This manual has been written to instruct the operator in the operation and maintenance of the Niagara Shear. When written, it was completely up-to-date. Because of later improvements in design, descriptions may vary slightly from the Shear delivered to you.

Your Niagara Shear is a precision-built, accurate, quality machine tool. Careful attention to the adjustment and maintenance of the Shear should result in many years of trouble-free service. Although your machine has been carefully inspected and tested in our plant, some of the adjustments may have been disturbed in transit. Therefore, it is recommended that your millwrights, maintenance men, and shear operators carefully read these instructions before the Shear is installed or operated. Additional copies of this manual will be furnished on request. We can assume no liability for unauthorized alterations or attachments to the Shear.
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RECEIVING
Immediately upon receiving shear, check it very carefully for damage or loss of parts in transit. Since all equipment is sold F.O.B. the Niagara plant, our responsibility for transit damage ceases when the transportation company signs the Bill of Lading indicating that it has received all of the listed items in good condition. Report any loss or damage to the delivering carrier promptly to insure proper handling of your claim.

Shortages not appearing on the Bill of Lading or discrepancies between equipment received and the order should be reported to us immediately.

INSTALLATION
If crane service is available, lift the shear onto the foundation. Protect the finished surfaces on the front of the bed with timber. CAUTION — do not attach sling around center of the shear because nose may spring and distort the crosshead. If crane service is not available rig the shear into position on the foundation and lower with jacks under the bed at each end.

FOUNDATION
The Series One Shear does not require a special foundation other than a solid wood or concrete floor which will support the weight of the shear without sagging or settling. It must be firm enough to prevent the action of the shear or truck traffic from causing a springboard motion. It must be stable enough to keep the shear level and in proper alignment. The type and thickness of the foundation depends upon the weight of the shear and sub-soil conditions.

The holes, provided in the feet for attaching shipping skids, can be utilized also for bolting the shear to the foundation and thus prevent its moving during use. FOUNDATION BOLTS OR LAG SCREWS SHOULD NOT BE TIGHTENED BUT LEFT LOOSE TO PREVENT TWISTING OF THE SHEAR THROUGH POSSIBLE SETTLING OF THE FOUNDATION.

To aid in preparing the foundation, an outline drawing of the shear giving overall dimensions will be furnished upon request.

CLEANING
The shear is protected from rusting during shipment by a slushing compound. This compound should be washed off with a suitable solvent such as Sowasol, carbon tetrachloride or other cleaning fluid. Wipe the knives clean and coat with light oil. Remove all dirt and cinders accumulated in transit. Inspect the oil cups to see that they are clean. If not, drain out but remove cup and wash in solvent. Periodic cleaning after the shear has been placed in operation is desirable.

LEVELING
Successful, accurate operation of the shear depends on careful leveling. When the shear is properly leveled, the crosshead and guide bearings carried by the left and right hand legs will be parallel and will guide the up and down movement of the crosshead without binding.

The simplest way to level the shear is to check the clearance of the crosshead guide bearings. Any misalignment will be readily apparent in the cross-corner binding of the crosshead bearing.

To level a shear by the feeler gage method, select a .002" feeler gage as a "Go" or "No Go" gage. If this feeler can be inserted into the bearing, the clearance can be considered open. If the feeler cannot be inserted, the clearance is considered closed.

The crosshead of a leveled shear will rest in the guide bearings tilted either forward or backward. If the crosshead is tilted forward, the bearing clearance in the top front and bottom rear bearings will be open to the feeler. If the crosshead is tilted forward, the top rear and bottom front bearings will be open.

To level the shear insert shims under the front or rear feet of the housing as required to make the crosshead bearing clearance relationship the same at each end of the shear. Note that the actual amount of bearing clearance is of no consequence when leveling. The feeler gage is used merely to determine which way the crosshead end bearing is resting in the guides.

The level of the machine should be checked periodically inasmuch as the foundation may settle.

SETTING UP
If the back gage has been removed for transit, attach the brackets to the underside of the crosshead with the bolts provided. Dowel pins in the back gage brackets properly locate them in relation to the crosshead. The single bracket back gage is attached with a single bolt in the center of the crosshead. Adjust the back gage in accordance with instructions under "BACK GAGE" (Pgs. 7 and 8).

The center support bearing for the trolley shaft should be secured to the floor so that it does not bind the shaft. Shimming between the support bearing and floor may be necessary.

Connect the motor to run in the direction indicated by the arrow cast on the gear box. CAUTION — DO NOT ATTEMPT TO RUN THE SHEAR UNTIL IT IS LUBRICATED AND THE KNIFE CLEARANCE CHECKED IN ACCORDANCE WITH SUBSEQUENT INSTRUCTIONS.) Direction of motor rotation may be observed by looking through the louvers, by removing the outer bearing cover or by removing the motor from the gear box. If the shear is equipped with an axial air gap or so-called "pancake" motor, the motor cover may be removed. IF THE MOTOR RUNS BACKWARD THE CLUTCH WILL NOT DISENGAGE AND THE CROSSHEAD WILL RECIPROCAT AS LONG AS THE MOTOR RUNS. WHEN STARTING THE MOTOR WAIT A FEW SECONDS BEFORE TRIPPING THE CLUTCH TO LET THE FLYWHEEL REACH FULL SPEED. This will insure the crosshead stopping at top position where the detent will hold it until the trolley is again depressed.

To special order, certain shears are equipped with an electro-pneumatic or solenoid foot treadle. Unless otherwise tagged, connect the coil of the solenoid valve to a 110 volt single phase line. Connect the air inlet of the solenoid valve to the shop air line. Use clean air at a minimum pressure of 80 lbs. per square inch.
LUBRICATION

The shear is now ready for lubrication. A metal lubrication plate is permanently attached to the shear at the left hand end giving the catalogue number of the shear, the serial number, and the shearing capacity as well as the recommended lubricants. Also see lubrication chart (Figs. 18 and 19).

Make certain that the oil is up to the oil level plug in the gear box and detent cam box.

Fill all oil cups to the top with the recommended oil; wait several minutes for the oil to fill the grooves and passages and again fill to the top.

The machine should be oiled by hand periodically in accordance with frequency of operation.

During the first hour of operation keep the oil cups filled to the top with the recommended oil to be sure that all passages are full and that the bearings will be flushed with fresh clean oil. A reasonably excessive amount of oil should be used for the first few weeks of operation.

CAUTION — Do not put waste or rags into oil cups to restrict the flow of oil.

Care should be taken to use only clean oil and clean oil cans as the least amount of dirt can damage bearings. Use the recommended specially compounded oils. Common machine oil or engine oil is not satisfactory.

Before starting a shear equipped with a centralized lubricator, fill the reservoir with the recommended oil and hand prime until the oil can be seen running out of the bearings. Periodically inspect the piping to see that it is not damaged. It is not practical to lubricate all parts, such as the holddown feet, with a centralized system. Therefore, these parts must be lubricated manually.

CAUTION — If an equivalent gear oil is used it must be non-gumming and must not exceed the viscosity or pour point of the gear oil recommended on the lubrication plate.

ADJUSTING KNIFE CLEARANCE

Before applying power to the shear or placing it in operation for the first time, the knife clearance should be checked. During transit the shear is subject to conditions which may decrease the knife clearance and endanger the knives by rubbing or overriding.

Turn the shear over slowly by hand and observe very carefully to make certain that the knives are not rubbing or overriding. To make sure that the knives are not rubbing, try with very thin tissue paper. The paper should fold down between the knives and not be cut. A convenient method of turning the crosshead over by hand, when equipped with an axial air gap motor, is to remove the cover of the motor, step on the treadle, and slowly rotate the motor armature. If the clutch does not engage, release the clutch lock. Shears which do not have an axial air gap motor may be turned over by hand by removing the motor and using the splined motor coupling (27-A) on a piece of pipe formed into a crank or "U" wrench. Do not forget to rewire the splined motor coupling set screw after replacing it. An alternative to turning the shear over by hand is to slowly and carefully jog the motor a little bit at a time.

To adjust the knife clearance, the entire bed carrying the lower knife is moved toward or away from the upper knife so as to decrease or increase the clearance between the upper and lower knives.

To adjust the bed, slack off but do not loosen the nuts or bolts at each end that attach and clamp the bed to the legs. There are four nuts on the outside of each leg. Referring to Figs. 1 and 2, screws (A) move bed in to reduce knife clearance and screw (E) move bed out to increase knife clearance.

When adjusting screws (A) and (B), they should not be completely loosened but should oppose each other. For example: When moving the bed inward continue tightening screws (A) without loosening screw (E) until no further inward motion is observed and then slightly slack screw (B). Tighten screws (A) again and repeat until the bed is adjusted to the required setting.

The center knife clearance may be adjusted by means of the truss rod post at the rear of the crosshead. Series One Shears have crossheads equipped with a straight truss rod within the rear of the crosshead. Tightening the nut on this truss rod will reduce the clearance at the center of the knives and loosening will increase the clearance.
ADJUSTMENT PROCEDURE: — Adjust the bed away from the upper knife so as to make sure the knives will not override. Then, with the power disconnected turn the shear over by hand until the knives intersect at the right hand end. Insert feelers equal in thickness to the desired setting vertically between the knives at the intersection as shown in Fig. 3 and adjust the bed accordingly. Next, turn the crosshead so that the knives intersect at the left hand end and adjust the bed to the feelers. Recheck right hand end. When both ends of the bed are adjusted to the desired clearance retighten the bed bolts and nuts. Then turn crosshead so that knives intersect at center. If necessary, adjust center to the same clearance or slightly less than at the ends, as outlined in previous paragraph.

It is recommended that knife clearance be set between .002" and .003" (or at a point where the machine will cut wrapping paper full length).

When mild steel of the lighter gages (say 20 gage to 30 gage) predominates better results are sometimes obtained if the upper knife is ground to have an included angle of less than 90° (say 85°).

Shearing of copper, Monel metal, nickel, stainless steel, silicon transformer stock, aluminum, brass, lead, German silver, and many other metals and nonmetallic materials may require closer knife settings. Some of these materials may also require special angles ground on the knives, or knives made of special alloys, and occasionally a reduced capacity rating of the shear. The factory will be pleased to make recommendations for your shearing problems.

REMOVAL OF HOLDDOWN

Before changing knives, the holddown should be removed.

Series One Models 12, 13, 14 and 16 are supplied with a one-piece reciprocating holddown which is removed in the following manner:

Before removing the holddown, the following precautions must be observed. As the holddown plunger is spring loaded and is under compression when retained by the lug on the leg, removing it from under the lug will cause the plunger to be ejected with force, and to prevent this, IT IS IMPORTANT THAT THESE STEPS BE FOLLOWED. Turn power off and open disconnect switch. Loosen locknuts on the holddown lifting adjustment screws (202). There is an upper and lower 9/32" hole in the holddown plunger (201). Insert a 1/4" pin in the upper hole and rotate the plunger until the pin is directly above the hole in the end block of the holddown. Back out the holddown lifting adjustment screw on one end of the holddown until the upper hole in the holddown plunger lines up with the hole in the end block of the holddown. Insert a 1/4" pin in this hole. Back out the holddown lifting adjustment screw until the holddown plunger is clear of the lug on the leg. Repeat this procedure at the opposite end of the shear. Remove the holddown from the guiding studs. Re-install holddown by reversing the order of procedure for removal. When assembling locknuts, (211) be sure to allow enough clearance to prevent binding.
The 18, 110, 112 and 1R models are equipped with a plunger type hold-down assembly which is removed in the following manner:

Turn power off and open disconnect switch. Lower the crosshead to bottom of stroke by engaging the clutch and by turning the shear over by hand (see page 5). Install 3/4" long socket head set screws in holes on channel (207) as shown in Fig. 4. One set screw should be installed at each end of the channel. On 8, 10 and 12 foot shears, a set screw should be installed in the center of the channel also. Tighten the set screws until the hold-down feet are lifted from the bed. The socket head screws (212) can now be removed and the entire hold-down assembly taken from the machine to make the upper knife accessible.

Change knives as outlined in the following section. Re-install hold-down by reversing order of procedure for removal.

When Series One Shears are assembled at the factory, the clearance between hold-down feet and the bed is set at 1/4" on Models 18, 110, 112 and 3/8" on 1R Models.

NOTE: The socket head cap screws (A) must be removed from the channel before operating the shear.

CHANGING KNIVES

BEFORE proceeding to change knives be sure to TURN OFF power and OPEN the disconnect switch. To facilitate removal or attachment of the upper knife, remove the hold-down as described above.

Remove the upper knife first. Before removing the plow bolts, block the upper knife in two or more places by inserting wood blocks between the knives and driving them slightly to the right so as to wedge the knives securely in position. When all the plow bolts have been removed, the upper knife may be lifted out from the front of the shear. Use great care in handling. If dropped, the cutting edges may be nicked or spoiled. Heavy leather gloves are recommended for protecting the hands. Boards may be placed on the bed perpendicular to the knife to protect the cutting edges from contacting the bed surface.

When removing the plow bolts from the lower knife be sure to hold or block the knife in place so that it cannot fall. Inspect all plow bolts to see that they are not damaged or worn. Periodic replacement of plow bolts is recommended.

Before proceeding to install new knives or changing to a new cutting edge, see that all faces of the knife seats are smooth and clean. Remove any burrs from the knife seats with a file. Also see that the knife surfaces are perfectly clean. Reassembly is a reversal of the disassembly procedure.

The distance from the cutting edge of the upper knife to the knife seat must be maintained as stamped on the center of the crosshead over the knife seat. Place a sheet metal shim between the knife seat and the top edge of the UPPER knife to maintain this distance after grinding.

The cutting edge of the LOWER knife must be even with the top of the bed. The height of the cutting edge is regulated by placing a shim UNDER, not behind, the knife.

Just before initially tightening the knives in position, replace the previously mentioned wood blocks and tap slightly to the right so as to flatten and clamp the upper and lower knife seats firmly in place on their respective seats.

Attach the knives loosely to the knife seats with full number of bolts. Care must be taken to seat the key of the bolt into the groove. When drawing the bolts home, start at the center and initially tighten these by working alternately right and left (of center) outward to the ends. As the plow bolts are tightened the bolt heads should be tapped with a heavy hammer and a large diameter drift or steel rod. This insures that the plow bolt heads will be properly seated in the knives.

After the shear has been in operation for a short time, inspect all bolts, making sure that they are still properly set. Retighten as required.

SETTING AND ADJUSTING BACK GAGE

Single Bracket Type

The back gage bracket is pivotally mounted and secured to the rear of the crosshead by a king pin bolt (A). Removal of this bolt will facilitate quick removal of the entire gage.

The angularity of the bracket for parallel or taper cutting is adjusted by means of the two set screws (B) at the inner end of the bracket under the crosshead. These screws butt against two downwardly projecting lugs to draw down the screw on one side and tightening the opposite screw will change the angularity of the bracket and gage.

The gage bar is pre-stressed for stiffness by a truss rod which also provides an adjustment for maintenance of straightness.

To adjust the gage for parallel cutting, a convenient method is to use a 1" square piece of cold rolled steel as a gage. Use this 1" gage block between the face of the gage bar and the lower knife. Adjust the bracket and gage bar so that the block just fits snugly at each end and slightly loose in the center. Then set the long scale (C) at the right hand side of the bracket to read 1" and the hand wheel scale (D) to read "0"
Positioning of the gage is accomplished by turning the hand wheel. Each full turn of the hand wheel moves the gage 1/4" and the plunger-type indexing handle engages locking holes at each 1/128" increment. When adjusting the gage, open it wider than the desired setting then make the final setting while moving the gage toward the bed.

Double Bracket Type
The double bracket type of back gage has two back gage brackets connected with a squaring shaft (Detail F, Fig. 6 which illustrates hand wheel end of the back gage operating mechanism).

Each full turn of the hand wheel moves the gage bar 1/4". The locking type plunger (E) must be pulled out against its spring to turn the hand wheel.

The position of the hand wheel is maintained by letting the plunger drop into one of a series of holes circumferentially spaced around the hand wheel. The spacing of the holes is such that the movement of the gage is 1/128" between the adjacent holes for the hand wheel plungers.

Positions of the gage bar are read to the nearest 1/4" on the adjustable scale (A). Scale (E) is calibrated to read the gage bar, position to the nearest 1/64" while the locking plunger may be set between the 1/64th graduations.

For accurate adjustment always open the gage beyond the point desired and make the final setting, moving the gage inward, to take up lost motion should any be present. If the shear is equipped with a Power Operated Back Gage always open the gage wider than the desired setting and make final adjustment with "Narrow" button.

Taper setting of the gage is easily accomplished. Slacken the cap screw at each end of the gage bar which attaches it to the bracket slides. Move the adjustment sleeve (D) away from the hand wheel bracket by gripping the sleeve with the left hand and pulling against retaining spring until the splined connection is exposed and disconnected. With the sleeve disconnected, the hand wheel will then actuate only one end of the gage bar. Do not forget to retighten the cap screws.

To set back gage parallel, select a steel block exactly 1" thick and place between the gage bar and the lower knife at each end of gage bar. Adjust until gage is parallel then check by actually doing work and adjust until a parallel cut is obtained. Then set dials (B) and (C) to 0 with gage (A) on an even inch mark.

The gage bar is equipped with an adjustable truss rod to stiffen it and permit an adjustment to concave or straight condition. Gage bar should be straight or slightly concave on its working face so that the sheet gaged against it cannot rock, thus causing inaccurate work. A good procedure is to trim a broad sheet taking a trim cut in width about equal 1 1/2 times the thickness of material. Then push the trimmed sheet against the back gage pressing on one end and then the other to see if any rocking can be detected. If rocking is noted, slack off on the center strut that hold the back gage brace rod, but not so much that an excessive hollow occurs.

FRONT GAGE
The front gaging may be obtained by bolting front gage stops to the top of the bed, using the dovetail slots. Adjustable steel scales at each end of the bed will aid in lining up the stops.

For gaging beyond the bed width, the stops may be bolted to the front brackets.

EXTENSION SQUARING GAGE
An extension squaring gage, as shown in Fig. 7 can be furnished as special equipment for squaring large sheets. It is recommended for use at the left hand side of the shear. The extension squaring gage is furnished with one adjustable stop and an inclin scale adjustable to compensate for knife wear.

To install the extension squaring gage remove the side gage from the shear bed. The side gage of the extension arm fits over the top of the bed and is fastened with the bolts provided. Extension squaring gages furnished after the shear has been shipped may require a certain amount of fitting by the purchaser to line up the bed holes properly. To accomplish this, loosen all of the bolts at the under side of the channel that attach the side gage. Move the side gage toward or away from the shear bed until the bed holes are in line, then re-tighten the attaching bolts. If there is not sufficient clearance for attaching bolts to line up the bed holes, remove the side gage and elongate the channel holes with a round file in the required direction.
Pack or shim between the outer gage support (A) and the floor until the gage arm is level. This gage arm may be tried for squareness by using a square against the lower knife or by checking the actual cut produced with the gage. When using an extension squaring gage it is extremely important that the shear is firmly positioned by use of angle brackets lagged to the foundation. Movement of the shear will have a tendency to throw the extension squaring gage out of line.

**CLUTCH**

The famous NIAGARA sleeve clutch is enclosed in the gear housing where it is protected from dirt and damage. The clutch operates in a bath of oil to promote long life.

The sleeve clutch applies the power or torque to the driveshaft concentrically because the fourteen jaws form a complete circle on the sleeve. The sleeve transmits the torque to the main shaft through spines machined circumferentially in the shaft.

Due to the fourteen engaging jaws, the load is divided, thus making wear on the driving surfaces of the engagement points negligible.

**Single Stroke Selector**

The shear may run continuously by keeping the treadle depressed or be made to come to a stop at the top of the stroke regardless of treadle position by merely suitably positioning the single stroke selector (Detail A, Fig. 8).

The selector knob is reached through the large pipe plug at the top of the gear box. By pulling up and turning this knurled selector knob, one-half turn, the shear may be set for either single stroke or continuous operation. The selector knob is round with a flat on one side. When the flat side is toward the sliding pin (167) the single stroke cam (.40) is rendered ineffective. Turning the flat side away from the pin will make single stroke operation effective. Be sure the knob snaps back into place when adjustment is made so that it will not turn without lifting.

The single stroke feature reduces the possibility of accidents that may be caused by the operator failing to remove his foot from the treadle in time to prevent a second stroke. It functions by unhooking the treadle mechanism by means of a specially timed, cam operated device.

**Clutch Lock**

A clutch lock (Detail B, Fig. 8) is provided for locking the clutch out of engagement. To lock clutch, pull out slightly on locking lever, and turn pointer to position marked “LOCK”. Make it a habit to always lock the clutch in addition to shutting off the power when making adjustments to the shear.

**WHERE TO CUT**

When shearing against a side gage it is well to use the gage at the left hand end of the shear. Shearing of short widths sheets of heavier material at the center of the bed should be avoided. Never exceed the capacity of the shear even in short widths, as short widths are as difficult to cut as wider sheets.

Shearing of two sheets, one on top of the other, requires more pressure than a single sheet of equivalent thickness. If pack cutting is desired a reduced capacity is called for. The factory will be pleased to offer assistance in such cases.

Never attempt to shear material that is not securely gripped by the holddown. Small pieces not gauged by the holldown may tip and fold between the knives.

**SHEARING TO A LINE**

It may be desirable to cut sheets to a scribed line rather than to a gage. This is accomplished by looking down behind the holldown bar and lining up the scribed work with the cutting edge. To facilitate better vision the front of the crosshead is sloped to the rear.

A light beam shearing gage, available as extra equipment, will aid in shearing to a line by illuminating the work area and casting a shadow of the upper knife on the work.
SHEARING OF NARROW STRIPS

A certain amount of difficulty may be experienced in the accurate shearing of narrow strips. The three major difficulties encountered in shearing of narrow strips are: camber, curl, and bow. The tendency for these conditions is usually greater in the softer and more ductile materials.

CAMBER is the tendency for a strip to distort in such a way that the edges are no longer straight but become bowed to form a long curve. Camber is influenced by the slope of the upper knife, the material being cut, and the width of the strip in proportion to its thickness. The low slope of these shears reduces camber to a minimum. Stress-filled stock will camber to a greater degree than will stress-relieved stock. The narrower the strip in proportion to its thickness, the greater the camber.

CURL is the tendency of a narrow strip to twist around itself or to cock-screw. Curl is influenced by the slope of the upper knife, the width of the strip, and the thickness and kind of material. The narrower and heavier the strip, the greater the amount of curl. Dull knives may increase the amount of curl.

BOW is the tendency for a strip to change from a flat condition. Bow usually accompanies camber and curl but is reduced by the low slope of the upper knife, a feature common to Niagara Shears.

MAINTENANCE

Under normal operating conditions the shears should require very little maintenance, other than that of good care in keeping it clean and well lubricated. The knives should be kept sharp and properly adjusted. Periodic inspections should do much to prevent minor conditions from developing into costly repairs and possible consequential loss of productive operating time.

When the main drive gear or clutch require attention, drain the oil from the gear box. On 1 and 1R Models, the gear box bearing is locked into the cover plate (25) by either one or three eccentric head bolts (24) depending on the particular model involved. Before the cover can be removed, the bearing must be released as follows: The locknuts on the outside of the cover are loosened while the bolt is held firm by inserting a screwdriver in its slotted end. Then, the screwdriver is used to rotate each bolt a one-half turn.

WHEN REASSEMBLING THE COVER, MAKE SURE THAT BOLTS ARE ROTATED ONE-HALF TURN TO LOCK THE BEARING AND THAT THE LOCK NUTS ARE DRAWN UP TIGHT. IMPROPER INSTALLATION OR TAMPERING WITH THESE BOLTS MAY CAUSE IMPROPER CLUTCH OPERATION.

Cover plate fits over the outer support bearing of the main shaft. Care must be taken to see that the cover is backed off evenly by inserting set-screws in the holes provided.

Removal of the spanner lock nut (143) and lock washer (143A) from the end of the shaft releases the outer support bearing (31), clutch gear (30), clutch sleeve (141), spring (144), and single stroke cam (140). These parts may be removed from the shaft in this order.

Before the latch bracket assembly can be removed, it will be necessary to remove the locking bar (135)
and treadle connection link (33A). The locking bar end collar (137) is placed on the locking bar next to the inside wall of the housing where it retains the locking bar spring. The locking bar end collar may be removed by knocking out the standard taper pin. This will permit withdrawal of the locking bar from the gear box.

When reinstalling the latch bracket assembly, before the throwout housing cap screws (133) are tightened, the locking bar should be replaced and the housing moved so that there is clearance between the recessed portion of the locking bar and the shoulder of the clutch sleeve when in the unlocked position.

Replace the clutch sleeve and single stroke cam correctly by observing that it slides on with the “O-O” on the internal spline straddling the “O” on the external spline. Compress the clutch sleeve spring by hand and turn the locking bar handle one-half turn to hold the sleeve in position while mounting the clutch gear. When tightening the clutch gear on the shaft, pull the locknut (143) tight and lock. The clearance for free running of the bearings has been provided for in the machining. Be sure the through bolts holding the clutch gear face plate are tight.

Gearing
The entire flywheel and pinion shaft can be removed as a unit by unbolting the motor adaptor flange and withdrawing it.

For servicing the intermediate gear and pinion assembly, the gear box should be removed from the shear. The motor and all parts on the eccentric shaft and the latch bracket must be removed as previously outlined. When the gear box has been removed the intermediate shaft can be driven from the gear box by tapping the outer end of the shaft. This shaft is stepped and cannot be removed by driving it in the opposite direction. The intermediate shaft does not rotate but is held in the walls of the gear box. The intermediate gear and pinion cluster rotate on this shaft.

Removal of Gear Box
After removal of the clutch gear, clutch sleeve, spring, single stroke cam and clutch bracket, the gear box can be removed by unbolting the cap screws which fasten the gear box to the housing. Those cap screws lying behind the intermediate gear can be reached with a socket wrench and extension handle through a cored hole in the web of the intermediate gear.

When replacing the gear box, follow the procedure outlined below so that it will not become loose in operation.

1. Clean mating surfaces and remove any burrs with a file.
2. Replace all cap screws.
3. Tighten screws, finger tight.
4. Raise up rear end of gear box with jack to take up backlash in bolt circle clearance.
5. Pull up cap screws as tightly as possible, using a sturdy socket wrench with good leverage.

Brake
A patented detent device controls the stopping of the shear.

The detent device consists of a cam and spring loaded cam roller mounted on anti-friction bearings. The detent is located in the housing at the end of the shear opposite the gear box.

To remove the detent cam housing, first remove the large pipe plug at the bottom of the spring pot and drain the oil. Then remove the round cover plate from the side of the cam box. Insert a cap screw and washer in the tapped hole at the bottom of the spring plunger. Tightening this cap screw will release the spring pressure from the cam roller so that the cam can be removed from the end of the shaft. Either the spring pot or the entire cam housing can then be removed.

On shears of 10 foot and greater cutting lengths, a drag brake is incorporated with the detent to supplement its action. The brake strap and brake collar are stamped with matching marks to show the correct stopping point of the brake. Should the mark on the brake collar be either to the right or the left of the brake strap, adjustment is necessary. If the mark on the brake collar is to the left of the mark on the brake strap, it indicates that the adjustment is too tight. Tightness can also be detected by a clicking of the clutch. If the mark on the brake collar is to the right of the mark in the brake strap, it indicates the adjustment is too loose. If the clutch will disengage but the machine will over-ride top stroke and the throw-out will strike the positive stop on the clutch sleeve, a resounding thud or creak will be heard.

Counterbalance
The 18, 110 and 1R Models are equipped with a counterbalance. The counterbalance spring adjustment is properly set at the factory and should not be disturbed. Should counterbalance have to be removed consult factory for correct installation.

REPAIR PARTS
When ordering repair parts, state the serial number of the shear. It is stamped on or near the front left-hand corner of the bed. Be sure to use complete names of parts (not numbers) listed on the following pages for positive identification.

It is recommended that knives be returned to the factory for regrinding. A fast regrinding service is available. Due to the hazards of improper regrinding, claims against knives reground outside our plant cannot be considered.

Reordering Knives
In ordering knives you will enable us to expedite delivery by sending the following information with your order:

1. The part numbers stamped on the knives.
2. Type and size of shear.
3. Serial number of shear.
4. Type of knife required. (Refer to catalog)
PARTS LIST

MODELS 12, 13, 14, 15, 16

1. Bed
2. Crosshead
3. Hold down
4. Left Hand Housing
5. Right Hand Housing
6. Eccentric Shaft
7. Treadle Shaft
8. R.H. Eccentric

9. L.H. Eccentric
10. Crosshead Eccentric Straps
11. Crosshead Wrist Pins
12. Gear Box
13. Detent Cam Box
14. Spring Pin
15. Detent Cam Box Cover
16. Front Cam Box Cover

20. Front Brackets
21. Front Gage Bolts
22. Side Gage
23. Eccentric Head Cover Bolts
   (one on Models 12-16, three on
   110 & 1R Models)
24. Gear Box Cover
25. Motor

Part Nos. for Figs. 10, 11, 12 and 13

FIG. 10

FIG. 11

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When ordering parts always give the catalog and serial number of the shear. The serial number is stamped at or near the front left corner of the bed and also on the metal lubrication plate. Be sure to use complete names of parts listed for positive identification.

MODELS 18, 110, 1R4 TO 1R10

Part Nos. for Figs. 10, 11, 12 and 13, contd.

33. Treadle Connection
34. Lower Knife
44. Upper Knife
45. Knife Plow Bolts
46. Crosshead Brace
47. Crosshead Brace Support Bolt
49. Back Gage Square
59. Counterbalance
62. Center Counterbalance Spring Washer
63. Lower Counterbalance Washer
64. Counterbalance Springs
132. Locking Bar Handle
200. Lock
201. Hold Down Plunger
201-A. Hold Down Plunger Spring
202. Hold Down Lifting Adjustment Screw
203. Treadle Foot
204. Treadle Rod Support
205. Lubrication Plate
211. Hold Down Locknuts
212. Hold Down Retainer Screws
206. Jam Nut

* Not Illustrated
FIG. 14 — ECCENTRIC SHAFT (Illustration typical but not exact in detail)

6. Eccentric Shaft
8. R.H. Eccentric
9. L.H. Eccentric
10. Crosshead Eccentric Straps
12. Crosshead Wrist Pins
30. Clutch Gear
31. Cover Bearing
40. Detent Cam
140. Single Stroke Cam
141. Clutch Sleeve
143. Locknut
143-A. Lockwasher
144. Clutch Sleeve Spring
213. Spacer

FIG. 15 HOLDDOWN

for models 18, 110, 1R4 to 1R10 (rear view)

3. Holddown
36. Holddown Foot
37. Holddown Spring
38. Knife Guard
174. Holddown Foot Retaining Nut
207. Holddown Lifting Bar

FIG. 16 — DETENT BRAKE

16. Detent Spring Pin
40. Detent Cam
40-A. Detent Cam Housing Washer
66. Detent Cam Roller
67. Detent Cam Lever
67-A. Detent Lever Pin
68. Detent Spring
69. Detent Spring Plunger
69-A. Detent Plunger Stem
177. Detent Cam Roller Bearings
178. Detent Cam Roller Snap Rings
FIG. 19 — SINGLE BRACKET BACK GAGE

17. Back Gage Bar
18. Single Bracket
21. Back Gage Handwheel
47. King Pin Bolt and Nut
48. Back Gage Brace Rod
52. Handwheel Scale
53. Bracket Scale
56. Handwheel Nut
57. Single Bracket Back Gage Adjusting Screw
58. Single Bracket Back Gage Slide
59a. Handle
208. Set Screws
209. Mounting Screws
210. Dowel

* Not Illustrated

FIG. 20 — EXTENSION SQUARING GAGE

34. Squaring Gage Support
34-A. Adjustable Scale
35. Adjustable Stop
175. Leg
176. Squaring Gage
LUBRICATION CHART

Socony Mobil Oil Company Engineers cooperating with our own staff recommended the following or equivalent lubricants.

Thoroughly oil bearings after each shutdown before starting shear and frequently thereafter. Keep bearings and oil clean and free from dirt or grit. The plain bearings of this shear are not designed to accommodate any type of grease. The oil has a special compounding for the purpose and its use is highly advocated. ORDINARY AUTOMOTIVE AND MACHINE OILS ARE NOT CONSIDERED SATISFACTORY.

<table>
<thead>
<tr>
<th>MODELS</th>
<th>12, 13, 14, 15, 16, 18, 110</th>
<th>184, 186, 188, 1810</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gear Box Capacities ...... Gal.</td>
<td>1½</td>
<td>6 Qts.</td>
</tr>
<tr>
<td>Detent Capacities .......... Gal.</td>
<td>½</td>
<td>3 Pts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POINTS OF LUBRICATION</th>
<th>PARTS</th>
<th>LUBRICANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Gear Box &amp; Detent</td>
<td>Mobil Compound Oil BB</td>
</tr>
<tr>
<td>B</td>
<td>Gibs, Holddowns, Counterbalance &amp; Eccentric Straps</td>
<td>Mobil Vactra Oil Extra Heavy</td>
</tr>
<tr>
<td>C</td>
<td>Wrist Pins</td>
<td>Mobilplex EP-1</td>
</tr>
<tr>
<td>D</td>
<td>Eccentric Shaft Bearings</td>
<td>Mobilplex EP-1</td>
</tr>
<tr>
<td>E</td>
<td>Backgage Gearbox</td>
<td>Mobilplex EP-1</td>
</tr>
<tr>
<td>F</td>
<td>Backgage Screws &amp; Slide</td>
<td>Mobilplex EP-1</td>
</tr>
<tr>
<td>G</td>
<td>Motor</td>
<td></td>
</tr>
</tbody>
</table>

FIG. 22 — REAR VIEW

FIG. 23 — FRONT VIEW

MODELS 12, 13, 14, 15, 16
<table>
<thead>
<tr>
<th>METHOD OF APPLYING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill through plug or cover, top of gear box</td>
<td>Drain and refill after first three months; thereafter, change oil every six months. Maintain oil level.</td>
</tr>
<tr>
<td>Oil cups or Centralized Pressure Lubrication</td>
<td>Fill oil cups until full before starting shear. After each shutdown, refill cups several times during each shift. Put a few drops of oil on top of each hold down foot. Fill reservoir on automatic lubrication as required.</td>
</tr>
<tr>
<td>Grease gun</td>
<td>Fill until grease shows on both sides of connection. <strong>Keep well lubricated.</strong></td>
</tr>
<tr>
<td>Grease gun</td>
<td>Fill until grease shows on side of eccentric cam.</td>
</tr>
<tr>
<td>Fill through plug by spooning</td>
<td>Check every six months.</td>
</tr>
<tr>
<td>Spread liberally on screws and slideways</td>
<td>Check every three months.</td>
</tr>
</tbody>
</table>

Follow motor manufacturer's recommendations.

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**FIG. 24 — REAR VIEW**

**MODELS 18, 110, 1R4 TO 1R10**

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