b) Operate gun for a few strokes further until air free lubricant emerges from lubricating connector.

CHECK VALVES

The JCT. 906 Junior Hand Compressor is fitted with the following:-

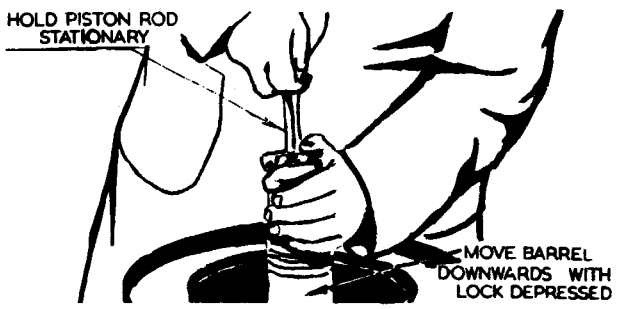


Fig. 5. Filling gun by suction.

Fig. 6. Using Gun Filler Attachment.

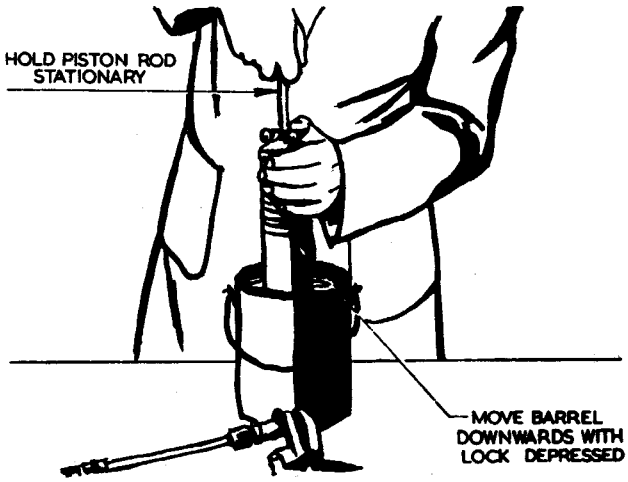


Fig. 7. Using Easy Filler Container.

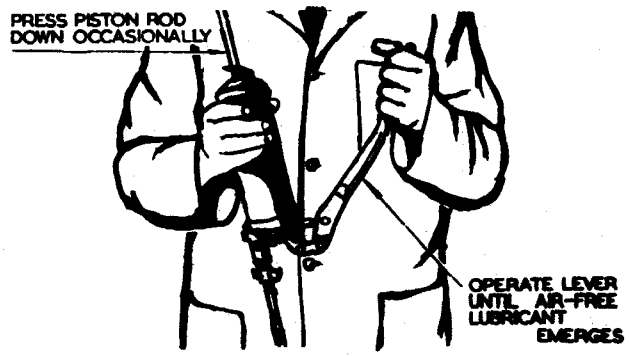


Fig. 8. Gun priming.

Outlet check valve in head, detachable.
Check valve in nozzle, detachable.

In the event of persistent air locking or poor outlet delivery pressure which cannot be rectified by use of air release valve, this indicates check valve obstruction.

Access to the outlet check valve is gained by removing the delivery tube and outlet connector. Take out, clean and examine the ball and spring.

Access to the nozzle check valve is gained by unscrewing the nozzle. Give similar treatment to the ball and spring as for the outlet valve, renew any parts necessary, and assemble in the reverse order. Ensure that the check valve balls are replaced at the gun barrel end of the springs.

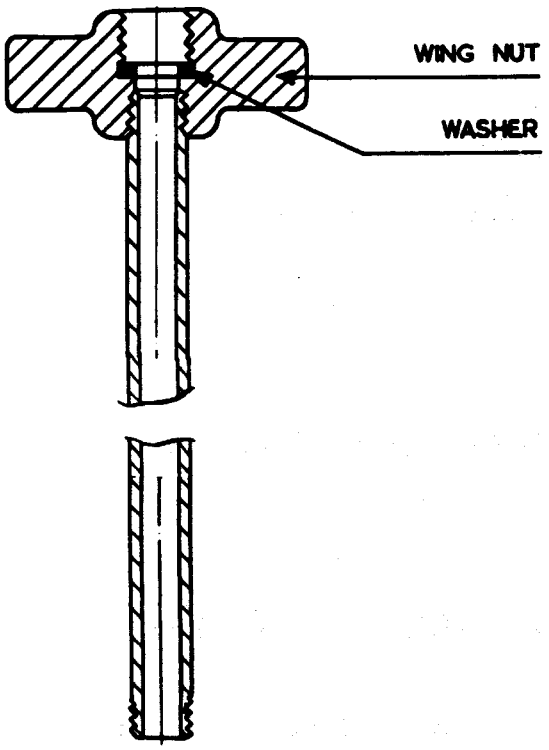


Fig. 9. Delivery Tube.

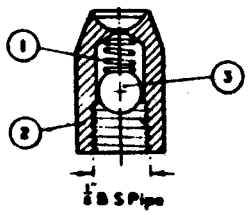


Fig. 10. Tecazerk Connector.

MAINTENANCE

Always keep gun clean and inspect occasionally for leakages. Lubricate linkage of operating lever by applying a few drops of oil at the three points of movement at least once each month.

FAULT DIAGNOSIS

FAULT 1.	**No lubricant ejected when gun is operated in the normal manner. No resistance to manual effort on pressure stroke.**
Cause 1a.	Gun empty.
Remedy 1a.	Refill and prime.
Cause 1b.	Too rapid operation. H.P. cylinder unable to charge properly.
Remedy 1b.	Operate gun more slowly especially in cold weather.
Cause 1c.	Outlet check or nozzle check valve fouled.
Remedy 1c.	Remove for cleaning. Renew any parts necessary.
Cause 1d.	Ram rod lock worn.
Remedy 1d.	Check lock by attempting to pull ram rod out of barrel. Inspect lock and renew this and the lock spring if necessary.
FAULT 2.	**No lubricant ejected when operating gun in normal manner. Full resistance to manual effort on pressure stroke.**
Cause 2a.	Delivery tube, nozzle, lubricating nipple or machine bearing oilway choked.
Remedy 2a.	Test gun for delivery. Dismantle and clear stoppage or clear or renew lubricating nipple. If the oilway is obstructed through neglect, workshop attention may be necessary.
FAULT 3.	**Persistant leakage between nozzle and nipple when operating.**
Cause 3a.	Defective lubricating nipple or nipple of incorrect angle in use.
Remedy 3a.	Inspect nipple, renew same if necessary. If angle nipple is fitted, ensure that the angle is correct, or nipple rotated on its thread to a position which will permit resonable alignment of the nipple with the hand gun nozzle.

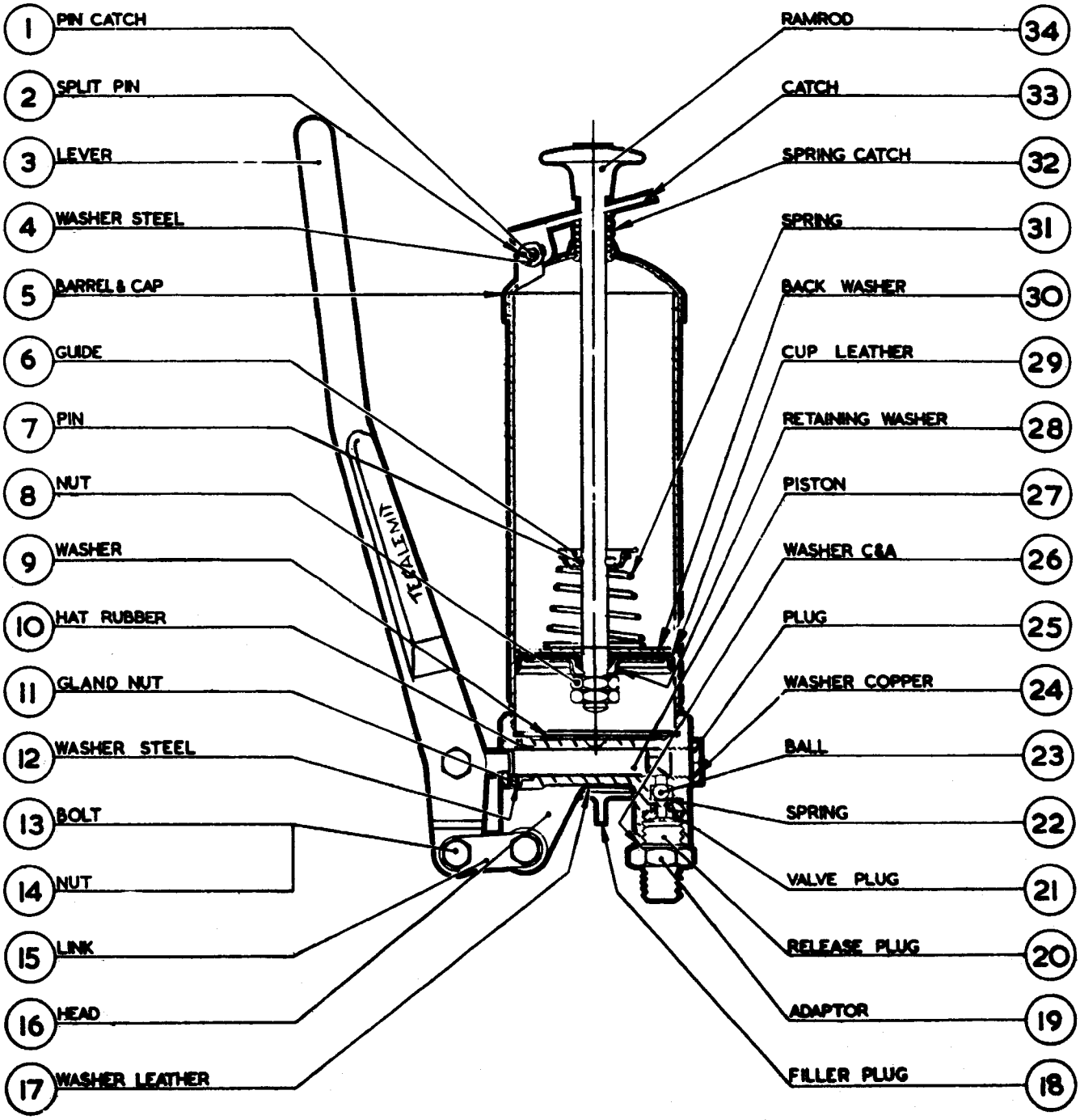


Fig. 11. The Junior Hand Compressor Grease Gun in section.

FAULT 4. Leakage of lubricant from rear of gun nozzle, or pressure joints of gun head.

Cause 4a. Loose or defective gaskets or delivery tube screw threads.

Remedy 4a. Examine and tighten joints or renew parts as necessary.

FAULT 5. Leakage of lubricant from rear cap of barrel.

Cause 5a. Worn or damaged follower piston.

Remedy 5a. Remove follower piston assembly clean and inspect cup leather, renew assembly if necessary.

FAULT 6. Leakage of lubricant around H.P. piston, between head and operating lever.

Cause 6a. Loose or defective gland nut or gland seal.

Remedy 6a. Tighten gland nut. If this does not remedy leakage, disconnect operating lever from H.P. piston, withdraw piston, unscrew gland nut, extract gland washer, clean out groove, fit new gland washer, re-assemble and test.

SECTION 7

7 SERVICING

CONTENTS

SERVICING

OPERATING ADJUSTMENTS AND REPLACEMENTS

The ease with which you can operate the machine and the amount of work you can get done with it, will depend considerably on the care that you take to keep the machine properly adjusted. Adjustments are easy to make, and you will not have to make them often, but it is important to make them as soon as necessary. To keep your machine operating at peak efficiency, watch adjustments regularly. A little time spent in checking adjustments will be paid back by steady operation.

This section covers all ordinary adjustments required in normal service, together with details of some of the replacements that may be encountered in the course of servicing the machine. No unit should be adjusted without reading the instructions covering that particular unit and following the procedure described.

Keep all wrenches and tools clean and in good repair. It is false economy to try to get by with tools that are in poor condition. Scrap that worn or stretched spanner, rather than risk damaging the nuts or hurting your knuckles.

Before changing the adjustment of any unit, check over the machinery and controls very carefully to make sure that a bent reach rod, worn pins, grease or oil on the linings or housings, or binding of some part is not causing the trouble.

Correct adjustments cannot be made unless the control levers, reach rods, bell cranks, etc., are in good condition.

For convenience in reference, adjustments will be covered up through the Upper Works to the Front End Equipment.

Many of the machinery units are protected by guards which must be removed when making adjustments. In some cases it may be advantageous if not necessary, to remove portions of the cab to give more room to work. Always replace guards and cab parts after completing adjustments or replacements.

LOWER WORKS ADJUSTMENTS

CRAWLER TRACK BELTS (Refer to Fig. 1.).

No definite rule can be given as to how tight or loose the track belts should be as the correct adjustment depends on the type of ground over which the machine is to be moved.

In general the belts should be kept as loose as possible without loosing proper tracking of the driving tumblers. When the belt is tight on the bottom, and slack on top there should be about 4-5 in. lift at the centre as shown in Fig. 1. (R.H. bottom corner). Firm footing permits use of a tighter track belt than is advisable when the machine is working in mud or loose earth.

> WATCH THE BELTS CLOSELY WHEN THE MACHINE IS WORKING IN LOOSE DIRT, SAND, OR MUD AND LOOSEN THE ADJUSTMENTS OF THE BELT IF THE DIRT TAKES UP ALL THE SLACK. PROPELLING WITH TIGHT BELTS IS EXTREMELY HARD ON THE PROPELLING MACHINERY.

Tension of each track belt is adjusted at the take-up tumbler end (opposite to the drive chain). Loosen the take-up tumbler clamping bolts, remove the adjusting screw nut locks and turn the adjusting nuts until the correct adjustment is obtained. Be sure to turn the nuts on both sides of the track frame the same amount, to keep the take-up tumbler shaft parallel to the front of the truck frame. When the correct adjustment is obtained, replace the adjusting nut locks and re-tighten the clamping bolts.

ADJUSTMENT OF DRIVING CHAINS (Refer to Fig. 1).

It is important to keep the two propelling chains in good adjustment. A too-tight chain wears rapidly; a chain that is too loose will tend to 'flap' excessively on the slack side, may jump the sprocket teeth, and may result in destructive jerks when propelling is started and stopped.

For normal service, when the top side of the chain is tight, it should be possible to obtain an up and down total movement of about 3-4 in. mid-way along the bottom of the chain as shown on Fig. 1. (R.H. top corner).

> THE TRACK BELTS MUST BE SLACKENED OFF BEFORE ATTEMPTING TO TIGHTEN THE DRIVING CHAINS.

The drive chains are adjusted at the driving tumbler end of the track side frames.

Before attempting to adjust the drive chains, loosen the track belts by means of the adjusting nuts at the take-up tumbler end, already described under 'Crawler Track Belts'.

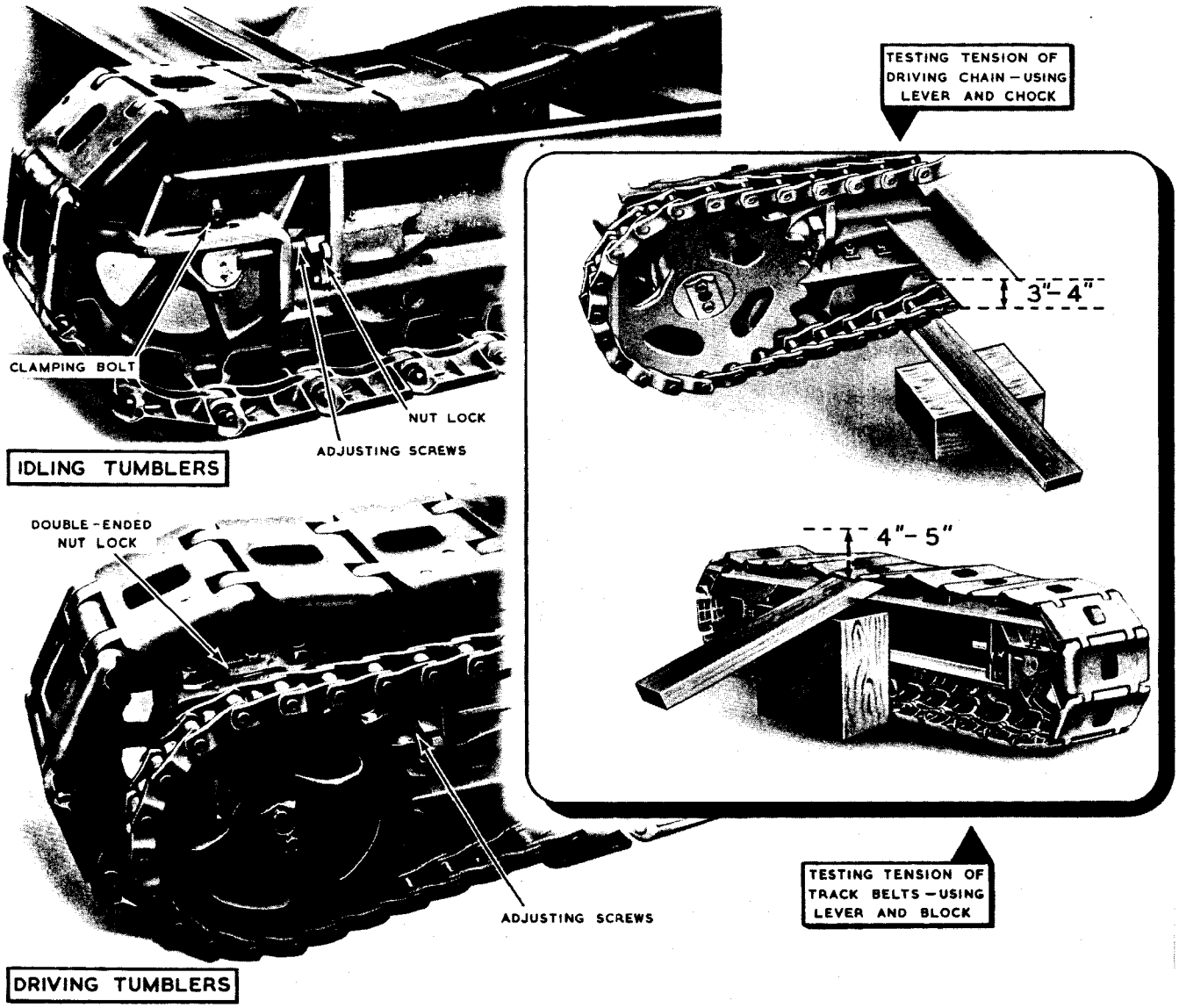


Fig. 1. Adjustment of Driving Chains and Track Belts.

To adjust the drive chains, first take off the nut locks and loosen the bearing bolts. Then turn the adjusting nuts until the condition is obtained where with the chain tight at the top there is a total up and down motion possible on the lower side of 3" and not more than 4", as indicated in Fig. 1. Be sure to turn both nuts of a pair the same amount, so as to keep the chain sprockets in correct alignment. When correct adjustment is obtained, replace the adjusting nut locks, tighten the bearing bolts and replace the double ended nut locks.

Re-adjust the crawler track belts for correct tension as described previously.

TO REPLACE A TRACK LINK (Refer to Fig. 2.)

Loosen the nuts on the track adjusting screws at the take-up tumbler end by equal amounts. Propel the machine so that the damaged link is in a position corresponding to ten o'clock on the driving tumbler. Secure the link below the faulty one to the driving tumbler by means of a rope and put a chock under the belt. Remove the split pins securing the track link pins. If necessary get a purchase on the upper run of the track belt with a pinch bar and remove the four link pins.

Fit the new link to the upper run first and using the pinch bar if necessary for alignment, fit the remaining link pins. Fit the four split pins, remove rope and packing, and re-adjust the tension of the track belt.

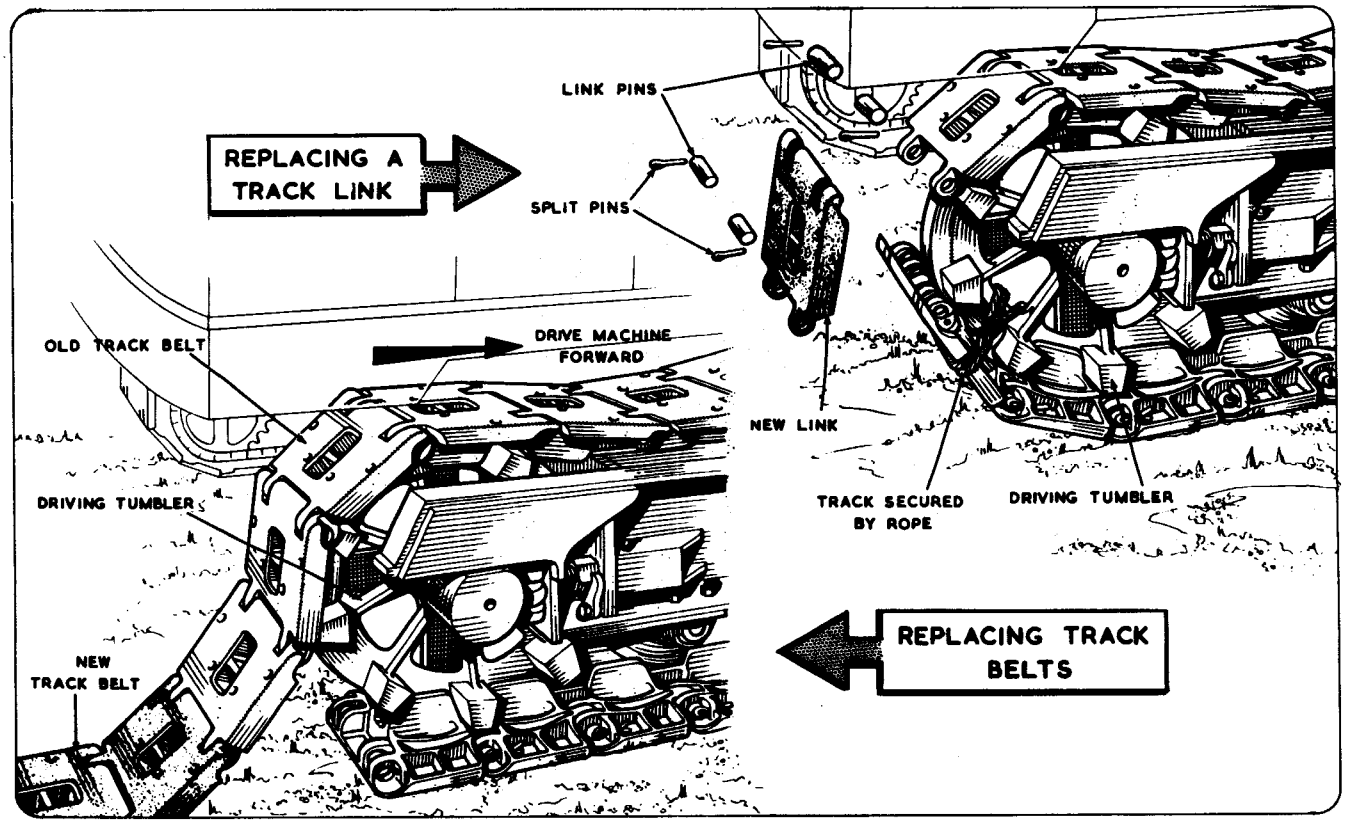


Fig. 2. Replacing Track Belts and Track Links.

TO REPLACE A TRACK BELT (Refer to Fig. 2).

If possible carry out this job on a level concrete surface; a clear run of about 35 ft. is required for the operation. Slacken the nuts on the track belt adjusting screws at the take-up tumbler end. Remove the track link pins from the belt at the position shown in Fig. 2, lay out the new track belt behind the machine and join one end of it to the upper run of the old track belt. Drive the machine forward getting an assistant to guide the new belt on to the driving tumbler. When the new belt is about three links past the axle centre of the driving tumbler, stop the machine. Remove the pins connecting the old and new belts, secure the end of the lower run to the driving tumbler by means of a rope. Join the ends of the new belt together and secure the link pins by means of the split pins. Adjust the track belt tension.

TO REPLACE A TRACK LOWER ROLLER (Refer to Fig. 3.)

Slacken the track belt and propel the machine on to a wood chock so that it is located under the tumbler nearest to the damaged roller, and allows the track belt to sag sufficiently for removal of the roller. Alternatively, if a suitable hydraulic jack is available, a similar result may of course be obtained without propelling the machine.

Remove the U-bolts from both ends of the roller shaft and lower the roller assembly into the sag of the track belt. Clean the outer end of the roller shaft, if necessary using a strip of emery band and put a few drops of oil on the shaft. Drive out the shaft, taking care not to damage the grease nipple and remove the dust shields from the roller. Remove the roller from the track.

Lubricate the shaft and check that it is a free fit in the new roller. Clean the remaining parts and lubricate them where necessary.

Put the new roller into the sag of the track belt and fit the dust shields on it. Fit the shaft in the roller, ensuring that the grease nipple is facing outward. Rotate the shaft so that the flats are uppermost and fit the U-bolts on the end of the shaft. With the aid of an assistant, lift the assembly into its proper position and fit the washers and nuts on the U-bolts.

Jack the machine down or propel the machine off the chock, as applicable, and adjust the tension of the track belt, as previously described.

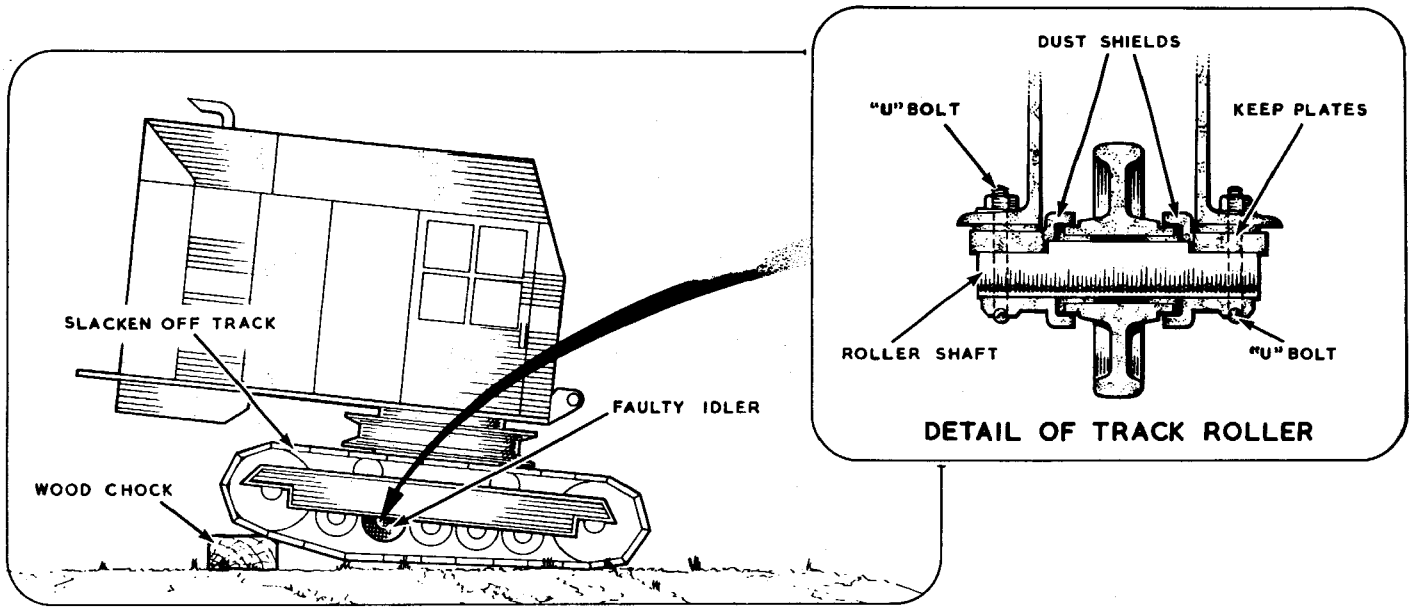


Fig. 3. Replacing a Track Roller.

ADJUSTMENT OF STEERING CLUTCHES (Refer to Fig. 4.)

When the steering clutch control lever (Lever 'L', Fig. 4, in Section 5) is in the central position both clutches should be fully engaged.

If the clutches are not fully engaged, slacken the lock nut on the reach rods 'A' and 'B' (Fig. 4 in this Section), remove the clevises from the cam levers and rotate each clevis to lengthen or shorten the reach rod as required. Refit the clevises and pins and check the engagement of the clutches.

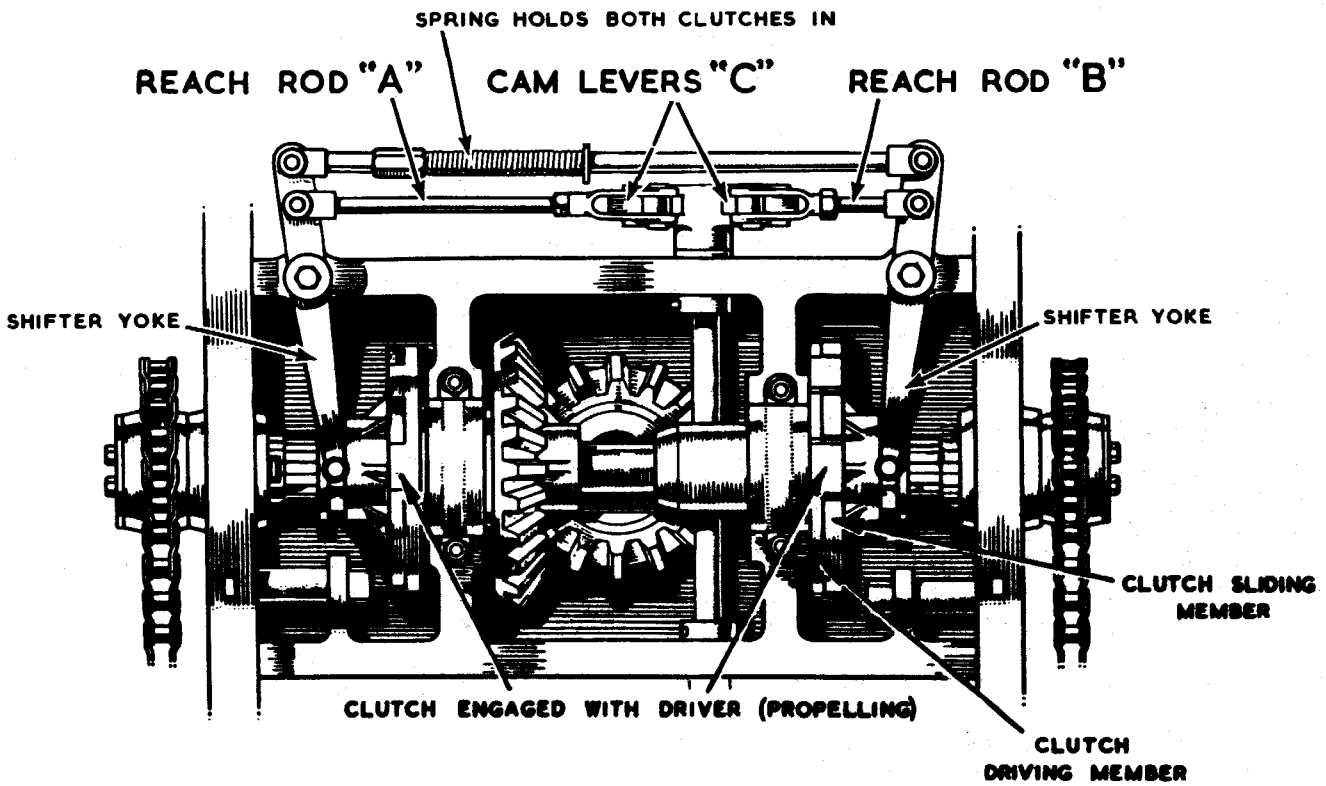


Fig. 4. Steering Clutch Adjustment.

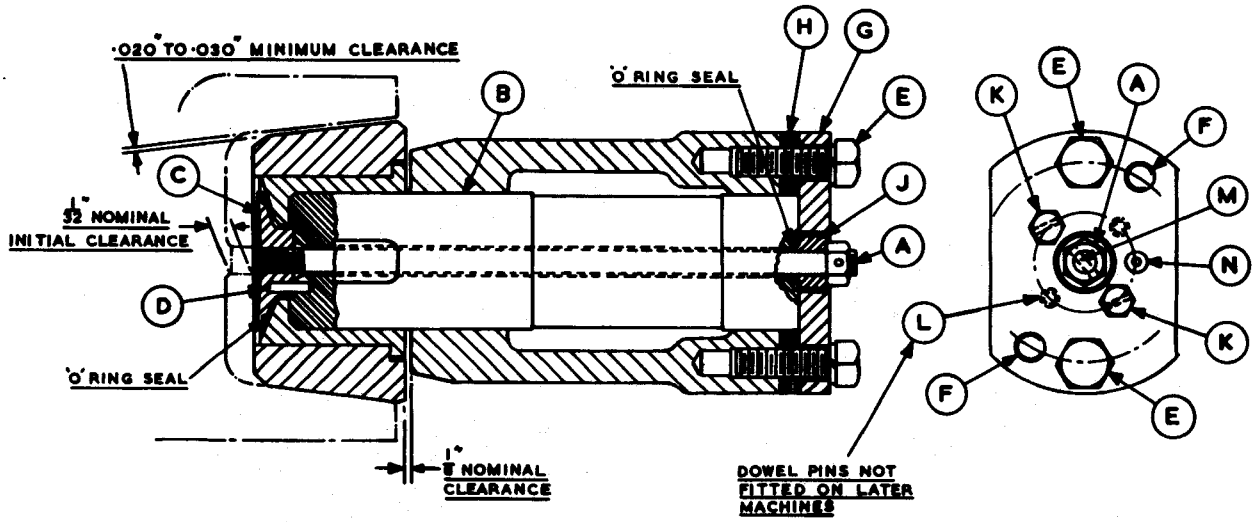


Fig. 5. Cone Roller Adjustment

Tighten the lock nuts and re-fit the split pins in the clevis pins.

The slots in the cam levers 'C' are so arranged that either clutch may be disengaged and also moved to the 'track belt locked' position without in any way moving the opposite clutch.

The arrangement of the slots also ensures that the withdrawn clutch is positively and automatically returned to the engaged position before the opposite clutch can be released.

It follows that under no circumstances can both clutches be out of engagement at the same time, which ensures that the machine could not normally run back, out of control, down a steep gradient.

REPLACEMENT OF ADJUSTABLE CONE ROLLERS (Refer to Fig. 5.)

To remove any of the cone rollers, support the weight of the upper superstructure on jacks or blocking, and check that there is clearance between the roller and the upper and lower flanges of the roller track.

Remove the rod bolt 'A' which goes right through the centre of the cone roller pin 'B' into the cone roller retaining nut 'C'. The nut is held from turning during the loosening of the rod bolt by means of the tension pin dowel 'D' fitted to the nut and locating in a hole drilled in the end of the cone roller pin.

Remove the setscrews 'E' and fit them in the tapped holes 'F' of the retaining plate 'G'. Screw up equally on each setscrew to draw out the pin evenly and until it is possible to pull out the roller pin and remove the cone roller and retaining nut from the track. The split shims 'H' should also be removed at this time and be retained carefully ready for replacement.

Clean and lubricate the cone roller pin. Locate the new cone roller and retaining nut in the roller path (Preferably fitting a new 'O' Ring Seal in the groove on the conical face of the retaining nut), and line them up ready to receive the roller pin. Insert the cone roller pin and refit the setscrews in their original holes in the retainer plate and screw them loosely into the tapped holes of the bracket or carriage.

Replace the 'O' Ring Seal behind the collar 'J' under the head of the rod bolt if necessary and refit the rod bolt through the cone roller pin into the retaining nut. If difficulty is experienced in holding the nut until the rod bolt is properly entered, a thin wooden wedge placed between the back of the roller path and the face of the nut will most likely prove helpful.

Tighten the rod bolt to pull the retaining nut snug into the spigot in the end of the cone roller pin. At this stage the roller should still be free to turn on the pin, but some slight drag may be caused by face contact with a new 'O' Ring Seal.

IMPORTANT NOTE:

When assembling the rollers, avoid over-tightening the rod bolt 'A' as this could result in damage to the 'O' ring seal between cone roller and retaining nut. It is recommended that the bolt be tightened to no more than 15lbs. ft.

Next, tighten the setscrews 'E' evenly to push the cone roller into the roller path, checking to provide a minimum clearance in the range of .020" to .030" between the top of the roller and the top flange of the track, when the roller is resting on the lower flange.

In the case of worn roller paths, care should be taken to ensure that the minimum clearance is present at the least worn and therefore smallest section of the roller path.

When satisfied that correct adjustment has been obtained, measure the gap between the face of the bracket or carriage and the inner face of the retaining plate to see how many split shims can be accommodated. Then, remove the setscrews 'E' and install the appropriate split shims, drawing back the retaining plate slightly if found necessary in order to get the shims in. Finally re-tighten the setscrews and re-check the roller clearance.

NOTE:- On some machines fitted with earlier type adjustable cone rollers, the shims are not of the split type and studs each with nut and lock nut are fitted in place of the setscrews 'E'. In such cases when adding or removing shims, it will be necessary to remove the retaining plate 'G' from the cone roller pin 'B', which is held by the two smaller setscrews 'K' and two tension dowel pins 'L'. When the retaining plate has been replaced, be sure to install a new locking wire through the holes 'M' drilled through the heads of the setscrews 'K' and the rod bolt 'A'.

The cone roller bushing is lubricated through the cone roller pin from the grease fitting 'N' fitted to the retainer plate.

Periodically check the cone roller clearance as previously described, and when this is found to exceed .030" at the narrowest point between the flanges of the roller path, remove one or more shims as necessary to reduce the minimum clearance to between .020" and .030".

UPPER WORKS ADJUSTMENTS AND REPLACEMENTS

REMOVING UPPER WORKS (SUPERSTRUCTURE)

To remove the upper superstructure from the bottom frame, first drain the oil from the gear case, using the drain at the bottom of the left hand gear case, then remove the cover from the gear case under the drums. This will expose the upper end of the vertical propelling shaft and the control linkage through the centre of rotation. Remove the two small levers by loosening the setscrew in the collar and the right hand end of the shaft and the setscrews holding the levers in place. Move the shaft to the right until the levers can be taken out. Remove the conical rollers as previously described and lift the upper superstructure off vertically.

To replace the upper structure back on the base, first remove the horizontal propelling gear jaw clutch and the oil seal flange at the centre of rotation. This precaution is necessary to prevent damage to the leather oil seal when entering the upper end of the vertical propelling shaft in the centre bushing. Lower the upper structure straight down into place, slipping the flange with the oil seal over the shaft and bolt in place. Replace the horizontal propelling gear and jaw clutch and reconnect the levers of the control rods through the centre of rotation. Replace the conical rollers and gear case cover, then refill the gear case with clean oil.

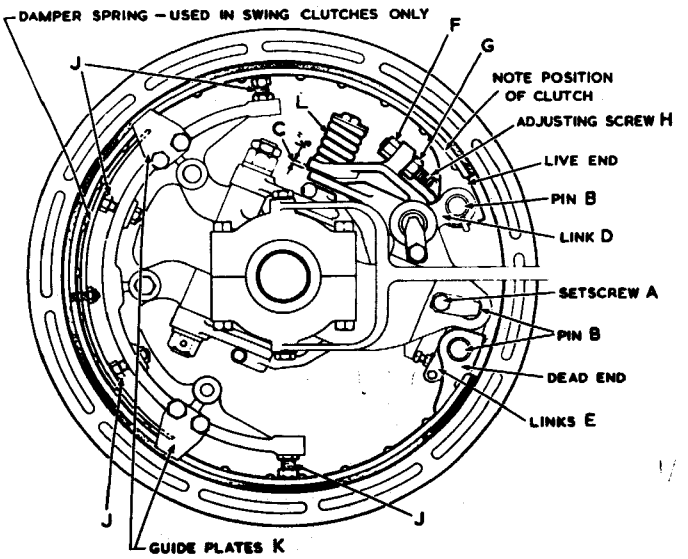


Fig. 6. Driving Clutch Adjustment and Reversing Clutch Band

ADJUSTMENT OF DRIVING CLUTCHES (Refer to Fig. 6).

The five driving clutches, i.e., both swing clutches, the hoist and crowd clutches and the front drum clutch, are almost identical in construction. The spring 'L' is set at the factory to 2.5/8" and should not be changed. To take up wear in a clutch band, proceed as follows:-

Engage the clutch by pushing or pulling the appropriate lever. Adjust the nuts 'F' and 'G' on the adjusting screw 'H' until the gap 'C' is 1/8". Ensure that the nuts are locked in position when the adjustment is correct. Adjust the jack screws 'J' so that there is uniform clearance between the band and the housing when the clutch is released. This adjustment should be carried out when the clutch is cold; if it must be done while the housing is hot, the gap should be slightly less than 1/8". DO NOT USE COMPOUND ON THE BAND.

TO REVERSE A CLUTCH BAND (Refer to Fig. 6.).

Disengage the main engine clutch, pull lever 'D' (Fig. 4, Section 5.), and then engage it gently until the clutch band is positioned as shown in fig. 6.

Stop the engine and set the appropriate clutch control lever in the neutral position. Remove the lock from the anchor pins at the live and dead ends of the clutch band. Remove the set-screws 'A' and the pins 'B'. Push the links 'D' and 'E' clear of the band lugs. Screw on nuts 'F' and 'G' until the eye of the adjusting screw 'H' is clear of the band lug. Adjust the jack screws 'J' so that the heads are clear of the clutch shoe. Remove the guide plate 'K'. Slide the clutch band out of the housing, turn it upside down, refit it in the reverse order to that described earlier in this paragraph and adjust it as detailed previously under 'Adjustment of Driving Clutches'. The anchor pin having a U-Shaped lock pin should be fitted to the live end of the clutch.

TO ADJUST THE BOOSTER CLUTCH AND BOOM HOIST BRAKE (Refer to Fig. 7.).

The boom hoist clutch setting should not be disturbed by the operator as it is automatically adjusted. The clutch band should be examined for wear from time to time; it can be reversed if it is showing signs of wear at one end. If the boom cannot be derricked in when the boom hoist control lever 'J' is pulled back, or if the clutch is found to

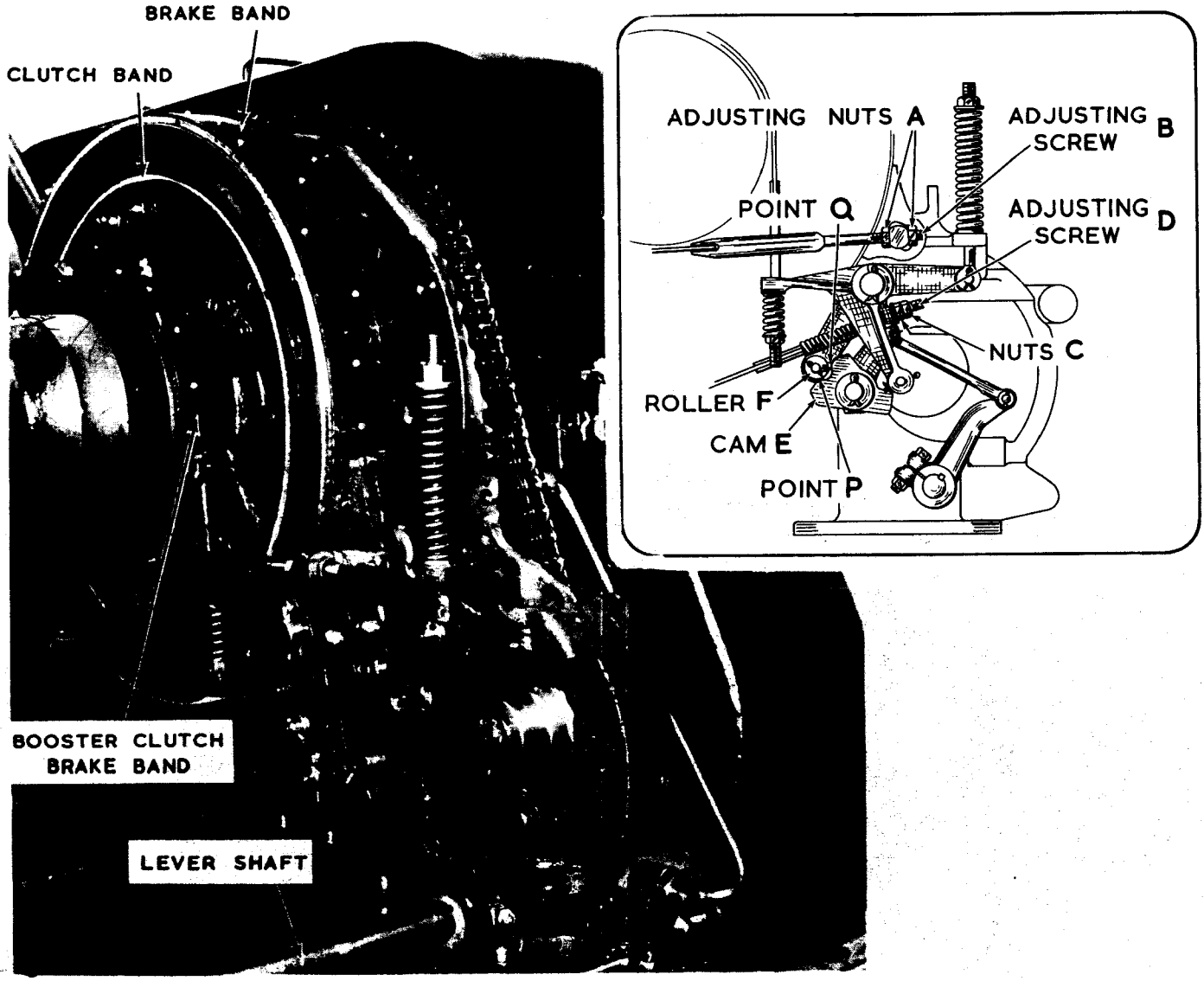


Fig. 7. Booster Clutch and Boom Hoist Brake Adjustment.

be slipping occasionally, the brake band on the booster clutch must be adjusted. To adjust the band put the control lever 'J' in the Neutral position, adjust the nuts 'A' on the adjusting screw 'B' so that there is a slight clearance about half way round between the housing and the brake band. Check the adjustment by engaging the boom hoist clutch and derricking in the boom; it is desireable to have a load in the shovel, bucket or crane hook during the test. Disengage the clutch and check that there is no binding of the booster band which would tend to engage the boom hoist clutch. Lock the nuts 'A' on the adjusting screw 'B'. The brake band on the boom hoist clutch housing must be adjusted when any downward creepage of the boom is observed. To carry out the adjustment put the control lever 'J' in the Neutral position. Tighten the nuts 'C' on the adjusting screw 'D' so that there is a clearance of 1/8" between the cam 'E' and the roller 'F' at the point 'Q' when the cam is rotated to make contact with the roller at the point 'P'. The tension of the other springs included in the assembly was set at the factory and this setting should not be disturbed by the operator. When lubricating the assembly ensure that oil or grease does not make contact with the clutch or brake bands.

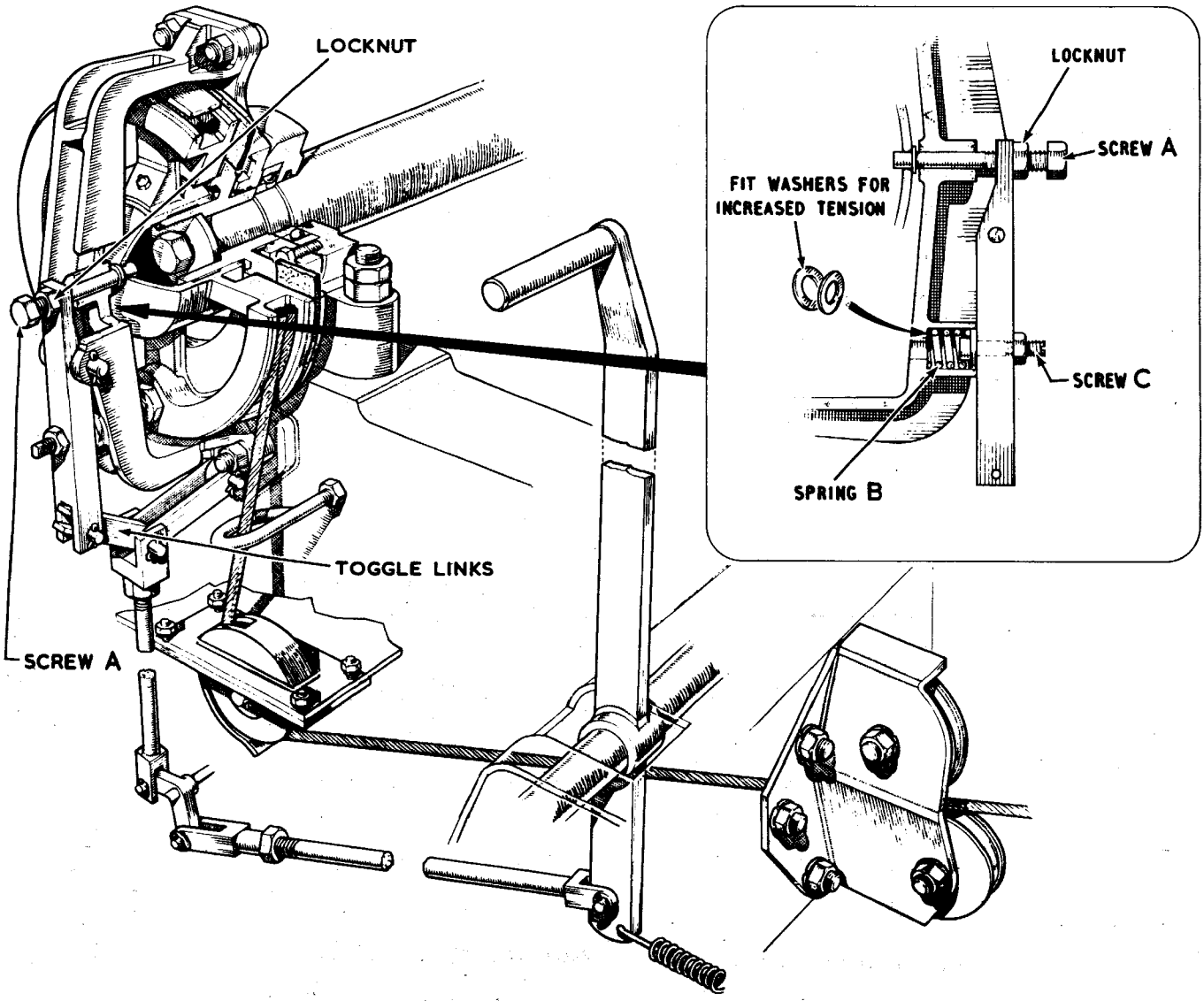


Fig. 8. Adjusting the Dipper Trip Clutch.

ADJUSTING THE DIPPER TRIP CLUTCH (Refer to Fig. 8.).

The clutch should be adjusted so that the trip rope follows the shovel in all its movements, for example, if the rope is sagging when the shovel is being retracted the clutch requires adjustment. Wear of the clutch plates is corrected by undoing the locknut on the screw 'A' and tightening the screw about one turn. Lock the screw and check the adjustment. When the screw 'A' has been adjusted a few times it may be necessary to increase the tension of the spring 'B' by tightening the nut on the slotted screw 'C', or by fitting one or two washers behind the spring. When the adjustment is correct, check that the toggle levers are free in the staggered position, otherwise there will be undue pressure on the clutch faces.

ADJUSTING THE BRAKES

The brake bands on the front and rear drums must be adjusted so that they are capable of holding the full rated load of the machine when the pedal is depressed to the limit of the normal working position as shown in Fig. 9. The brake should be adjusted by taking up on the nuts 'D', Figs. 11 and 12, so that when the pedal is depressed to the stop bar, as shown, it is capable of sustaining a fully loaded bucket, BUT when released the brake is just clear of the brake housing.

The stop bar is in the normal working position when the lock rod 'E' is pulled upwards.

Fig. 10, shows the brake pedal in the 'Hard On' position. When the operator desires to leave the controls, lock rod 'E' should be pushed down to release the stop bar. The brake pedal should then be depressed to the 'Hard On' position until the ratchet pawl engages with the toothed ratchet.

To release a brake pedal lock, it is merely necessary to apply sufficient foot pressure on the brake pedal so that the locking pawl can be released by pulling the brake pedal locking rod 'E' upwards in to the 'free' or normal working position.

When moving either brake pedal locking rods into 'lock' or 'free' position a definite feeling of 'engagement' or 'disengagement' will be felt at the hand grip as the locking pawl toggles in or out of locking position.

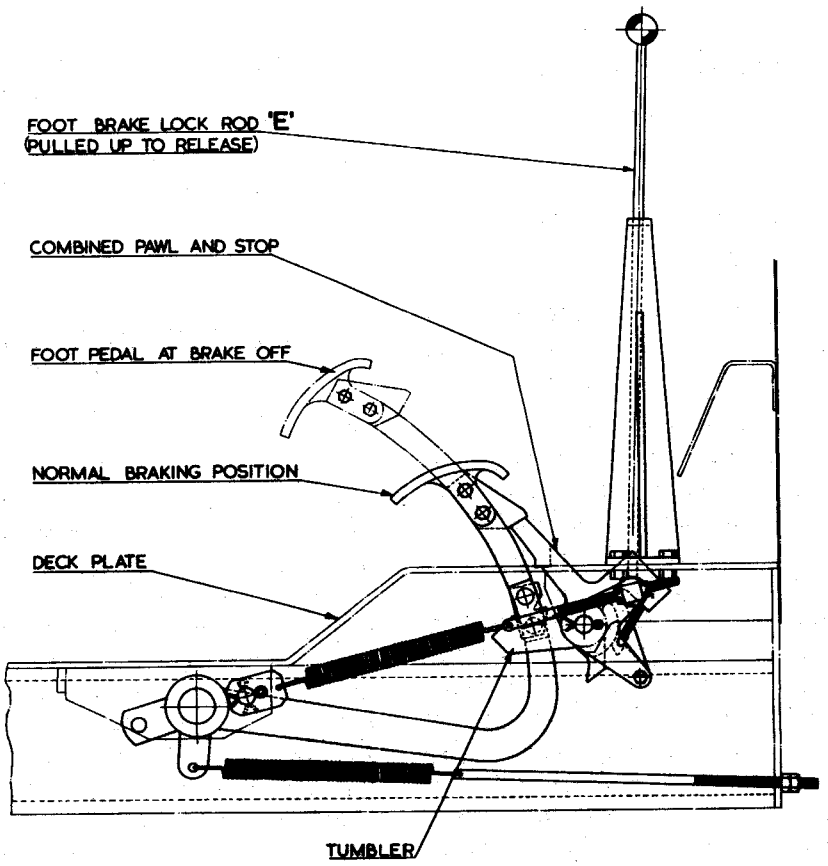


Fig. 9. Foot Pedal depressed to Normal Braking Position

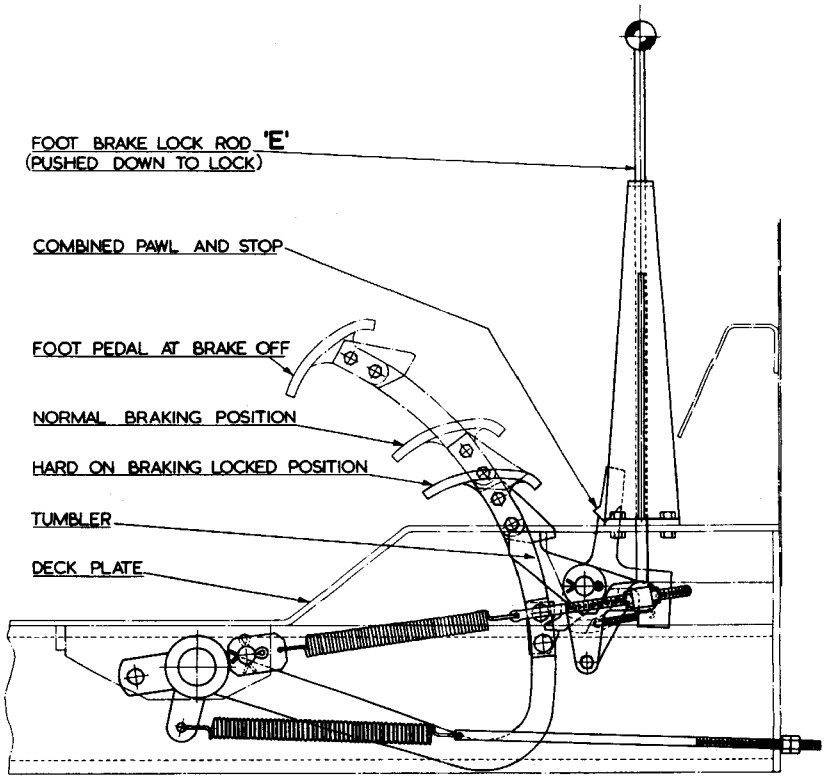


Fig. 10. Foot Pedal locked in 'Hard-On' Position

DO NOT leave the machine standing with a load suspended on the brakes unless the operator is at his seat. Cooling of brake housings or unauthorized tampering with the machine might cause the brakes to slip or release entirely with serious results. ALWAYS set the bucket or load on the ground if it is necessary to get off the machine or work on any of the machinery which is directly connected with the load.

The general arrangement of the forward drum brake band for Dragline, Cambered Boom Dragshovel, Crane or Pile Driver is shown in Fig. 11. For Shovel, Straight Boom Dragshovel or Skimmer operation the live and dead ends of the forward drum brake band are reversed to the arrangement shown in Fig. 12. To make this change remove pins 'A', 'B', and 'C' and adjusting bolt 'D'. Re-assemble the band, bell crank and reach rod to the arrangement desired and replace the pins 'A', 'B', and 'C', and the adjusting bolt 'D'. The brake should be so adjusted that the conditions previously referred to are obtained. All adjustment for band wear is made by taking up on the nuts on the adjusting bolt 'D'.

In the case of the rear drum brake band, the assembly remains as originally installed irrespective of the equipment fitted. Adjustment is by similar adjusting bolt to that employed for the front brake.

TO ADJUST THE SWING LOCK (Refer to Fig. 13).

Engage the swing lock, pull lever 'M' and check the engagement of the lock between the teeth of the fixed gear ring. The lock should extend at least half way along the teeth profile, if it does not, put the control lever on the forward position, remove pins 'A' and 'B' and unscrew the adjusting screw one or two turns. Re-assemble the pins in the toggle links and check that the lock does not foul the top of the teeth. Swing the revolving frame and ensure that there is clearance between the lock and the gear ring all round.

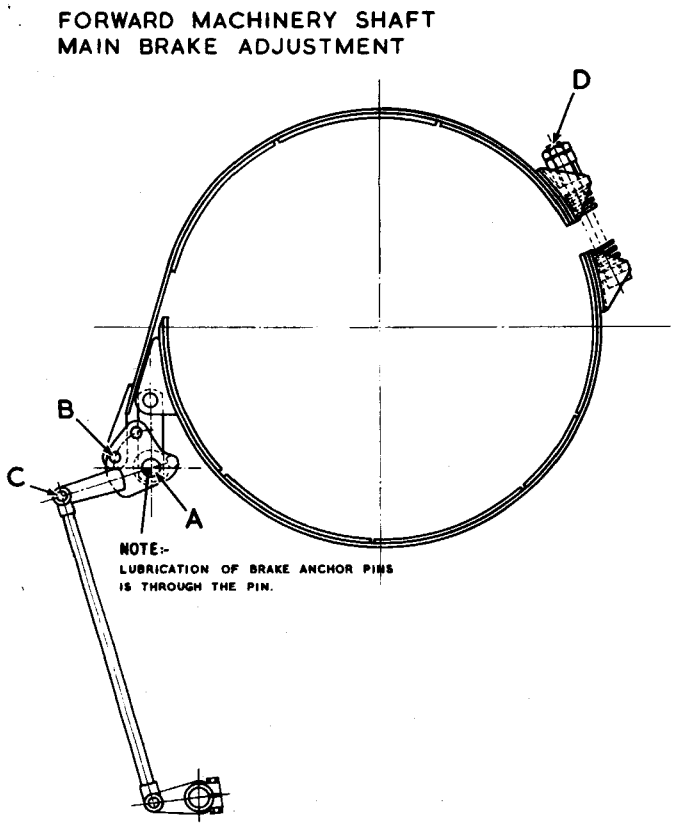


Fig. 11. Forward Drum Brake Arrangement for Dragline, Cambered Boom Dragshovel, Clamshell, Crane or Pile Driver.

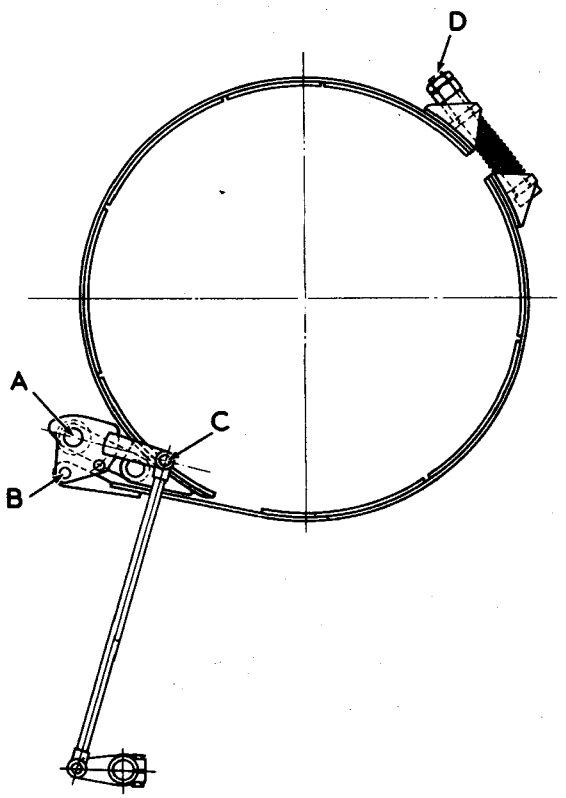


Fig. 12. Forward Drum Brake Arrangement for Shovel, Straight Boom Dragshovel or Skimmer.

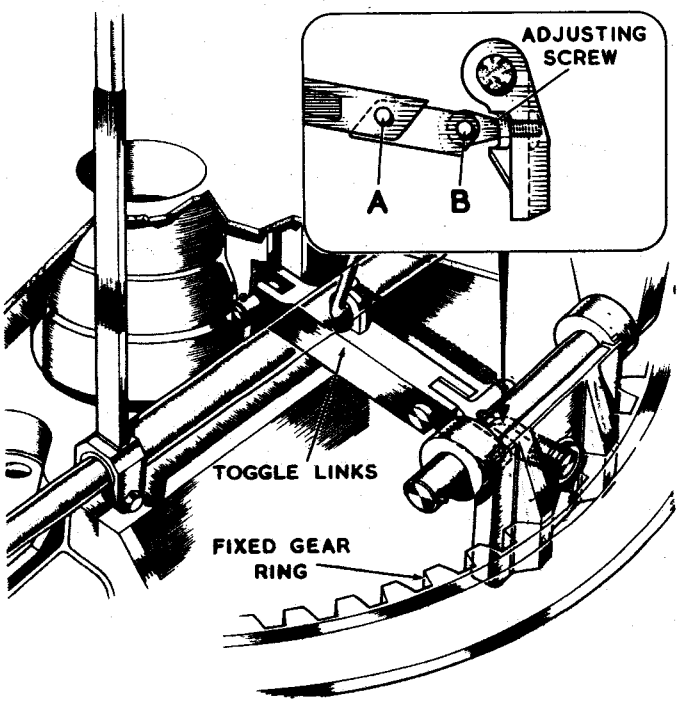


Fig. 13. Adjustment of Swing Lock.

TO REPLACE THE WEARING PLATES AND TOGGLE LINK PINS IN THE DRIVING CLUCHES. (Refer to Fig. 14).

Put the appropriate clutch control lever in the neutral position. Slacken the clutch shifter dies 'A' so that they are clear of the shifter collar 'B'. Remove the clutch shifter 'C'. Remove the shifter collar 'B'. Remove the clamping bolts 'D' from the toggle yoke. Screw one of the clamping bolts into the end of the toggle pin 'E' and draw out the pin and the bush 'F'. Remove the other toggle pin in a similar manner. Slide the shifter sleeve towards the end of the shaft and check the location of the machined surfaces shown in Fig. 14, so that the sleeve can be replaced correctly. (Note that the slots are cut off centre and that the 'machined surfaces' should be towards the toggle yoke, in order to ensure that the slots are the right way round.) Remove the old wearing plates, fit the new ones and secure them from falling outwards by means of a centre punch. Replace the shifter sleeve. Remove the worn pin from the bush and fit a new one in it. Fit the pin and the bush through the outer leg of the

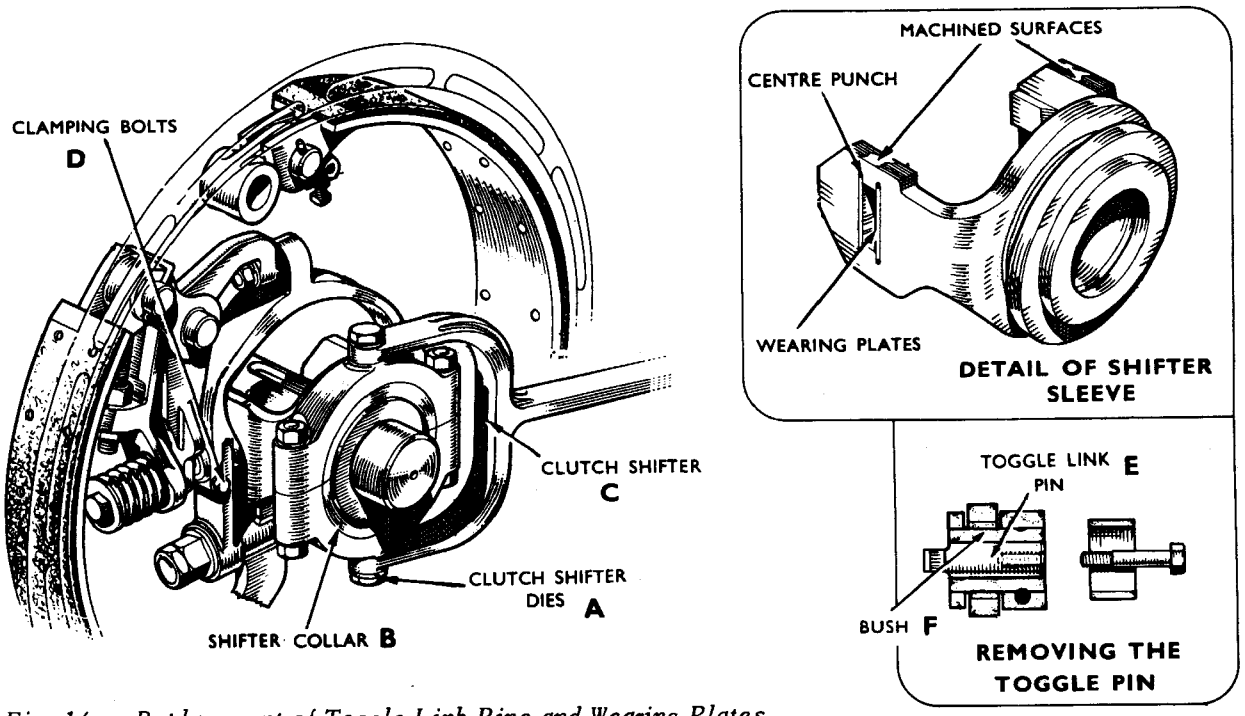


Fig. 14. - Replacement of Toggle Link Pins and Wearing Plates.

toggle yoke and line up the tongue on the pin with the slot in the shifter sleeve. Line up the toggle link between the legs of the toggle yoke, push the pin and the bush until the ends of them are flush with the outside leg of the toggle yoke. Refit the clamping bolts and tighten the nuts. Fit the shifter collar so that the grease nipple is uppermost and tighten the clamping bolts. Put on the clutch shifter, screw the dies into the holes in the shifter collar and then secure the shifter by means of the two bolts, spring washer and nuts. Adjust the shifter dies and lock them in position.

ADJUSTING THE MAIN TRANSMISSION CHAIN. (Refer to Fig. 15.)

There is no tensioner fitted to the chain and any adjustment to its length is made by removing four links and fitting three links. To shorten the chain proceed as follows. Remove the top half of the chain case. Engage the main clutch and hand crank the engine until the chain link connection is near the top of the large chain sprocket. Secure the lower run of the chain to the sprocket by means of a piece of rope or wire and remove the connecting link. Press out the pin 'A' from the end of the upper run and remove the four links shown shaded in Fig. 15. Replace the links removed by a double cranked link,'B', joining it to the end of the chain with a single connecting link 'C'. Pull the upper run of the

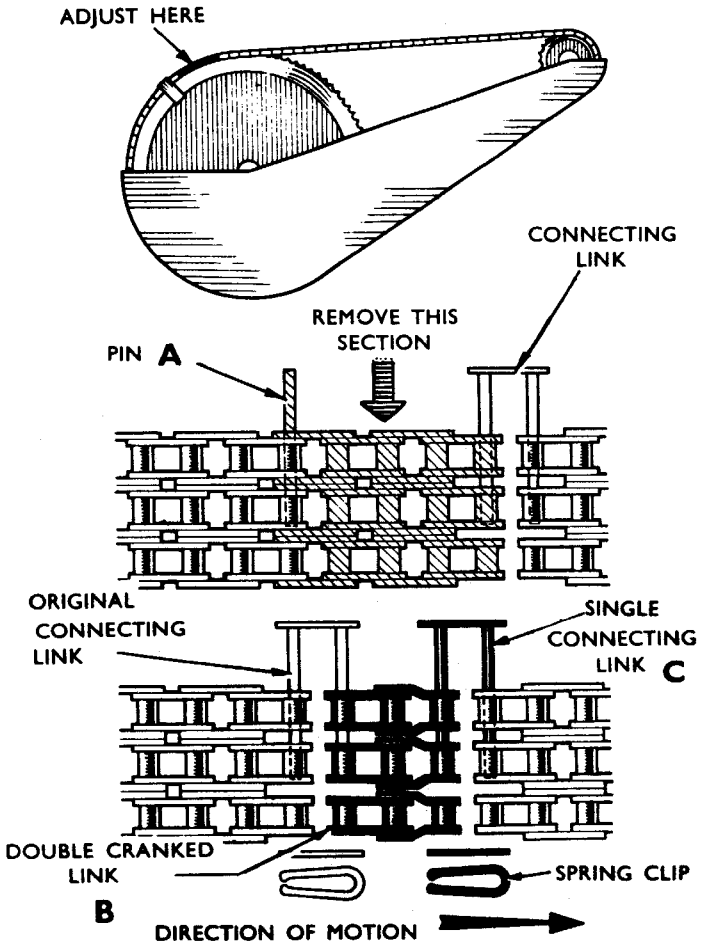


Fig. 15. - Shortening Transmission Chain.

chain by hand cranking the engine and locate the end link on the sprocket so that it is located on the tooth adjacent to the end link of the lower run. Replace the original connecting link. The spring clips of the connecting links should be fitted so that their rounded ends point in the direction of motion of the chain. Shorten the other run of the chain similarly.

ADJUSTING THE CHAIN DRIVE OF THE BOOM HOIST CONTROLLED LOWERING UNIT.
(Refer to Fig. 16.)

Apart from shortening the chain there is no means of adjusting the tension of it. To shorten the chain, remove the pins 'A' and 'B', Fig. 15. Lift the upper run of the chain from the sprocket and advance it one tooth towards the other end of the chain. Fit the cranked link 'C' and refit the pins 'A' and 'B'. The back of the chain must be supported when driving out and fitting pins 'A' and 'B'.

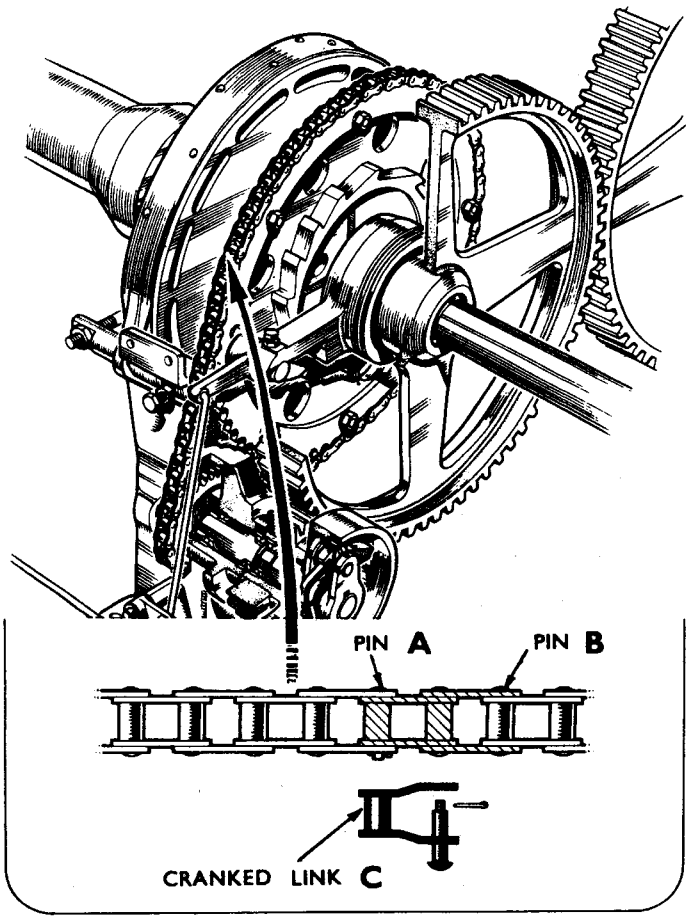


Fig. 16. - Shortening Boom Hoist Controlled Lowering Unit Chain.

FRONT END EQUIPMENTS

GENERAL NOTES

When fitting a front end equipment it is advisable to clean and lubricate the mating surfaces, this ensures that the machine will work satisfactorily until it is due for the next lubrication servicing.

Do not fit a sheave if the rim of it is damaged. Sheaves are a clearance fit on the shafts on which they are mounted and the shafts are a clearance fit in the bushes in which they fit, do not drive a shaft through a sheave or bush. If the ends of the shaft are burred, dress them with a fine cut file or emery cloth. Do not fit bent lock pins, they are difficult to remove, save time and trouble by straightening the pins before fitting them. When fitting split pins splay out the legs of them slightly but do not curl them round the bolt or lock pin.

Spring washers are supplied with all bolts required for assembly of any front end, these washers are a vital part of the assembly because nuts are apt to loosen due to the vibration of the machine. If a bolt is too long, put a plain washer under the head of it, do not put the plain washer under the nut or the spring washer. Generally fit a bolt down through a hole rather than up through it.

SERVICING THE SHOVEL FRONT END EQUIPMENT

ADJUSTMENT OF CROWD AND RETRACT ROPES

Check the tension of the crowd and retract ropes to ensure that there is not more than two inches of sag and tighten if necessary. (See Section 8, Pages 6 and 7, and refer particularly to Fig. 8, and Paragraph 8 for more details.)

TO ADJUST DIPPER DIGGING ANGLE

Lower the shovel dipper on to a wood chock and apply both brakes. Check that the back brace straps between dipper and dipper handle are free. Remove the bolts securing the straps to the handle and reassemble them in a lower hole in the handle to decrease the digging angle or in a higher hole to increase the digging angle. Rock the dipper on the chock by means of a lever to align the holes in the straps with the appropriate hole in the dipper handle.

TO CHANGE A SHOVEL DIPPER DIGGING TOOTH

Hoist the dipper clear of the ground, lower the boom to an angle of 20°- 25°, run out the dipper handle to the limit of its travel and then lower the dipper to the ground. Clean the mouth of the dipper. Drive out the split pin securing the tooth in the socket. Remove the shims and clean out the socket. Fit new shims, the new tooth and a new split pin.

TO ADJUST THE DIPPER TRIP LATCH

The latch should be adjusted so that the latch bar enters the latch keeper just enough to hold the dipper door closed. Before carrying out the adjustment check that the dipper trip clutch is correctly adjusted and that the control lever 'N' is back in the released position.

Lift the latch by hand and clear out the hole in the keeper. The depth of engagement of the latch in the keeper depends on the adjustment of the dump chain and on the position of the washers on the latch bar fulcrum bolt. The lower run of the dump chain can be shortened by threading the end of it through the pinch link in the upper run, this provides approximate adjustment of the latch. A finer adjustment is obtained by transferring washers on the fulcrum bolt from one side of the door web to the other side of the web. Moving washers from the upper position to the lower position increases the depth of engagement of the latch. (Refer to Fig. 19, on Page 18 in Section 2.)

TO ADJUST THE SADDLE BLOCK WEARING PLATES (Refer to Fig. 17.)

Hoist the dipper handle to the horizontal position, the padlock sheave block should be directly under the boom point, lock both brakes in the "hard-on" position. Check the clearance between the dipper handle and the wearing plates fitted to the sides of the saddle block. Lever the dipper handle to one side by means of a piece of wood and then check that the clearance at the other side is not more than 1/8". If the clearance is more than 1/8", one or more shims must be fitted at either side of the handle and behind the wearing plates. To fit the shims undo the setscrews 'A' a few turns and slide the slotted shims into position behind the wearing plates. The same number of shims must be fitted at either side and the total clearance should be maintained at 1/8". Check the clearance at the front of the dipper handle, if it exceeds 1/16" add the appropriate number of shims behind the wearing plates.

If for any reason the setscrews 'A' are removed be sure to fit lock washers when replacing the setscrews.

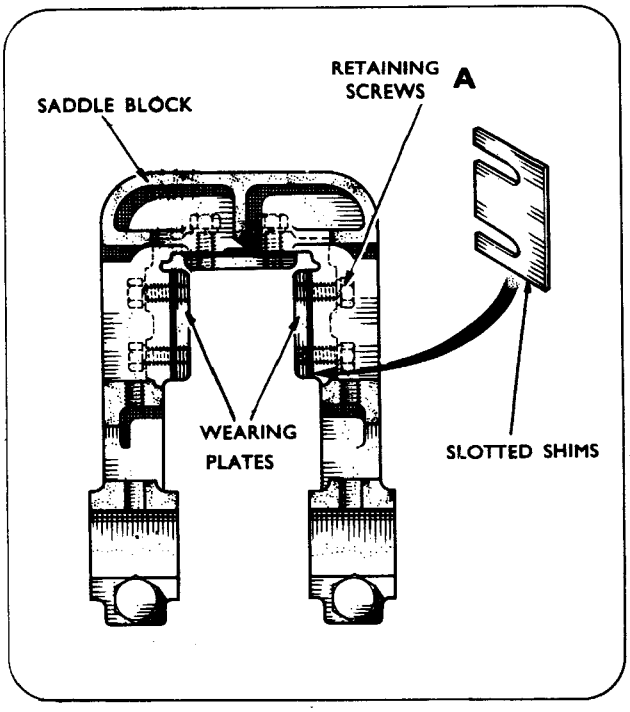


Fig. 17. Adjusting the Saddle Block Wearing Plates.

SERVICING THE DRAGSHOVEL FRONT END EQUIPMENT

TO ADJUST DIPPER DIGGING ANGLE

With dipper arm fully extended lower the dipper so that the teeth rest on a block of wood, the weight of the boom and dipper arm should be taken by the hoist rope. Take up any slack in drag rope but do not apply more than very slight tension, so that all weight remains substantially on hoist rope, then apply both brakes in the "hard-on" position. Check that the pin securing the brace bars to the dipper handle is free and remove the lock pin. Get an assistant to hold the brace bars, remove the pin and refit it through the brace bars and one of the other holes in the dipper handle.

In the case of front opening type dippers, lowering the brace bars increases the digging angle and raising them decreases the angle. The adjustment of the brace bars for hoe-type dippers is directly opposite in that raising the brace bars increases the digging angle and lowering them decreases the angle. To line up the holes in the brace bars with those in the dipper handle, get an assistant to rock the dipper using a piece of wood as a lever.

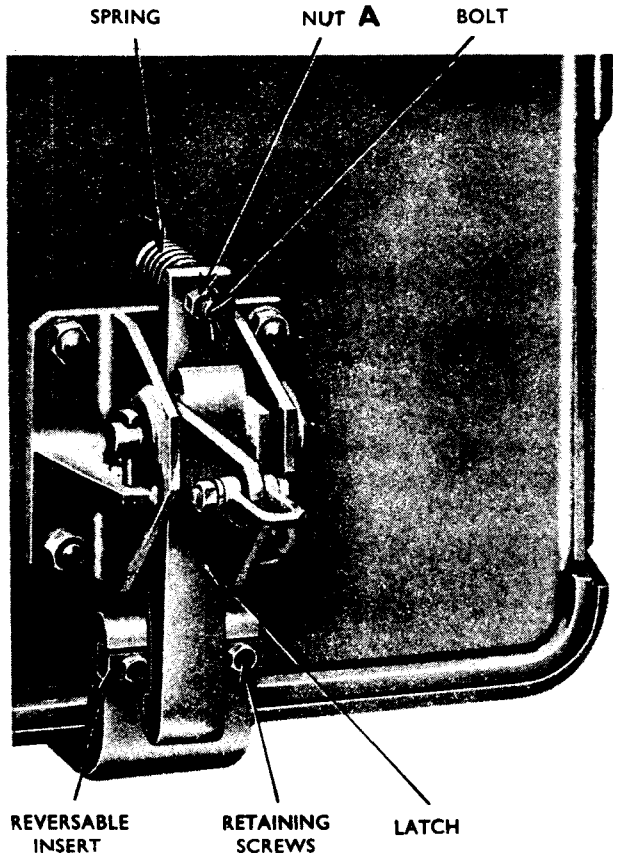


Fig. 18. Dipper Trip Latch Adjustment for Straight Boom Dragshovel - Front Opening Dipper.

TO REPLACE A DIGGING TOOTH

Hoist the dipper a few feet off the ground and lock both brakes in the "hard-on" position. Clean the mouth of the dipper. Subsequent procedure will then vary according to the type of dipper, as follows:-

FRONT OPENING TYPE DIPPER

Remove the hexagon nuts from the four bolts securing the tooth to the dipper, drive out the bolts, remove the tooth and replace it with a new one. These digging teeth are not reversible. The side cutters can be removed by removing the three bolts and nuts securing them to the dipper; the side cutters are not interchangeable.

HOE-TYPE DIPPER

Drive out the split pin securing the tooth in socket. Remove the shims and clean out the socket. Fit new shims, the new tooth and a new split pin.

The side cutters can be removed by removing four bolts and nuts securing them to the dipper; the side cutters are right and left-hand and are therefore not interchangeable.

TO ADJUST THE DIPPER TRIP LATCH (Refer to Fig. 18.)

This adjustment applies to dragshovel dippers of the front opening type only, as hoe-type dipper have no opening door and therefore no latch.

The tension of the latch return spring can be adjusted by removing the nut 'A', pulling out the bolt from inside the dipper and putting one or two spacing washers on the bolt between the spring and the back of the latch; replace the nut and split pin on the bolt.

A reversible insert is fitted in the latch striker plate. When the lower outside edge of the insert becomes rounded due to wear, remove the two retaining screws securing it to the plate, reverse the insert and refit it to the plate. When all four edges of the insert are worn, it should be replaced.

SERVICING THE SKIMMER FRONT END EQUIPMENT

TO ADJUST THE CLEARANCE BETWEEN THE BOOM AND THE WEARING PLATES ON THE SKIMMER BUCKET ROLLER CARRIAGE BRACKETS. (Refer to Fig. 19.)

Allow the bucket to run back towards the boom foot and lower the boom. Clean the track rails of the boom, drag out the bucket towards the boom point and lower it to the ground. Release the swing lock and swing the boom very slightly so that one side of it is in contact with both wearing plates. Check the clearance between the boom and the wearing plates at the other side of the boom. If the clearance is more than 1/8" shims must be fitted behind the wearing plates. The shims should be drilled 13/16" dia. at 4" centres, and shims of equal thickness should be fitted at either side of the bucket.

TO REPLACE A SKIMMER DIGGING TOOTH OR A CUTTER

The digging teeth are bolted to the mouth of the bucket. The bolts are countersunk nib headed, they are fitted from inside the bucket. The cutters are fitted between the digging teeth, that are secured to the bucket by similar bolts fitted from underneath the bucket. The side cutters can be removed by removing the five nuts securing each of them to the side of the bucket.

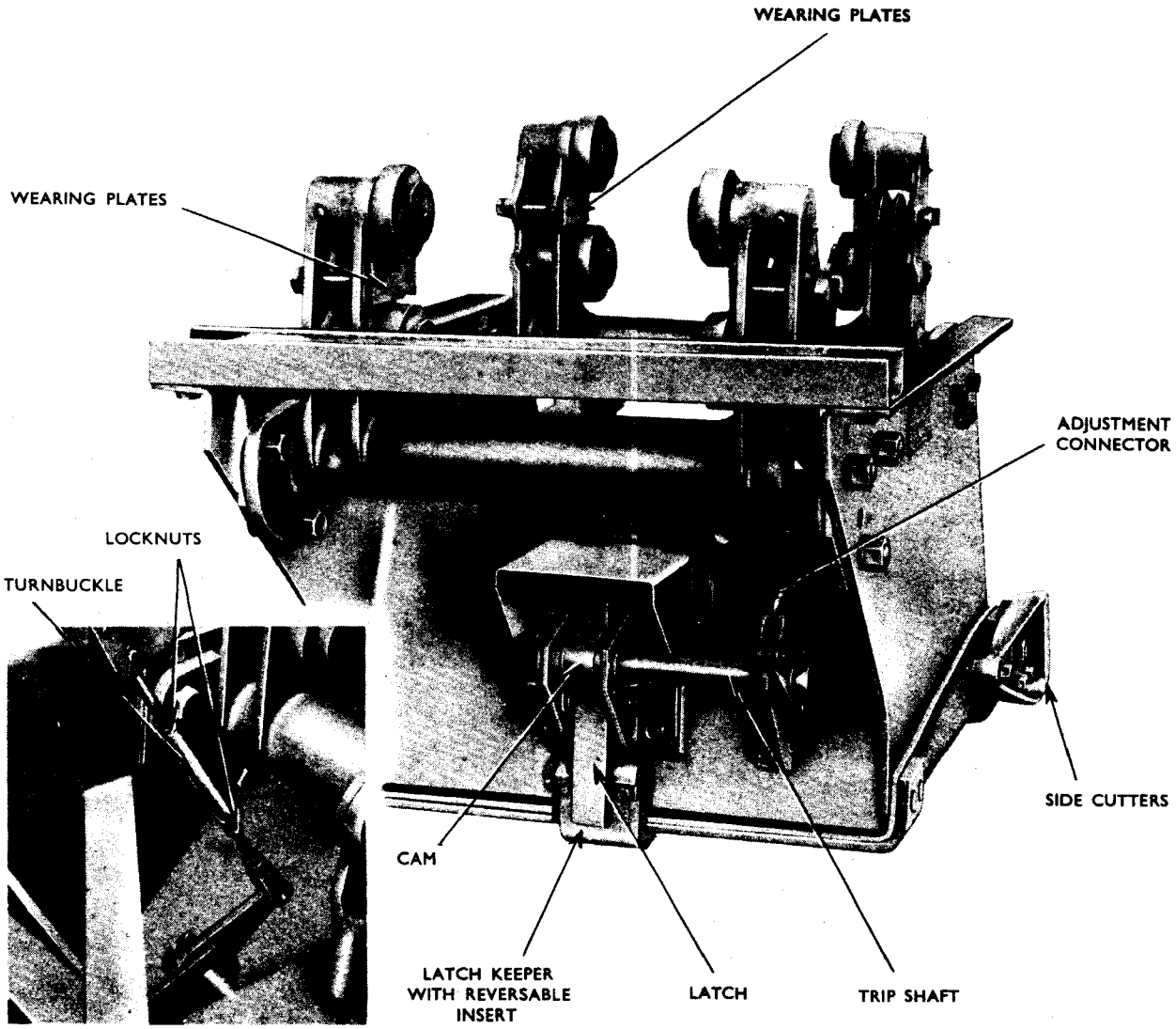


Fig. 19. The Skimmer Bucket - Dipper Trip and Wearing Plates.

TO ADJUST THE DIPPER TRIP

(Refer to Fig. 19.)

Normal wear of the mechanism is taken up by shortening the connector between the jockey sheave bracket and lever on the end of the trip shaft at the back of the bucket.

To carry out the adjustment undo the locknuts at either side of the turnbuckle and screw the turnbuckle on the right hand threaded rod until the back of the cam makes contact with the latch. Check the adjustments by operating the bucket and the control lever 'N' (Fig. 4, Section 5, Page 6.) and if no further adjustment is required tighten the locknuts on the turnbuckle. When no further adjustment can be obtained by shortening the connector the dipper trip secondary rope tension must be adjusted. To carry out the adjustment proceed as follows:-

Close the bucket door and lower it to within a few inches of the ground. Check that the dipper trip clutch is correctly adjusted and set the control lever 'N' in the disengaged position. Do not stop the engine or disengage the main clutch. Remove the clevis pin securing the connector to the lever of the trip shaft at the back of the bucket. Adjust the length of the secondary trip rope so that the outer lever on the shaft of the trip rope bracket is in a position corresponding to 7 o'clock. The inner lever on the shaft should then be in a position corresponding to 4 o'clock. Engage the dipper trip clutch, check that the jockey bracket movement is free, and release the clutch, lift the lever on the trip shaft until the peak of the cam commences to bear on the latch. Adjust the length of the connector so that it can be connected to the lever, refit the clevis pin and split pin.

Check the adjustment and tighten the turnbuckle locknuts. The tension of the latch return spring can be increased by undoing the hexagon headed screw at the top of the latch and putting one or two large spacing washers on it behind the spring, tighten the screw and check that the spring is sitting on the washer. The latch keeper is fitted with a detachable insert. When the lower edge of the insert becomes rounded due to wear the insert should be removed and refitted so that a square edge is presented to the latch.

SERVICING DRAGLINE, CRANE AND CLAMSHELL FRONT END EQUIPMENTS

GENERAL NOTES

The boom is constructed to take a limited amount of shock load in addition to that set up when the machine is rigged as a piledriver or dragline. Apart from hitting some obstruction with the top of the boom or allowing the clamshell or dragline bucket to foul the underside of it, one of the principle causes of boom distortion arises from dragging a load sideways. In many cases this can be avoided by sitting the machine in a fresh position. Care should be taken when loading and un-loading the boom to ensure that the side members and struts are not damaged. A block of wood should be fitted between the point side members to reduce the risk of damage during handling and transit. When assembling the point machinery first check that the point shaft is a sliding fit in the point bushes. Distortion at the point can sometimes be corrected by means of a small jack fitted between the members, but this method should only be used in case of an emergency.

ATTENTION TO THE BOOM MACHINERY

Lower the boom on to a trestle, spool off a few turns of the suspension and hoist ropes so that the point sheaves can be rotated by hand. Examine all the sheaves for side wear of the rope grooves and check that the rope guards are not fouling the ropes or the sheaves. Examine the ropes for flats or broken wires, and replace as necessary. Examine the three sheave brackets fitted on the upper side of the boom, i.e. the suspension yoke sheave, the deflecting sheave and the jockey sheave. Check the lock pins and the fixing bolts. Check the crane hoist rope anchor yoke and the connection to the hoist rope anchor socket. Check the ball swivel and ensure that it can be rotated in either direction, these parts should be liberally coated with preservative. Examine the crane hook and ensure that all moving parts are free and clean. If the front and rear shaft bearings are due for servicing get an assistant to take the slack in one of the ropes. Engage the appropriate clutch and spool the rope off the drum until the grease nipple is exposed. Do not allow your assistant to take the slack hand over hand and coil it in a heap at his feet, get him to make one big loop of it along the ground so that the rope will not curl or kink.

SETTING PENDULUM TYPE BOOM ANGLE INDICATOR (Refer to Fig. 20.)

Ensure that the machine is standing on level ground. Lower the crane hook so that it is about 4'-6" from the ground level to the centre of the hook block sheave pin. Derrick the boom so that the distance between the boom foot pins and the centre line of the crane hook corresponds with dimension "A" in the table given in Fig. 20, for the particular boom length concerned. Loosen the three screws in the indicator quadrant and adjust the indicator to read 40°, then re-tighten the the quadrant in that position.

CLAMSHELL BUCKET

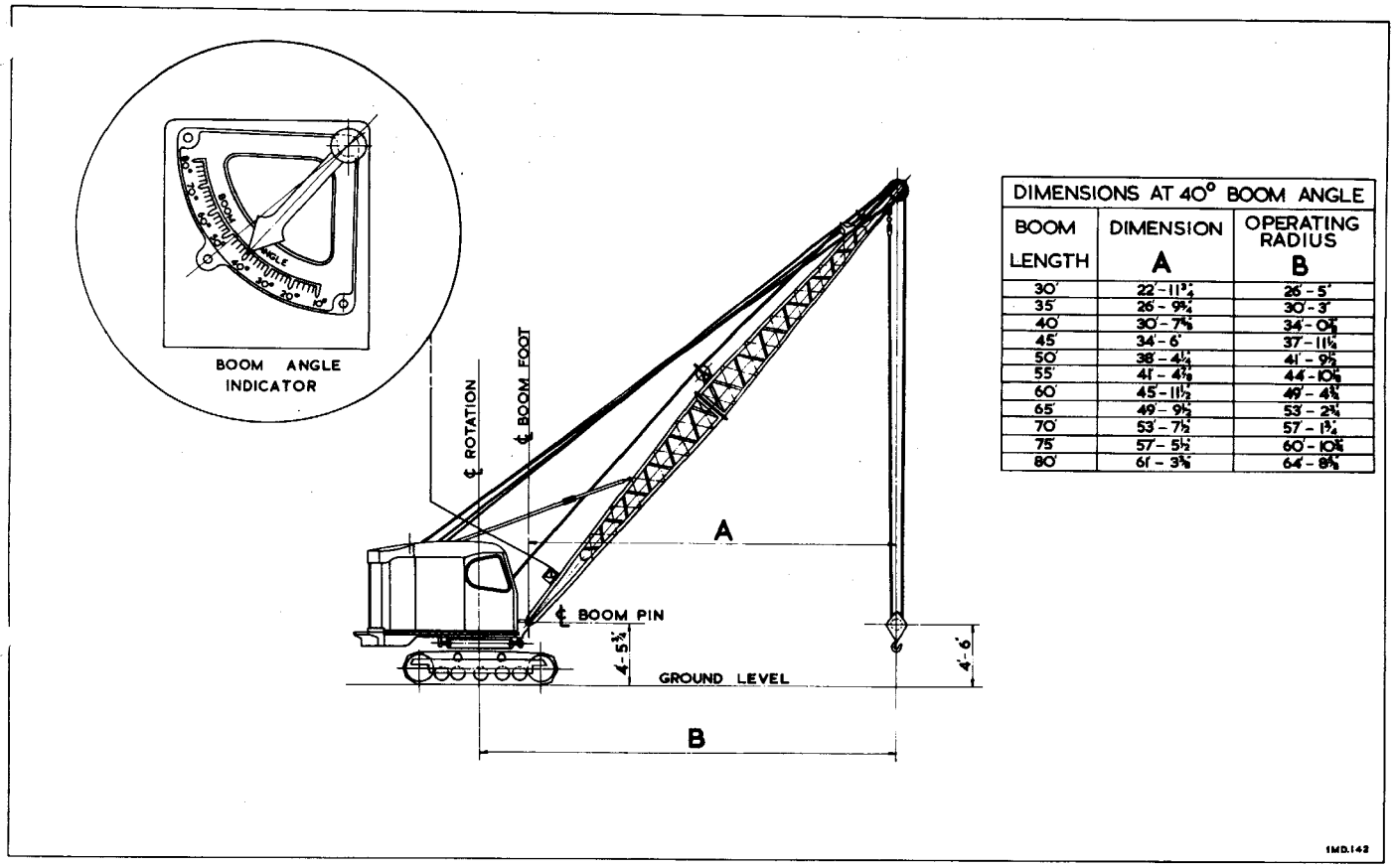
When excavating under water or when clearing dykes likely to contain chemically contaminated water the clamshell bucket should be hosed down afterwards. If mud is allowed to cake on the mechanism the assembly may have to be stripped and cleaned to render it serviceable. In cases of prolonged under water work, a water resisting lubricant should be used.

If the bucket tends to close when it is being lowered, the fault is probably due to binding of the front drum brake.

TO REPLACE A DRAGLINE BUCKET TOOTH

To change a digging tooth, clean the mouth of the bucket, drive out the split pin then drive out the tooth by means of a drift. Fit new tooth and new split pin.

When digging various materials with the dragline it will sometimes be advantageous to change the angle of the bucket by adjustment of the dump rope, or it may be helpful to reverse the drag clevises. These adjustments have already been referred to under "Dragline Operating Control" (See Section 5, Pages 19 to 21.)



DIMENSIONS AT 40° BOOM ANGLE		
BOOM LENGTH	DIMENSION A	OPERATING RADIUS B
30'	22'-11¾"	26'-5"
35'	26'-9¾"	30'-3"
40'	30'-7⅞"	34'-0⅝"
45'	34'-6"	37'-11¼"
50'	38'-4⅛"	41'-9⅝"
55'	41'-4⅛"	44'-10⅝"
60'	45'-11½"	49'-4⅝"
65'	49'-9½"	53'-2⅝"
70'	53'-7½"	57'-1⅝"
75'	57'-5½"	60'-10⅝"
80'	61'-3⅝"	64'-8⅝"

Fig. 20. Setting Pendulum Type Boom Angle Indicator.

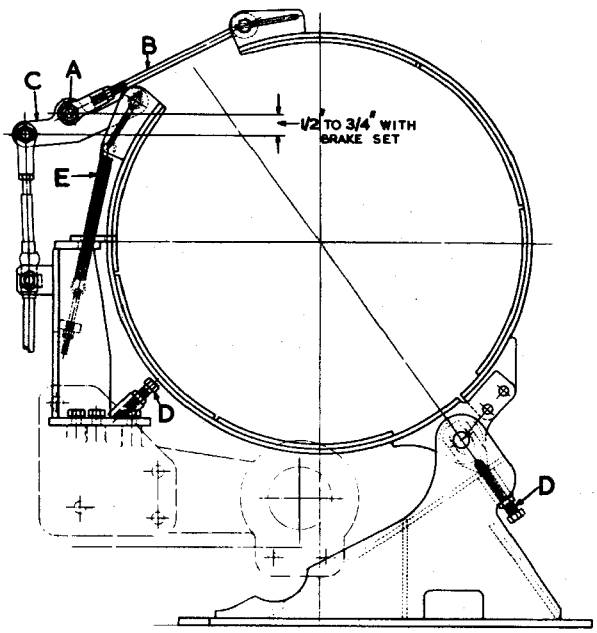


Fig. 21. Adjustment of Swing Brake.

OTHER SPECIAL OR OPTIONAL EQUIPMENT

SWING BRAKE (Refer to Fig. 21.)

A Swing Brake is supplied as standard equipment for Heavy Duty Cranes and Transit Cranes and is also an optional fitment for other types of machines.

The swing brake consists of an external brake band applied to the periphery of the rear swing-clutch housing and controlled by Hand Lever 'S' at the operator's position. (See Fig. 4 in Section 5, and Page 15, Section 4.)

The swing brake permits sensitive setting of the superstructure in relation to the position of the crawler tracks. The swing lock which engages with the internal swing gear ring, is retainedl to enable the superstructure to be locked positively in relation to the tracks for longer periods, e.g. during transportation. The swing brake may also be used as a propel brake on crawler mounted machines.

To adjust the swing brake to compensate for

lining wear, refer to Fig. 21, and proceed as follows:-

1. With the brake released, remove bolt 'A' and swing rod 'B' up clear of the lever 'C'.
2. Loosen the lock nut and screw the adjustable end of the rod 'B' onto the rod, thus shortening the effective length of the rod 'B'.
3. Re-connect the rod 'B' to the lever 'C' and apply the brake with the hand lever. When correctly adjusted, the lever 'C' should go into toggle about ½" to ¾" as shown on Fig. 21. Shorten or lengthen rod 'B' until this amount of toggle is obtained.
4. With the brake released, adjust support screws 'D' and the tension of release spring 'E' so that the band is free of the housing all the way round.

INDEX TO ILLUSTRATIONS IN SECTION 7.

SECTION 8

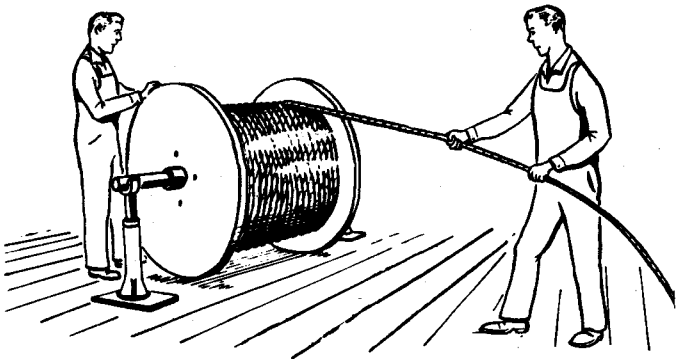
CONTENTS

REEVING INSTRUCTIONS

HANDLE WIRE ROPES CAREFULLY

Wire Rope life is dependent on proper care and lubrication. Careless handling of a new rope may destroy its usefulness before it is put into actual operation. Here are a few pointers on the proper handling, care and lubrication of ropes on excavating equipment.

Extreme care must be taken to avoid kinking the rope. When rope is un-coiled from a reel, it is best to mount the reel on a horizontal shaft shown in Fig.1.



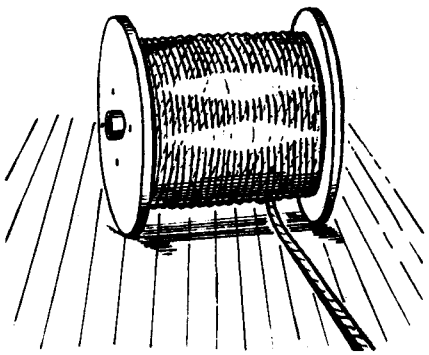


Fig.. 1. Un-coil wire rope from a reel by rotating the reel, or by rolling it along the ground.

If the rope is in a coil, the correct way to uncoil it is by rolling the coil along the ground, as shown in Fig.2.

Never take wire rope off a coil or reel as shown in Fig 3, as to do so is sure to result in a kink which will seriously damage, if not ruin the rope.

When a new rope is installed, it is advisable to operate a short time without load to enable the rope to adjust itself to the working conditions.

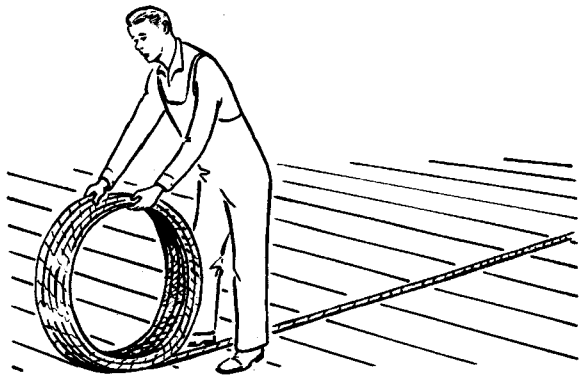
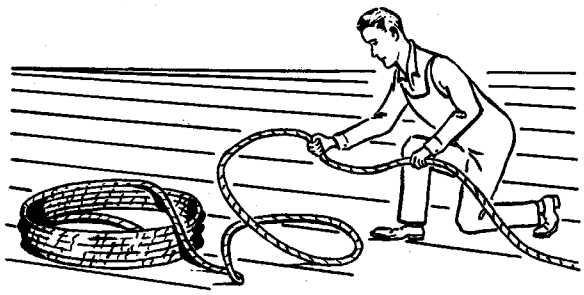


Fig. 2. Un-coil wire rope from a coil by rolling the coil along the ground.



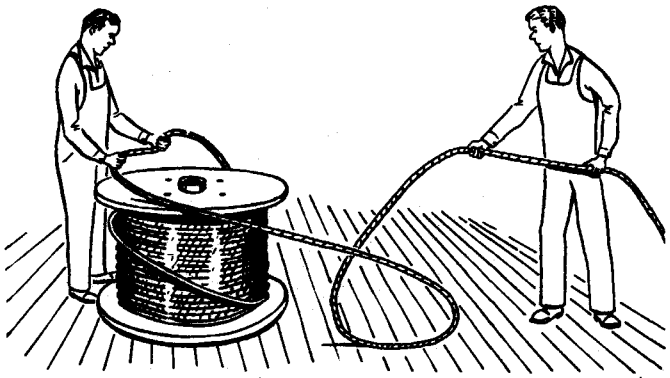


Fig. 3. These ways of un-coiling wire rope will only lead to trouble, and should always be avoided.

It may be necessary to disconnect the socket on the end of the rope to permit it to turn to its natural position to eliminate the initial twist that a new rope may develop. This is particularly necessary in the case of shovel or dragline hoist cables where heavy load always comes when the rope is travelling in the same direction.

SAFETY PRECAUTIONS

(a) INSPECTION

Do not wait for a rope to fail before replacing it as serious damage and perhaps loss of human life may result. Ropes should be inspected each shift when the boom is lowered for greasing, defects should be reported and any rope that is damaged or worn or has an excessive number of broken wires should be replaced. Inspect sheaves and drums for wear and damage, replace any sheave that has broken flanges or badly worn grooves. Watch spooling of ropes on drums during operation, if rope does not spool correctly the operation must be stopped and the spooling corrected before the rope becomes damaged.

Ropes such as dragline drag ropes or shovel hoist rope often begin to show signs of wear over a short length of rope long before the rope is worn out. Longer service can usually be obtained by turning such ropes end for end before the wear has become excessive.

It is advisable to keep spare ropes in stock to avoid having to wait for the arrival of a new rope. Store spare rope in a dry place and at least twice a year lubricate with light oil.

(b) REPLACEMENT AND ADJUSTMENT

Whenever ropes are being reeved or adjusted in any way and when the machine power is being used to assist this operation the following precautions **MUST** be observed.

The boom must be lowered and the engine set to run at idling speed.

All rope and machinery guards must be in position.

A competent operator must always be at the machine controls. At no time should the operator leave the controls whilst there is a suspended load or whilst the engine or machinery is running.

THE OPERATOR MUST NEVER ATTEMPT TO REEVE OR ADJUST A ROPE UNAIDED. Adjustment of the ropes must be done by an assistant who should be in full view of the operator at all times, if this is not possible a second assistant must be so positioned as to have a view of both, and the operator must respond to the second assistant's instructions.

To prevent injury from stray wires, tough gloves should be worn at all times when handling ropes.

Keep hands clear of ropes feeding in on sheaves or drums, to guide a rope being wound on to a drum use a bar to shift the rope.

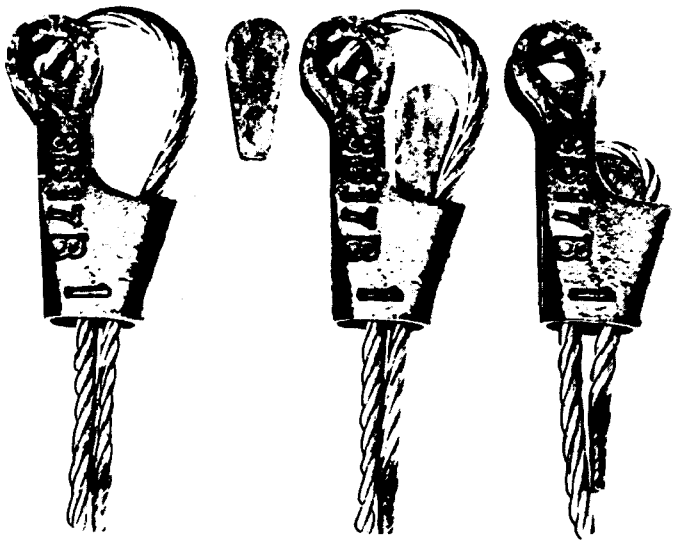


Fig. 4. Reeving wire rope in rope socket.

Reeve ropes in accordance with the instructions contained in this section.

METHODS OF WIRE ROPE ATTACHMENT

Rope sockets provide a very simple and quick method for making attachments to the ends of wire ropes. These sockets are annealed steel castings which have been carefully designed so that the rope pulls directly in line with the point of attachment and does not tend to kink or wear where it leaves the sockets. It is only necessary to reeve the rope in the socket as shown in Fig. 4, and work it down as tight as possible without pounding or injuring the rope. After reeving attach the socket and apply the load gradually until the rope is tight in the socket.

Rope Clips (See Fig. 5) provide a quick and handy way of making attachments where rope sockets would not be satisfactory. This method, however, does not develop the full strength of the rope.

If this method is used the clips should be attached with the U-bolt side on the dead end of the rope, also use a rope thimble when making a connection with clips to prevent bending the rope on too small a radius. Centre to centre between clips should be six times the diameter of the rope.

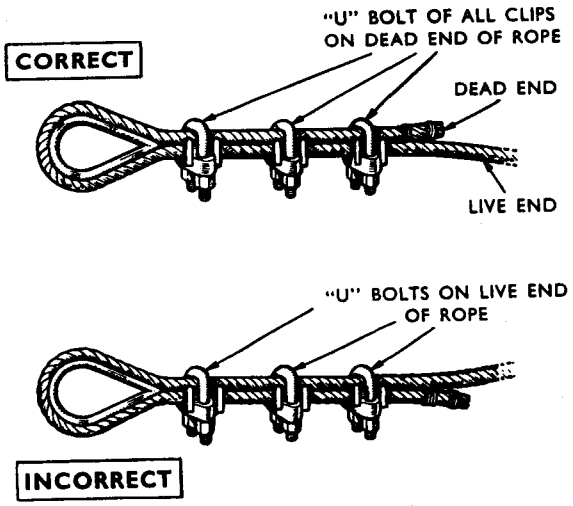


Fig. 5. Method of fitting Rope Clips.

After two or three hours service, nuts on a new clip attachment should be tightened. Clips should be inspected regularly thereafter to be sure that the nuts are tight and that the rope has not slipped.

ROPE REEVING INSTRUCTIONS

For positive crowd shovel, straight boom dragshovel, and skimmer equipments a special lagging is provided for the front drum which incorporates a chain sprocket. This sprocket is connected by chain to the chain sprocket keyed to the right hand clutch on the rear shaft.

These sprockets and chain are only used for the three equipments mentioned above. For dragline, clamshell, crane, or cambered boom dragshovel operation a special lagging is provided for the front drum which is used in place of the one carrying the chain sprocket.

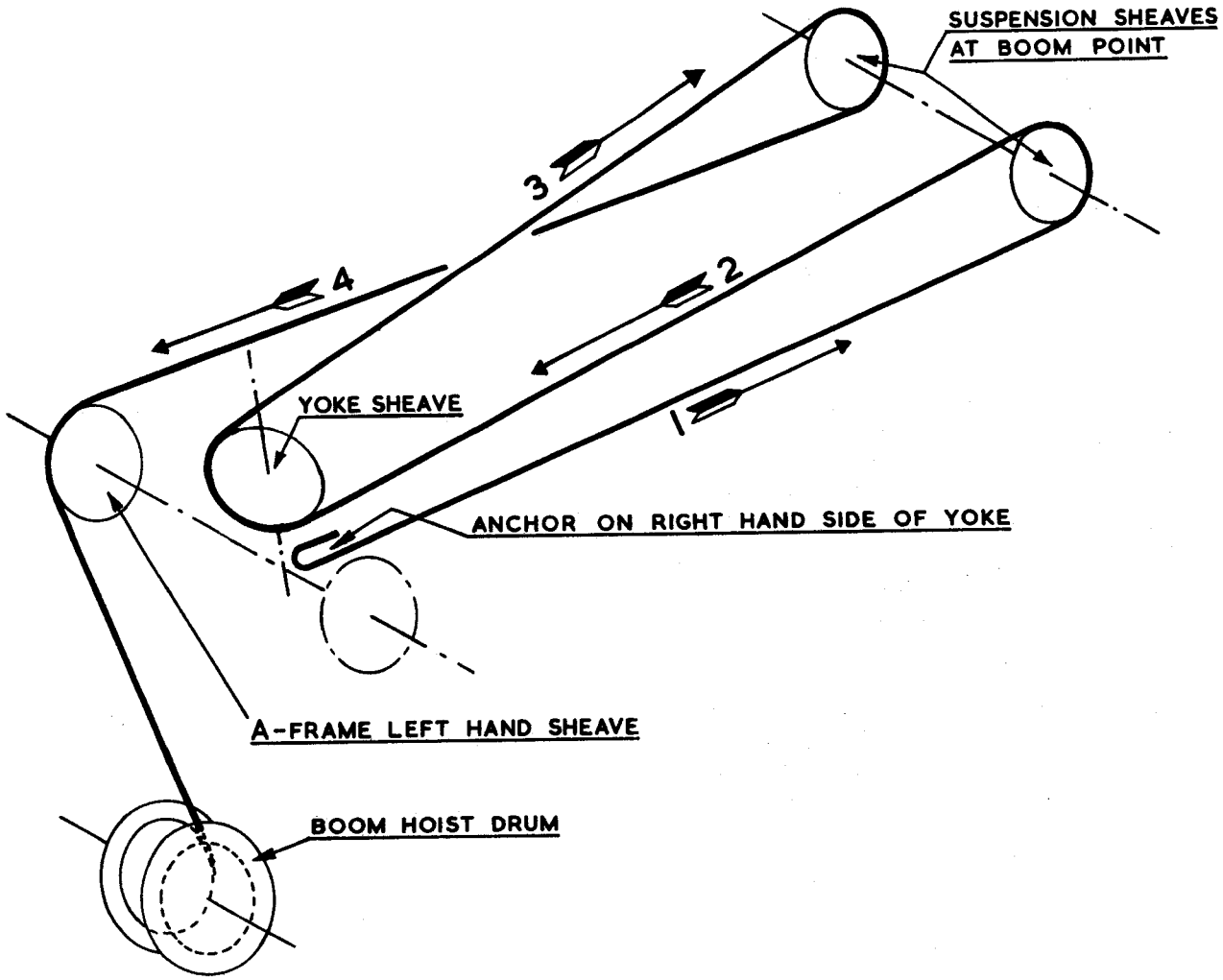


Fig. 6. Boom Suspension Reeving.

POSITIVE CROWD SHOVEL REEVING

3OOM SUSPENSION ROPE (Refer to Fig. 6.)

To replace the suspension rope, proceed as follows:-

1. Lower the boom on suitable blocking at the point end so that it is nearly horizontal.

   NOTE:-
   To block the shovel boom, rest the dipper on the ground, with handle fully extended, then lower the boom until it rests on a timber placed across the dipper handle just behind the front stop.

2. Spool off all rope from the boom hoist drum and drive out the rope socket wedge. Also remove the rope socket from the right side of the 'A' frame yoke and detach the rope by driving out the wedge.

3. Support the reel or coil of new rope so that it can be spooled off without kinking.

4. Lead the rope over the right hand boom point suspension sheave back to the yoke sheave, round this sheave from right to left, then forward again over the left hand boom point suspension sheave and back over the A-frame left hand sheave down to the boom hoist drum.

5. Fasten the leading end of the rope to the boom hoist drum, by inserting the wedge, and attach the other end of the rope to the 'A' frame yoke by means of the rope socket provided.

6. Turn the boom hoist drum in the hoisting direction until all slack is out of the suspension rope, making sure that the rope spools evenly. Check the rope wedges to be sure they are holding properly, then raise the boom to the working position.

HOIST ROPE (Refer to Fig. 7.)

The two part hoist rope is reeved to the hoist drum on the rear drum shaft as shown in Fig. 7.)

To fit a new hoist rope proceed as follows:-

1. Lower the dipper to the ground with the handle fully extended.

2. Disconnect the rope anchor from the lug on the boom by taking out the pin, then drive out the wedge in the rope socket. Free the other end of the rope by driving out the wedge in the drum and remove the old rope.

3. Support the reel or coil of new rope so that it can be spooled off without kinking.

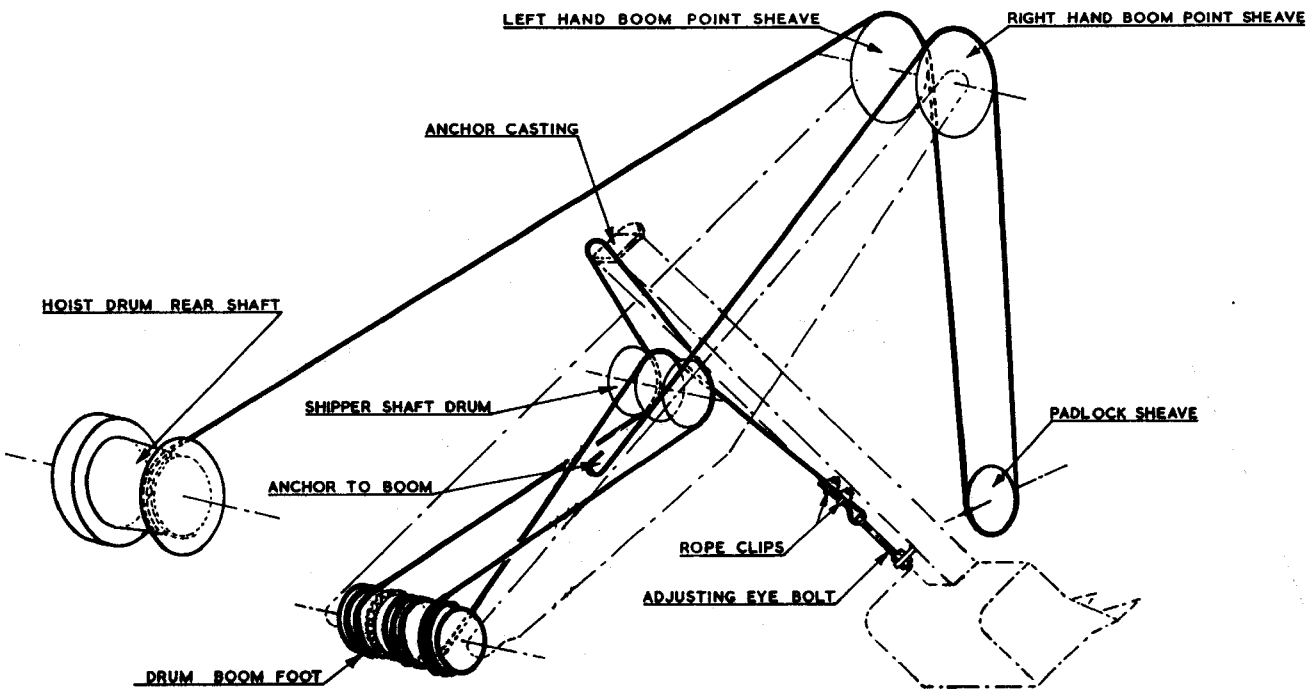


Fig. 7. Reeving for Hoist, Crowd and Backhaul Ropes.

4. Lead the rope up forwards over the right hand boom point hoist sheave and down to the padlock sheave on the dipper, round this sheave from right to left and then up and over the left hand boom point hoist sheave, backward down to the hoist drum on the rear drum shaft.

5. Fasten the leading end of the rope to the hoist drum, by inserting the wedge, and attach the other end of the rope to the anchorage on R.H. side of the boom by means of the rope socket provided.

6. Turn the hoist drum in the hoisting direction until the dipper is lifted just clear of the ground, then check the rope wedges (both in the drum and in the dead end socket) to be sure the wedges are holding properly, before hoisting to the desired working position,

CROWD AND BACKHAUL ROPES (Refer to Fig. 7.)

The twin crowd rope and single retract or backhaul rope are reeved between the dipper handle and the crowd drum at the foot of the boom as shown on Fig. 7.

To replace the crowd and backhaul ropes proceed as follows:-

1. Extend the dipper handle until the stop rests against the saddle block, then lower the dipper on to any convenient blocking.

2. Release the tension in the backhaul rope by slacking off the adjusting eye bolt at the lower end of the dipper handle, (See Fig. 8) and remove the rope clips. Drive out the wedges holding the ends of the crowd and backhaul ropes in the crowd drum at the foot of the boom and take off the old ropes.

3. Apply a liberal coating of grease to the anchor casting on the end of the dipper handle so that the crowd rope will equalize more readily.

4. Anchor one end of the new crowd rope to the flange on the right side of the boom foot crowd drum with the wedge provided, lead the rope from the top of the drum, through the boom to the under side of the shipper shaft drum right hand groove, around the drum to the rear of the dipper handle, around the groove in the anchor casting, from right to left, then down round the left hand groove of the shipper shaft drum, and through the boom to the top of the left hand side of the boom foot crowd drum. Anchor the rope to the left hand flange. Take up all slack on the boom foot drum by rotating the drum in the 'crowd out' direction, making sure that the rope spools evenly at both ends of the drum, and then hold the drum in position with the foot brake.

5. Anchor the new backhaul rope to the centre wedge socket of the boom foot drum, and wind approximately one wrap on the drum, then lead the rope forward from the bottom of the drum, up through the boom and over the centre groove in the shipper shaft drum, down to the adjusting eye bolt on the dipper handle. (Fig. 8).

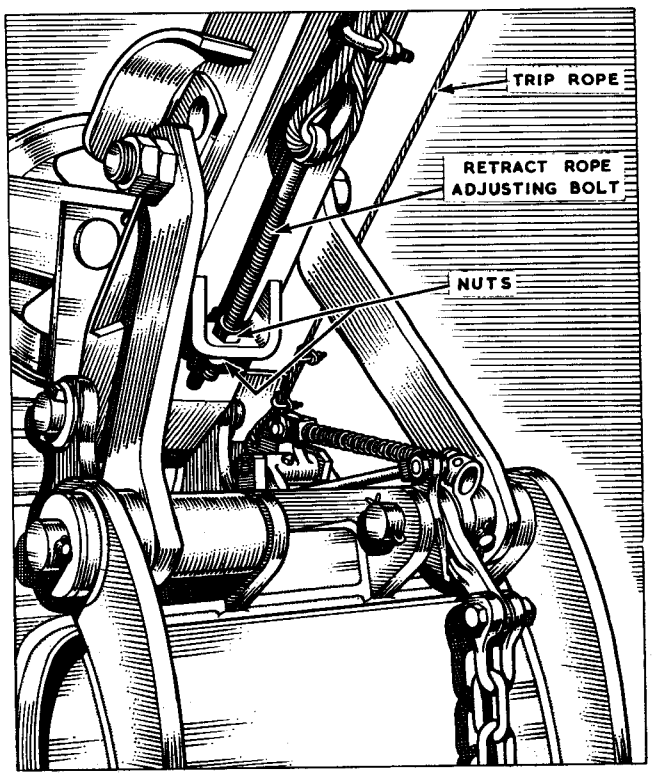


Fig. 8. Adjusting the Tension of the Crowd and Retract Ropes.

6. Run the nuts on the adjusting bolt back to the end of the bolt to give maximum adjustment.

7. Attach dead end of the backhaul rope to the adjusting eye bolt by means of the rope clips provided, taking up as much slack as possible by hand. Release the foot brake and draw on the adjusting bolt to remove all remaining slack in both the crowd and backhaul ropes.

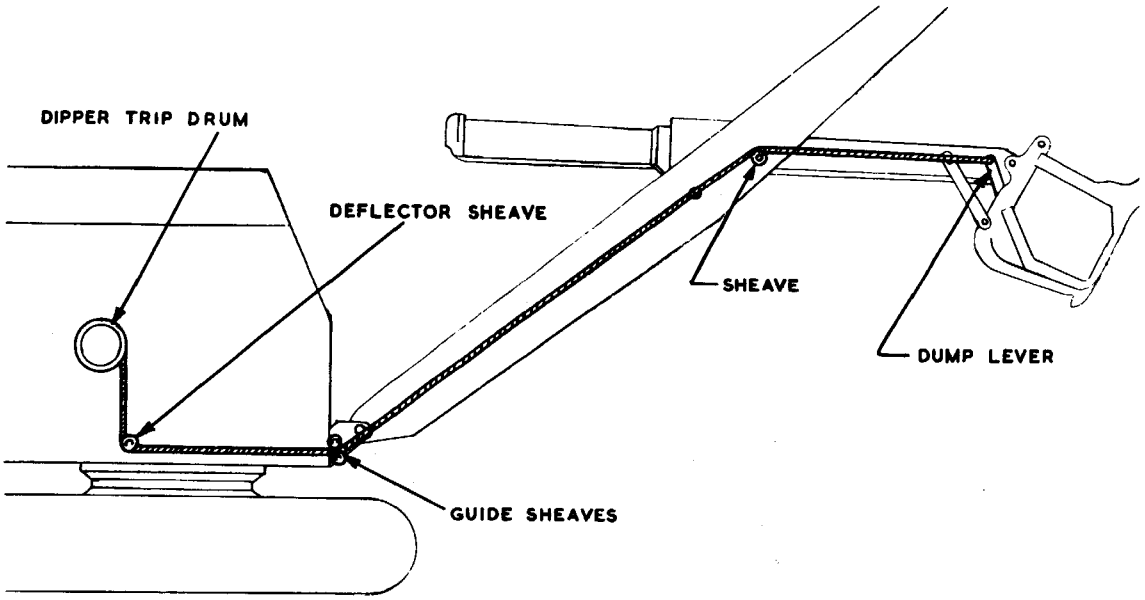


Fig. 9. Reeving the Dipper Trip Rope

8. With the dipper handle horizontal and fully extended, check to see that there is not more than two inches sag in the backhaul rope. If the sag is greater than two inches, draw on the adjusting bolt until the slack is correct.

DIPPER TRIP ROPE FOR SHOVEL EQUIPMENT (Refer to Fig. 9.)

The Dipper Trip Rope for the Shovel Equipment is reeved between the Dipper Trip Drum at the right hand end of the rear drum shaft and the dump lever located at the top of the Shovel Dipper.

To fit a new Dipper Trip Rope, proceed as follows:-

1. Anchor the end of the rope to the dump lever on top of the shovel dipper by passing it through the thimble and securing it by means of two bulldog clips (See Fig. 8.)

2. Lead the other end of the rope over the small sheave on the right hand side of the boom, then between the guide sheaves near the right hand side of the boom foot and under the right hand deck plate taking care not to foul the control rods. Lead the rope around the rear of the small deflector sheave secured to the underside of the deck plate, put it through the guard below the dipper trip drum and secure the end of the dipper trip drum.

3. Rotate the drum anti-clockwise to take up all the slack in the rope and at the same time get someone to ensure that the rope is correctly located on all the sheaves and that it is clear of the control rods under the deck plate. It is not necessary to remove the dipper trip arm guard when fitting the rope to the drum. If the drum cannot be rotated by hand, check that Lever 'N' is pulled back and then undo the locknut and the adjusting screw on the dipper trip bridge lever one or two turns. Spool on the rope and then screw up the adjusting screw one or two truns as applicable and tighten the locknut.

CHECK ALL ROPE FASTENINGS BEFORE OR SOON AFTER STARTING WORK

DRAGLINE REEVING

8-PART CONTINUOUS SUSPENSION

To replace the suspension rope, refer to Fig. 10, and proceed as follows:-

1. Lower the boom on to a tall trestle (or other suitable packing) located near the point end of the boom, so that the boom will be nearly horizontal.

2. Spool off all rope from the boom hoist drum and drive out the rope socket wedge. Also

remove the rope socket from the left side of the 'A' frame yoke and detach the rope by driving out the wedge.

3. Support the reel or coil of new rope so that it can be spooled without kinking.

4. Lead the new rope from forward over the boom point left hand inner suspension sheave and down to the lower sheave in the 'A' frame yoke, round this sheave from left to right and forward over the boom point right hand outer suspension sheave and back to the bottom of the right hand sheave on the 'A' frame, up round this sheave and forward again to the underside of the boom point right hand inner suspension sheave, next lead the rope up round this sheave and back to the upper sheave in the 'A' frame yoke, round this sheave from right to left and forward over the boom point left hand outer suspension sheave, then finally back over the left hand sheave on the 'A' frame and down to the boom hoist drum.

5. Fasten the end of the rope to the boom hoist drum by inserting the rope socket wedge. Fasten the other end of the rope in the rope socket (previously removed from the 'A' frame yoke) by means of the rope socket wedge and re-connect the rope socket to the 'A' frame yoke by means of the pin provided.

6. Turn the boom hoist drum in the hoisting direction until all the slack is out of the suspension rope, and making sure that the rope spools evenly on the drum. Check the rope wedges to be sure they are holding properly, then raise the boom to the working position.

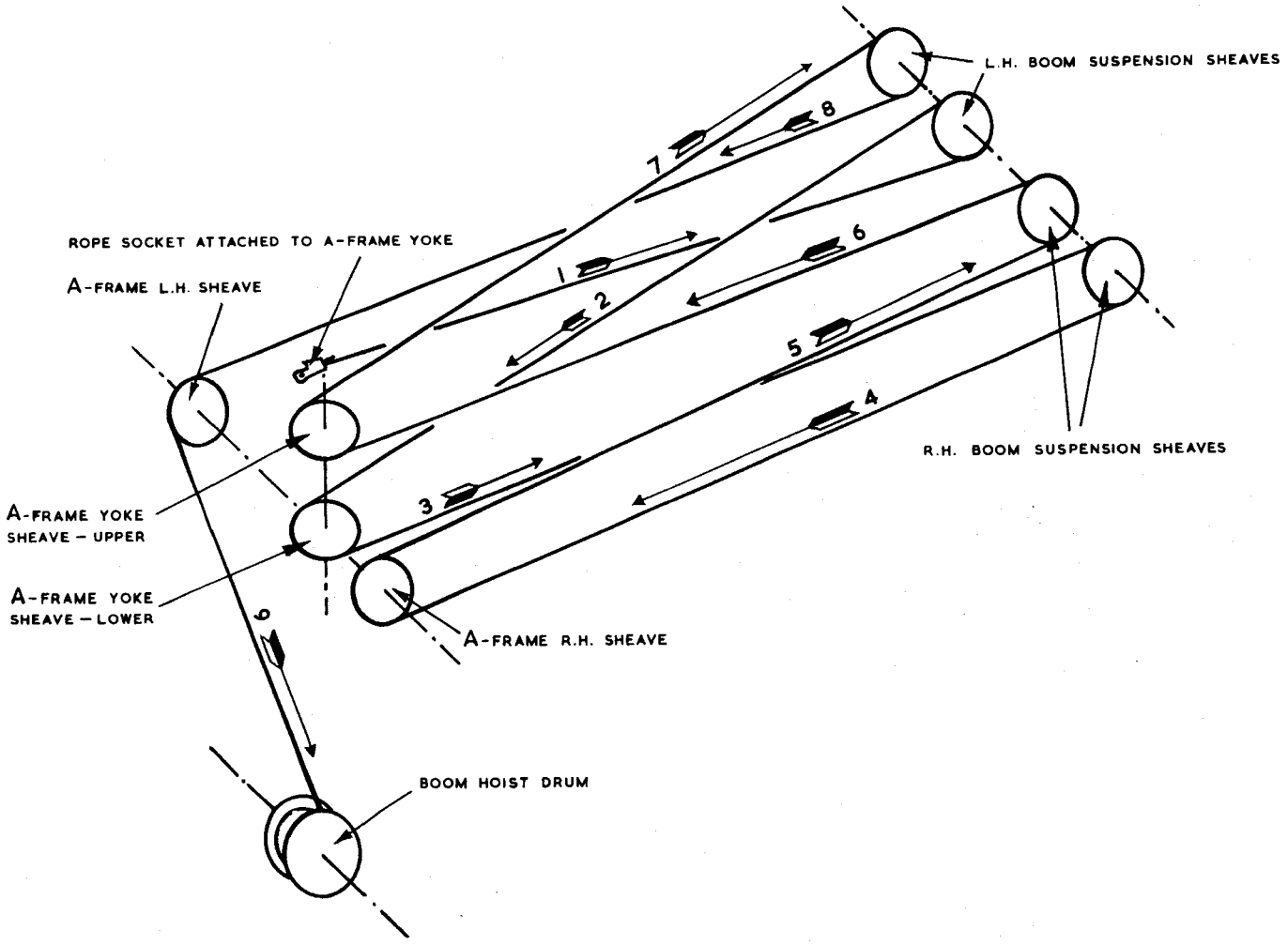


Fig. 10. 8-Part Continuous Boom Suspension Reeving

DRAGLINE HOIST ROPE (Refer to Fig. 11).

The dragline hoist rope is reeved to the rear drum. To fit a new hoist rope, proceed as follows:-

1. Lower the boom until it is nearly horizontal, then remove the old hoist rope, first driving out the wedge in the drum socket and in the rope socket attached to the top of the dump sheave frame.
2. Lead the new rope over the boom point sheave and down to the rear drum, and fasten the end in the wedge rope socket on the right hand side of the drum by replacing the rope socket wedge.
3. Attach the other end of the hoist rope to the rope socket on the dump sheave frame by replacing the socket wedge.
4. Raise the boom to the working position, then hoist the bucket just clear of the ground and check the rope wedges to be sure they are holding properly.

DRAGLINE DRAG ROPE (Refer to Fig. 11).

The dragline drag rope is reeved to the front drum. To fit a new drag rope, proceed as follows:-

1. Remove the rope wedges in the drum and in the drag rope socket attachment to the bucket chains and take out the old rope.
2. Now lead the new rope between the fairlead sheaves and fasten the end in the wedge rope socket on the front drum.

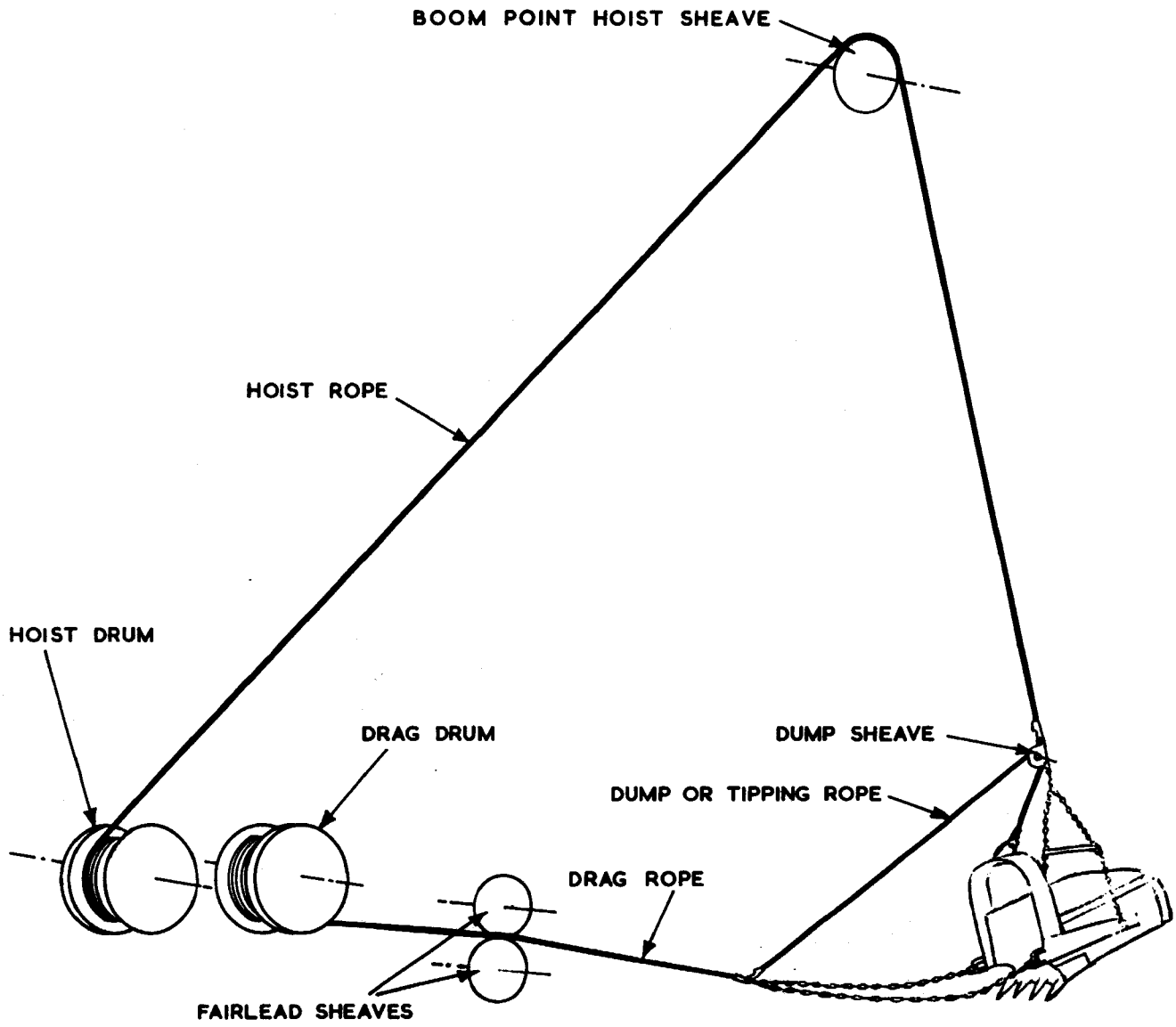


Fig. 11 Dragline Hoist and Drag Rope Reeving

3. Attach the other end of the rope to the drag rope socket by replacing the wedge. Put a slight tension on the drag rope and check the socket wedges to see that they are holding properly before placing full load on the drag rope.

Drag ropes usually wear longer if they are turned end for end occasionally to distribute the wear. Do not lubricate the drag rope as the oil will simply pick up excess dirt and carry it into the machine. From time to time clean out the dirt trough under the drum so that excess dirt does not accumulate.

DRAGSHOVEL REEVING

AUXILIARY 'A' FRAME SUSPENSION

Straight Boom Dragshovel Equipments can either be fitted with rigid type suspension, using tie bars between the main and auxiliary A-Frames as shown on Page 7, in Section 4, or as an alternative, continuous wire rope suspension can be provided, as is standard for Cambered Boom Dragshovel Equipments. In these cases the suspension rope is reeved just as shown on Fig. 6 (Boom Suspension Reeving), except that the rope is reeved round similiar suspension sheaves on the Auxiliary A-Frame instead of going round suspension sheaves at the boom point.

DRAGSHOVEL HOIST ROPE REEVING

Straight or Cambered Boom Dragshovel Equipments all use the rear drum as the hoist drum. The hoist rope is reeved 3-Part between the Auxiliary A-Frame and the Hoist Link Sheave Block connected to the dipper handle, as shown on Fig. 12.

To replace the dragshovel hoist rope, proceed as follows:-

1. With the dipper handle near to vertical, lower the boom until dipper rests on ground. Also lower auxiliary A-frame until it rests on suitable blocking placed between it and the boom. (It is of course quite un-necessary to lower the auxiliary A-frame when fixed suspension by tie bars is employed.)
2. Spool off all rope from rear drum and drive out socket wedge. Also remove socket from hoist link sheave block at the end of the dragshovel dipper handle and detach the rope by driving out the wedge.
3. Support the reel or coil of new rope so that it can be spooled off without kinking.
4. Lead the new hoist rope forward over the left hand hoist sheave on the auxiliary A-frame, to the top of the sheave in the hoist link block attached to the top of the dipper handle, then down round this sheave and back to the

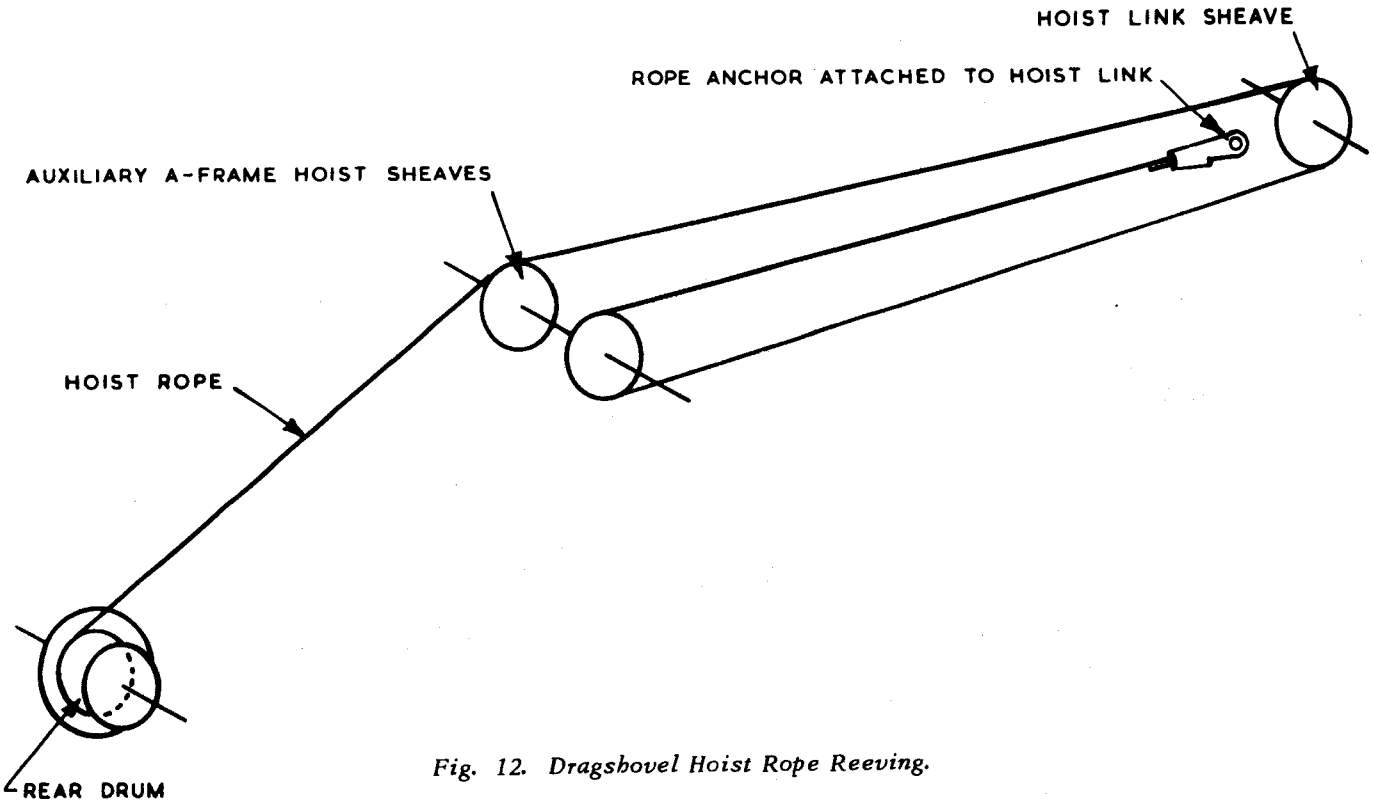


Fig. 12. Dragshovel Hoist Rope Reeving.

underside of the right hand hoist sheave on the auxiliary A-frame, then up round this sheave and forward to the rope anchor on the hoist link sheave block.

5. Fasten the end of the rope in the wedge rope socket and replace the pin attaching the socket to the hoist link sheave block.

6. Lead the free end of the rope down to the rear drum and anchor the rope in the socket provided.

7. Turn the drum in the hoisting direction until all the slack is taken out of the hoist rope and check the rope wedges to be sure they are holding properly. Then using the boom hoist machinery raise the auxiliary A-frame to its normal position. Next operate the main hoist to bring the boom to the desired working position.

DRAGSHOVEL DRAG ROPE REEVING

Unlike the Dragshovel Hoist Reeving which is substantially the same for Straight or Cambered Boom Dragshovels, the Drag Rope Reeving is quite different for the two types of boom, as follows:-

DRAG ROPE REEVING – STRAIGHT BOOM

The forward drum, driven from the rear shaft by the roller chain, carries the drag rope, which is reeved single part as shown on Fig. 13.

To replace the drag rope on straight boom dragshovel equipments, proceed as follows:-

1. With the dipper handle hauled in past the vertical, lower the boom until the dipper rests on the ground.

2. Spool off all rope from the front drum and drive out the socket wedge. Also remove the rope socket from the dipper and detach the rope by driving out the wedge.

3. Support the reel or coil of new rope so that it can be spooled off without kinking.

4. Lead the new drag rope forward along the boom and over the lower guide sheave to the rope anchor on the dipper.

5. Fasten the end of the rope in the wedge rope socket and replace the pin attaching the socket to the dipper.

6. Lead the free end of the rope down to the front drum and anchor the rope in the drum socket.

7. Turn the drag drum in the hauling direction until all the slack is taken out of the drag rope, and check the rope wedges to be sure that they are holding properly.

DRAG ROPE REEVING – CAMBERED BOOM

The forward drum also carries the drag rope for the cambered boom dragshovel, but in this case the drum is driven normally from the front shaft and rotates in the opposite direction to that used with the straight boom equipment. The drag rope is reeved two-part round a padlock sheave attached to the dipper and is lead to the underside of the drum as shown on Fig. 14.

To replace the drag rope on cambered boom dragshovel equipments, proceed as follows:-

1. With the dipper handle hauled in past the vertical, lower the boom until the dipper rests on the ground.

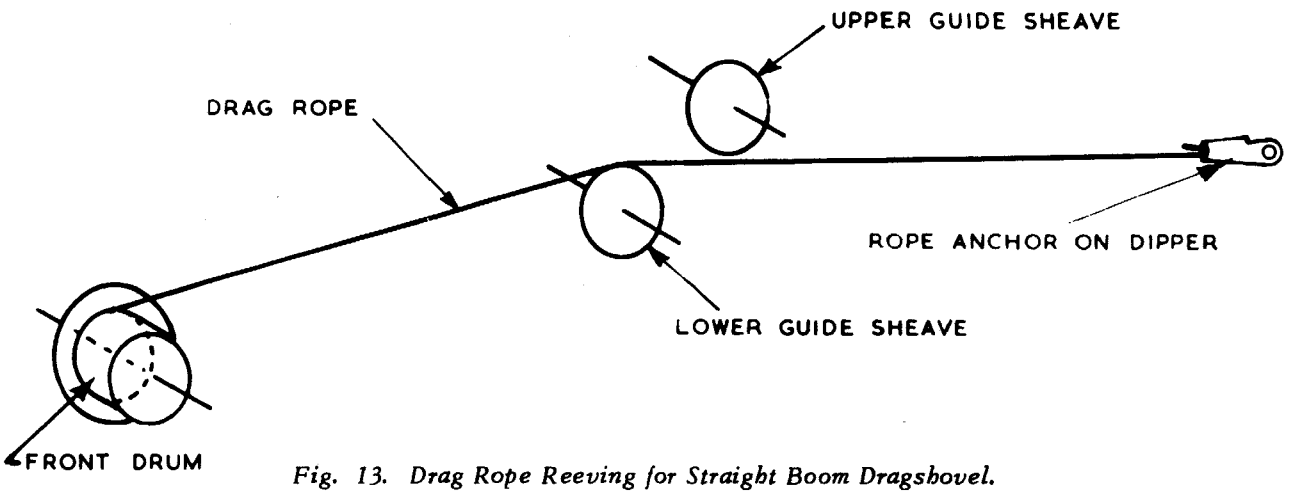


Fig. 13. Drag Rope Reeving for Straight Boom Dragshovel.

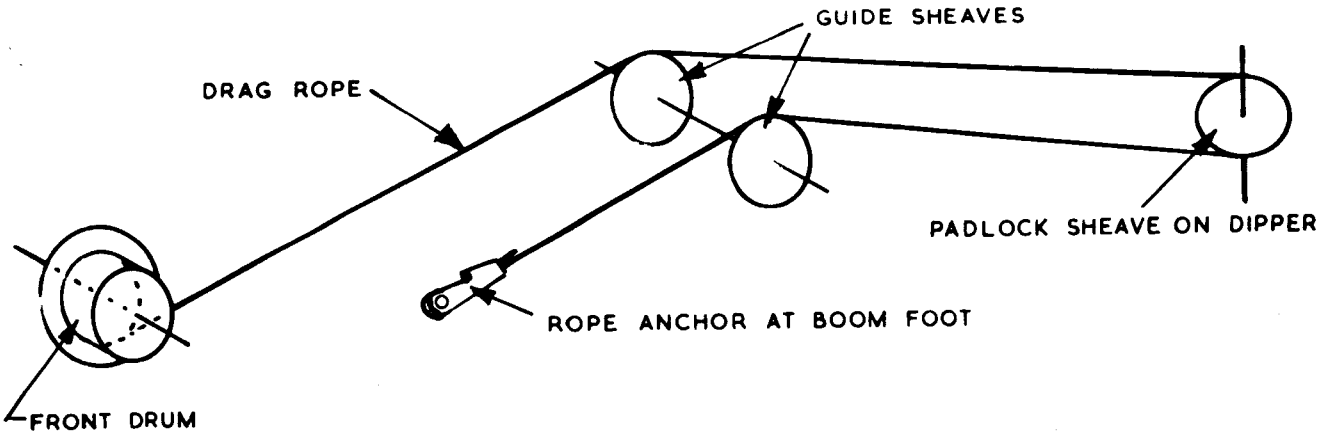


Fig. 14. Drag Rope Reeving for Cambered Boom Dragshovel.

2. Spool off all rope from the front drum and drive out the socket wedge. Also remove the rope socket from the boom and detach the rope by driving out the wedge.
3. Support the reel or coil of new rope so that it can be spooled off without kinking.
4. Lead the new drag rope forward over the left hand guide sheave on the boom to the padlock sheave on the dipper, round this sheave from left to right and then back over the right hand guide sheave on the boom to the rope anchor on top and towards the foot of the boom.
5. Fasten the end of the rope in the wedge rope socket and replace the pin attaching the socket to the boom.
6. Lead the free end of the rope down to the front drum and anchor the rope in the drum socket with the wedge provided.
7. Turn the drag drum in the hauling direction until the slack is taken out of the drag rope and check the rope wedges to be sure they are holding properly.

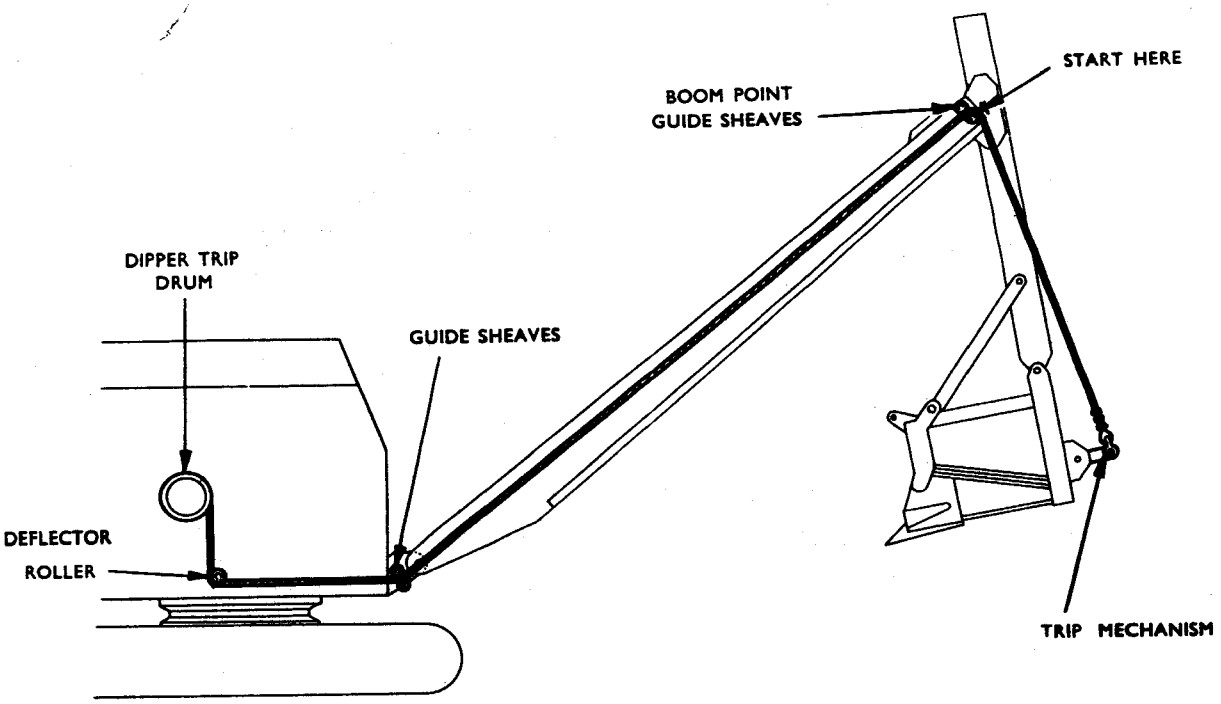


Fig. 15. Dragshovel Dipper Trip Reeving.

DRAGSHOVEL DIPPER TRIP ROPE REEVING

Hoe-type Dragshovel Dippers are not fitted with an opening door and do not therefore require a Dipper Trip Device.

On the other hand, the Front Opening Type Dipper available as an alternative, with the straight boom dragshovel, has a hinged door which is opened by power operated action of the Dipper Trip.

To replace a dragshovel dipper trip rope on such equipments, refer to Fig. 15, and proceed as follows:-

1. With the dipper resting on the ground (For sake of convenience), disconnect old trip rope from dipper trip drum and trip lever on dipper and spool off the rope.
2. Lay out and check the new rope.
3. Put one end of the new rope through the guide sheaves at the boom point and secure the forward end round the thimble on the trip lever shackle by means of the two rope clips.
4. Reeve the other end of the rope between the guide sheaves at the front of the revolving frame, and then up round the deflecting roller below the R.H. deck plate and fasten to the dipper trip drum.
5. Rotate the drum anti-clockwise and spool on the slack rope.

SKIMMER REEVING

For Skimmer operation the rear drum serves as the hoist drum, whilst the Front Drum takes the Digging (or Drag) rope. The Auxiliary A-Frame is in this instance also suspended by tie bars like the Straight Boom Dragshovel.

SKIMMER HOIST ROPE REEVING

To replace a skimmer hoist rope, refer to Fig. 16, and proceed as follows:-

1. With the bucket near to the boom point, lower the boom so that the bucket rests on the ground or suitable packing.
2. Spool off all rope from the rear drum and drive out socket wedge. Also remove socket from boom point sheave assembly and detach the rope by driving out the wedge.
3. Support the reel or coil of new rope so that it can be spooled off without kinking.
4. Lead the new hoist rope forward over the right hand hoist sheave on the auxiliary A-frame to the top of the boom point hoist sheave, then down round this sheave and back to the underside of the left hand hoist sheave on the auxiliary A-frame, then up round this sheave and forward to the rope anchor on the boom point sheave assembly.

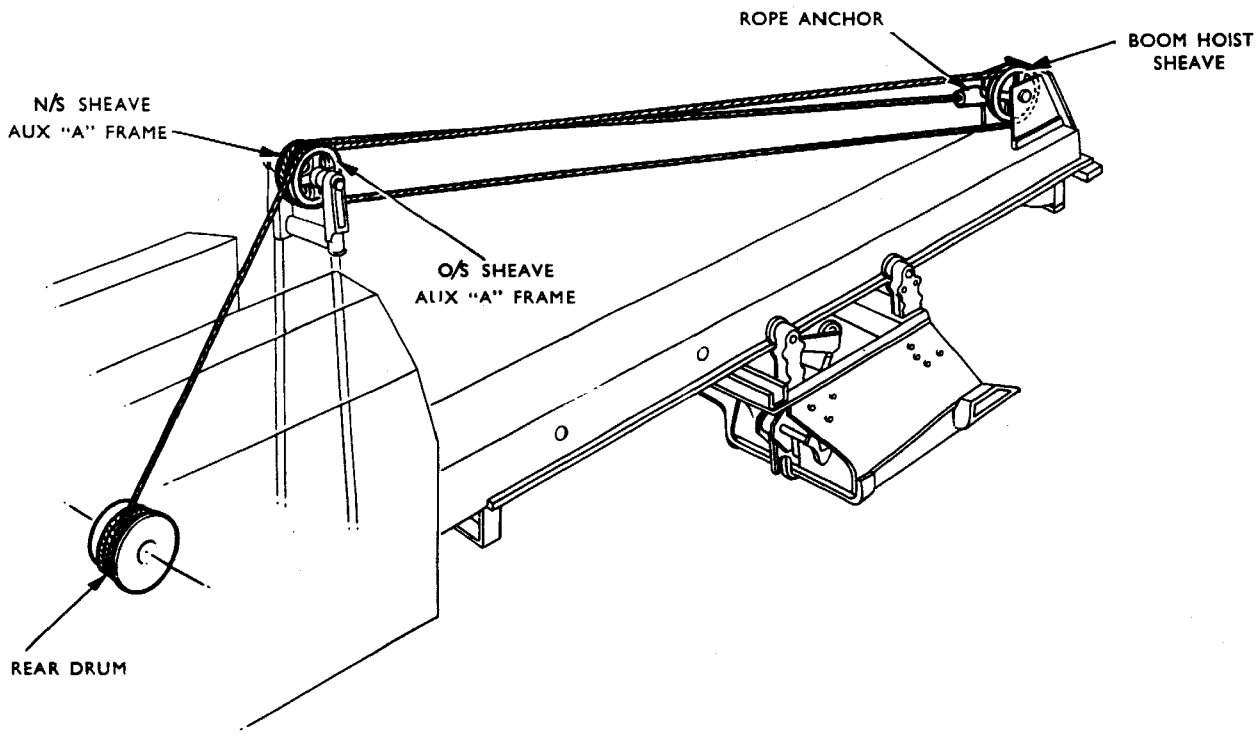


Fig. 16. Reeving the Skimmer Hoist Rope.

5. Fasten the end of the rope in the wedge rope socket and replace the pin attaching the socket to the sheave assembly.
6. Lead the free end of the rope down to the rear drum and anchor the rope in the socket provided.
7. Turn the drum in the hoisting direction until all the slack is taken out of the hoist rope and making sure that the rope spools evenly. Then hoist the boom just clear of the ground and check that the rope wedges to be sure they are holding properly.

SKIMMER DIGGING ROPE REEVING

To replace the skimmer digging rope (sometimes called a drag rope), refer to Fig. 17, and proceed as follows:-

1. With bucket drawn about half way up boom lower boom so that bucket rests on suitable packing with boom near to horizontal.
2. Spool off all rope from front drum and drive out socket wedge. Also remove socket from rear cross member on bucket and detach the rope by driving out the wedge.
3. Support the reel or coil of new rope so that it can be spooled off without kinking.
4. Lead the new rope forward up the boom and over the boom point drag rope sheave, then down round this sheave and back to the rope anchor on the rear cross member of the skimmer bucket.
5. Fasten the end of the rope in the wedge rope socket and replace the pin attaching the socket to bucket rear cross member.
6. Lead the free end of the rope down to the front drum and anchor the rope in the socket provided.
7. Turn the drum in the digging direction until all the slack is taken out of the rope, and check the rope wedges to be sure they are holding properly.

SKIMMER DIPPER TRIP ROPES

Skimmer equipments require the two-rope dipper trip arrangement as shown in Fig. 18. For differentiation the two ropes are known as the Dipper Trip Primary Rope and the Dipper Trip Secondary Rope.

The forward end of the dipper trip primary rope is secured to the outer lever of the trip lever bracket on the boom by means of a thimble and two rope clips. The other end is reeved between the guide sheaves at the front of the revolving frame, back under the left hand deck plate and up round the deflector sheave to the dipper trip drum. After securing the end of the rope in the drum, rotate the drum anti-clockwise to take up the slack in the rope.

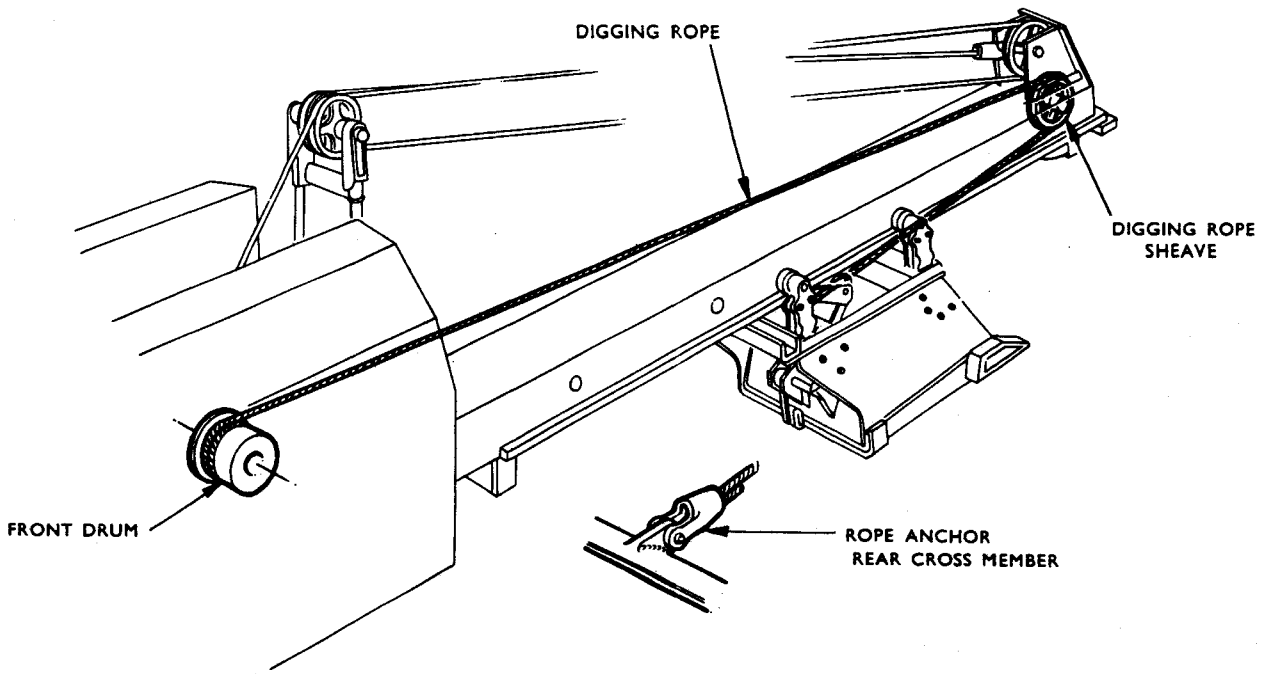


Fig. 17. Reeving the Skimmer Digging Rope.

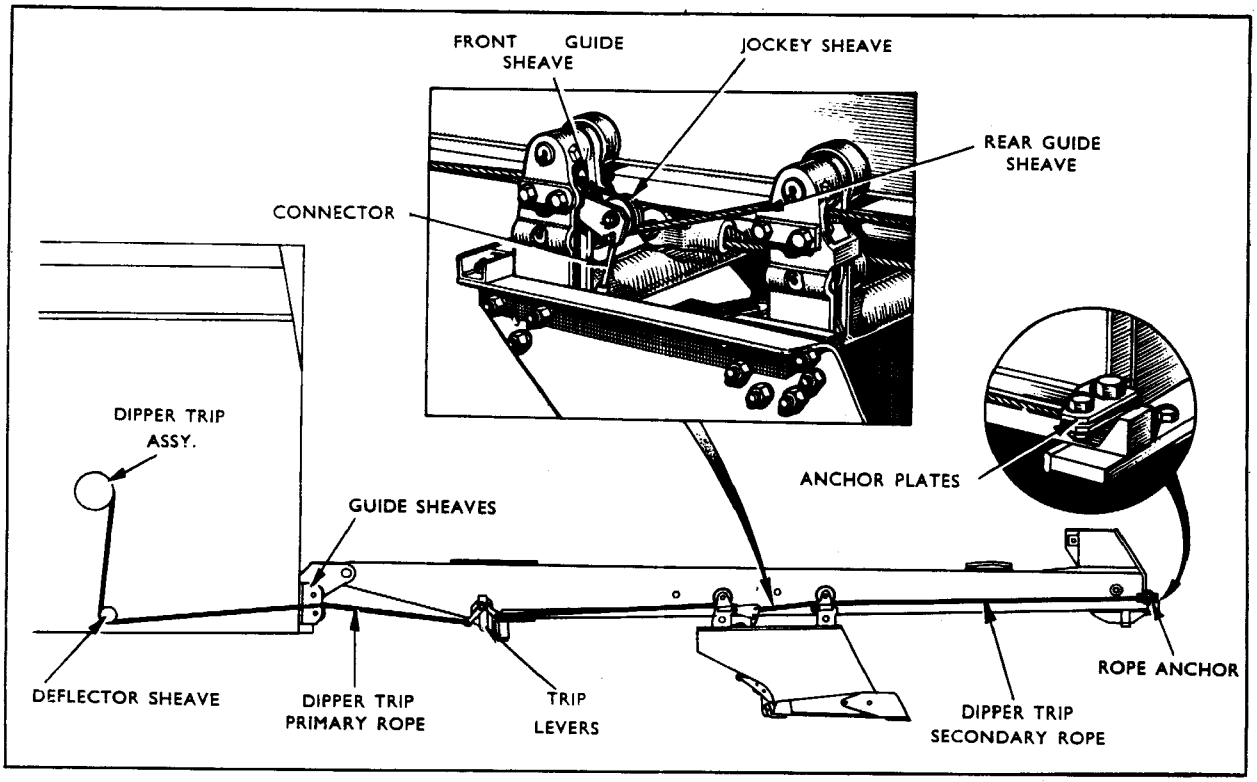


Fig. 18. Reeving the Skimmer Dipper Trip Rope

The forward end of the dipper trip secondary rope is secured by the rope anchor plates at the point end of the boom.

Lead the free end of the dipper trip secondary rope over the front guide sheave attached to the roller hanger, then under the jockey sheave and over the rear guide sheave to the inner lever on the trip bracket shaft.

Fit the rope thimble in the eye of the inner lever on the trip bracket shaft. Get an assistant to lift the jockey bracket so that the short connector is in tension, pull the free end of the secondary rope so that there is about six inches deflection in it at the point of contact with the jockey sheave. Rotate the inside lever of the trip lever bracket to a position corresponding to four o'clock, thread the rope through the thimble and secure it by means of two rope clips.

CLAMSHELL REEVING

BOOM SUSPENSION ROPE

This rope is reeved exactly the same as for Dragline, see Page 8, and Fig. 10.

HOLDING ROPE

This rope uses the rear drum and is reeved over the left hand boom point sheave and down to the holding rope anchor socket on the bucket. (See Fig. 19 and 20).

To install a new holding rope, proceed as follows:-

1. Lower the boom until it is nearly horizontal, then remove the old rope, first driving out the wedge in the drum socket and in the socket on the clamshell bucket.
2. Lead the new rope over the left boom point sheave and then down to the rear drum. Anchor the end of the rope in the wedge rope socket on the right hand flange of the drum.
3. Attach the other end to the rope socket on the bucket by replacing the wedge (or fasten it round the thimble with rope clips, if attachment is of that type).
4. Raise the boom to working position, then hoist the bucket just clear of the ground and check the rope wedges to make sure that they are holding properly.

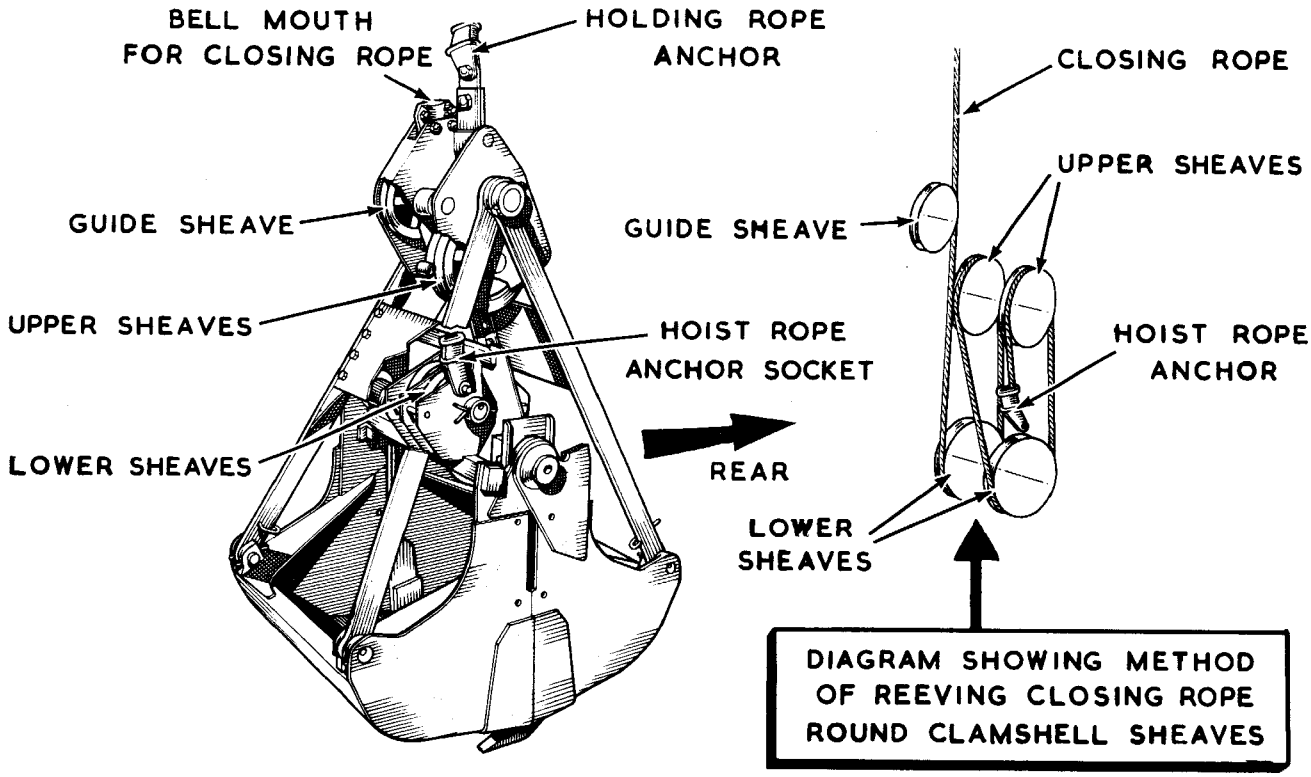


Fig. 20. Clamshell Bucket Rope Reeving.

CRANE REEVING

CRANE BOOM SUSPENSION

For occasional crane duty with booms up to 50ft. in length, the same 8-part Continuous Boom Suspension Reeving is sued as for Dragline equipments, and which has already been illustrated in Fig. 10. on Page 8 of this Section.

8-Part Pendant Suspension (Refer to Fig. 21), is recommended for regular crane duty and is essential for booms over 50ft. in length.

A 'Wylie' Safe Load Indicator can be applied only to machines having one of the 8-Part suspension systems.

8-PART PENDANT SUSPENSION

To replace the suspension rope, refer to Fig. 21, and proceed as follows:-

1. Lower the boom on to a tall trestle (or other suitable packing) located near the point end of the boom, so that the boom will be nearly horizontal, and continue the lowering motion until the pendant yoke rests on suitable wood packing, which should be placed across the boom back stops where the yoke would other wise make contact.
2. Spool off all rope from the boom hoist drum and drive out the rope socket wedge. Also remove the rope socket from the left side of the 'A' frame yoke and detach the rope by driving out the wedge.
3. Support the reel or coil of new rope so that it can be spooled off without kinking, from a point near to the boom foot.
4. Lead the new rope up the boom and round the lower L.H. pendant yoke sheave from

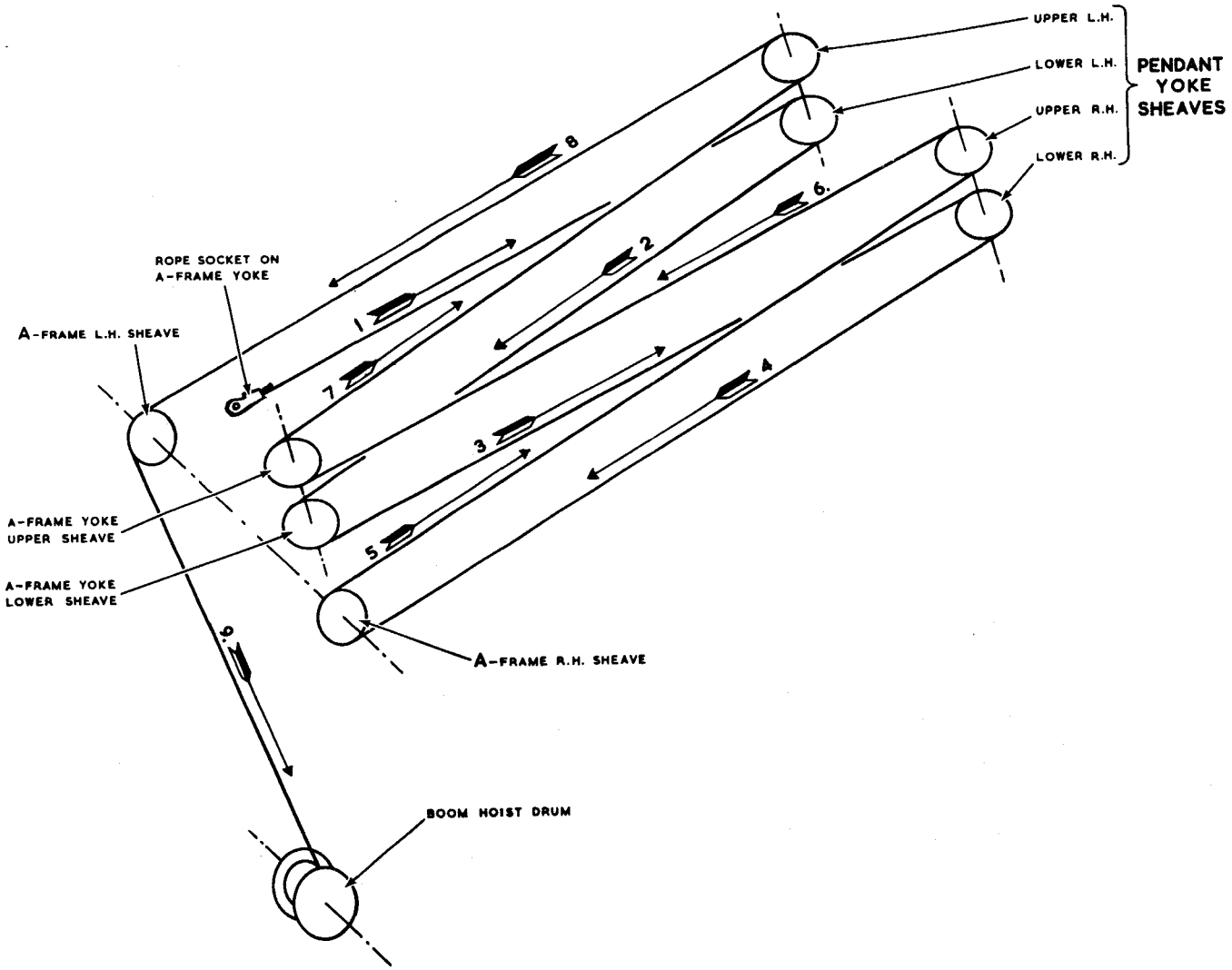


Fig. 21. 8-Part Pendant Suspension Reeving

left to right and back to the lower sheave in the 'A' frame yoke, round this sheave from left to right and forward round the lower R.H. pendant yoke sheave from left to right, then back to the bottom of the 'A' frame R.H. sheave, up round this sheave and forward to the upper R.H. pendant yoke sheave, round this sheave from right to left and back to the upper sheave in the 'A' frame yoke, next lead the rope forward once more to the upper L.H. pendant yoke sheave, round this sheave from right to left and then back over the 'A' frame L.H. sheave and down to the boom hoist drum.

5. Fasten the end of the rope to the boom hoist drum by inserting the rope socket wedge. Fasten the other end of the rope in the rope socket (previously removed from the 'A' frame yoke) by means of the rope socket wedge, and re-connect the rope socket to the 'A' frame yoke by means of the pin provided.

6. Turn the boom hoist drum in the hoisting direction until all the slack is out of the suspension rope, and making sure that the rope spools evenly on the drum. Check the rope wedges to be sure they are holding properly, then raise the boom to the working position.

When pendants need to be replaced, or the pendant combination needs to be changed to suit a change in boom length, the boom is first of all lowered as in (1) above. Pendants can then be easily exchanged by removing the pendant rope connecting pins and replacing them after the pendants have been changes to suit the circumstances involved.

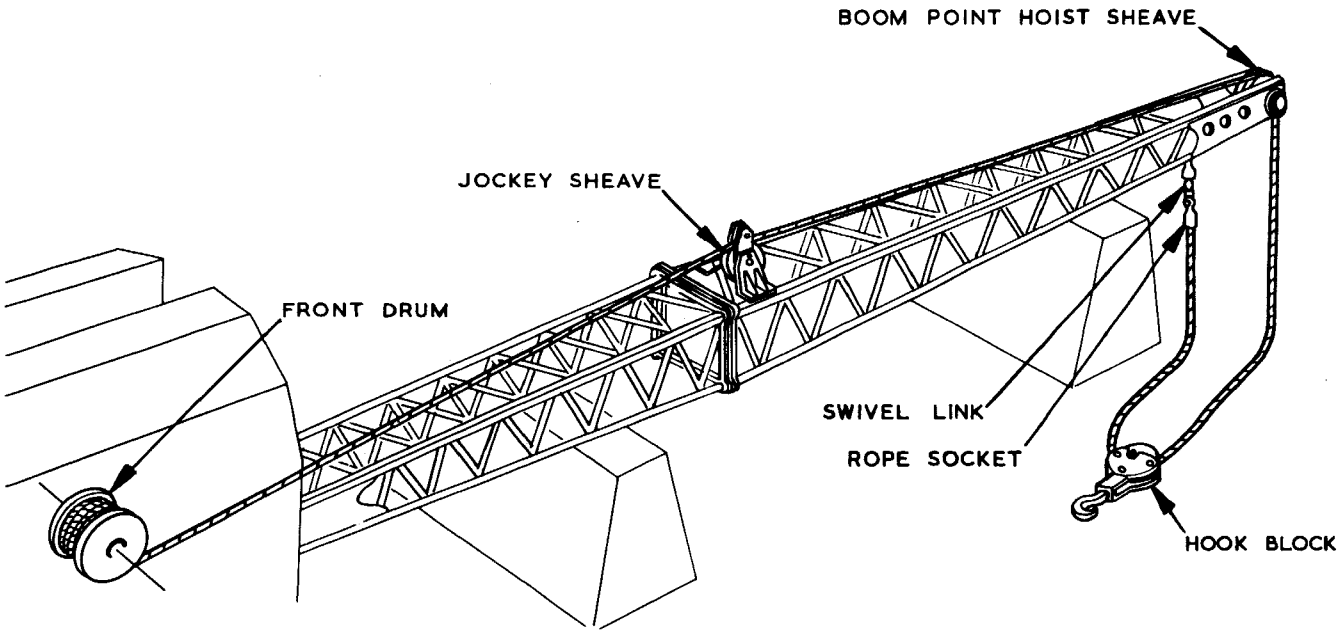


Fig. 22. Reeving the Hoist Rope

HOIST ROPE

Two hoist sheaves at the boom point are standard for 22-RB, allowing for 3-Part Hoist Reeving if required.

For Crane operation with 2-Part Hoist, the hoist rope is reeved as shown in Fig. 22 from the underside of the front drum, up the boom and over the jockey sheave and right boom point hoist sheave in turn, then down round the hook block sheave and finally up to the rope socket attached to the swivel link, shown in more detail inFig.23.

When it is desired to provide 3-Part Hoist, then instead of finishing at the swivel link at the boom head, the rope is lead forward over the left boom point hoist sheave and down to a swivel anchorage attached to the hook block as shown in the top right hand corner of Page 6, in Section 4 of this book.

By exchanging the hook block for a similar hook block but having two sheaves, and by carrying the hoist rope round the second sheave and up to the boom head anchorage as used for 2-Part Hoist, the number of parts in the tackle can be increased to four, for I.C.D. Booms only.

When the number of parts in the hoist tackle is an even number, then the hoist rope will always be anchored at the boom head. On the other hand when the number of parts is an odd number, the end of the hoist rope is anchored at the hook block.

When increasing the number of parts in the hoist tackle, always be sure to change the hoist rope for the longer and correct rope, as listed in the tabulation of wire rope sizes at the end of this section.

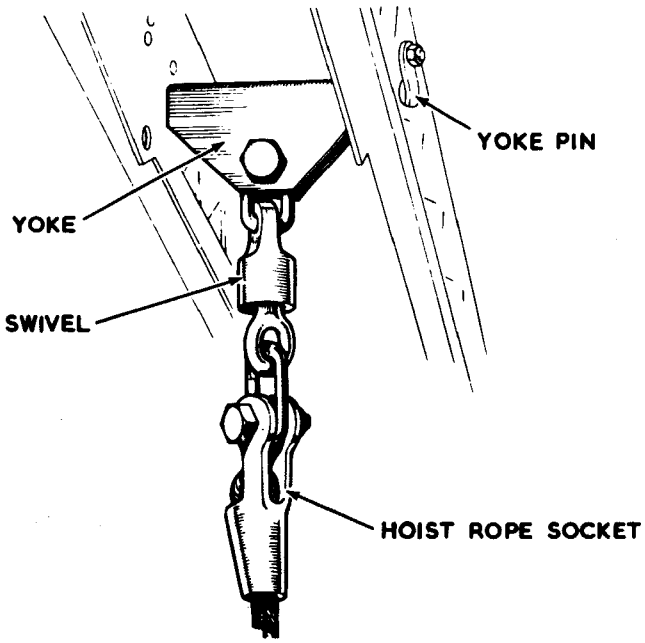


Fig. 23. The Swivel Link

REEVING FOR EXTENSION JIBS (See Page 7 in Section 4 and Page 25 of this Section)

Jibs are designed for lifting purposes only, and are not suitable for dragline or grabbing crane operation.

The point sheave of the jib must not be offset more than 7'0" from the centre line of the main boom.

The basic length of the jib is 10'0" comprising two 5'0" sections, and this is extendable to a maximum of 30'0" by the insertion of intermediate sections. Intermediate sections having lengths of 10'0" and 20'0" are available.

CRANE JIB SUSPENSION

The jib is supported by upper and lower pendants, the upper pendant is connected to the jib point and led round the upper jib mast sheave, and the lower pendant is attached to lugs on the lower end of the boom upper section and led round the lower jib mast sheave.

Pendant combinations are selected to suit varying conditions of 'jib in-line' or 'jib offset' for alternative jib lengths. A tabulation of the pendant and pendant link combinations, together with a reeving diagram can be found on Page 25 of this section.

To replace, remove, or insert a pendant or link, proceed as follows:-

1. Lower the boom until the jib point rests on blocking or tall trestle placed on the ground to receive it.
2. Disconnect the guy ropes at the appropriate connecting pins to enable insertion or removal of the upper or lower pendant inserts, as required.

AUXILIARY HOIST ROPE REEVING

When the crane is equipped with a jib, reeve the auxiliary hoist rope from the rear drum, over the deflecting sheave on the jib mast and thence over the jib point sheave. The end of the rope is then either attached to a single-line swivel hook by means of a wedge rope socket, or alternatively when tow-part hoist is required, the rope end is led round the sheave of a single-sheave swivel-hook block and back up to a rope socket connected to a swivel link at the jib point. In the case of single part hoist lines, it is usual for a bob weight to be attached to the rope just above the hook in order to make it easier to pay out the un-loaded hoist line.

Replacing the auxiliary hoist rope is a very similar operation to replacing the main hoist rope (previously described) and it is not considered necessary to describe it in full detail. It is however important to remember one essential difference in that whereas the main hoist rope is led to the underside of the front drum, the auxiliary hoist rope is led over the top of the rear drum. Refer to the reeving diagrams Fig. 22 and Page 25 of this section.

WIRE ROPE CONSTRUCTION NOTES

The type of rope listed in the tabulation for each application has been based on wire rope manufacturer's recommendation and field experience. Use a rope of recommended diameter, measured correctly (See Fig. 24) and cut it to the correct length. A rope which is too long will be damaged by overwinding and a rope that is too short may pull out of its attachment with serious results.

When identifying different kinds of wire rope, the following characteristics of the rope should be examined:

1. STRANDING (See Fig. 25)

This means the number of strands in the rope and the number of individual wires in each strand. For instance, a 6 x 19 rope has 6 strands, each made up of 19 individual wires.

2. 'LAY' of Strands in Rope.

This means the direction of twist of the strands in the rope. The strands of a right lay rope spiral clockwise, while the strands of a left lay rope spiral counter-clockwise.

3. 'LAY' of Wire in the Strands (See Fig. 26)

If individual wires in the strands have a spiral opposite to the spiral of the rope strand, the rope is 'regular lay'. If the spiral of the individual wires is the same as the strands, then the rope is 'lang lay'. A lang lay rope offers greater resist ance to abrasion but will crush more easily.

4. TYPE OF ROPE CENTRE OR CORE

The strands of an ordinary wire rope are 'laid up' on a hemp centre but for greater strength an independent wire rope centre is used with some loss of flexibility.

In addition to the above readily identified characterestics the grade of steel in the individual wires, and many variations in the arrangement of the wires in the strands affects the strength of the rope and its fitness for a particular application, hence it is important to use only ropes of the exact specification recommended.

Most rope manufacturers can supply ropes either of ordinary construction or 'preformed'. In the preformed rope the individual wires are in a more or less stressfree condition so that the rope has less tendency to kink or unravel at the ends and is generally easier to handle.

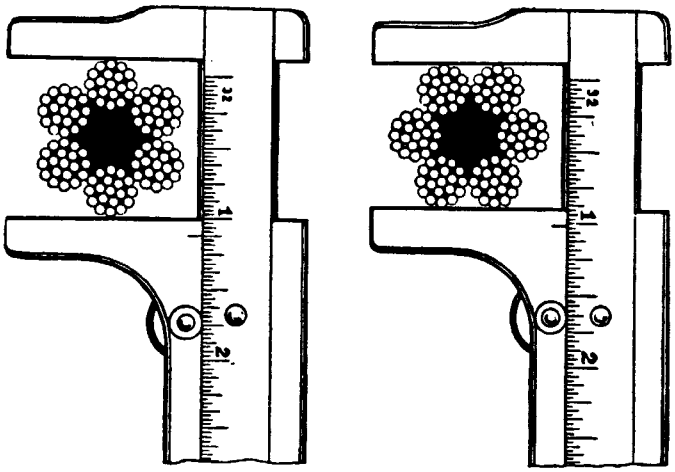


Fig. 24. How to Measure Wire Rope.

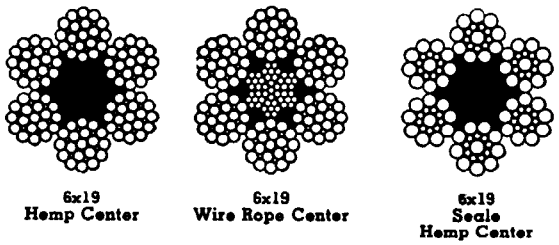


Fig. 25. Examples of Wire Rope Construction.

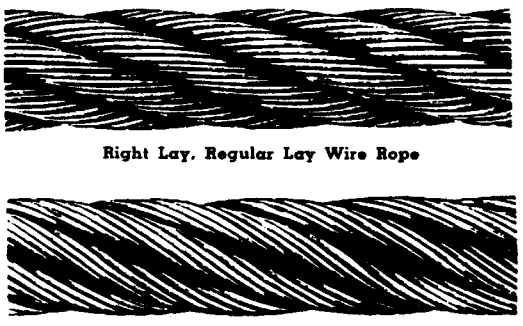


Fig. 26. Two Types of 'Lay'.

WIRE ROPE SIZES FOR 22-RB DRAGLINE, CLAMSHELL AND CRANE EQUIPMENT.

BOOM LENGTHS	CONTINUOUS SUSPENSIONS	PENDENT SUSPENSIONS		DRAGLINE ROPES		CLAMSHELL ROPES			CRANE ROPES		
	STANDARD BOOM 8-PART 11 mm. Dia. RBSD 870	STANDARD BOOM 8 PART TACKLE 11 mm. Dia. RBSD 870	PENDANTS REQUIRED	HOIST 16 mm. Dia. RBSD 870	DRAG 19 mm. Dia. RBSD 870	CLOSING 16 mm. Dia. RBSD 872	HOLDING 16 mm. Dia. RBSD 872	VERTICAL FRAME △ TAGLINE 8 mm. Dia. RBSD 872	2 PART HOIST 18 mm. Dia. RBSD 869	3 PART HOIST 18 mm. Dia. RBSD 869	
40′	404′-0″	180′-0″	2×29′-9″	90′-0″	65′-0″	135′-0″	110′-0″	65′-0″ & 7′-6″	142′-0″	187′-0″	
45′	445′-0″	180′-0″	2×5′-0″ & 2×29′-9″	100′-0″	65′-0″	145′-0″	120′-0″	70′-0″ & 7′-6″	157′-0″	207′-0″	
50′	485′-0″	180′-0″	2×10′-0″ & 2×29′-9″	110′-0″	65′-0″	155′-0″	130′-0″	75′-0″ & 7′-6″	172′-0″	227′-0″	
55′	—	180′-0″	2×5′-0″ 2×10′-0″ & 2×29′-9″	—	—	—	—	—	187′-0″	247′-0″	
60′	—	180′-0″	2×20′-0″ & 2×29′-9″	—	—	—	—	—	202′-0″	267′-0″	
65′	—	180′-0″	2×5′-0″ 2×20′-0″ & 2×29′-9″	—	—	—	—	—	217′-0″	287′-0″	
70′	—	180′-0″	2×10′-0″ 2×20′-0″ & 2×29′-9″	—	—	—	—	—	232′-0″	307′-0″	

The rope lengths tabulated are the minimum lengths necessary to suit the varying lengths of boom and number of parts in the hoist tackle.

The standard 232′-0″ HOIST ROPE is suitable for all lifts within the lifting capacity of the standard crane and covers the rope lengths shown above the dotted line. However, when it is desirable to slow down the hoisting speed by increasing the number of parts in the hoist tackle, then the rope lengths listed below the dotted line may be required.

FOR SUMMARY OF WIRE ROPE SPECIFICATIONS COVERED BY "RBSD" NUMBERS, SEE BACK OF THIS TABULATION.

WIRE ROPE SIZES FOR 22-RB SHOVEL, DRAGSHOVEL, SKIMMER & PILE DRIVER.

CROWD SHOVEL			CAMBERED BOOM DRAGSHOVEL			STRAIGHT BOOM DRAGSHOVEL			SKIMMER			PILE DRIVER		
ROPE	DIA & LENGTH	RBSD	ROPE	DIA & LENGTH	RBSD	ROPE	DIA & LENGTH	RBSD	ROPE	DIA & LENGTH	RBSD	ROPE	DIA & LENGTH	RBSD
SUSPENSION 4 – PART	16 mm. x 120′-0″	870	SUSPENSION	16 mm. x 86′-0″	870	TIE-BAR SUSPENSION	—	—	TIE-BAR SUSPENSION	—	—	SUSPENSION AS CRANE	—	—
HOIST	16 mm. x 80′-0″	870	HOIST	16 mm. x 110′-0″	870	HOIST	16 mm. x 110′-0″	870	HOIST	16 mm. x 86′-6″	870	HAMMER LIFTING	16 mm. x 90′-0″	869
CROWD	19 mm. x 55′-0″	872	DRAG	19 mm. x 70′-0″	870	DRAG	22 mm. x 40′-0″	870	DRAG	19 mm. x 45′-0″	871	HAMMER LATCH	8 mm. x 23′-0″	872
BACKHAUL	19 mm. x 28′-3″	872				DIPPER ✳ TRIP	8 mm. x 44′-0″	872	DIPPER TRIP	8 mm. x 19′-0″ & 17′-0″	872	PILE LIFTING	16 mm. x 106′-0″	869
DIPPER TRIP	8 mm. x 35′-0″	872												

REFERENCE NOTES:–

✳ DIPPER TRIP NOT REQUIRED WITH HOE TYPE DIPPER.

△ WHEN FITTED. B & A GRABLINE IS ALTERNATIVE FITMENT ON CLAMSHELL OR GRABBING CRANE.

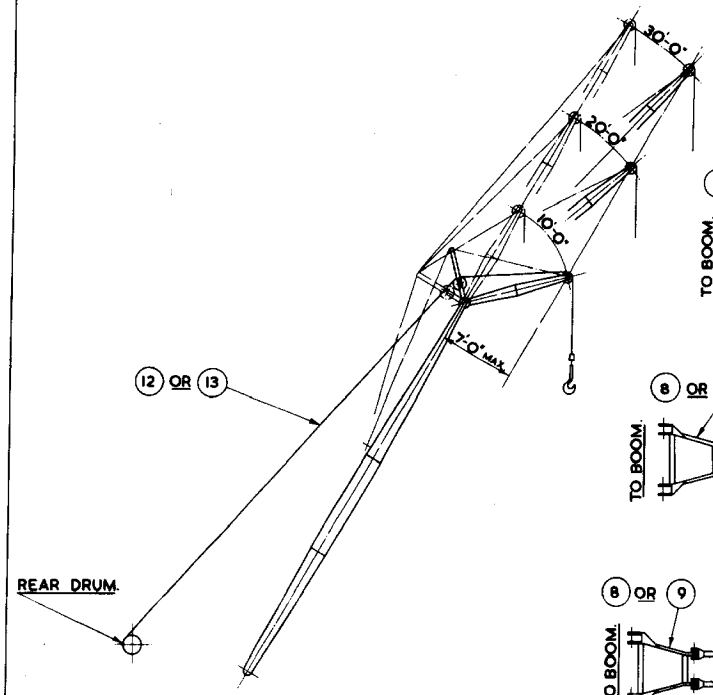
IMD 132/R4

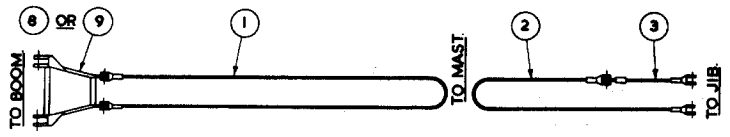
SUMMARY OF WIRE ROPE SPECIFICATIONS

RBSD No.	TYPE	GROUP	WIRE ROPE CONSTRUCTION	TENSILE RANGE kgf./sq mm.	LAY	CORE
866	UNGALVANIZED ROUND STRAND	6×19	6×9/9/1	140	REGULAR L.H.	FIBREFILM
867	UNGALVANIZED ROUND STRAND	6×19	6×9/9/1	180	LANGS R.H.	INDEPENDENT WIRE ROPE
868	GALVANIZED ROUND STRAND	6×19	6×12/6/1	180	REGULAR R.H.	WIRE STRAND CORE
869	UNGALVANIZED ROUND STRAND	6×19	6×12/6+6F/1	180	REGULAR R.H.	INDEPENDENT WIRE ROPE
870	UNGALVANIZED ROUND STRAND	6×19	6×12/6+6F1	180	LANGS R.H.	INDEPENDENT WIRE ROPE
871	UNGALVANIZED ROUND STRAND	6×19	6×12/6+6F1	190	LANGS R.H.	INDEPENDENT WIRE ROPE
872	UNGALVANIZED ROUND STRAND	6×36	6×14/7 & 7/7/1	180	REGULAR R.H.	INDEPENDENT WIRE ROPE
873	GALVANIZED ROUND STRAND	7×7	7×6/1	180	REGULAR R.H.	INDEPENDENT WIRE ROPE
874	UNGALVANIZED MULTI-STRAND	17×7	17×6/1	180	LANGS R.H.	FIBREFILM
875	UNGALVANIZED MULTI-STRAND	17×7	17×6/1	SEE BELOW *	LANGS R.H.	FIBREFILM

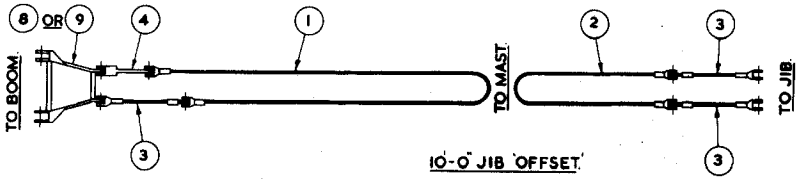
* TO AVOID COMPLICATIONS AND POSSIBILITY OF RECEIVING A ROPE OF LOWER BREAKING STRAIN DO NOT ORDER REPLACEMENTS FOR THESE SPECIAL NON-ROTATING ROPES DIRECT FROM ALTERNATIVE SUPPLIER WITHOUT REFERENCE FIRST TO RUSTON-BUCYRUS LTD. (FOR TENSILE RANGE REFER TO SPECIFICATION).

IMD. 875

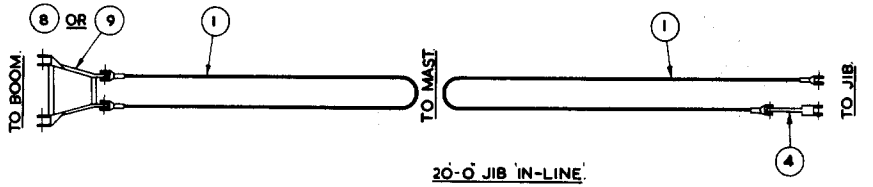




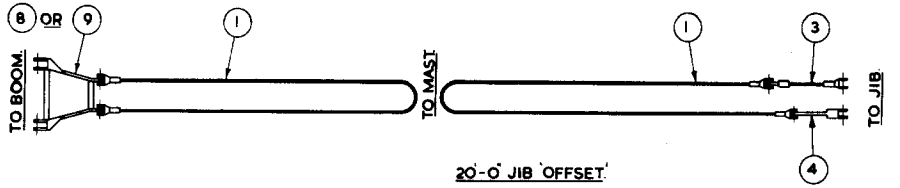
10'-0" JIB 'IN-LINE'.



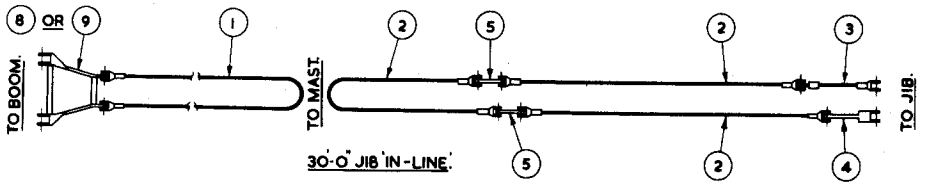
10'-0" JIB 'OFFSET'.



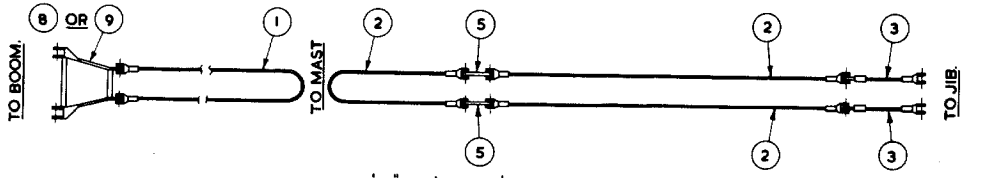
20'-0" JIB 'IN-LINE'.



20'-0" JIB 'OFFSET'.



30'-0" JIB 'IN-LINE'.



30'-0" JIB 'OFFSET'.

STANDARD & I.C.D CRANE BOOM.			
		12 AUXILIARY HOIST ROPE 18mm (11/16") RBSD 974.	13 AUXILIARY HOIST ROPE 18 mm (11/16") RBSD 974.
BOOM.	JIB.	SINGLE LINE.	2 PART.
40'-0"	10'-0"	120'-0"	170'-0"
	20'-0"	140'-0"	200'-0"
	30'-0"	160'-0"	230'-0"
45'-0"	10'-0"	130'-0"	185'-0"
	20'-0"	150'-0"	215'-0"
	30'-0"	170'-0"	245'-0"
50'-0"	10'-0"	140'-0"	200'-0"
	20'-0"	160'-0"	230'-0"
	30'-0"	180'-0"	260'-0"
55'-0"	10'-0"	150'-0"	215'-0"
	20'-0"	170'-0"	245'-0"
	30'-0"	190'-0"	275'-0"
60'-0"	10'-0"	160'-0"	230'-0"
	20'-0"	180'-0"	260'-0"
	30'-0"	200'-0"	290'-0"
65'-0"	10'-0"	170'-0"	245'-0"
	20'-0"	190'-0"	275'-0"
	30'-0"	210'-0"	305'-0"
70'-0"	10'-0"	180'-0"	260'-0"
	20'-0"	200'-0"	290'-0"
	30'-0"	220'-0"	320'-0"
80'-0"	10'-0"	200'-0"	290'-0"

PENDANT & LINK COMBINATIONS.

JIB IN-LINE STANDARD & I.C.D CRANE BOOM.

	1	2	3	4	5	6	7
JIB LENGTH.	PENDANT 37'-4"	PENDANT 17'-6"	PENDANT 3'-1"	LINK 1'-4"	LINK 7"	PIN.	LINCH PIN.
10'-0"	1	1	1			5	5
20'-0"	2			1		5	5
30'-0"	1	3	1	1	2	10	10

JIB OFFSET STANDARD & I.C.D. CRANE BOOM.

10'-0"	1	1	3	1		8	8
20'-0"	2		1	1		6	6
30'-0"	1	3	2		2	10	10

PARTS TO COMPLETE STANDARD & I.C.D. CRANE BOOM.

	8	9	10	11			
TYPE	LINK 2'0"	LINK 2-0½"	PIN.	LINCH PIN			
STANDARD	1		2	2			
I.C.D.		1	2	2			

NOTE :- PENDANTS 16mm (5/8") DIA. X RBSD 870.

PENDANT GUY ROPE AND AUXILIARY HOIST ROPE TABULATION FOR 22-RB.

IMD.962

SECTION 9

9 CONVERSIONS

CONTENTS

ILLUSTRATIONS

CONVERSION INSTRUCTIONS

GENERAL NOTES

The same basic machine is used for all types of front end equipment. Instructions for changing over a machine from one type of operation to another are covered in this section.

On page 3, (Opposite these notes) is an abridged key chart showing in diagrammatic form how the various standard machines and equipments are built up from defined groups of parts and/or assemblies. A brief study of this chart will help all concerned to quickly understand the make-up of a particular machine and will also give some help in assessing the extent of the change in carrying out a desired conversion.

Before starting any conversion, move the machine to a clear, level space having good drainage so that standing water will not interfere with the work. If possible arrange to have a crane, or overhead hoist, to lift the heavy parts. Don't take chances supporting heavy parts on rickety blocking. Have plenty of sound, sawn timber on hand so that good substantial cribs or supporting trestles can be built.

CONVERSION TO SHOVEL

When converting the machine to shovel operation from dragline, clamshell or crane operation, remove the forward drum lagging and install the split two-chain sprocket lagging as used for shovel operation (Refer to Fig. 13 in section 2 and Fig. 9 in Section 5). Connect the roller chain between the sprockets on the rear and forward drum shafts.

NOTE:

If the machine was originally supplied as a crane and fitted with power controlled load lowering equipment, then it will be necessary to remove the split sprocket on the rear shaft and the chain between the two shafts before fitting the larger pitch chain and sprockets now required.

Reverse the dead and live ends of the forward drum brake band and re-adjust as described in Section 7, Pages 10 to 12, Fig. 12.

It is also necessary to change the linkage from hand lever 'B' so that the crowd clutch on the rear drum shaft will be engaged by pushing on lever 'B'.

To carry out the change over, refer to Fig. 1, and proceed as follows:-

Swing the revolving frame so that the reach rods under the R.H. deck plate are between the crawler tracks, stop the engine and set the controls in the Neutral position. Remove the split pins and the clevis pins securing the long and short reach rods to the bell crank. Remove the short reach rod from the bell crank, support the long reach rod with one hand and swing the bell crank round to engage the arm that was connected to the short reach rod, with the clevis of the long reach rod. Refit the clevis pin in the long rod. Undo the locknut on the adjusting bolt of the short reach rod a 1/4 turn and unscrew the rod from the large clevis. Swing the large clevis

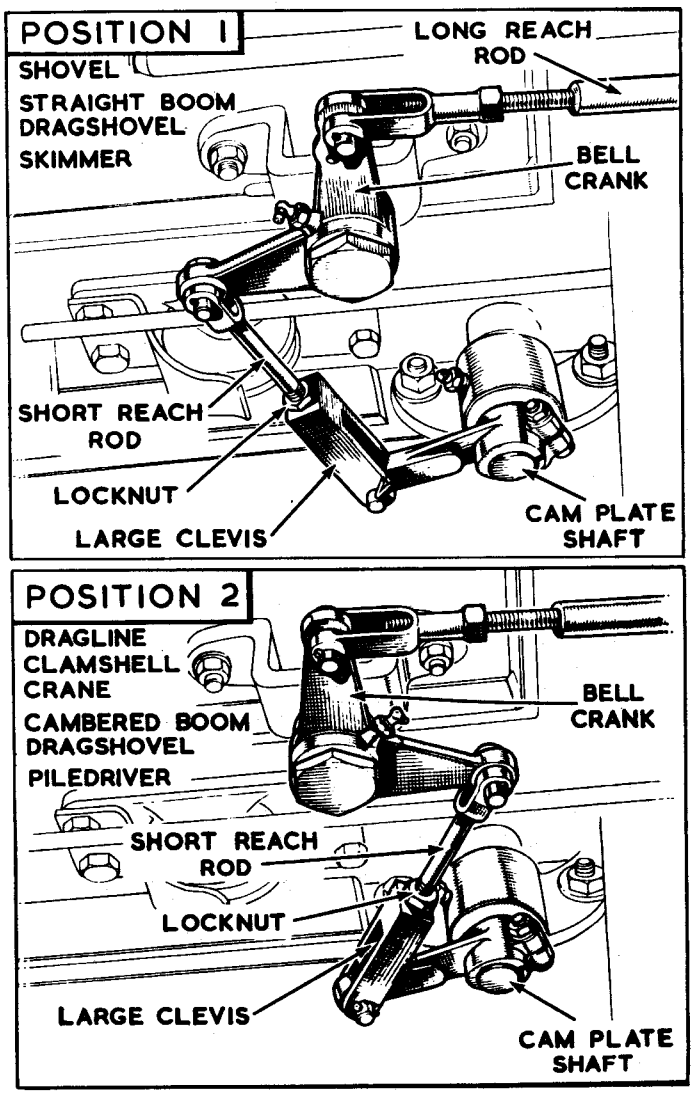
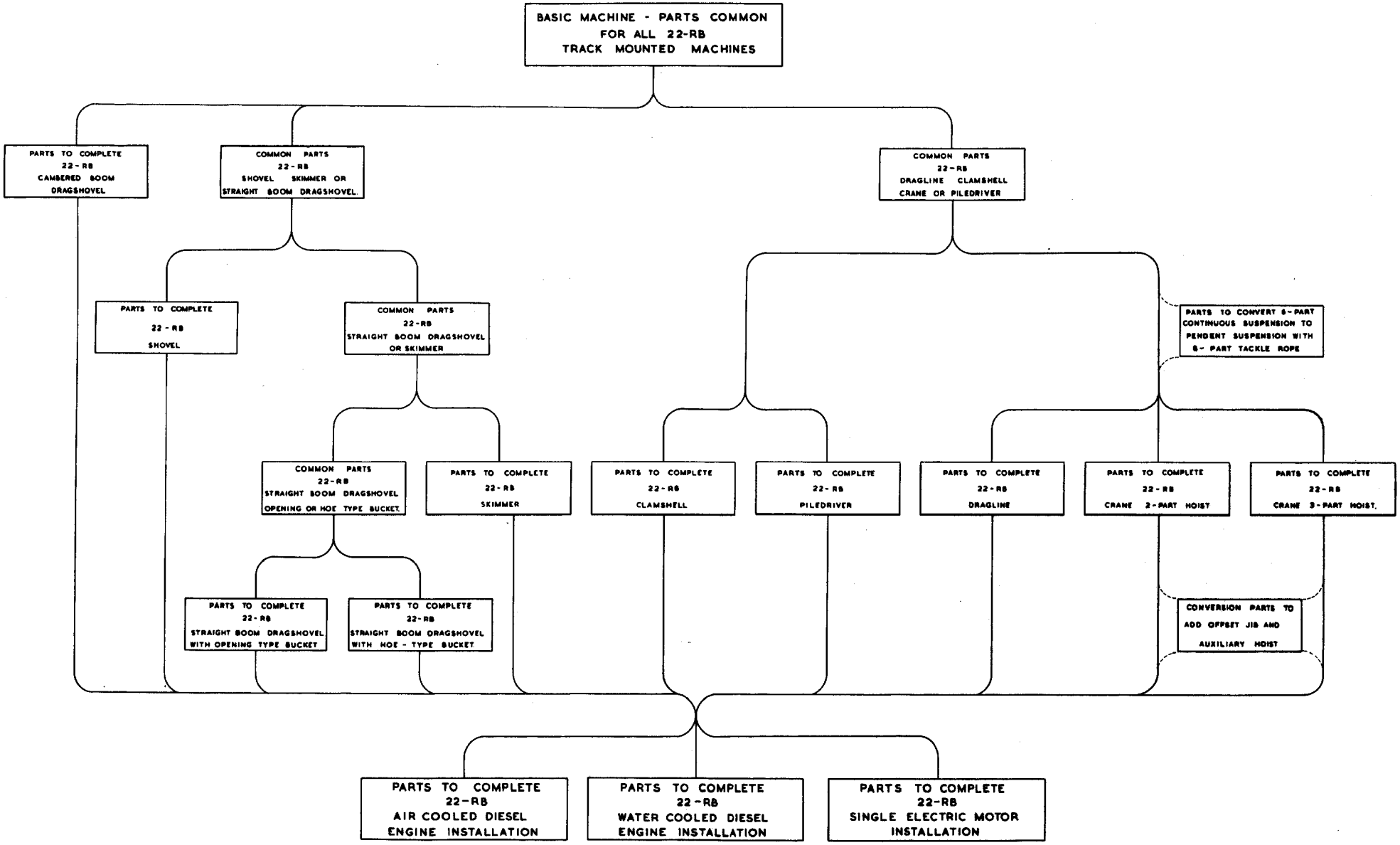


Fig. 1. Changing Bell Crank Lever position, to reverse linkage for Lever 'B'.

KEY TO THE COMPOSITION OF STANDARD 22-RB CRAWLER TRACKED MACHINES

(CHART IN DIAGRAMMATIC AND ABRIDGED FORM)



IMD 143

so that the rod can be assembled to it and to the other arm of the bell crank. Assemble the rod to the clevis ensuring that the lock nut requires only a 1/4 turn to secure it. Assemble the other end to the arm of the bell crank, fit the clevis pin and the split pin.

The short reach rod mentioned earlier is connected to a lever at the lower end of a shaft that projects through the deck plate. A cam plate having two rollers is secured to the top of the shaft; each roller engages into a slot in a cam lever. One cam lever is bolted to the front drum clutch shifter yoke, the other one is bolted to the rear shaft R.H. clutch shifter yoke. One end of each yoke is pivoted on a post, the other ends of them are fitted with shifter screws that engage into the clutch shifter collars. Reference to the General Arrangement of Control Levers shown on Page 15, Section 4, and the text on Pages 10 to 12 in Section 2, at this stage, may also be helpful.

When the bell crank is in 'Position 1', Fig. 1, forward movement of lever 'B' causes the cam plate to rotate anti-clockwise thereby engaging the rear shaft R.H. or crowd clutch, for shovel, straight boom dragshovel or skimmer operation. When the bell crank position is reversed to 'Position 2', forward movement of lever 'B' rotates the cam plate clockwise which engages the front drum clutch for dragline, clamshell, crane, cambered boom dragshovel and piledriver operation.

CONVERSION TO STRAIGHT BOOM DRAGSHOVEL

When changing from a shovel to a straight boom dragshovel, the shovel boom dipper and handle are replaced by the straight boom dragshovel front end equipment, (Refer to Fig. 22, Section 2, and Page 8, Section 4). The dragshovel boom and auxiliary 'A' frame are pin connected to the same lugs on the revolving frame used for attachment of shovel or crane booms. The boom is connected to the front holes and is fitted between the lugs whilst auxiliary 'A' frame members are connected to the rear holes and are located in the overhung position to the inside of the lugs. No change in operating lever linkage is required and the forward drum clutch is not used. When converting from a shovel the shovel lagging must be removed and the dragshovel lagging fitted. When converting from skimmer, no change of lagging is required. When converting from dragline, clamshell or crane operation, reverse the bell crank operating the forward drum clutch as described under 'Conversion to Shovel', Fig. 1, so that hand lever 'B' is pushed to set the rear crowd clutch. Also reverse the dead and live ends of the forward drum brake band as described in Section 7, Pages 10 to 12 and Fig. 12.

NOTE:

If the machine was originally supplied as a crane and fitted with power controlled load lowering equipment, then it will be necessary to remove the split sprocket on the rear shaft and the chain between the two shafts before fitting the larger pitch chain and sprockets now required.

Note that the special long brake anchor pins used to connect the drag drum guard should be removed and the short anchor pins fitted to clear the chain.

CONVERSION TO CAMBERED BOOM DRAGSHOVEL

With this equipment (Refer to Fig. 23, Section 2, and Page 9, Section 4.) a chain is not fitted between the drum shafts and the dragline drag drum is used on the forward drum shaft. The operating levers are arranged as for use with dragline equipment.

CONVERSION TO SKIMMER

For skimmer operation (Refer to Fig. 24, Section 2.) the boom and auxiliary 'A' frame are pin connected to the revolving frame as for the straight boom dragshovel. The same operating levers control skimmer operation as are used for straight boom dragshovel operation. No change in operating lever linkage is required when changing from shovel or straight boom dragshovel, and the forward drum clutch is not used.

When converting to skimmer from a shovel, the shovel lagging must be removed and the skimmer lagging fitted.

When converting from a straight boom dragshovel no change of lagging is required.

When converting from a dragline, clamshell, crane, cambered boom dragshovel or piledriver, reverse the bell crank operating the forward drum clutch, as described under 'Conversion to Shovel', Fig. 1, so that hand lever 'B' is pushed to set the rear shaft sprocket clutch. Also reverse the dead and live ends of the forward drum brake as described in Section 7, Pages 10 to 12 and Fig. 12.

NOTE:

If the machine was originally supplied as a crane and fitted with power controlled load lowering equipment, then it will be necessary to remove the split sprocket on the rear shaft and the chain between the two shafts before fitting the larger pitch chain and sprocket now required.

The instructions regarding brake anchor pins given under 'Conversion to Straight Boom Dragshovel' also apply when converting to 'Skimmer'.

CONVERSION TO DRAGLINE

For dragline operation, the shovel, dragshovel or skimmer front end equipments are replaced by a dragline boom which fits the same boom foot lugs (front holes).

The rotating-type fairlead (Refer to Fig. 20 in Section 2.) is carried between extended boom foot pins and is anchored by an arm to the front of the revolving frame. This arm is adjustable in angle by removing or adding distance piece washers.

The chain connecting the rear shaft and forward shaft sprockets must be removed and the forward drum lagging and sprocket halves removed before the dragline forward drum lagging halves can be bolted in place. The forward drum lagging on the cambered boom dragshovel is identical to that used for the dragline drag rope, so can be left in place if already fitted.

When changing to dragline from shovel, straight boom dragshovel or skimmer, reverse the live and dead ends of the forward drum brake as described in Section 7, Pages 10 to 12 and Fig. 11, also reverse the bell crank controlling the forward drum clutch, (See 'Conversion to Shovel' and Fig. 1.) so that the forward drum clutch is set by pushing hand lever 'B', (Fig. 1, Position 2.)

The clutch controlling the rear shaft sprocket is not used in dragline operation.

When converting to dragline from clamshell, it is necessary to re-arrange the linkage of levers 'A' and 'B', so that they operate the rear and front drum clutches respectively. (See 'Main Lever Functions Interchangeable' later in this Section). Also remove the spring loading device under the right hand deck plate and remove tagline gear.

CONVERSION TO CLAMSHELL

For clamshell operation the same boom and forward drum lagging is used as for dragline, with the addition of a tagline arrangement in the boom.

When converting to clamshell operation from shovel, dragshovel or skimmer, the clamshell boom must be installed in place of the other equipment. Also the chain connecting the rear shaft and forward shaft sprockets must be removed and the forward drum lagging and sprocket halves removed before the dragline forward drum lagging halves can be bolted in place. If the machine is being converted from cambered boom dragshovel to clamshell it will not be necessary to change the forward drum lagging as the dragline lagging is used on both of these equipments.

For clamshell operation, hand lever 'A' is connected to control the forward drum clutch and hand lever 'B' is connected to the rear drum clutch.

For converting to clamshell operation from some other front end equipment the hand levers must be re-connected to the above arrangement as described under 'Main Levers Interchangeable' later in this section.

When converting from shovel, straight boom dragshovel or skimmer, the dead and live ends of the forward drum brake bands must be reversed as described in Section 7, Pages 10 to 12 and Fig. 11. Also reverse the bell crank controlling the forward drum clutch, so that the forward drum clutch is set by pusingh lever 'A'. (Refer to 'Conversion to Shovel', Fig. 1, Position 2.)

The clutch controlling the rear shaft sprocket is not used in clamshell operation.

In clamshell operation the holding line is automatically taken in when hoisting the closed bucket. A small spring (Refer to Fig. 25 in Section 5.) is connected to the bell crank below the right hand deck plate, which controls the rear drum clutch. This spring causes the clutch to drag slightly. Adjust the spring by turning the adjusting nuts until the spring exerts just enough pull on the lever system so that the clutch drags sufficiently to make the cable follow the bucket, yet does not interfere with its free opening. This spring must be added when converting from any other front end equipment and must be removed when re-converting.

CONVERSION TO CRANE

The same boom is used for crane operation as for dragline or clamshell operation with the addition of a dead end anchor for the hoist rope at the upper end of the boom or on the crane hook and return block for maximum lift.

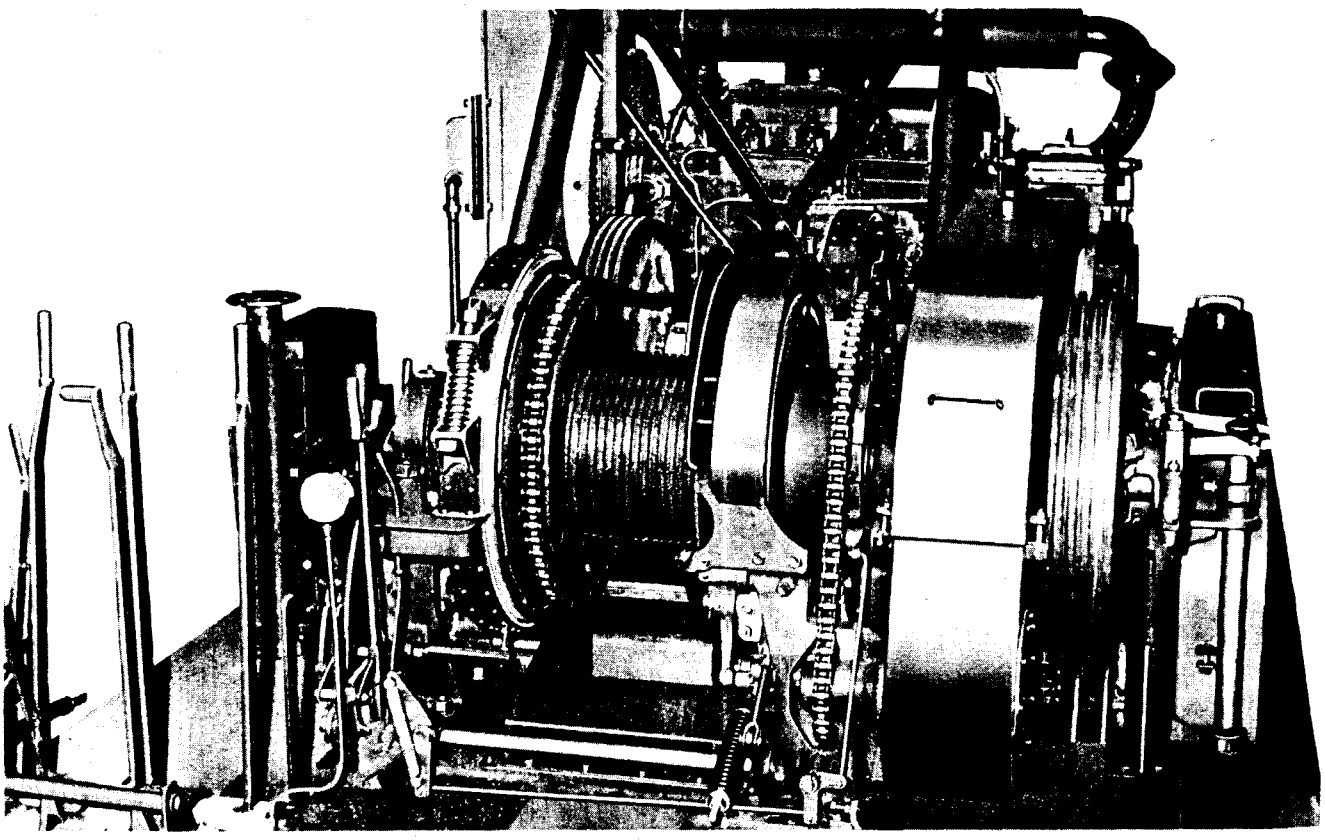


Fig. 2. Deck Machinery arranged for Crane Operation, with Power Controlled Load Lowering Equipment fitted.

When changing from shovel, straight boom dragshovel, or skimmer operation to ordinary crane operation, the chain connecting the rear shaft and forward shaft sprockets must be removed and the forward drum lagging and sprocket halves removed before the crane forward drum lagging halves can be bolted in place.

When changing to crane from shovel, straight boom dragshovel or skimmer, reverse the live and dead ends of the forward drum brake as described in Section 7, Pages 10 to 12 and Fig. 11. Also reverse the bell crank controlling the forward drum clutch, so that the forward drum clutch is set by pushing hand lever 'B', (See 'Conversion to shovel' and Fig. 1, Position 2.)

When converting to crane from clamshell, it is necessary to re-arrange the linkage of levers 'A' and 'B' so that they operate the rear and front drum clutches respectively. (See 'Main Lever Functions Interchangeable' later in this section). Also remove the spring loading device under the right hand deck plate and remove the tagline gear. (Refer to notes under 'Conversion to Clamshell' and Fig. 25, in Section 2).

When required, an offset jib can be added at the boom point, and the auxiliary hoist can be provided from the rear drum. For general arrangement of this equipment refer to Page 7, Section 4, and for reeving to Section 8, Pages 21 and 25.

POWER CONTROLLED LOAD LOWERING

Power Controlled Load Lowering in crane operation is accomplished by providing a roller chain connexion between the right-hand clutch on the rear drum shaft, (Normally inoperative for ordinary lifting crane service) and the hoist drum on the forward shaft. This chain drive reverses the direction of rotation of the hoist drum, in much the same way as the crowd drum drive is reversed on the shovel equipment. By this means powered control of the hoist line is obtained when lowering the load. (See Fig. 2.)

The power controlled load lowering chain connexion between the two shafts however, differs very considerably when compared with that used for the shovel equipment. The chain itself is of a different size and the split driving sprocket (having 30 teeth) bolted to the rear clutch housing replaces the larger pitch 13 tooth sprocket used in shovel operation. The driven sprocket has 61 teeth, is also split and is bolted to the crane hoist drum fitted to the forward shaft in place of the twin chain sprocket lagging used in shovel operation.

With the 30 tooth sprocket driving the 61 tooth sprocket on the hoist drum in the lowering direction a ratio of approximately 2 to 1 is achieved, so that the load can be lowered at half hoisting speed. Further variation in the lowering speed can be made by slowing down the engine speed by means of the governor control.

Note that the Forward Drum Brake arrangement should conform to Fig. 11 on Page 12, in Section 7. Also refer to the general arrangement drawing on Page 18 in Section 4, and ensure that the clutch band on the rear right hand driver is reversed end for end as against the same clutch band when used for shovel and all other equipments. This means that when the rear clutch is set to control the lowering of the load the clutch band is more smoothly and gradually applied to the housing

MAIN LEVER FUNCTIONS INTERCHANGEABLE

HAND LEVERS

For normal operation of all equipments other than Clamshell (or Grabbing Crane) machines, hand levers 'A' and 'B' are connected to control the rear and forward drum clutches respectively, as indicated in Section 5, Pages 6 to 8.

For clamshell operation the functions of levers 'A' and 'B' are interchanged so that hand lever 'B' will control the rear drum clutch and hand lever 'A' will control the froward drum clutch.

To make this change, refer to Fig. 3, and proceed as follows:-

Swing the revolving frame so that the control rods under the right hand deck plate are located over the space between the track belts, for ease of access.

Set the controls to neutral position. Remove the pin connecting reach rod (7) from lever (8) (lower end of hand lever 'A'). Refit the forked end of reach rod (7) to the end of lever (9).

Take out the setscrews (3) and (4) connecting the lever extension (6) to the short lever (10) (Extension to lever 'B'). Reverse setscrews (3) and (4) and replace in position shown in dotted lines, securing lever extension (6) to the short lever (5) which is keyed to the shaft (11). Hand lever 'A' is also keyed to the shaft (11), therefore hand lever 'A' now operates the forward drum clutch through reach rod (2). In a similar way because lever (9) is connected to hand lever 'B' by means of a sleeve (12), hand lever 'B' will now operate the rear drum clutch through reach rod (7).

BRAKE PEDALS

For standard operation foot pedals 'F' and 'G' are connected to control the rear and front drum brakes respectively, but for Clamshell operation the linkage is changed over to ensure

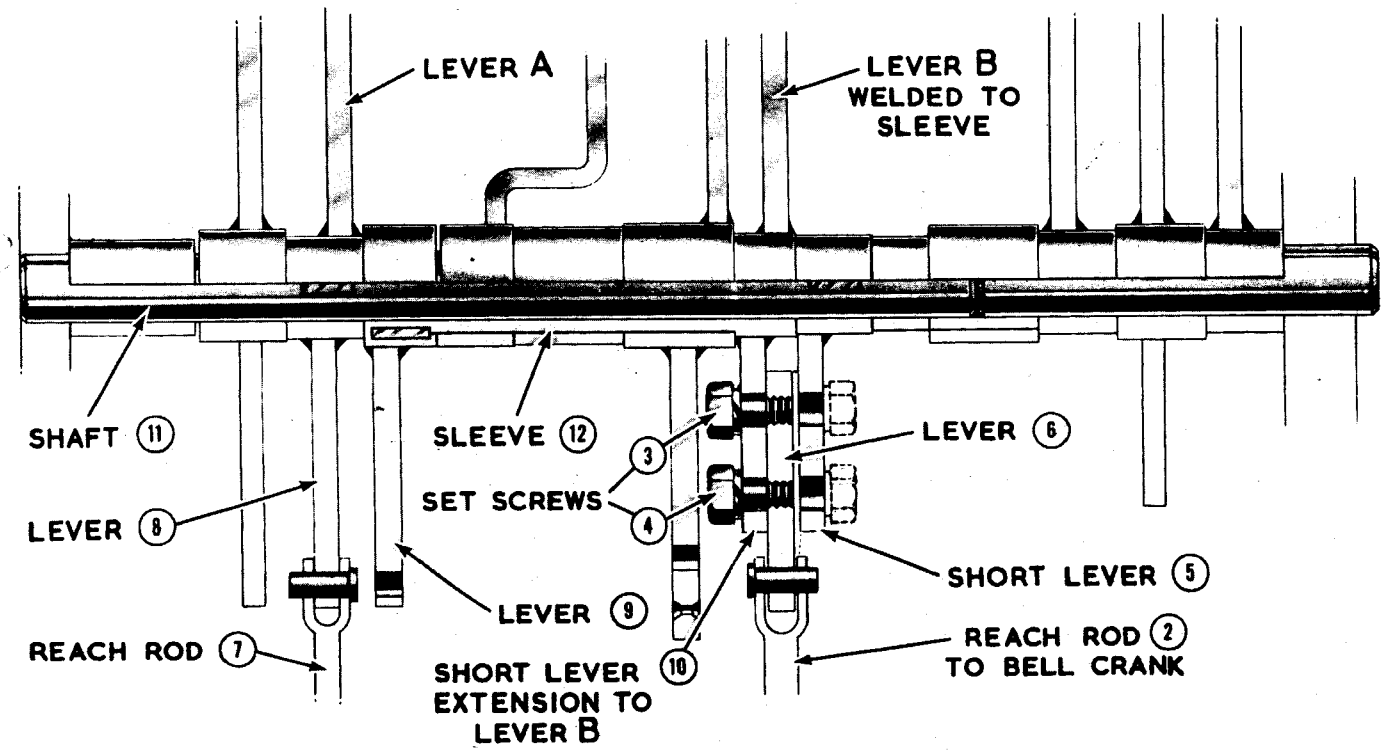


Fig. 3. Interchanging Functions of Hand Levers 'A' and 'B'.

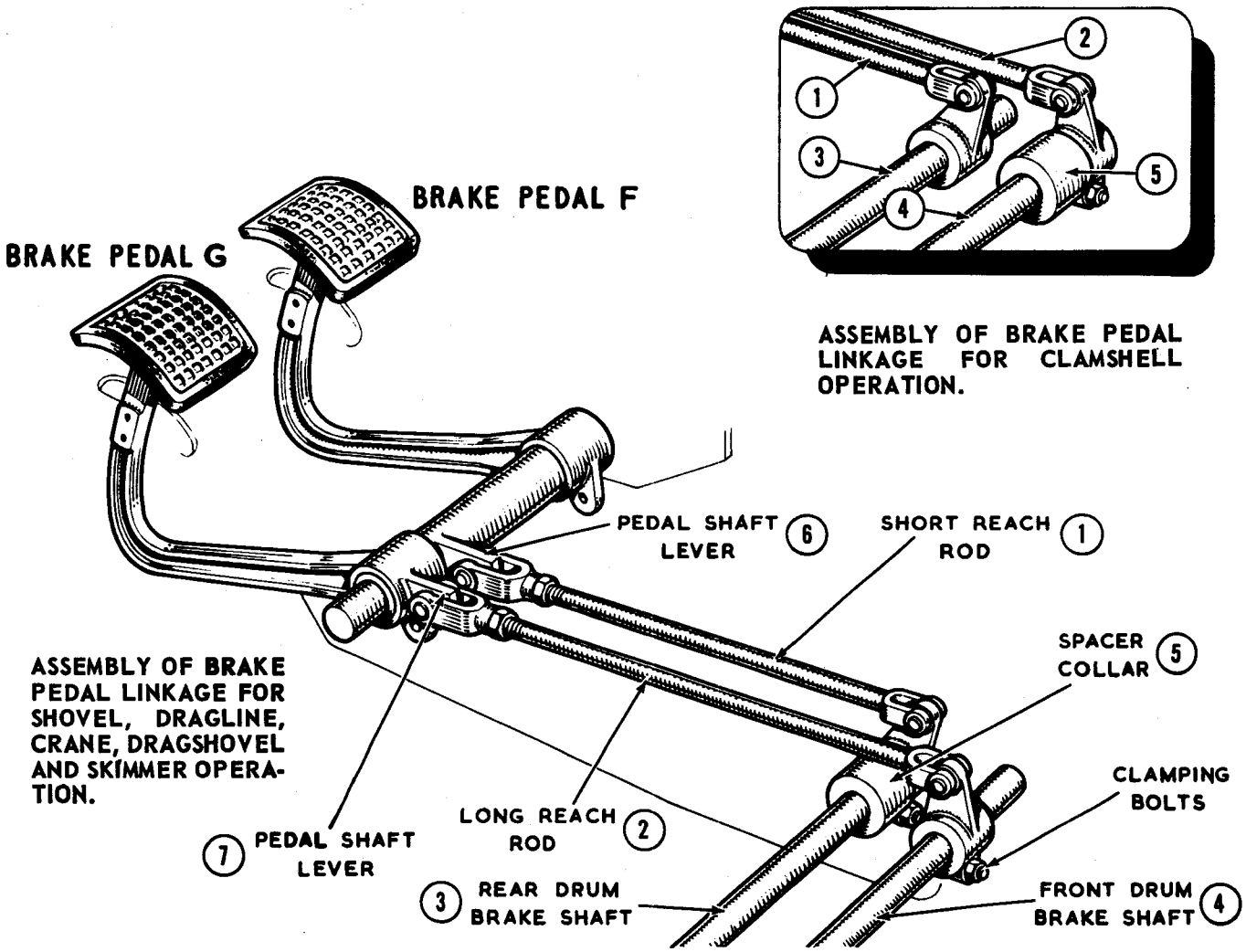


Fig. 4. Interchanging Functions of Brake Pedals.

that the hoist brake on the front drum is controlled by the operator's right foot.

To make this change, refer to Fig. 4, and proceed as follows:-

Swing the revolving frame so that the control rods under the right hand deck plate are located over the space between the track belts, for ease of access.

Stop the engine and release both brake pedals. Disconnect the short and long reach rods (1) and (2) from the levers attached to the brake shafts (3) and (4). Remove the levers from the brake shafts by undoing the clamping bolts.

NOTE:

Do not lose the Woodruff keys locating the levers on the shafts.

Transfer the spacing collar (5) from the shaft (3) to a similar position on shaft (4). Refit the Woodruff keys and the short levers on the shafts ensuring that the lever on shaft (3) is located against the boss welded to web of the casting. Remove the reach rods (1) and (2) from the pedal levers (6) and (7). Refit the short reach rod to lever (7) and the lever on shaft (3). Refit the long reach rod (2) between lever (6) and the lever on shaft (4) as shown in the insert of Fig. 4. It will be helpful to get an assistant to move the appropriate foot pedal when removing or replacing the clevis pins. Check that the split pins are fitted and that the clamping bolts are tight.

COUNTERWEIGHT CHANGES

For counterweight tabulation refer to Page 3, in Section 3, of this book, and for position of weights see Section 1, in the Repair Parts Catalogue for the same machine.

SAFE LOAD INDICATOR LOCK-OUT DEVICE (Refer to Page 10 of this Section)

For Crane duties the Indicator lock-out device must be in the 'unlocked' condition as shown in Fig. 5a. The locating lug on the locking bar must locate against the flats on the Indicator operating lever extension and the lock-out bar securely clamped in line with, and clear of, the main Indicator side plates. The Safe Load Indicator is thus free to operate.

For all excavating duties the Safe Load Indicator must be protected from abuse by securely clamping the operating lever lock-out bar across, and bearing on, the bottom edges of the main Indicator side plates as shown in Fig. 5a. This should be carried out when the boom suspension is under load.

IMPORTANT

WHEN CHANGING FROM EXCAVATING TO CRANE DUTIES IT IS VITAL TO ENSURE THAT THE LOCK-OUT DEVICE IS IN THE 'UNLOCKED' CONDITION AND THE INDICATOR FREE TO OPERATE.

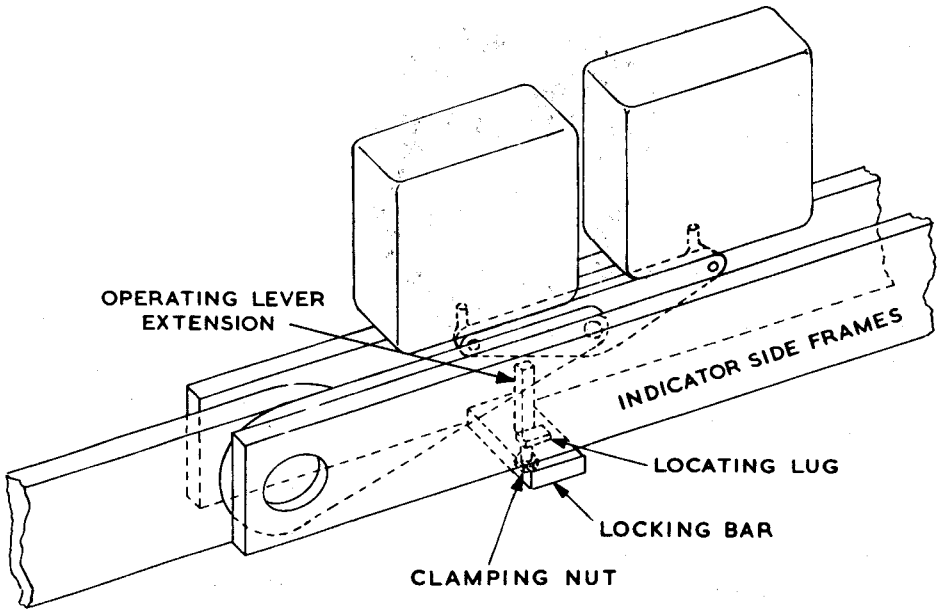


FIG. 5A. LOCKED POSITION – EXCAVATING DUTIES

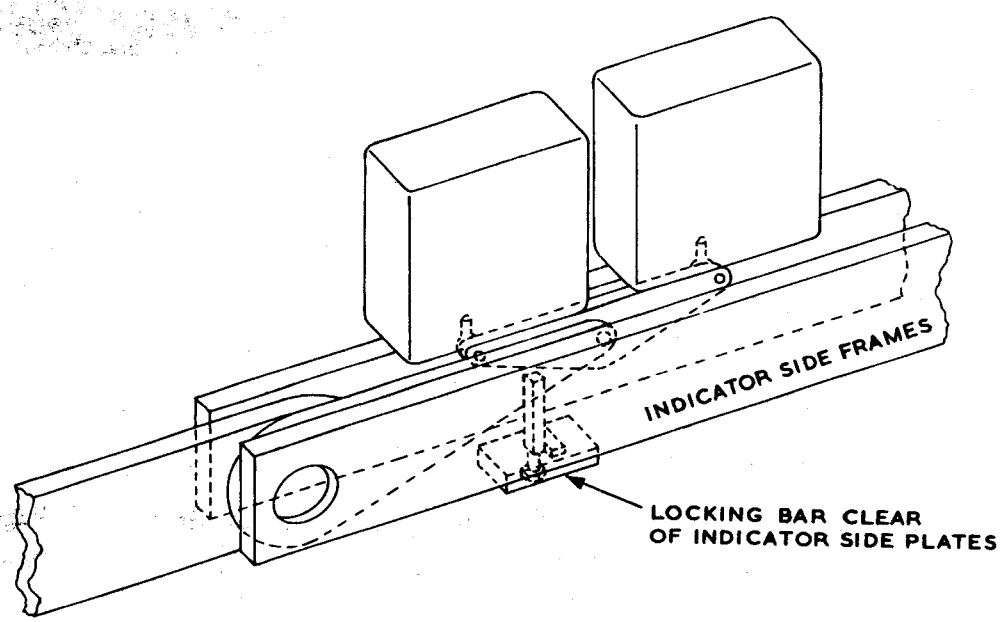


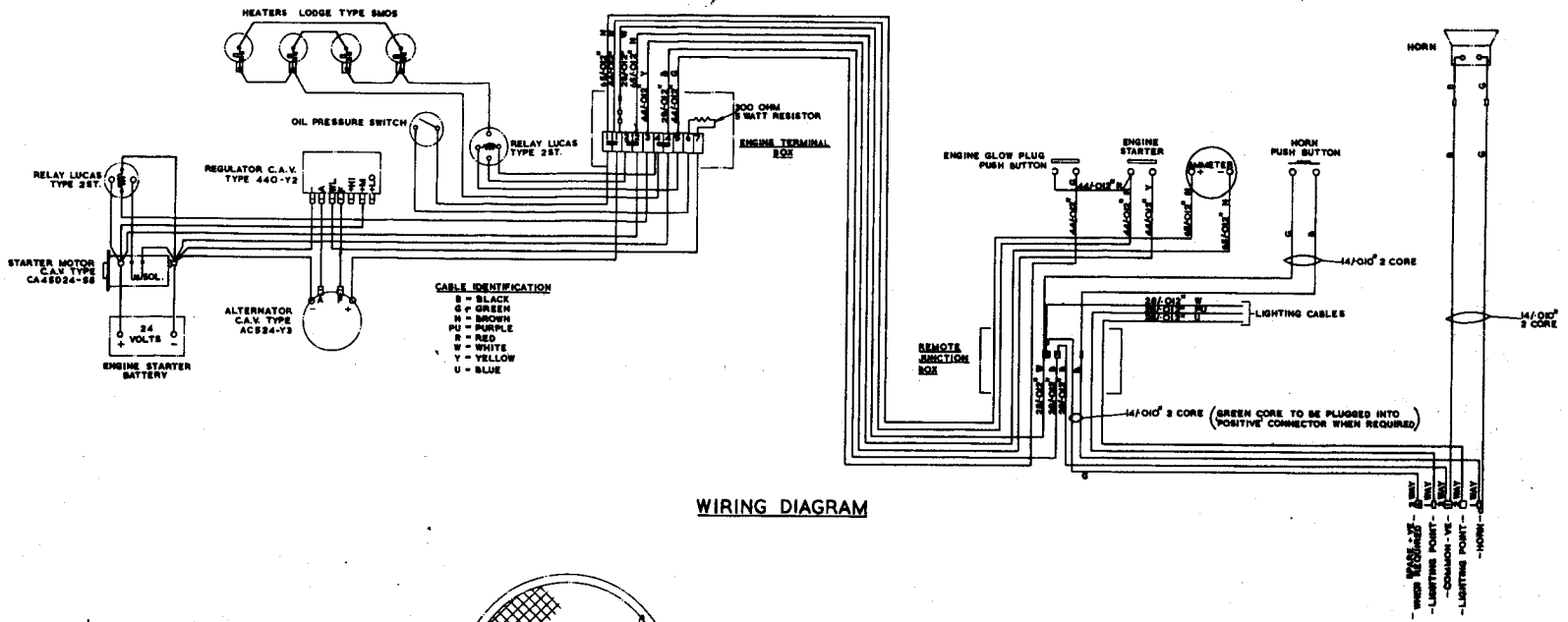
FIG. 5B. UNLOCKED POSITION

FIG. 5. SAFE LOAD INDICATOR LOCK-OUT DEVICE

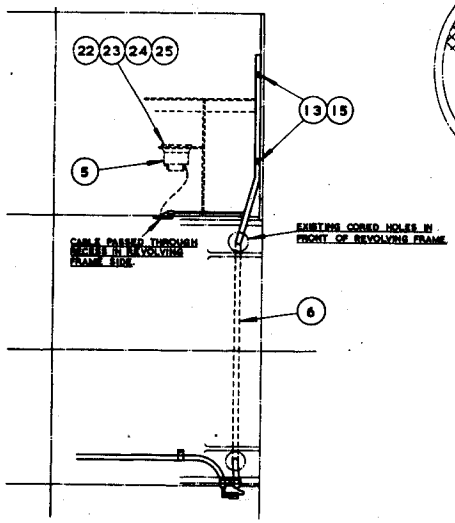
SECTION 11

11 MISCELLANEOUS ELECTRICAL EQUIPMENT

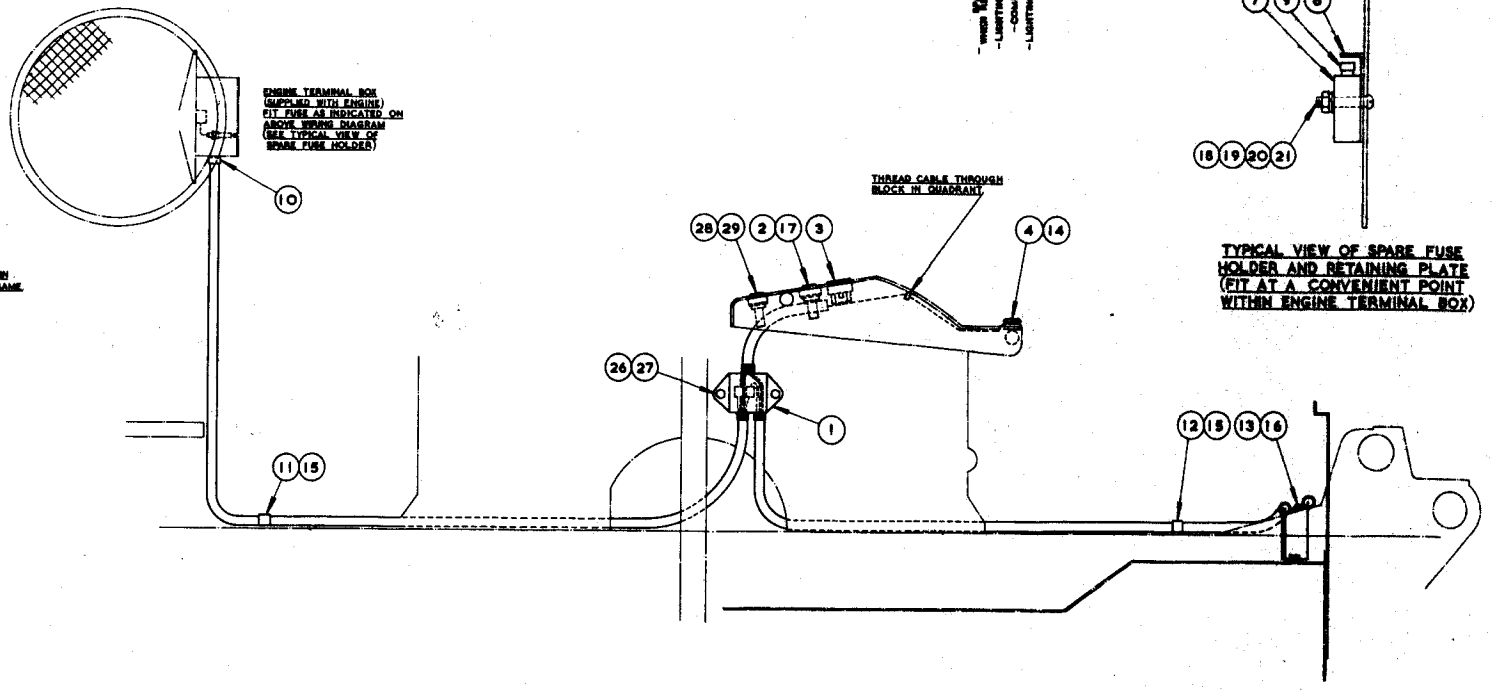
CONTENTS



No.	DESCRIPTION
1	FUSE BOX SUPPORT
2	ENGINE START BUTTON
3	AMMETER
4	HORN PUSH BUTTON
5	SIGNAL HORN
6	TWIN CORE CABLE
7	SPARE FUSE HOLDER
8	FUSE HOLDER RETAINING PLATE
9	15 AMP. FUSES
10	CONDUIT LOCKNUT
11	CONDUIT HALF SADDLE
12	CONDUIT HALF SADDLE
13	CONDUIT CLIPS
14	HORN PUSH BUTTON SCREWS
15	CONDUIT HALF SADDLE SCREWS
16	CONDUIT CLIP SCREWS
17	ENGINE START BUTTON SCREWS
18	FUSE HOLDER SCREWS
19	FUSE HOLDER NUTS
20	FLAT WASHERS
21	LOCKWASHERS
22	SIGNAL HORN SETSCREWS
23	SIGNAL HORN NUTS
24	FLAT WASHERS
25	LOCKWASHERS
26	FUSE BOX SUPPORT SETSCREWS
27	LOCKWASHERS
28	ENGINE GLOW PLUG PUSH BUTTON
29	ENGINE GLOW PLUG PUSH BUTTON SCREWS



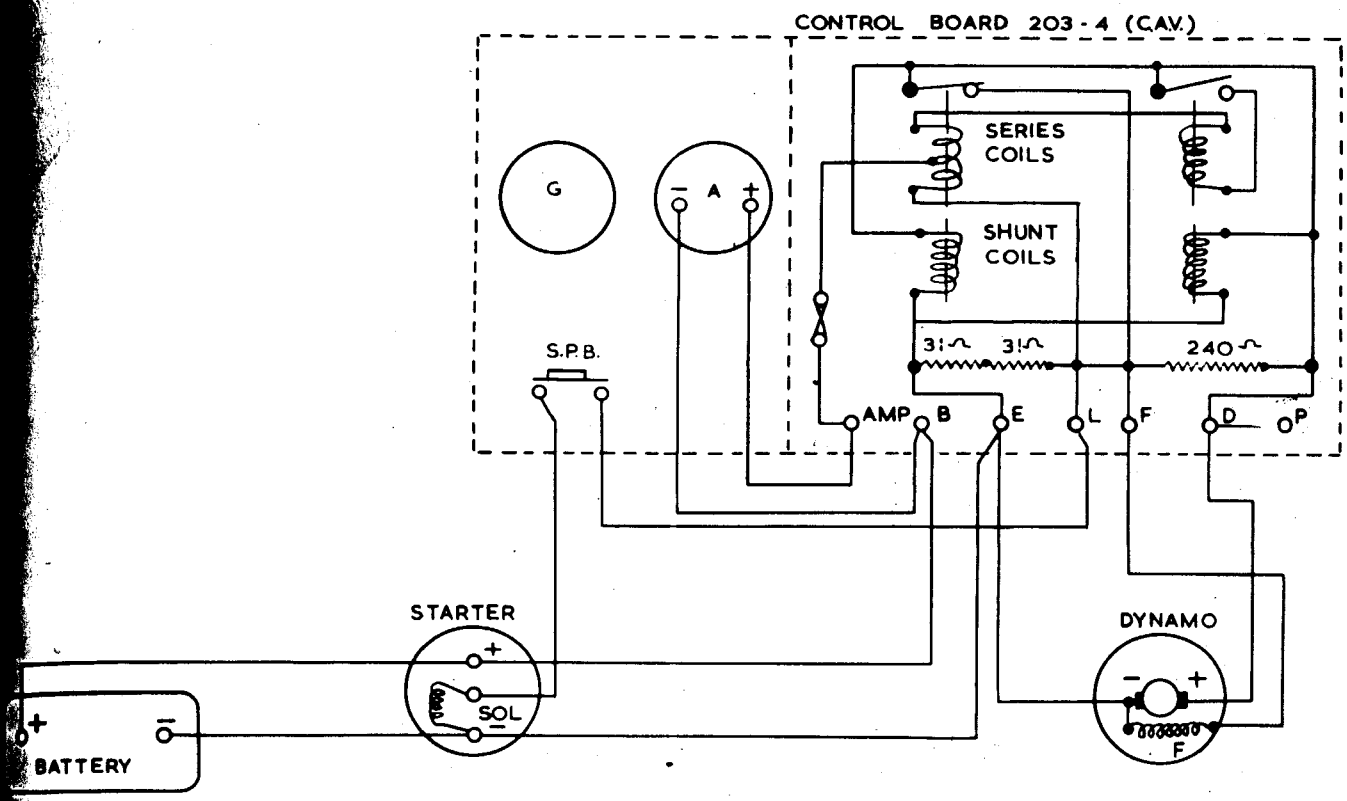
HORN CABLE ASSEMBLY (PLAN VIEW)



TYPICAL VIEW OF SPARE FUSE HOLDER AND RETAINING PLATE (FIT AT A CONVENIENT POINT WITHIN ENGINE TERMINAL BOX)

ARRANGEMENT AND WIRING DIAGRAM OF REMOTE ENGINE STARTING AND SIGNAL HORN.

IMD 453/R2



24 VOLT. STARTING & CHARGING CIRCUIT.

R STARTER MOTOR

The starter motor is arranged for flange mounting. It is most important that the starter be mounted so that the clearance between the pitch circles of the pinion and the flywheel rack is not less than .020" and not more than .025", and that the starter be mounted with its axis parallel with the flywheel axis.

VICING INSTRUCTIONS

As the starter motor is of such simple design and its periods of running so short, little or no trouble should be experienced with this unit during the life-time of the engine. Unless troubles occur, the starter motor should not be stripped.

The most probable causes of trouble are lack of adequate lubrication and the use of wet air.

During engine overhauls the following two points should receive attention:

1. Drain off the lubricating oil, remove the crankcase cover and examine the interior of the crankcase. If the oil film is clear and clean no attention is necessary and the cover may be replaced. If however, the crankcase contains sludge, due to the admixture of