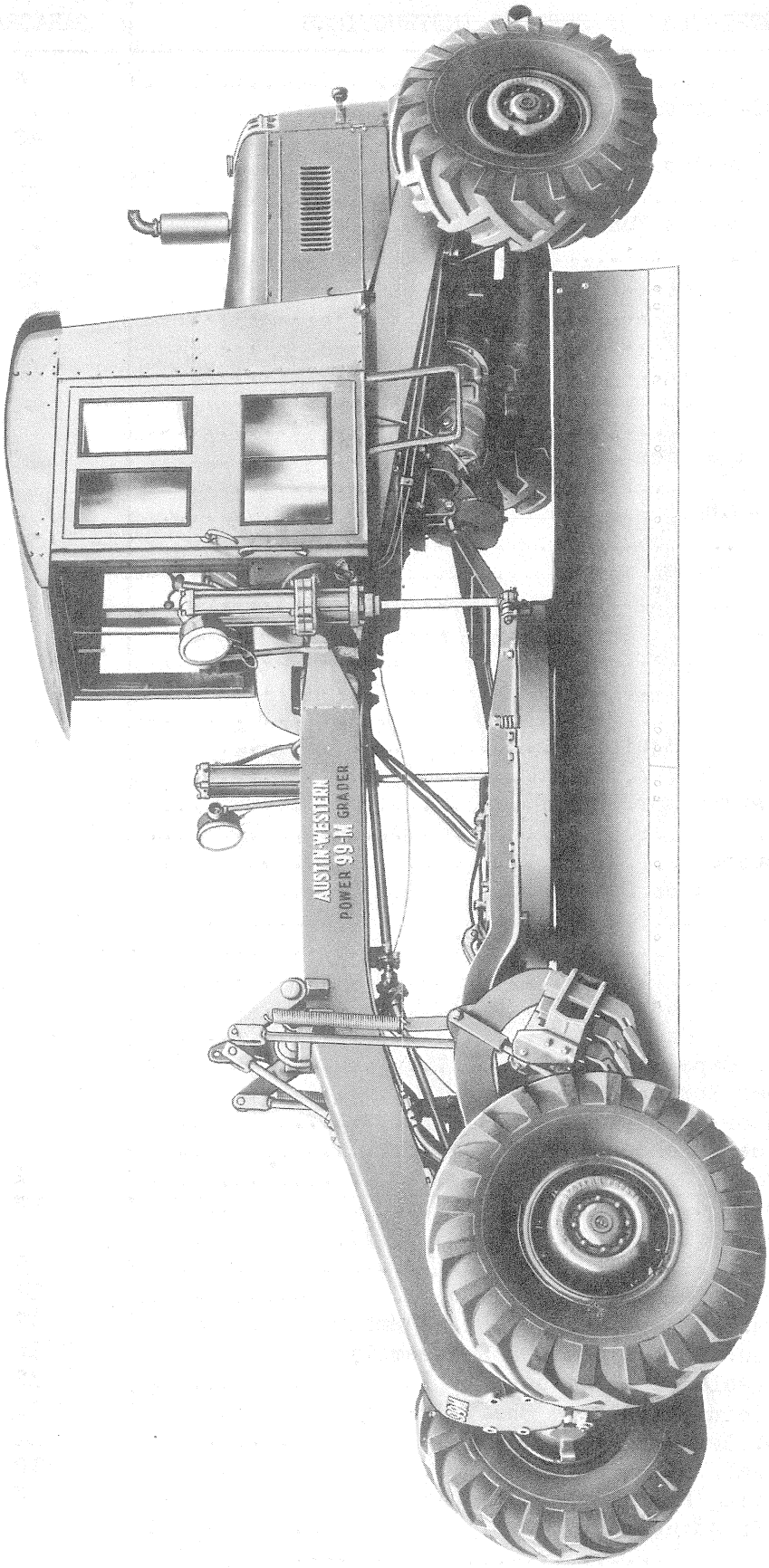
AUSTIN-WESTERN
POWER 99-M GRADER

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LIST OF ILLUSTRATIONS

SERVICE

Avail yourselves of the Austin-Western Distributor's Service Department facilities and their servicemen. Have an experienced serviceman make yearly inspections and adjustments in order to prolong the life of your machine.

GENERAL DATA

LOCATION OF SERIAL NUMBERS

Grader	On name plate, also the frame, on left hand side of machine above front axle.
K-428 Engine	On name plate attached to left side of engine below water pump.
UD-14 Engine	On name plate attached to right side of flywheel bell housing below engine support angle.

NOTE: When ordering parts, ALWAYS give power grader serial number.

GOVERNOR SPEED - FULL THROTTLE - NO LOAD

K-428 Engine	1400	R.P.M.
UD-14 Engine	1365 ± 15	R.P.M.

TRAVELING SPEEDS

Reverse	2.78	M.P.H.
1st	1.90	M.P.H.
2nd	3.30	M.P.H.
3rd	4.71	M.P.H.
4th	7.93	M.P.H.
5th	12.25	M.P.H.

LUBRICANT CAPACITIES

Front Axle	12 Quarts
Rear Axle	13½ Quarts
Transfer Case	5 Quarts
Transmission	10 Quarts

CRANKCASE CAPACITIES

K-428 Engine	9 Quarts
UD-14 Engine	14 Quarts

COOLING SYSTEM CAPACITIES

K-428 Engine	9½ Gallons
UD-14 Engine	14 Gallons

FUEL TANK CAPACITIES

K-428 Engine - Gasoline	40 Gallons
UD-14 Engine - Diesel Fuel	40 Gallons
UD-14 Engine - Gasoline (for starting)	1 Gallon

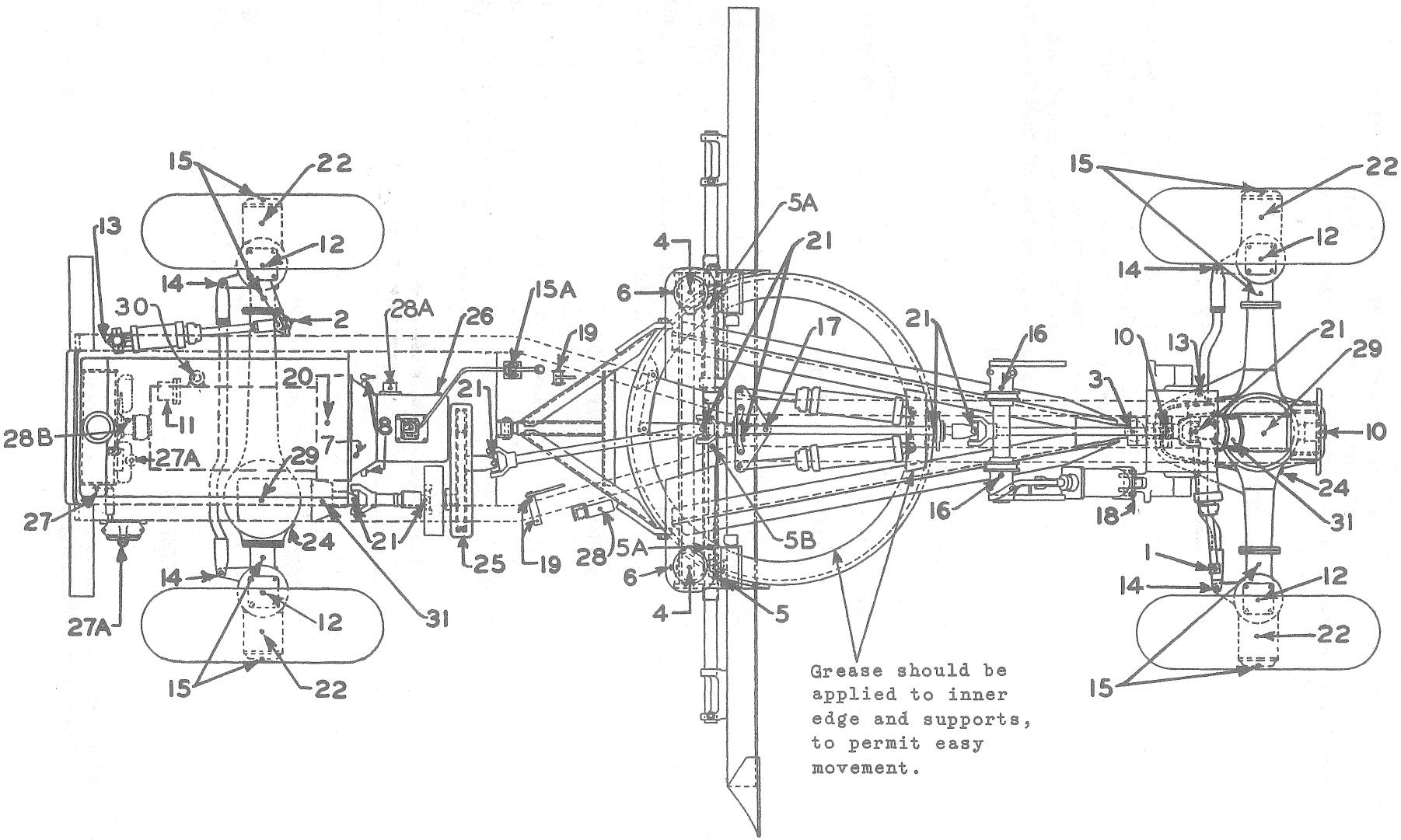


Figure 1. Lubrication Chart

Key to Lubrication Chart - Refer to Figure 1

LUBRICATE DAILY (8 to 12 HOURS OF OPERATION)

Two strokes of lubricator at each grease fitting

REF.		
1.	Ball - axle steer (front)	With pressure gun grease
2.	Ball - axle steer (rear)	With pressure gun grease
3.	Ball - segment draft	With pressure gun grease
4.	Ball - lift ram (on circle)	With pressure gun grease
5.	Ball - side shift (on blade)	With pressure gun grease
5A.	Side shift shaft - upper	With pressure gun grease
5B.	Side shift shaft - lower	With pressure gun grease. Remove pipe plug and install grease fitting temporarily. Reinstall pipe plug after greasing.
6.	Ball - lift ram (for blade) upper and lower. S.A.P.S.	With pressure gun grease
7.	Clutch - throw-out bearing	With pressure gun grease
8.	Clutch - throw-out shaft	With pressure gun grease
10.	Pivot shaft - front and rear (front axle)	With pressure gun grease
11.	Pump - hydraulic	With #2 Marfak grease or equal
12.	Trunnion bearings - upper (front and rear axles)	With pressure gun grease
13.	Steer ram base - front and rear axles	With pressure gun grease
14.	Tie rod ends - front and rear axles	With pressure gun grease
15.	Steering knuckles - front and rear axles	With pressure gun grease. Grease level can be determined by removing pipe plug from lower side of each trunnion socket.
15A.	Pins, rods, levers, parts with oil holes, etc.	Occasionally lubricate with a few drops of motor oil.

LUBRICATE WEEKLY (50 to 80 HOURS OF OPERATION)

Two strokes of lubricator at each grease fitting

16.	Bearings - scarifier lift	With pressure gun grease
17.	Pivot - circle reverse	With pressure gun grease
18.	Ram base - scarifier	With pressure gun grease
19.	Brake and clutch pedals	With pressure gun grease
20.	Clutch - pilot bearing. (See Page 45, Paragraph 24)	With pressure gun grease
21.	Universal joints - propeller shafts	With [redacted]

LUBRICATE 4 TIMES PER YEAR (1000 HOURS OF OPERATION)

22.	Bearings - front and rear wheels	Remove wheel drive flanges from all wheels and check bearing adjustment. Adjust bearings if necessary. Inspect grease compartment and replenish with wheel bearing grease. Also check when overhauling.

CHECK WEEKLY (50 to 80 HOURS OF OPERATION)

24.	Gear and pinion carrier (front and rear axles)	When temperatures are 32°F. and above, use SAE-140 extreme pressure lubricant, when temperatures are below 32°F. use SAE-90 extreme pressure lubricant. NEVER MIX GRADES OR KINDS OF EXTREME PRESSURE LUBRICANTS. If in doubt, drain, flush & refill.

Key to Lubrication Chart - Refer to Figure 1

REF. CHECK WEEKLY (50 to 80 HOURS OF NORMAL OPERATION)

25. Transfer case)
26. Transmission)..... Check every 50 hours of normal operation and refill if necessary with SAE-140 extreme pressure lubricant. When temperatures are below 32°F., use SAE-90 extreme pressure lubricant. NEVER MIX GRADES OR KINDS OF EXTREME PRESSURE LUBRICANTS. Drain and flush every 50 to 80 hours of normal operation or weekly with kerosene or diesel fuel. Refill with extreme pressure lubricant.

27.)
27A.) Hydraulic oil..... Check oil level pet cocks at Ref. 27 and refill with SAE-10W for temperatures of 32°F. and above. For temperatures below 32°F. use ice machine oil having a pour point of minus 40 and a viscosity of 100 seconds at 100°F. Drain and clean entire hydraulic system at least twice a year.

Battery..... Check and add distilled water if needed.

CHECK EVERY 4 WEEKS

28. Brakes..... Check the hydraulic master cylinder and refill with genuine Lockheed #21 brake fluid.

28A. Clutch brake..... With pressure gun grease. Two strokes of lubricator.

28B. Fan bearings

(A) K-428 Engine (plug in fan hub).... Re-pack with ball bearing grease. (Ball bearing grease is similar to wheel bearing grease). Remove plug and install grease fitting temporarily. Be sure to reinstall plug before starting engine.

(B) UD-14 Engine (grease fitting)..... See engine instruction book.

NOTE:

29. Vent plugs - gear carrier..... To prevent accumulation of air pressure in gear carriers.
(front and rear axles)

CAUTION: Do not remove unless for cleaning because of dirt or dust stoppage. Keep air vent in plug open.

30. Engine..... See engine instruction book.

31. Bearings - pinion carrier..... After repairing or overhauling front or rear gear carrier unit, be sure to remove the pipe plugs at Ref. 31 and inject about one pint of SAE-140 or SAE-90 extreme pressure lubricant. If you do not do this you may start out with dry pinion bearings.
(front and rear axles)

We recommend that you use only the best lubricants obtainable varied to suit temperature changes.

EXTREME PRESSURE LUBRICANT
For Use in Front and Rear Axle Housings, Etc.

We recommend that the owner use the lubricant shipped with the machine in the gear housings and when a seasonal change becomes necessary, the housing should be thoroughly drained, flushed and refilled.

Austin-Western machines are filled at the factory with one of the lubricants on this list and we suggest that the owner, rather than add to the original oil, drain out and refill with an approved EXTREME PRESSURE LUBRICANT obtainable in his locality. We prefer this rather than mixing two unknown brands.

In flushing out any gear housing, use a regular flushing oil in preference to kerosene, gasoline, or other thin fuels.

We recommend the following brands of EXTREME PRESSURE LUBRICANTS for summer and winter use in Austin-Western machines where the LUBRICATION CHART specifies its use.

In case these lubricants are not available in your territory, secure SAE-90 or SAE-140 equivalent grades of stable inactive types. The following are of the stable or inactive types of EXTREME PRESSURE LUBRICANTS and contain either combined sulphur, chlorine, phosphorous, leaded soaps or combinations.

APPROVED LIST OF EXTREME PRESSURE LUBRICANTS

EXTREME PRESSURE WINTER LUBRICANTS FOR TEMPERATURES BELOW 32°F.		EXTREME PRESSURE SUMMER LUBRICANTS FOR TEMPERATURES OF 32°F. AND ABOVE		
NAME	NO.	NAME	NO.	MANUFACTURER
Alemite	E.P.SAE-90	Alemite	E.P.SAE-140	Alemite Corp., Chicago, Ill.
Koolmotor Trans. Lub.	E.P.SAE-90	Koolmotor Trans. Lub.	E.P.SAE-140	Cities Service Oil Co., New York City, N.Y.
Lubre-Kar	E.P.SAE-90	Lubre-Kar	E.P.SAE-140	Continental Oil Co., Ponca City, Okla.
D-A Lubricant	E.P.SAE-90	D-A Lubricant	E.P.SAE-140	D-A Lubricant Co. Inc., Indianapolis, Ind.
Kendall E.P. Gear Lube	E.P.SAE-90	Kendall E.P. Gear Lube	E.P.SAE-140	Kendall Refining Co., Bradford, Penna.
Keystone 73-W	E.P.SAE-90	Keystone 73-S	E.P.SAE-140	Keystone Lubricating Co., Philadelphia, Penna.
Marquette Lub.	E.P.SAE-90	Marquette Lub.	E.P.SAE-140	Marquette Petrol.Prod.Co., Chicago, Ill.
Pennzoil #4191	E.P.SAE-90	Pennzoil #4191	E.P.SAE-140	Pennzoil Co., Oil City, Penna.
Phillips	E.P.SAE-90	Phillips	E.P.SAE-140	Phillips Petroleum Co., Kansas City, Mo.
Purelube	EE	Purelube	DD	Pure Oil Co., Chicago, Ill.
Shell Super Gear Lub.	E.P.SAE-90	Shell Super Gear Lub.	E.P.SAE-140	Shell Corp., St. Louis, Mo.
Opaline Gear Lubricant	BX	Opaline Gear Lubricant	CX	Sinclair Refining Co., New York City, N.Y.
Mobiloil	GX	Mobiloil	GXH	Socony-Vacuum Co., New York City, N.Y.
RPM Gear Oil	E.P.SAE-90	RPM Gear Oil	E.P.SAE-140	Standard Oil - Calif. San Francisco, Calif.
All Purpose Gear Lub.	E.P.SAE-90	All Purpose Gear Lub.	E.P.SAE-140	Standard Oil - Indiana Chicago, Ill.
Sohio Leaded Compound	#3	Sohio Leaded Compound	#6	Standard Oil - Ohio Cleveland, Ohio
Sturaco Super Gear Lub.	E.P.SAE-90	Sturaco Super Gear Lub.	E.P.SAE-140	Stuart & Co., D.A. Chicago, Ill.
Texaco Univ. Gear Lub.	E.P.SAE-90	Texaco Univ. Gear Lub.	E.P.SAE-140	Texas Co., New York City, N.Y.
Veedol Lub.	E.P.SAE-90	Veedol Lub.	E.P.SAE-140	Tidewater Oil Co., New York City, N.Y.
Red Line E.P. Gear Lub.	E.P.SAE-90	Red Line E.P. Gear Lub.	E.P.SAE-140	Union Oil Co. - Calif. Los Angeles, Calif.

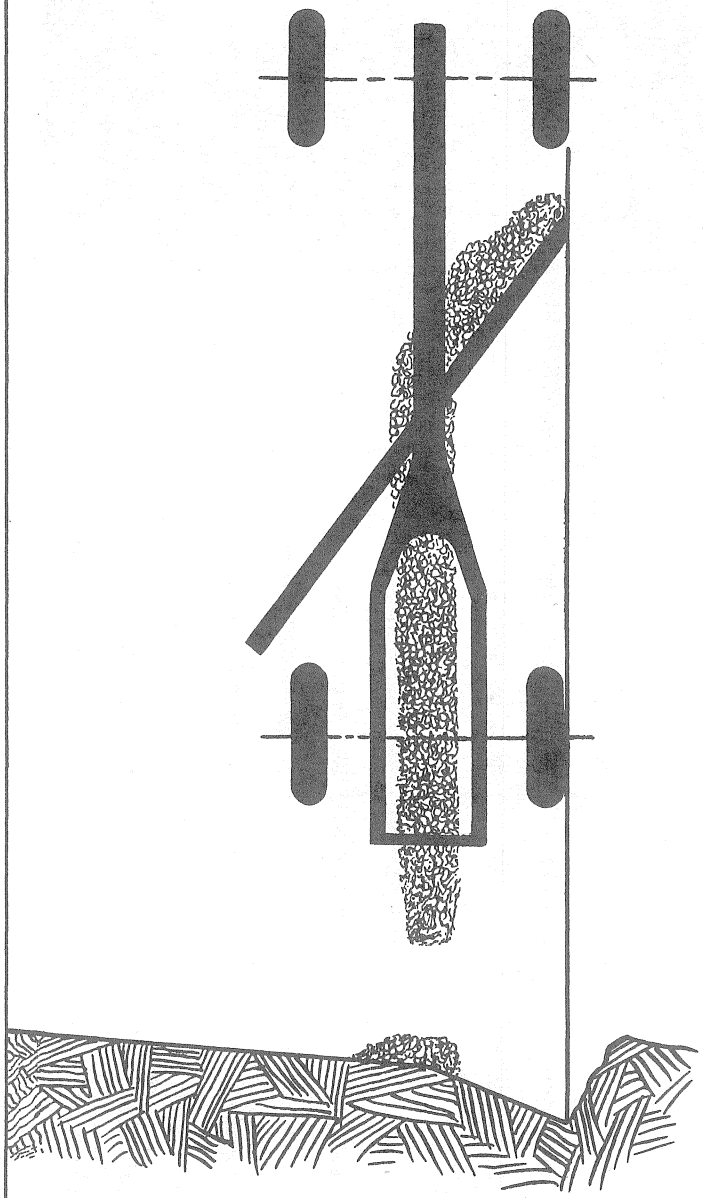


Figure 2. Starting a Ditch

When starting a new ditch do not attempt to take too much the first time through.

Keep the amount of material moved easily within the capacity of the machine and drive at a speed consistent with conditions, straight steering considered.

1. Side shift the blade on the arms (away from ditch) as far as it will go.

2. Rotate circle. Set blade point behind the front wheel.

3. Elevate heel of blade so material is delivered between the rear wheels.

Generally two passes are made in this cut before making the pass shown in Figure 3, and the second pass requires a slight adjustment of the rear wheels in order to permit the right one to travel in the furrow properly.

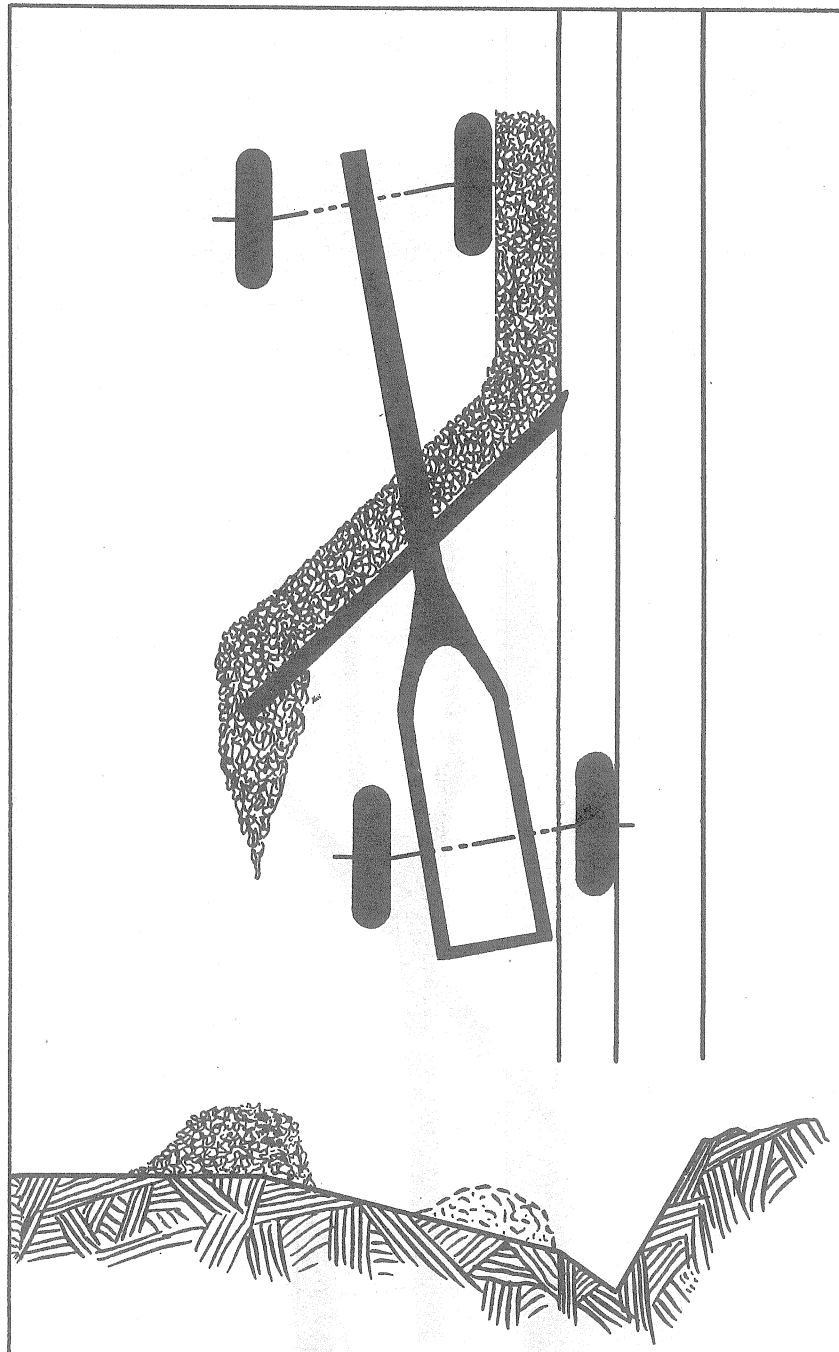


Figure 3. The Second Pass in Ditching

This operation is always the most difficult for any but the A-W No. 99-M. Due to the side load on the heel of the blade affecting the course of the rear wheels.

Always arrange to perform this operation before there is too much material thrown up from the ditch cuts to be handled at one "pass". By this method an even runway, with a moderate slope, is made for successive ditch cuts.

To Perform Operation

1. Rotate circle to third or fourth hole from the last.

2. Adjust rear wheels, to the extreme, toward the ditch.

3. Shift blade sidewise (by valve in cab) toward the ditch, sufficiently to reach the windrow.

4. Drive with the rear wheel in the ditch, same as for first ditch cut, and with both front wheels to one side (not in) the windrow, as shown in this illustration.

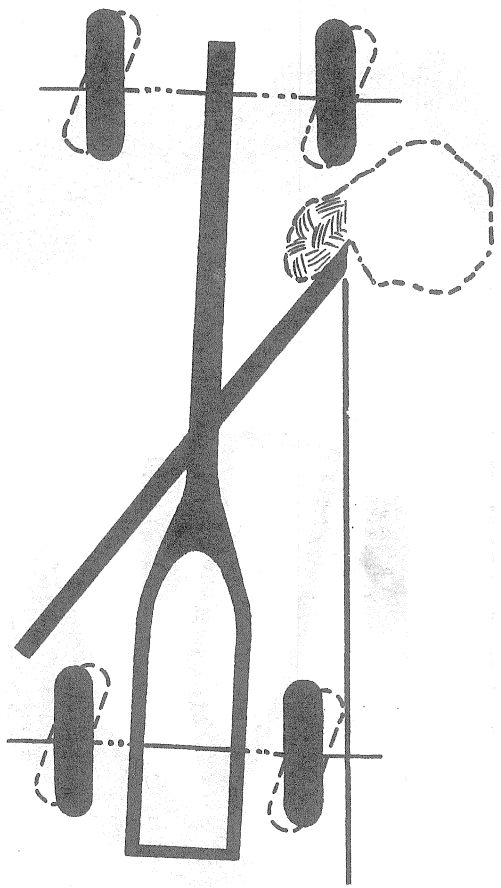


Figure 4. Backing Out

When obstructions are encountered in ditching, proceed as follows:

1. Declutch.
2. Steer the front and rear drivers as shown by dotted lines.
3. Shift into reverse slowly and back up a few feet.

The machine will move sidewise (as it goes backward) away from obstruction and out of the ditch.

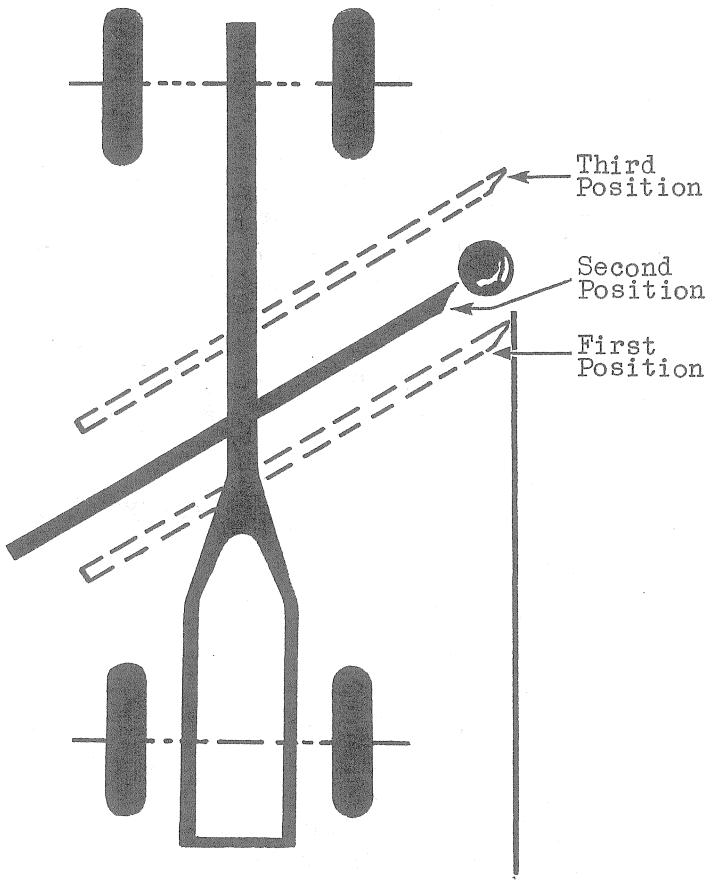


Figure 5. Grading Close to an Immovable Object

The blade can be either extended or retracted without leaving the "floor", and "grade" maintained close to obstructions. Ditch lines can be straightened with ease. This operation is controlled by a valve while grader is moving or standing.

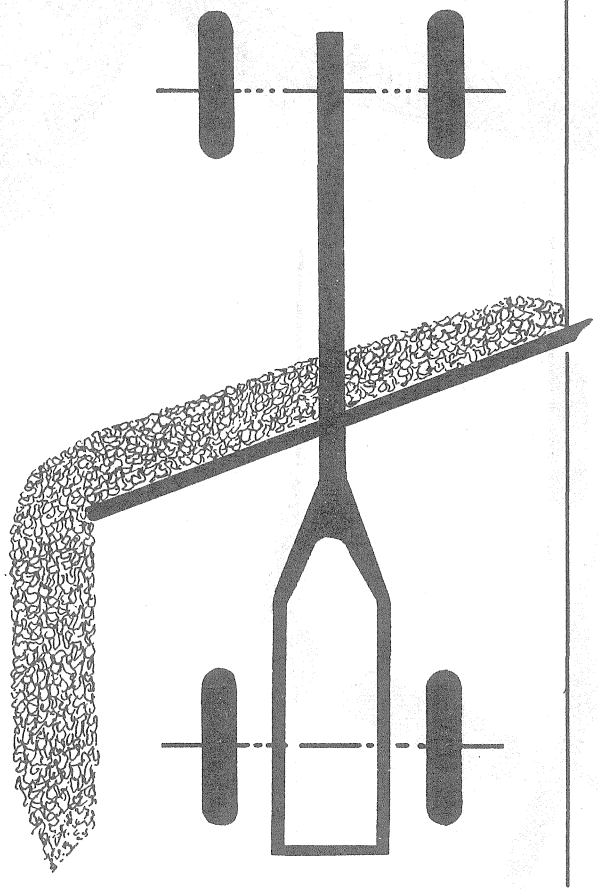


Figure 6. Conventional Maintenance

The above shows wheels and blade adjusted for conventional maintenance operation.

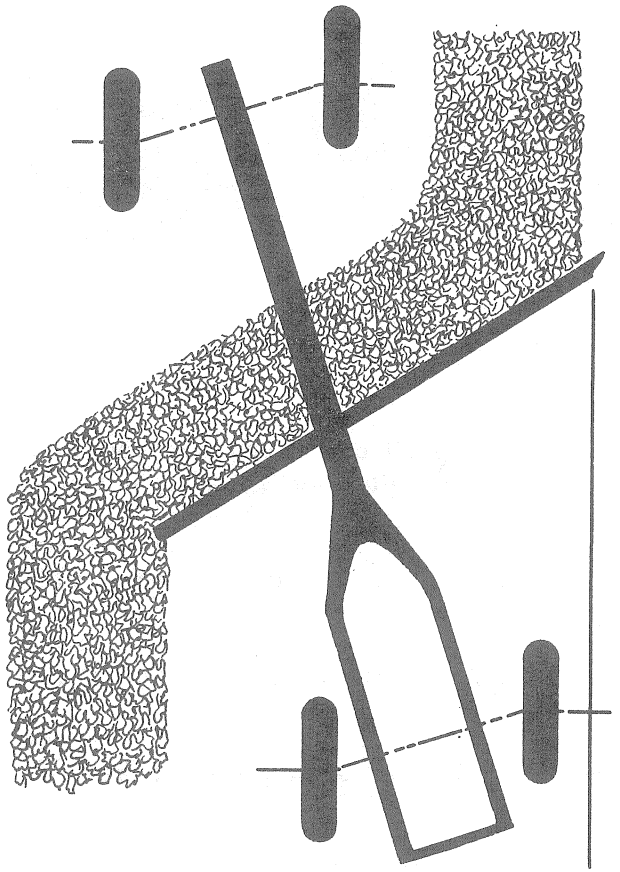


Figure 7. Handling Oil-Mix or Heavy Maintenance

1. Adjust rear wheels toward windrow as shown; this puts a driving wheel behind the blade point.

2. Rotate blade to suit conditions, approximately as shown.

3. Shift blade on arms toward the windrow far enough to permit the front wheels to travel at the side of (not in) windrow.

Note: One front wheel will then be directly in front of the heel of the blade.

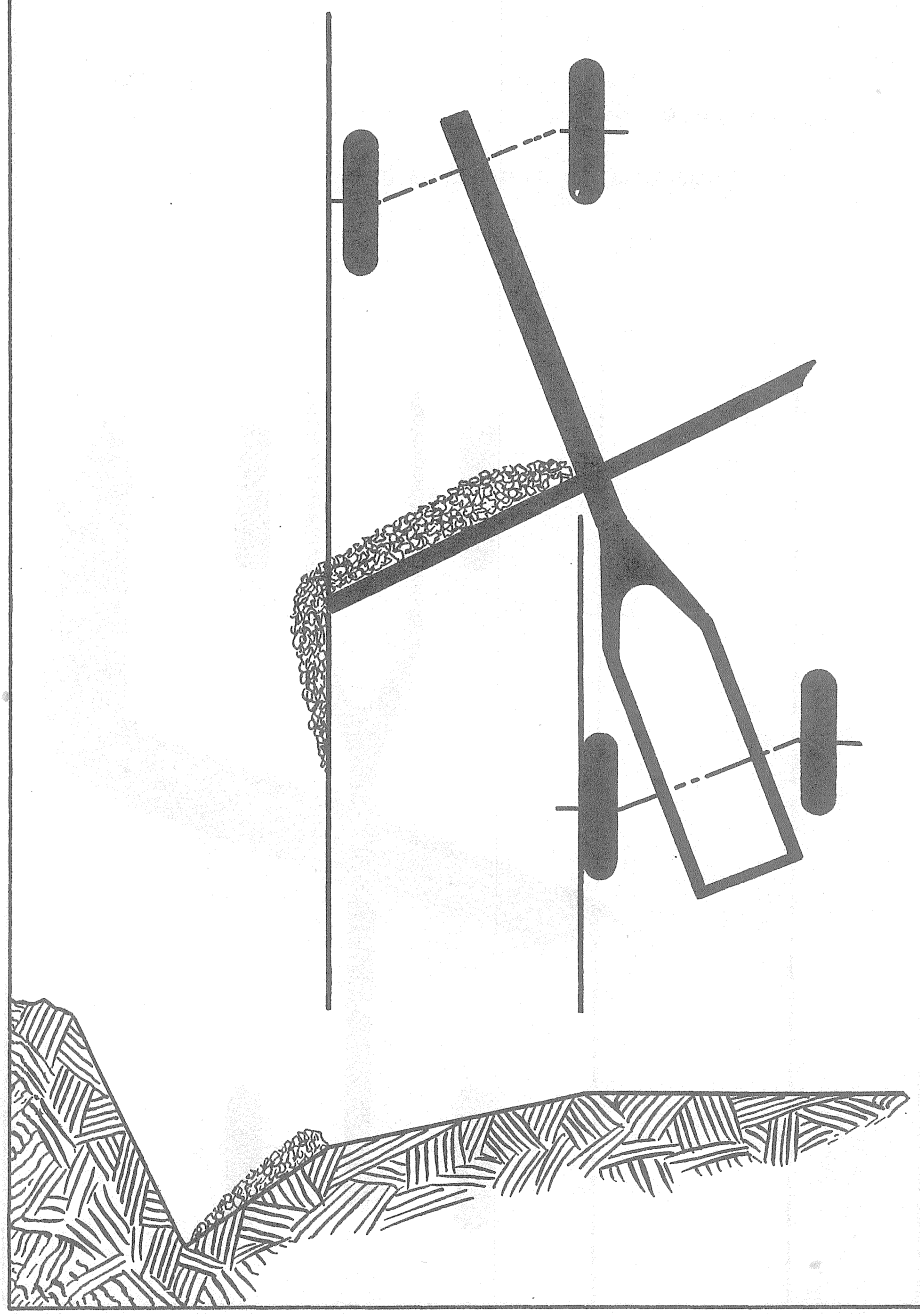


Figure 8. Resloping of Grade Shoulders

To reslope a shoulder without leaving wheel tracks:

1. Adjust rear wheels to the extreme as shown.
2. Set blade approximately crosswise of main frame.
3. Shift blade toward ditch as far as it will go.
4. Observe conditions carefully. Do not overload and spoil the grade.

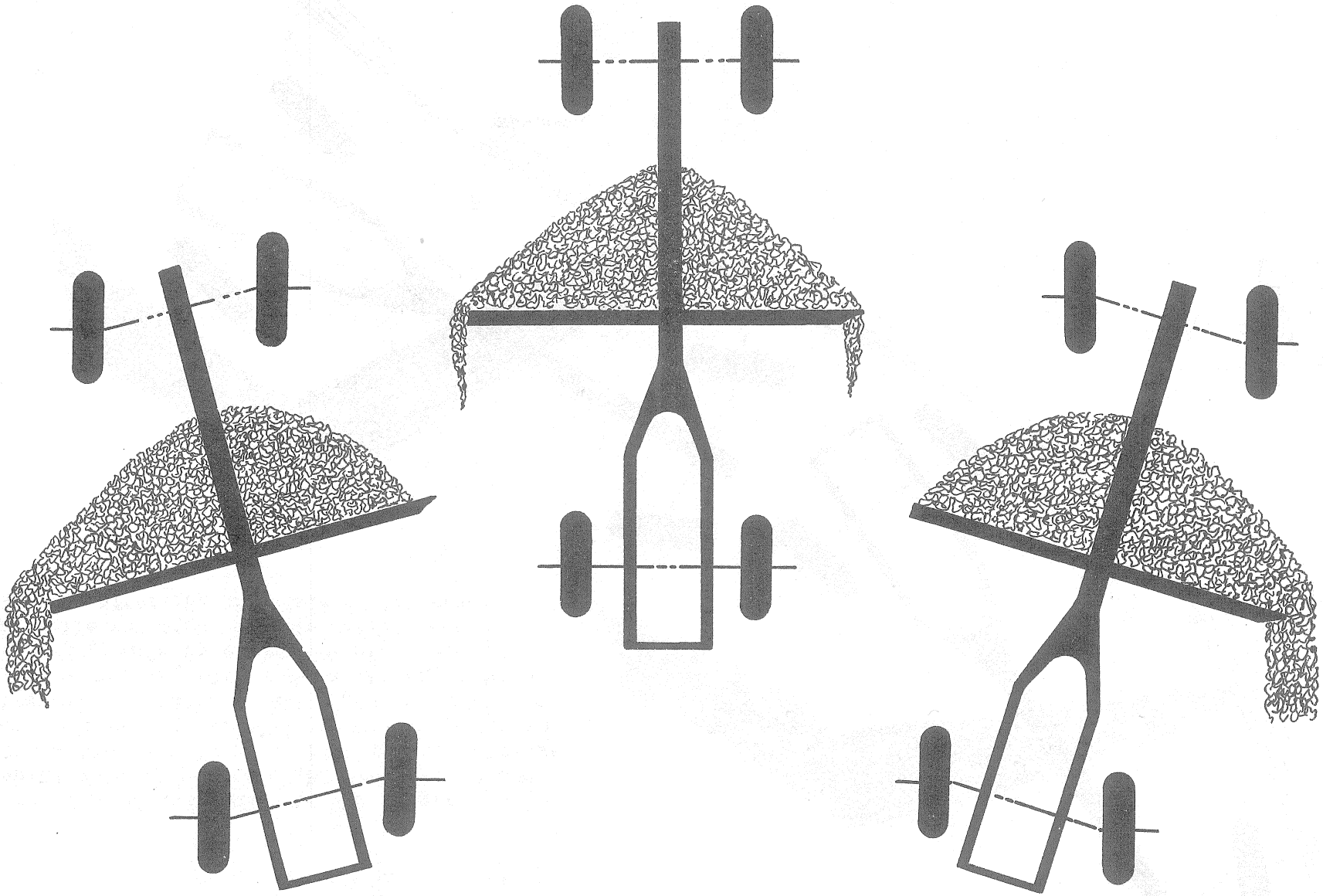


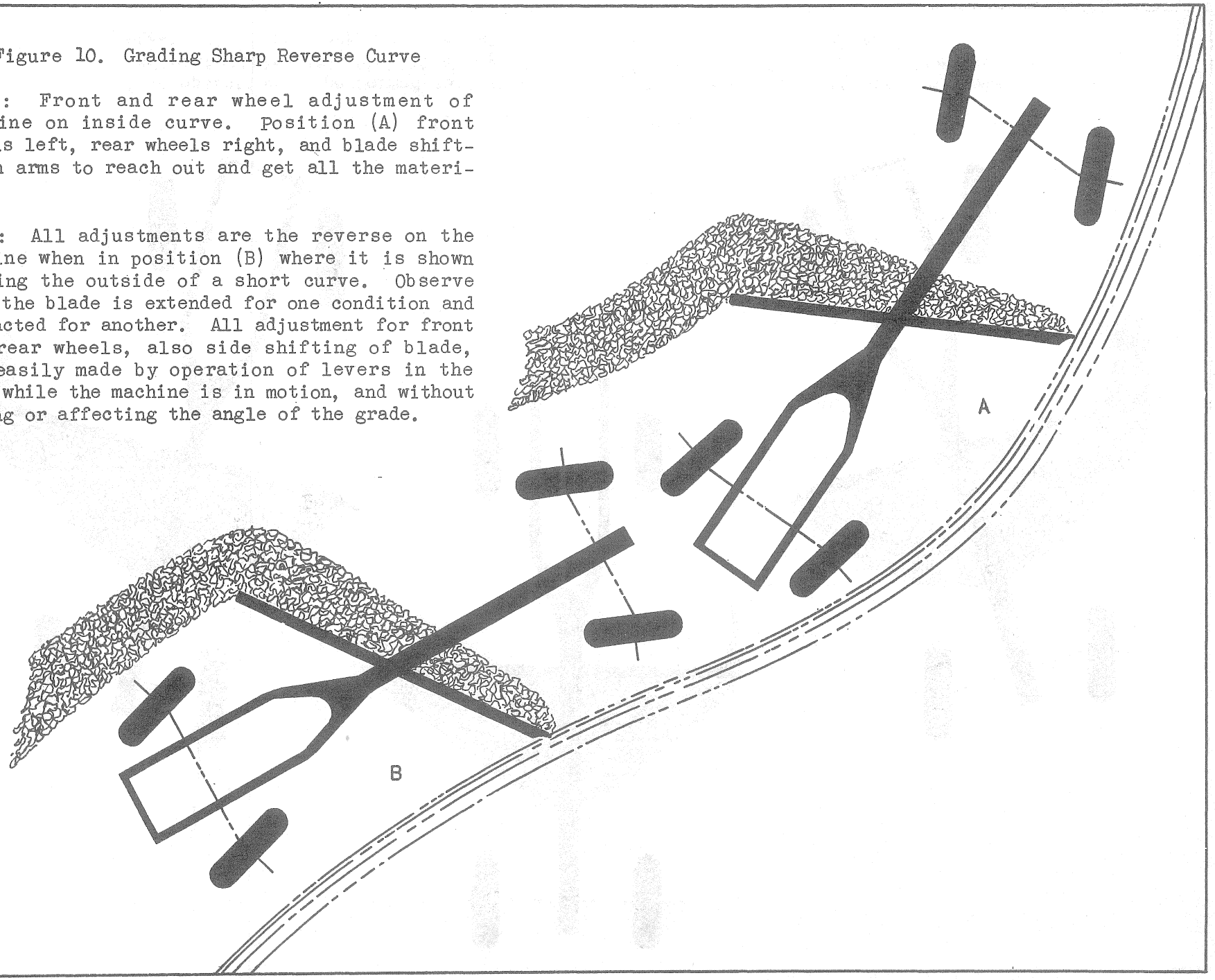
Figure 9. Cutting High and Filling Low Places

This operation is performed easiest by setting the blade square across the frame and controlling the "drifting" by adjusting the rear wheels to suit. The rear wheel adjustment responds to a valve in the cab. It is simple and easy.

Figure 10. Grading Sharp Reverse Curve

Note: Front and rear wheel adjustment of machine on inside curve. Position (A) front wheels left, rear wheels right, and blade shifted on arms to reach out and get all the material.

Note: All adjustments are the reverse on the machine when in position (B) where it is shown working the outside of a short curve. Observe that the blade is extended for one condition and retracted for another. All adjustment for front and rear wheels, also side shifting of blade, are easily made by operation of levers in the cab, while the machine is in motion, and without losing or affecting the angle of the grade.



1. *INSPECTION.*

Before starting to use this grader, be sure to inspect it thoroughly and see that all bolts are tight. Grease and oil carefully all bearings and working parts and see that all operating units are free and easy.

Before starting the engine be sure that the radiator is filled with clean, soft water, the motor crankcase filled to the top line of bayonet gauge with an approved lubricating oil.

Make sure there is oil in the hydraulic tank before starting the engine. To operate the hydraulic pump without oil will mean serious damage to the pump mechanism. The hydraulic pump is driven by a belt from the engine.

2. *ENGINE INSTRUCTIONS.*

Read carefully separate engine instruction book for further details on the engine.

3. *ENGINE OIL FILTER.*

The lubricating oil filter on the "99-M" power grader engine is furnished for the purpose of purifying the oil in the crankcase. Diesel engine filters are more elaborate than gas engine filters, but both should be serviced frequently to avoid contamination of crankcase lubricating oil. A clogged filter becomes useless and will by-pass oil that should be cleaned.

The filters furnished as original equipment have been carefully tested and if serviced as instructed are entirely adequate.

> CAUTION: Do not replace the original filter with another make of filter or add another make of filter to the engine oiling system. Every engine manufacturer is undoubtedly striving to increase the life of his engine and is testing various makes of filters to accomplish this. Therefore, it is obvious, that the engine manufacturer knows what is best for his engine.

Do not run the engine longer than recommended between oil changes. Refer to engine instruction book.

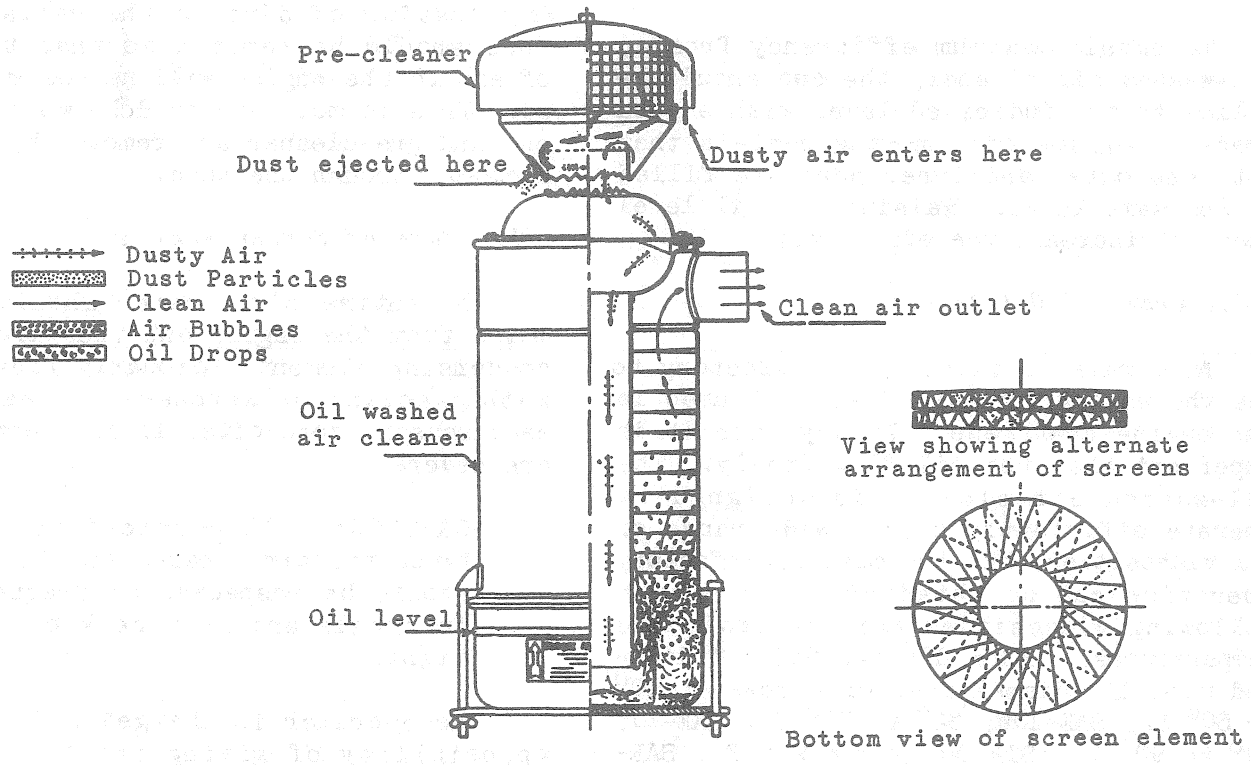


Figure 11. Air Cleaner and Pre-Cleaner

4. ENGINE AIR CLEANER.

.a. General.

The air cleaner on the "99-M" power grader is of the oil bath type and care in following the instructions herewith, together with those on the cleaner name plate itself are most essential. The life of the motor depends largely upon the air cleaner and neglect to service this cleaner will surely cause excessive motor repairs.

Abrasive dust is the chief cause of engine wear. The function of an air cleaner is to prevent the entrance of dirt-laden air into the engine cylinders. In order to remove the dirt efficiently the air cleaner must be properly serviced.

b. Servicing.

Service air cleaner daily or more often under severe dust conditions. Remove oil cup, empty oil and scrape out dirt. Refill to the oil level with new engine oil. Replace oil cup securely. Never remove oil cup while engine is running.

c. Amount of Oil to be Used.

To obtain maximum efficiency from an oil-washed air cleaner, the cup should be filled to the indicated level with a good grade of engine oil, making certain that both the outer and inner cups are filled to the same level. Raising the oil level does not increase the efficiency.

d. Grade of Oil to Use.

As a rule it is quite satisfactory to use the same grade of oil as that used in the engine crankcase. In any case it is important that the oil flow freely. The oil-washed air cleaner is designed to operate efficiently over a wide range of oil viscosities, but the most satisfactory operation can be obtained by using the following viscosities for the indicated temperatures: Below 10° F., SAE-10W diluted with 1/3 diesel fuel or kerosene; 10° to 50° F., SAE-10W; 32° to 70° F., SAE-20; 50° to 90° F., SAE-30; above 90° F., SAE-40.

e. Dirt Holding Capacity.

Never allow more than 1/2" of dirt to collect in the outer cup before servicing. The depth of dirt at the bottom can be measured with a stick, screw driver, or whatever is convenient. Service the air cleaner when the oil appears too thick or heavy to flow freely. A definite periodic inspection is necessary to enable the operator to see when any of these conditions have been reached. The frequency of these inspections depends entirely on the amount of dust in the air. For ordinary operation, daily servicing is recommended.

f. Care of Lower Screens.

Ordinarily, if the correct oil level is maintained, using the proper oil, the wire screen condensing element will need very little attention. However, the bottom of the screen element should be inspected whenever the cleaner is serviced, and any accumulation of chaff, leaves or straw removed.

g. Care of Center Inlet Tube.

Periodic attention must be given to the center inlet tube of the air cleaner. Any coating of dirt on the walls of the tube should be removed so that the flow of air to the engine will not be restricted. This is most easily done when the oil cup and pre-cleaner are removed by ramming a cloth through the tube.

h. Care of Screen Element.

The entire air cleaner should be removed from the engine and the wire screen condensing element thoroughly flushed out with gasoline or kerosene at least once each season, more often if dust conditions are severe.

> CAUTION: All connections between the air cleaner and engine should be inspected at frequent intervals and must be kept air tight.

The operator is charged with the responsibility of giving the air cleaner regular and proper attention according to

these instructions. Maximum engine life cannot be obtained without proper care of the air cleaner.

In dusty operating conditions, it may be necessary to service the air cleaner as many as five times per ten hours of operation.

5. HYDRAULIC SYSTEM.

a. Hydraulic Pump.

The hydraulic pump is a small, important unit and should be handled with care. Do not attempt to dismantle it. Loss of volume will more than likely be due to loose connections or to a clogged screen in the hydraulic oil strainer. We strongly recommend leaving the pump alone. Should anything occur that would lead you to believe that the pump might be in need of repair, procure another pump from your nearest Austin-Western Distributor and return the old one to the distributor.

> CAUTION: If the seal on a returned hydraulic pump is broken, the warranty on the pump will be void. Because of this, we strongly recommend that you do not attempt to adjust or make repairs to pump locally.

Care must be exercised during assembly of pump to support bracket, that screws are tightened moderately and evenly.

Precise alignment with drive shaft must be maintained when mounting and piping.

To adjust pump drive belt, remove pump pulley cap screws and transfer shim or shims from between pulley flanges to a position under cap screw heads.

When installing a new or exchange pump, be sure to pack the exposed bearing with a fibrous grease similar to Texaco Marfak #2 before mounting pump on bracket.

b. Hydraulic Oil Reservoir or Tank. (See Fig. 12 for all References)

The hydraulic oil reservoir or tank, Ref. 75, is located between the two main frame rails below the radiator. It is filled thru the inlet filter, Ref. 85, which is located at the right side of radiator on the main frame. (See Para. 5-C).

At the bottom of the hydraulic oil reservoir or tank is a drain plug and handhole from which sludge can be removed when draining or cleaning the system. Draining and cleaning the oil system may be necessary after the first week of operation due to the accumulation of pipe scale, threading cement, or abrasives. In any event, drain and clean it at least twice a year.

c. Hydraulic Oil Inlet Filter.

The hydraulic oil inlet filter, Ref. 85, is located at the right side on the main frame near the rear end of the machine. The oil enters the hydraulic system thru this inlet filter where the filtering medium (#1 cotton white waste) eliminates any dust or dirt that might accidentally be poured in. If hydraulic oil poured into the inlet filter does not go thru as fast as it should, it may be due to clogged or dirty waste, in which case the cover should be removed and a new supply of waste put in. In so doing, first soak the waste in hydraulic oil, squeezing it dry before putting it into filter.

d. Hydraulic Oil Strainer.

There is a suction line strainer, Ref. 50, between the tank and the pump. This strainer will be found on the front side of the hydraulic reservoir. To clean the strainer, unscrew the hex nut, Ref. 51, on top of the tank casting or head, Ref. 53, and let the tank down; remove screen, Ref. 56, wash out thoroughly with air and kerosene, and reinsert.

A coil spring, Ref. 57, is used to hold the screen tightly up against the head: Be sure that this spring is not lost in cleaning operation, otherwise screen will drop to bottom of tank and become useless.

Be careful not to lose or destroy small gasket, Ref. 54, (between tank and head) and copper washer, Ref. 52, under nut, Ref. 51. This strainer will probably need more attention than any other item

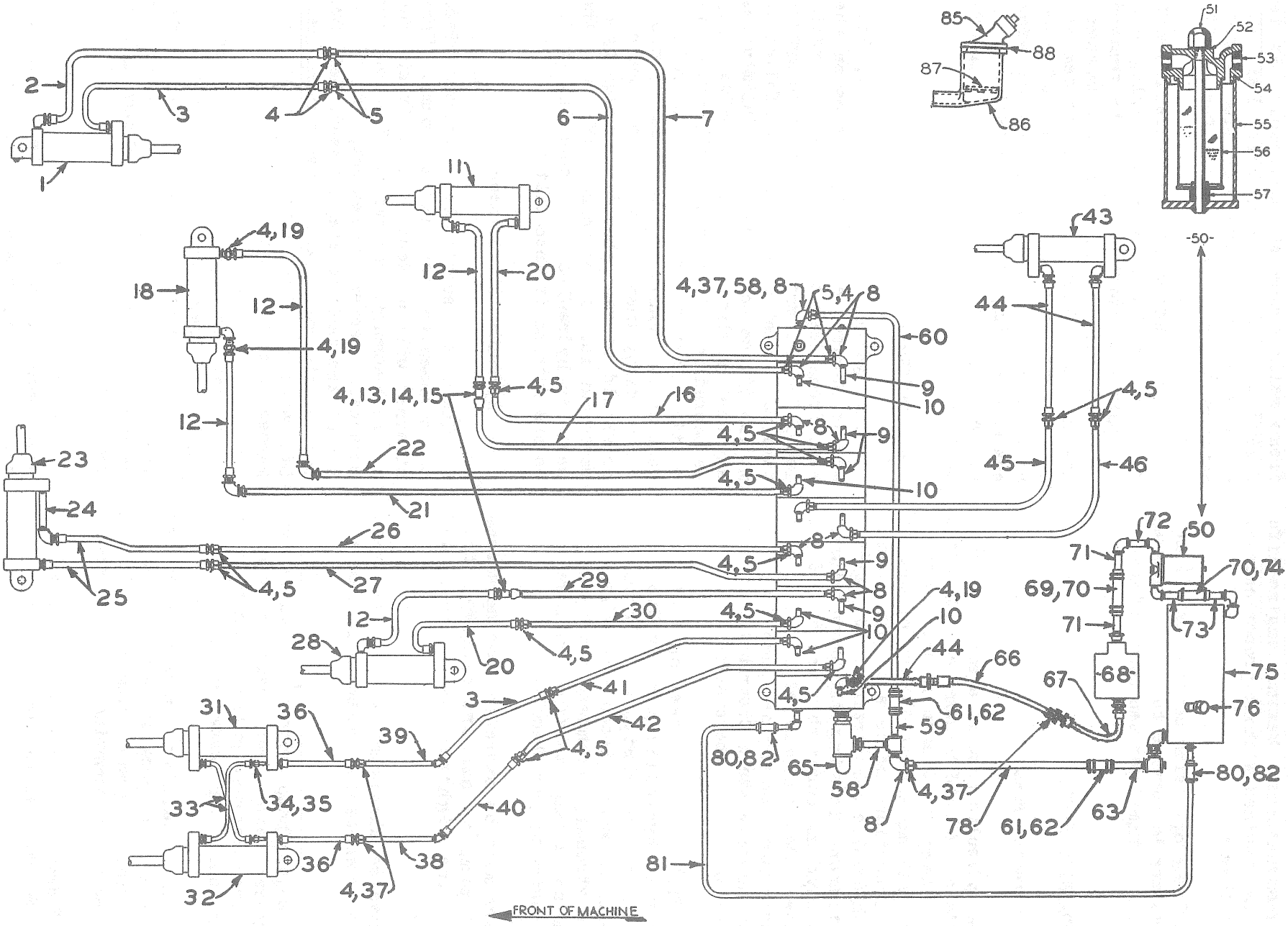


Figure 12. Hydraulic System (Piping Diagram)

Key to Hydraulic System (Piping Diagram) - Refer to Figure 12

REF.	DESCRIPTION
1.	Scarifier ram
2.	Hydraulic hose
3.	Hydraulic hose
4.	Union ring
5.	Union tail piece
6.	Pipe
7.	Pipe
8.	Union elbow
9.	Nipple
10.	Nipple
11.	Blade lift ram-R.H.
12.	Hydraulic hose
13.	Check valve body
14.	Check valve body seat
15.	Check valve body spacer
16.	Pipe
17.	Pipe
18.	Front steer ram
19.	Union tail piece
20.	Hydraulic hose
21.	Pipe
22.	Pipe
23.	Blade side shift ram
24.	Pipe
25.	Hydraulic hose
26.	Pipe
27.	Pipe
28.	Blade lift ram-L.H.
29.	Pipe
30.	Pipe
31.	Circle reverse ram-R.H.
32.	Circle reverse ram-L.H.
33.	Hydraulic hose
34.	Coupling
35.	Adapter
36.	Hydraulic hose
37.	Union tail piece
38.	Pipe
39.	Pipe
40.	Hydraulic hose
41.	Pipe
42.	Pipe
43.	Rear steer ram
44.	Hydraulic hose
45.	Pipe
46.	Pipe
50.	Hydraulic oil strainer
51.	Nut
52.	Washer
53.	Head
54.	Gasket
55.	Tank
56.	Screen
57.	Spring
58.	Pipe
59.	Pipe
60.	Pipe
61.	Hose
62.	Hose clamp
63.	Pipe
65.	Relief valve
66.	Pipe
67.	Hydraulic hose
68.	Hydraulic oil pump
69.	Hose
70.	Hose clamp
71.	Pipe
72.	Pipe
73.	Pipe
74.	Hose
75.	Hydraulic oil tank
76.	Breather cap
78.	Pipe
80.	Hose
81.	Pipe
82.	Hose clamp
85.	Cover
86.	Body
87.	Screen
88.	Gasket

and should be your first thought in case of sluggish operation or failure of the oil to properly move the rams.

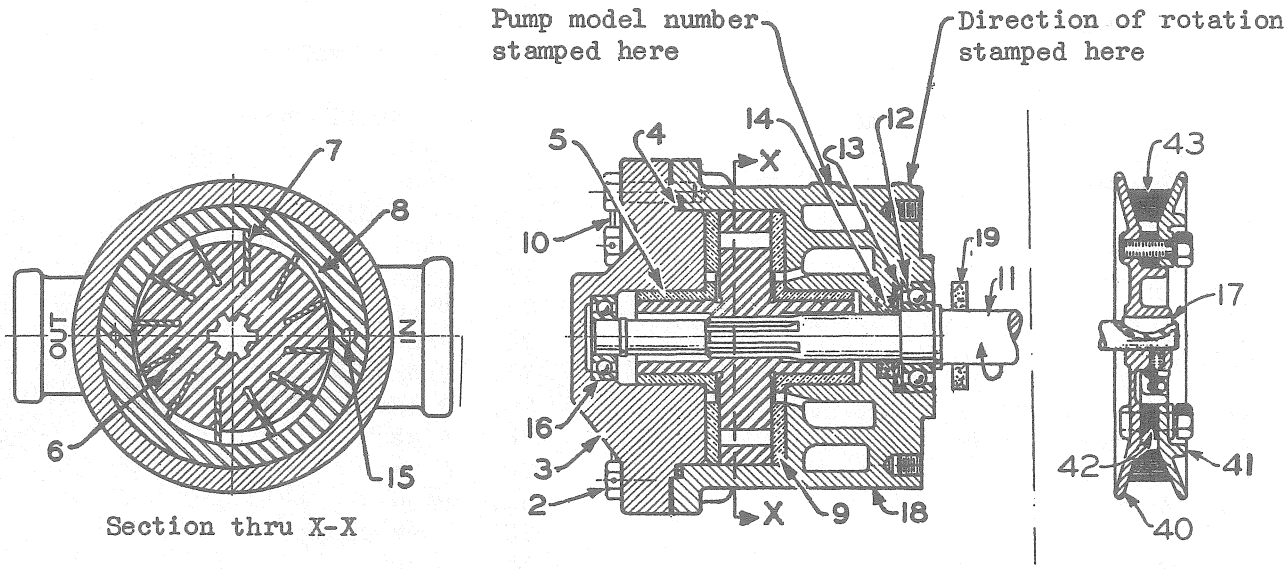
e. Hydraulic Oil.

The oil in the hydraulic system can be contaminated by dust of a gritty nature that is finer than the openings in the screen of the hydraulic oil strainer. By maintaining the quality of the oil in the hydraulic system, you increase the life of the pump, valves and rams, and you also keep your machine at a high degree of efficiency. Change the hydraulic oil frequently (at least twice a year). Flush out supply tank thoroughly using clean hydraulic oil only. Keep oil supply free from dust.

The kind of oil to use in the hydraulic system is SAE-10W for temperatures above 32° F. For temperatures below 32° F. use ice machine oil having a pour point of minus 40 and a viscosity of 100 seconds at 100° F. Using a heavier oil than the above will cause air bubbles and foaming. Either a parafin or asphalt base oil will be acceptable.

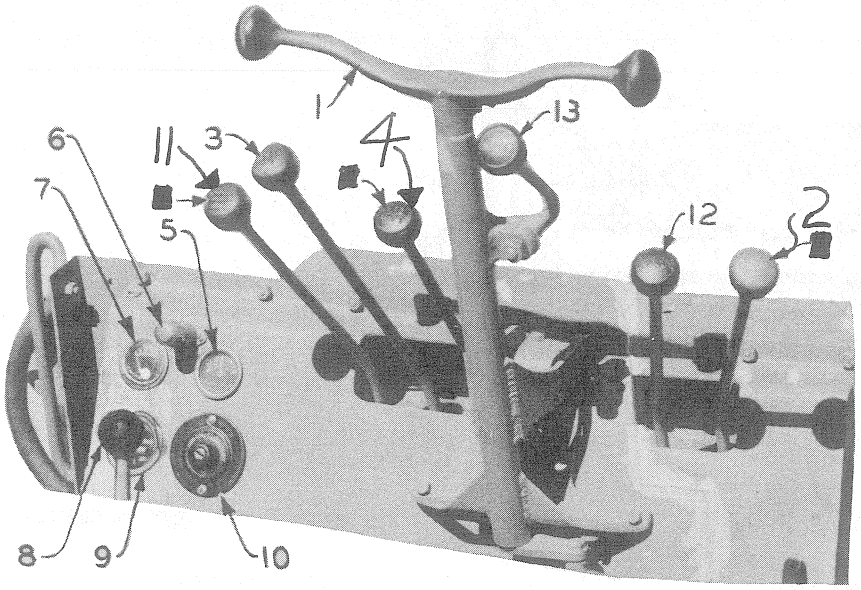
f. Hydraulic Relief Valve.

The relief valve, Ref. 65, has been properly set at the factory and should not be tampered with. Should loss of power occur (slow action in the rams or a howling noise in the pump) your trouble is most likely due to a clogged screen in the hydraulic oil strainer or to the quality of oil. The proper setting of the relief valve is 700 pounds.



REF.	DESCRIPTION	REF.	DESCRIPTION
2.	Cap screw	13.	Gland
3.	Head	14.	Packing
4.	Packing	15.	Ring pin
5.	Bushing	16.	Bearing
6.	Rotor	17.	Woodruff key
7.	Vane	18.	Body
8.	Ring	19.	Felt
9.	Bushing	40.	Pulley-inner half
10.	Wire	41.	Pulley-outer half
11.	Shaft	42.	Shim
12.	Bearing	43.	Pump belt

Figure 13. Hydraulic Pump



REF.	*DESCRIPTION*	*REF.*	*DESCRIPTION*
1.	Front steer	7.	Oil gauge
2.	Scarifier, snow plow or bulldozer	8.	Transmission gear shift
3.	Left hand blade lift	9.	Temperature gauge
4.	Blade side shift	10.	Light and ignition switch
5.	Ammeter	11.	Circle reverse
6.	Dash light	12.	Right hand blade lift
		13.	Rear steer

Figure 14. Hydraulic Valve Controls

Never attempt to set relief valve without using a pressure gauge, as too high relief valve setting will materially shorten life of hydraulic working parts.

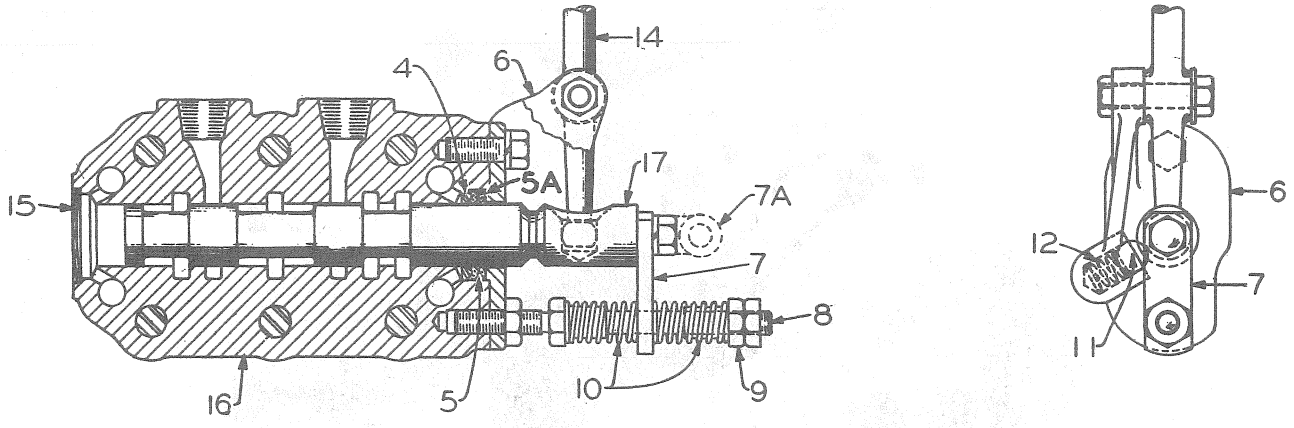
g. Hydraulic Control Valves.
(See Fig. 15 for all References)

The control valves which are located in front of the dash panel are operated by ball handled levers, see Fig. 14. A separate valve is used to control each operating ram, and all the valve bodies are bolted together to form a single unit. Each valve is held in a neutral position by two springs, Ref. 10, Fig. 15.

CAUTION: (See Fig. 15) Never remove valve plug from body when replacing valve stem chevron. When installing new chevrons, Ref. 5, add sufficient shims, Ref. 5A, causing the chevron to slightly squeeze the valve plug, Ref. 17. Insufficient shims, Ref. 5A, will cause oil leakage. Inserting too many shims may cause chevron, Ref. 5, to squeeze onto the valve plug, Ref. 17, in such fashion that return springs, Ref. 10, will not bring the valve plug, Ref. 17, into a neutral position. Adjusting nuts, Ref. 9, are provided for positioning springs, Ref. 10, to return the valve plug, Ref. 17, to a neutral position. Do not turn or alter the position of nuts located at each end of the six rods which run through the seven valve bodies and the two valve body ends.

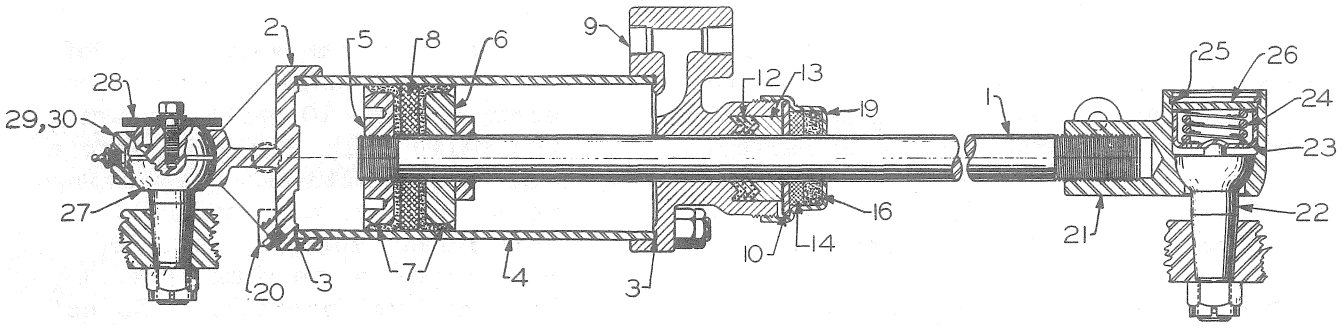
h. Hydraulic Hose.

The connecting hose and tubing is amply strong to stand the pressures encountered. Constant vibration may tend to loosen some of the fittings and they should be inspected occasionally and tightened with special wrenches provided. In disassembling any fitting except at union, be sure to apply a good grade of acid-free pipe threading cement. A good mechanic will stop all leaks or learn the cause of them.



REF.	DESCRIPTION
4.	Seal ring
5.	Chevron packing ring
5A.	Paper shim
6.	Bracket
7.	Strap
7A.	Yoke end
8.	Stud
9.	Sleeve nut
10.	Spring
11.	Steel ball
12.	Spring
14.	Control lever
15.	Welch plug
16.	Valve body
17.	Valve plug

Figure 15. Hydraulic Control Valve



REF.	DESCRIPTION
1.	Piston rod
2.	Base
3.	Gasket
4.	Cylinder
5.	Outer spreader
6.	Inner spreader
7.	Cup
8.	Piston
9.	Head
10.	Retainer
12.	Chevron packing ring
13.	Press ring
14.	Felt
16.	Leather wiper
19.	Cap
20.	Tie rod
21.	Socket
22.	Ball stud
23.	Spring seat
24.	Spring
25.	Lock wire
26.	Plug
27.	Ball stud
28.	Washer
29.	Ball cap
30.	Ball cap shim

Figure 16. Front Axle Steering Ram

i. Hydraulic Ram Cylinders.
(See Fig. 17. for all References)

Ram cylinders should require little or no attention. The cylinder walls are of special annealed quality steel and pistons are of special construction to eliminate scoring by the use of special molded cups and spacer shoes. The piston rod gland contains a special packing ring assembly and care should be taken not to turn the nut too tightly as this destroys the feather-edged action of the "V" shaped rings, Ref. 11. In making cylinder cup replacements, do not replace with leather or other questionable material as the special moulded duck cups, Ref. 5, supplied as original equipment are the only type recommended. Each cylinder has a special wiper ring, Ref. 15, and felt, Ref. 13, in the gland to prevent the entry of dirt in the packing chamber. The wiper ring and felt have an important function and should be inspected frequently and replaced when necessary.

The service instructions in paragraph 5-I (with exception of Ref. Nos.) also apply to the two blade lift rams, Fig. 18.

The head, Ref. 14, is at the bottom when the ram is attached to the machine.

The downward speed of both piston rods, Ref. 1, is regulated by the two special valves, Ref. 4,13,14,15, Fig. 12, attached to the hoses, Ref. 12.

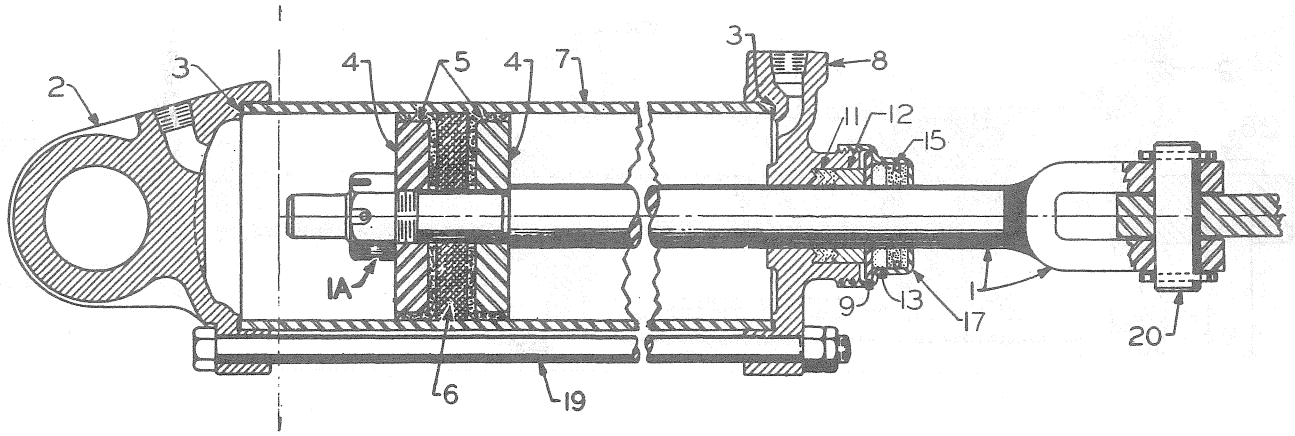
The service instructions in paragraph 5-I (with exception of Ref. Nos.) also apply to the two circle reverse rams, Fig. 19.

The piston rod, Ref. 1, has an oil metering hole, Ref. A, drilled into the side of the rod, and this hole connects with another hole drilled into the end of the rod, at Ref. B.

The purpose of metering hole, Ref. A, is to permit oil to flow from chamber A to B, or vice versa, thereby acting as a safety device.

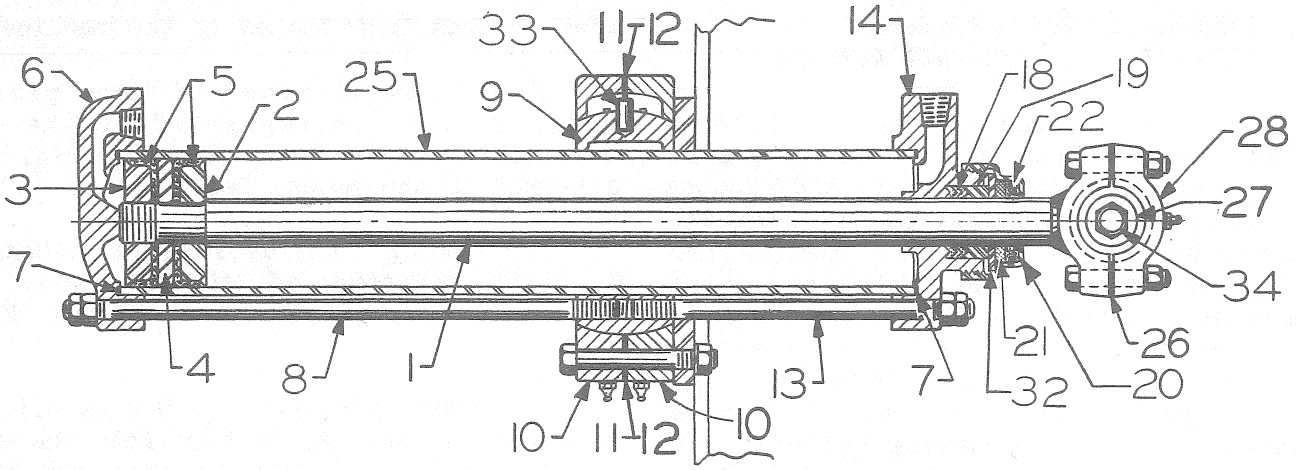
The service instructions in paragraph 5-I (with exception of Ref. Nos.) also apply to the blade side shift ram, Fig. 20.

Nut, Ref. 31, should only be tightened sufficiently to remove all end clearance between parts, Ref. 2, 3 and 4, after



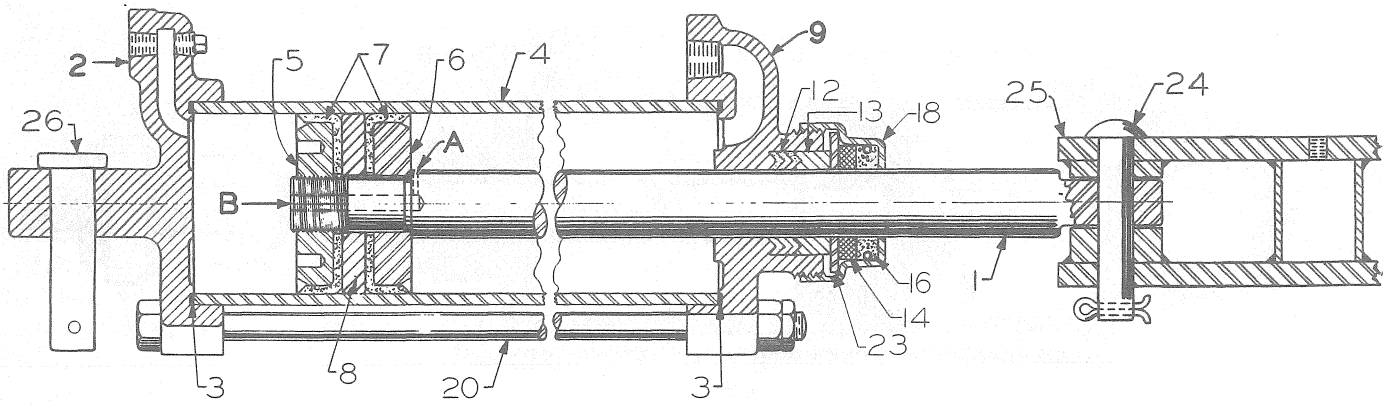
REF.	DESCRIPTION
1.	Piston rod
1A.	Slotted nut
2.	Base
3.	Gasket
4.	Spreader
5.	Cup
6.	Piston
7.	Cylinder
8.	Head
9.	Retainer
11.	Chevron packing ring
12.	Press ring
13.	Felt
15.	Leather wiper
17.	Cap
19.	Tie rod
20.	Pin

Figure 17. Scarifier Ram



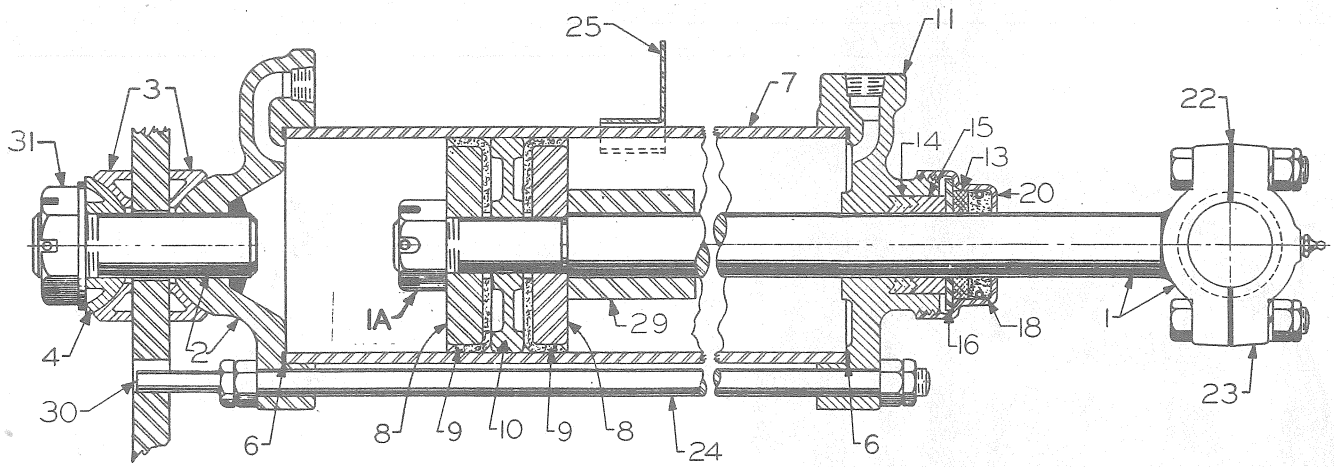
REF.	DESCRIPTION
1.	Piston rod
2.	Inner spreader
3.	Outer spreader
4.	Piston
5.	Cup
6.	Head
7.	Gasket
8.	Tie rod
9.	Ball
10.	Cap
11.	Shim
12.	Shim
13.	Tie rod
14.	Head
18.	Chevron packing ring
19.	Press ring
20.	Cap
21.	Felt
22.	Leather wiper
25.	Cylinder
26.	Shim
27.	Ball
28.	Cap
32.	Retainer
33.	Pin
34.	Bolt

Figure 18. Blade Lift Ram



REF.	DESCRIPTION
A.	Drilled oil hole
B.	Drilled oil hole
1.	Piston rod
2.	Base
3.	Gasket
4.	Cylinder
5.	Outer spreader
6.	Inner spreader
7.	Cup
8.	Piston
9.	Head
12.	Chevron packing ring
13.	Press ring
14.	Felt
16.	Leather wiper
18.	Cap
20.	Tie rod
23.	Retainer
24.	Pin
25.	Circle reverse lever
26.	Pin

Figure 19. Circle Reverse Ram



REF.	DESCRIPTION
1.	Piston rod
1A.	Slotted nut
2.	Base
3.	Ball socket
4.	Ball plate
6.	Gasket
7.	Cylinder
8.	Spreader
9.	Cup
10.	Piston
11.	Head
13.	Felt
14.	Chevron packing ring
15.	Press ring
16.	Retainer
18.	Leather wiper
20.	Cap
22.	Shim
23.	Cap
24.	Tie rod
25.	Hose clamp
29.	Spacer
30.	Tie rod
31.	Ball plate nut

Figure 20. Blade Side Shift Ram

which a cotter pin should be inserted thru the nut and stud, Ref. 31.

6. *BLADE CIRCLE.*
(See Fig. 21 for all References).

The blade circle, Ref. 2, is manually unlatched for reversing, by a cable, Ref. 44, connected to a handle located in the cab. A coil spring, Ref. 47, is provided to retain the latch, Ref. 46, in the locked position. Be sure that the latch drops into locked position before proceeding with the grading operation, as the reversing cylinders, Ref. A, are not intended to resist the rotating load while working. Make sure the circle is locked before releasing the circle reverse valve lever. The side shift of the blade is controlled by a ram which does not have a lock. The blade can be side shifted while working.

7. *BLADE CIRCLE ANTI-CHATTER.*

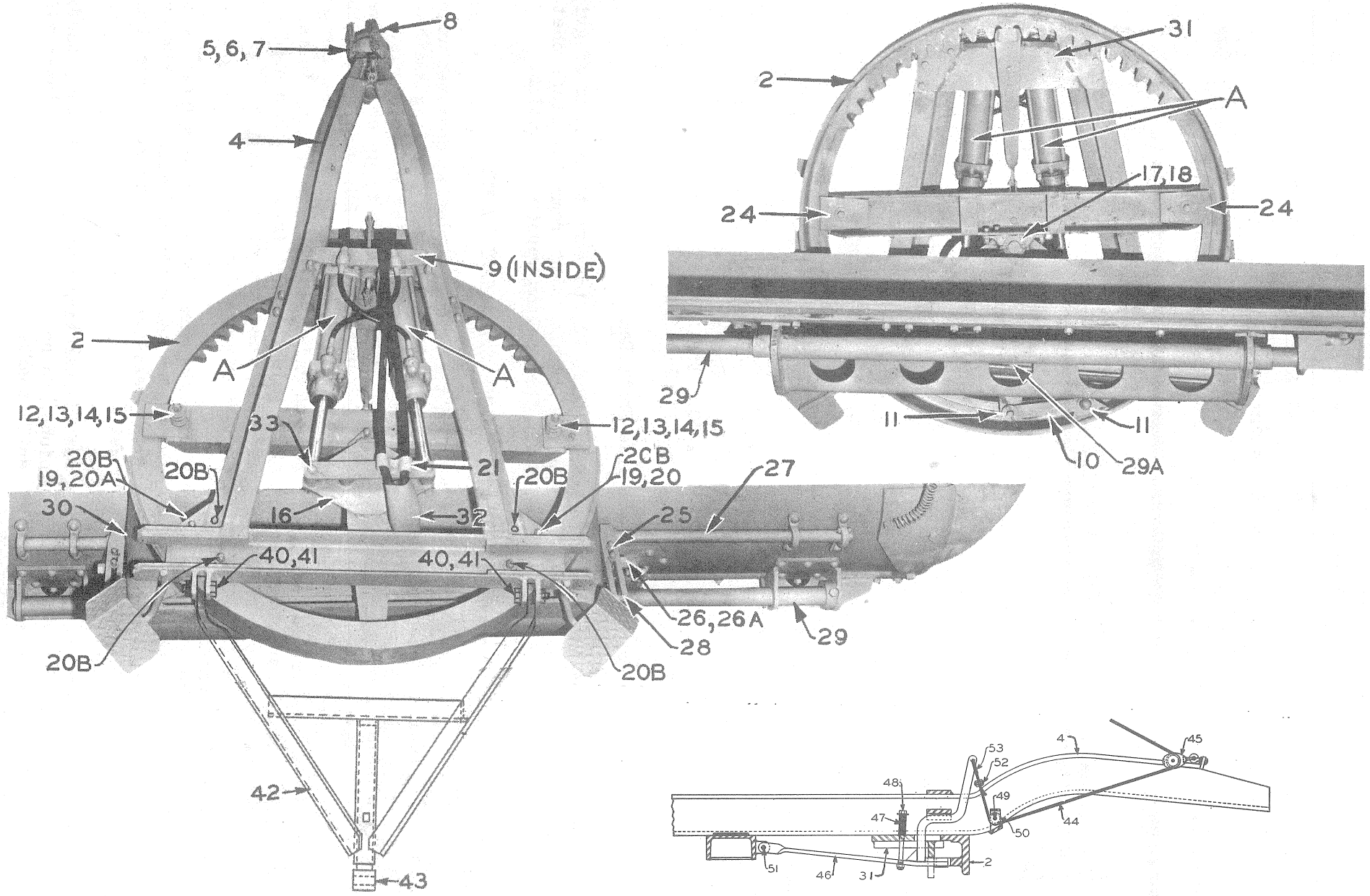
The tension of the anti-chatter springs, Ref. 12, are adjusted by the threaded bolt, Ref. 13, to vary the amount of grip on the circle, thus removing blade chatter. They seldom require attention.

8. *BLADE SIDE SHIFT SHAFTS.*

When the machine is being operated under muddy conditions during freezing weather, always apply a coating of anti-rust or water resistant grease to upper and lower shafts, Ref. 27 and 29, for easy side shifting of blade. Plug, Ref. 29A, can be removed and a Zerk grease fitting installed to inject grease into the tube when required. The tube over upper shaft, Ref. 27, has two grease fittings.

When the machine is not being used, coat the shafts and moldboard with anti-rust or water resistant grease to keep them from rusting.

When operating under dry or dusty conditions, do not grease upper and lower side shift shafts.



View showing circle latch mechanism

Figure 21. Segment and Circle

Key to Segment and Circle - Refer to Figure 21

REF.	DESCRIPTION
A.	Circle reverse ram
2.	Circle
4.	Gooseneck
5.	Ball socket
6.	Shim
7.	Draft ball
8.	Ball socket
9.	Spacer pipe
10.	Reverse arm link
11.	Pin
12.	Anti-chatter spring
13.	Anti-chatter spring bolt
14.	Anti-chatter spring washer
15.	Anti-chatter spring spacer
16.	Circle reverse lever
17.	Reverse arm bracket
18.	Washer
19.	Rear support shim
20.	Rear support-R.H.
20A.	Rear support-L.H.
20B.	Washer
21.	Hydraulic hose strap
24.	Anti-chatter plate
25.	Washer
26.	Stud
26A.	Block
27.	Upper shaft
28.	Tilt link
29.	Lower shaft
29A.	Pipe plug
30.	Tube
31.	Circle front plate
32.	Rubber hose guard
33.	Pin
40.	Bolt
41.	Bolt nut
42.	"A" frame
43.	End shaft
44.	Latch cable
45.	Sheave block
46.	Latch lever
47.	Circle latch spring
48.	Latch spring bolt
49.	Pulley pin
50.	Pulley
51.	Pin
52.	Cable clamp
53.	Cable thimble

9. *FRONT AXLE.*

The front axle unit of the "99-M" power grader is of the double reduction type. The drive from the propeller shaft to the front axles is made first through a spiral pinion and bevel gear, and then through a pinion and spur gear fully enclosed, running in oil. It is equipped with dust proof oil seals and mounted on anti-friction bearings throughout.

A differential is incorporated between the two axle shafts.

In making repairs to parts located at either end of main axle housing, including replacing the drive shafts, it is unnecessary to remove the main axle housing from front end of power grader frame. However, should repairs be necessary to gear carrier or main axle housing itself, then axle assembly must be removed from frame. If possible, place the machine on a level place and block rear wheels securely.

If machine can be operated, it will be easier to wash out the main axle housing before disassembly is started. First remove the drain plug and allow all the oil to flow from gear case. Then refill the case with kerosene or diesel fuel.

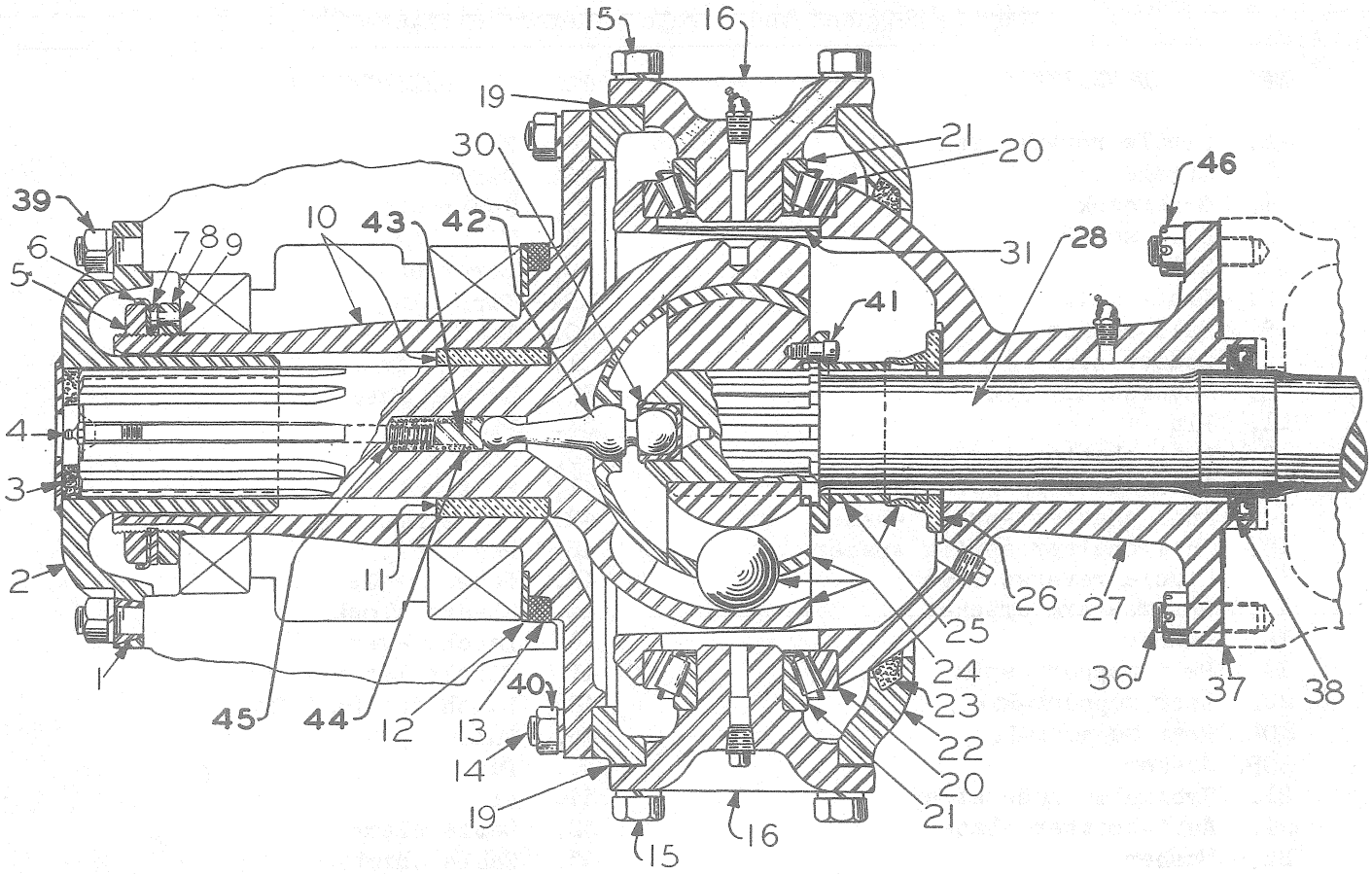
> CAUTION: Do not use gasoline as it is dangerous because it may explode and cause a fire. Run machine with the kerosene or fuel oil in gear case for several minutes both forward and reverse and drain gear case. If you wish to get it absolutely clean, refill case a second time with clean kerosene or diesel fuel and repeat washer operation.

10. *FRONT WHEEL REMOVAL.*
(See Fig. 22 for all References)

Both wheels are attached in the same manner, so the following will apply to either right or left hand wheel.

1. Remove the eight nuts, Ref. 39, from the drive flange studs.

2. Remove the drive flange, Ref. 2.



REF.	DESCRIPTION
1.	Dowel bushing
2.	Drive flange
3.	Felt
4.	Grease fitting
5.	Lock nut
6.	Lock washer
7.	Washer
8.	Adjusting nut
9.	Adjusting nut pin
10.	Steering knuckle
11.	Steering knuckle bushing
12.	Washer
13.	Felt
14.	Stud
15.	Cap screw
16.	Pivot bearing cap
19.	Shim
20.	Bearing cup
21.	Bearing cone and rollers
22.	Knuckle flange

REF.	DESCRIPTION
23.	Felt
24.	Drive joint group
25.	Joint and shaft retainer
26.	Thrust washer
27.	Trunnion socket
28.	Axle shaft
30.	Pilot pin seat
31.	Grease retainer
36.	Stud
37.	Gasket
38.	Oil seal
39.	Hex nut
40.	Hex nut
41.	Joint retainer screw
42.	Pilot pin
43.	Pilot pin plunger
44.	Plunger spring-large
45.	Buffer spring-small
46.	Slotted nut

Figure 22. Front Axle Steering Knuckle and Universal Joint

There are four tapered dowel bushings, Ref. 1, placed over four of the studs holding the flange in place. These dowel bushings may stick to the studs or bind in tapered holes. They can usually be jarred loose by striking the drive flange sharply near each dowel. This should cause them to loosen and pop out slightly. You can then remove them with a pair of pliers.

If the drive flange still sticks too tightly to be pulled off by hand, secure a couple of 1/2" hardened set screws to remove the flange. Lubricate the threads of hardened set screws well before inserting them in the threaded holes provided in the drive flange. Be sure to clean the threaded holes carefully and blow out all dirt present. The flange can then be forced off by screwing the set screws in through the flange against the wheel face.

3. Unlock the bent over edge of lock washer, Ref. 6, and remove the hub bearing lock nut, Ref. 5.

4. Remove the lock washer, Ref. 6.

5. Remove the drilled washer, Ref. 7.

6. Remove the adjusting nut (with pin), Ref. 8.

7. Jack up on axle housing inside of wheel till wheel clears ground.

8. Place a well greased metal plate under the tire, and lower jack until weight of wheel only rests on plate.

9. Slide the wheel off. Be sure to catch the bearing cone, forced off by wheel, so it does not fall on the ground and become dirty.

10. If the hub bearing felt, Ref. 13, is worn or damaged, replace it by prying off the inner bearing and removing the washer, Ref. 12, and felt, Ref. 13.

11. Be sure to wash all the old grease from inside the wheel and from axle end and bearings. Repack the bearings with wheel bearing grease when reassembling. If bearings show any flat spots or chipping, replace both cone and cup.

12. In reassembly after replacing the wheel and outer bearing, replace the adjusting nut, Ref. 8, (with pin on outside). Tighten this nut up snugly. (Do not back it up for bearing clearance, as none is needed or desirable). The slight pre-load thus put on the wheel bearings will prevent any load misalignment due to working strains.

13. Replace the drilled washer, Ref. 7. Be sure one of the holes aligns with the pin protruding from the adjusting nut, Ref. 8. If they fail to align, try taking the washer off and turning other side inward. If this fails to align the pin and a hole in washer, then the nut will have to be loosened slightly.

14. Replace the lock washer, Ref. 6.

15. Replace and securely tighten the lock nut, Ref. 5.

16. Bend one edge of the lock washer, Ref. 6, so as to firmly fix the lock nut, Ref. 5.

17. Replace the drive flange, Ref. 2.

18. Replace the four tapered split dowel bushings on proper studs.

19. Replace lock washers and nuts on all studs.

20. Tighten the four nuts on dowel bushing studs first.

21. Tighten remainder of stud nuts.

22. Check all nuts and retighten if necessary after operating grader about an hour and again after a day's operation.

11. FRONT UNIVERSAL JOINT WITH AXLE SHAFT REMOVAL. (See Fig. 22 for all Ref.)

a. Follow the instructions in paragraph 10 covering wheel removal.

b. Remove the twelve nuts, Ref. 40, and lockwashers from studs, Ref. 14.

c. Loosen the eight cap screws, Ref. 15.

d. Remove the steering knuckle, Ref. 10.

e. Grasp the splined end of universal joint now exposed and carefully pull the

joint, with axle shaft attached, out of housing. Be especially careful not to damage the oil seal, Ref. 38. There is another seal at inner end of axle shaft near the differential, see Fig. 25, Ref. 45. Use care not to damage these seals when reassembling.

f. Place the universal joint and axle assembly on a bench (or a box if bench is not available) and remove the lock wire and six cap screws, Ref. 41. Be sure to lock these screws with a new wire when reassembling.

g. The universal joint can now be slid off the end of axle shaft. Be careful not to lose the pilot pin, Ref. 42, the plunger, Ref. 43, or the springs, Ref. 44 and 45. When the axle is out of joint, these parts are loose, and may fall out.

h. The joint shaft retainer, Ref. 25, can now be removed from axle shaft by sliding it off the inner end.

i. Wash all parts carefully with kerosene and check them carefully before reassembly.

j. If axle shaft is replaced be sure that the pilot pin seat, Ref. 30, is in place in end of shaft, and that the springs, Ref. 44 and 45, the plunger, Ref. 43, and the pilot pin, Ref. 42, are properly in place inside of the universal joint as shown.

12. *FRONT AXLE UNIVERSAL JOINT DISASSEMBLY. (For Cleaning and Inspection Purposes Only) (See Fig. 23)*

a. Whenever the joint is removed from its housing for any purpose, it is a good idea to wash it and inspect it. If it is desired to disassemble it, study Fig. 23, and follow the procedure outlined below.

b. By pushing down on one side of inner race, the opposite side will automatically come up, Illustration 4, and one ball can then be removed. By pressing down at another point, another ball can be removed, and so on until all balls are removed.

c. Straighten the cage and inner race and roll them upside down, Illustration 3.

d. Lift off the pilot, Illustration 3.

e. Continue rolling the cage and inner race until they are standing on edge, Illustration 2. If the rectangular slots are not aligned with outer race, revolve the cage slightly to align. Then lift inner race and cage out.

f. Roll the inner race right angles to the cage so that one lug projects through one rectangular slot in cage. Remove inner race from cage, Illustration 1.

g. Clean and inspect all parts. If excessively worn, chipped or cracked, procure a new drive joint group from your nearest Austin-Western Distributor and return the old one to the distributor. It is not practical to replace any parts in a used joint with new parts. Therefore, the entire joint group must be replaced as a unit.

13. *FRONT WHEEL STEERING KNUCKLE DISASSEMBLY. (See Fig. 22 for all Ref.)*

a. Follow the instructions in paragraph 11 covering universal joint with axle shaft removal.

b. Remove the lock wire and nuts from the eight studs, Ref. 46, in outer end of axle main housing.

c. Remove the tie rod fork bolt, Ref. 10, Fig. 24.

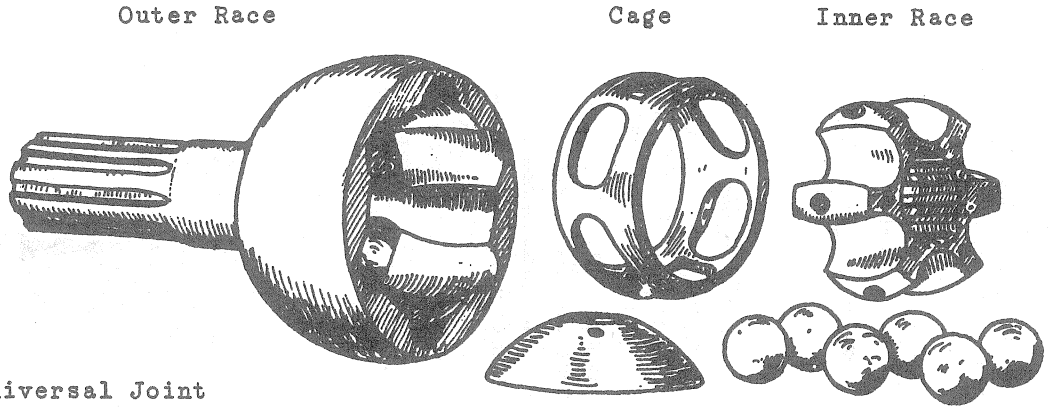
d. Pull the entire trunnion and knuckle flange off the studs. It may stick and require force to remove it. At this point, it is well to check the seal, Ref. 38, in end of trunnion socket, and replace it if necessary. Be sure to oil it well before reassembling.

e. Remove the four cap screws, Ref. 15, from top pivot bearing cap, Ref. 16, and remove the cap and shims, Ref. 19. Keep the cap and shims together. (It will be well to tie them together if original parts are to be reassembled again).

f. Now remove the lower pivot bearing cap, Ref. 16, following the same procedure used to remove the upper pivot bearing cap, Ref. 16.

g. Slip the knuckle flange, Ref. 22, off flanged (inner) end of trunnion socket, Ref. 27.

Pilot Springs and Plunger | Pilot Pin | Pilot Seat



Parts of Universal Joint

Universal Joint Assembly

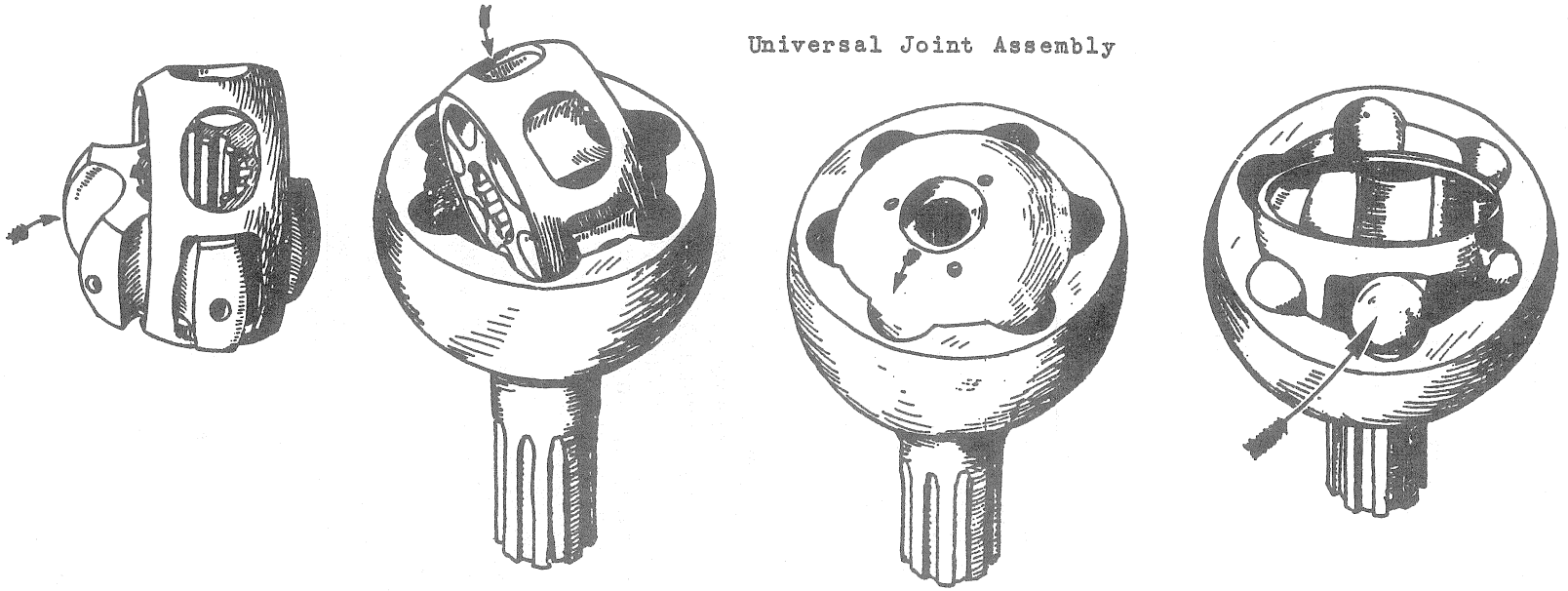


Illustration 1

Removing or Inserting Inner Race Into Cage

Illustration 2

Removing or Inserting Inner Race and Cage Into Outer Race

Illustration 3

Removing or Inserting Pilot

Illustration 4

Removing or Inserting Balls

Figure 23. Universal Joint

h. The felt, Ref. 23, can now be removed and replaced with a new one, if necessary.

i. For reassembling, reverse the above procedure.

> CAUTION: Before reassembling, be sure to wash and inspect all parts carefully. Cleanliness is most essential in preventing wear.

14. *FRONT WHEEL PIVOT BEARING ADJUSTMENT. (Ref. 20 and 21) (With the Wheel Removed but Steering Knuckle still on the Power Grader) (See Fig. 22 for all References)*

a. Remove the four cap screws, Ref. 15, from top pivot bearing cap, Ref. 16, and remove the cap and shims, Ref. 19. Keep the cap and shims together. (It will be well to tie them together so they can be easily assembled in the original position). Mark the cap, Ref. 16, so it can be put back in the original position.

b. Carefully wash out the bearing cup, Ref. 20, and its compartment. Be sure to remove all grit and chips present. Wash bearing cone and rollers carefully. If bearings show signs of chipping or flat spots, replace both the cup and the cone with new ones.

c. Remove the lower pivot bearing cap, Ref. 16, with shims, Ref. 19. Keep these together for reassembly in original position.

d. Wash the bearing cone and rollers and cup carefully. If there are any signs of chipping or flat spots, replace both the cup and the cone with new ones.

e. Pack the bearings with grease and reassemble both caps with shims in original positions.

f. Tighten the cap screws, Ref. 15, evenly on both caps.

g. If there is any end play in bearings, they will have to be adjusted by removing equal amounts of shim thickness from both top and bottom. If too tight, add new shims to both top and bottom of same thickness. Continue this adjustment until the play is just out of bearings when screws are tight, then remove a thin shim (.007") from under both the top and the bottom bearing cap. This will bind the bearings slightly and is called pre-loading. This is done to eliminate slight play from existing when these bearings are actually carrying the weight of machine while at work. The shims are of three different thicknesses, namely, .005", .007" and .020".

> CAUTION: The cap screws, Ref. 15, holding top and bottom pivot bearing caps, Ref. 16, must be left loose until the axle and knuckle drive joint group have been put in place and knuckle, Ref. 10, has been securely tightened down in place by the twelve studs and nuts, Ref. 40. Otherwise, knuckle flange, Ref. 22, will distort and the pre-loading effect will be destroyed.

15. *FRONT WHEEL TOE-IN ADJUSTMENT.*

a. The "99-M" power grader is equipped with a tie rod adjusting nut, Ref. 5, Fig. 24, (which has both right and left hand threads). Turn the adjusting nut so that front toe-in is from 0" to 1/16" maximum. Measurements to be made at the side wall of tires as close to the center line of axle as possible.

b. No toe-out should be tolerated. Failure to comply with the above will cause excessive tread wear.

16. *REMOVAL OF FRONT AXLE ASSEMBLY FROM FRAME. (See Fig. 24 for all References)*

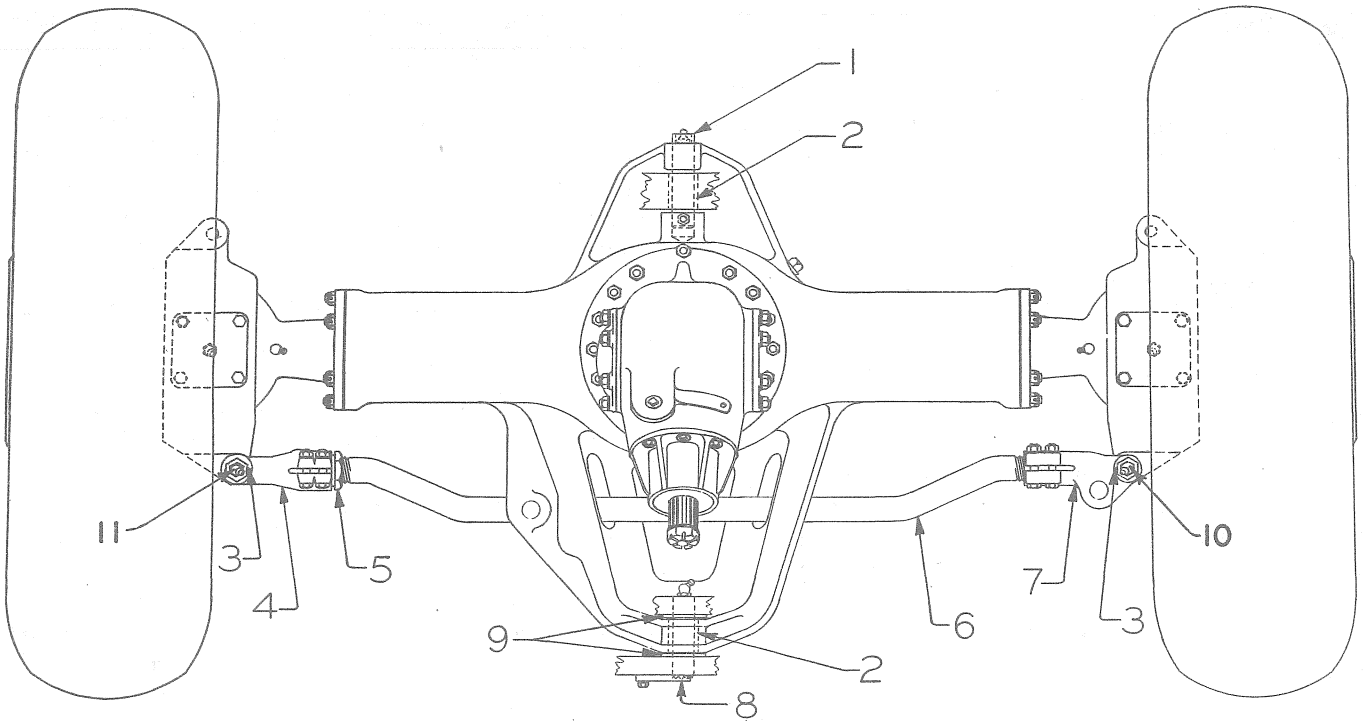
a. Place machine on level place.

b. Revolve blade until it is square across and lock circle latch.

c. Block both rear wheels securely to prevent possibility of machine rolling forward or backward.

d. Remove bolt through front pivot pin, Ref. 1.

e. Disconnect steering ram hydraulic



REF.	DESCRIPTION	REF.	DESCRIPTION
1.	Pivot pin	7.	Fork
2.	Pivot pin bushing	8.	Pivot pin
3.	Pin	9.	Washer
4.	Fork	10.	Fork bolt
5.	Adjusting nut	11.	Fork bolt
6.	Tie rod		

Figure 24. Front Axle Tie Rod and Axle Support

hoses at their union ends.

f. Unlock and remove the four cap screws from front propeller shaft universal joint fitting yoke.

g. Start the engine and raise blade as high as possible. Place blocking under each end of blade about a foot from the ends.

h. Force blade downward. This will lift the front end of frame upward. Lift it only enough so that axle pivot pins are free of excessive binding.

i. Remove the pivot pin, Ref. 1.

j. After removing locking cap screw, remove rear pivot pin, Ref. 8.

k. Again push blade down to lift frame high enough to clear axle.

l. Roll axle out from under front end of frame. It will be a close fit but can usually be tipped and rolled out without further jacking.

m. Reverse above procedure for reinstalling.

17. *FRONT AXLE GEAR CARRIER REMOVAL.* *(See Fig. 25)*

a. Remove axle from frame. See paragraph 16.

b. Remove drain plug, Ref. 50, Fig. 25, to drain oil from axle.

c. Block up under axle housing to hold it when wheels are removed.

d. Remove the lock wire and the eight nuts, Ref. 46, Fig. 22, on right side.

e. Remove fork bolt, Ref. 10, Fig. 24.

f. Slide out, about 8", the right wheel with trunnion socket and axle still attached. If the oil seal, Ref. 38, Fig. 22, is damaged or worn, be sure to replace it before reassembling.

g. Remove the lock wire and the eight nuts, Ref. 46, Fig. 22, on left side.

h. Remove the tie rod fork bolt, Ref. 11, Fig. 24.

i. Slide out, about 8" the left wheel with trunnion socket and axle attached. If the oil seal is damaged or worn, be sure to replace it before reassembling.

j. Remove the fourteen nuts from studs, Ref. 51, Fig. 25.

k. Remove the one tapered dowel bushing, Ref. 47, Fig. 25, from one of the studs.

l. Lift the gear and pinion carrier out of main axle housing.

18. *FRONT AXLE GEAR AND PINION CARRIER DISASSEMBLY. (After Removing the Assembly from Axle Housing) (See Fig. 25 for all References)*

a. Remove the lock wires (or cotters) and nuts on the four studs, Ref. 20.

b. Remove the bearing caps, Ref. 19. (If they are not already marked, mark them so they can be put back in exactly the same position in reassembly).

c. Lift out the bull gear and differential group, Ref. 16.

d. If ball bearings, Ref. 17, on differential hub are worn, replace them with new ones.

e. Remove the six nuts and washers from pinion carrier studs, Ref. 26.

f. Pull entire pinion carrier assembly out of large gear carrier housing. Tapped holes are provided for draw screws in case it sticks. Keep gasket, Ref. 22, and shims, Ref. 23, in original positions for reassembly.

g. Check the pinion carrier assembly for loose bearings. Be sure the nut, Ref. 42, is tight against the universal joint fitting yoke when checking, otherwise, looseness may appear in bearings that are properly adjusted and not worn. If looseness or wear is actually present, disassemble it as follows:

1. Remove the cotter and nut, Ref. 42.

2. Remove washer, Ref. 41, and universal joint fitting yoke, Ref. 43.

3. Check oil seal, Ref. 39, and replace it with new one if necessary.

4. Place a drift on threaded end of pinion shaft and drive it back through bearing, Ref. 30. Be careful to save all the shims, Ref. 36, and washer, Ref. 35.

5. If inspection shows any flat spots or chipping on bearings, Ref. 30 or Ref. 31, replace both the bearing cone and the cup of damaged bearing.

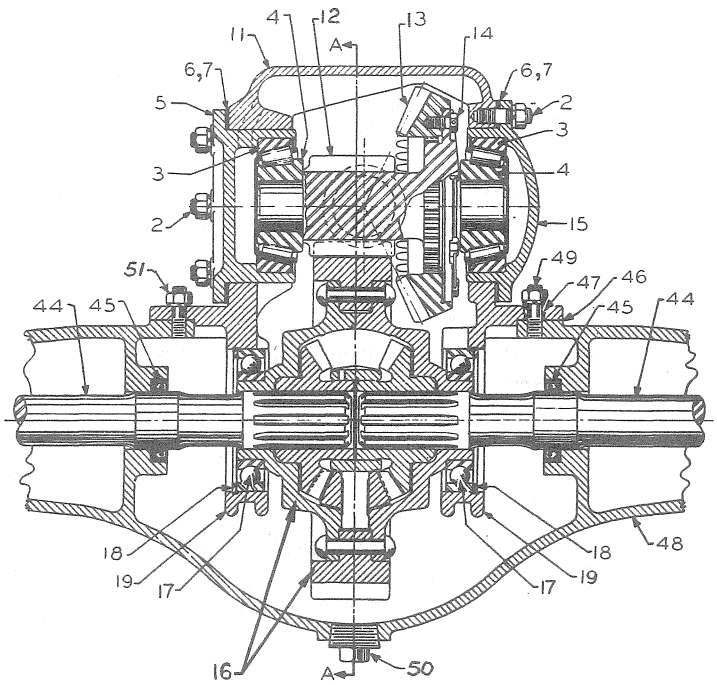
6. To remove any bearing end play in pinion shaft assembly, remove shims, Ref. 36, until play is eliminated; but be sure there is no binding after universal joint fitting yoke is tightened in place and nut, Ref. 42, is down tight. The shims are of two thicknesses, namely, .003" and .030" with a bearing washer, Ref. 35.

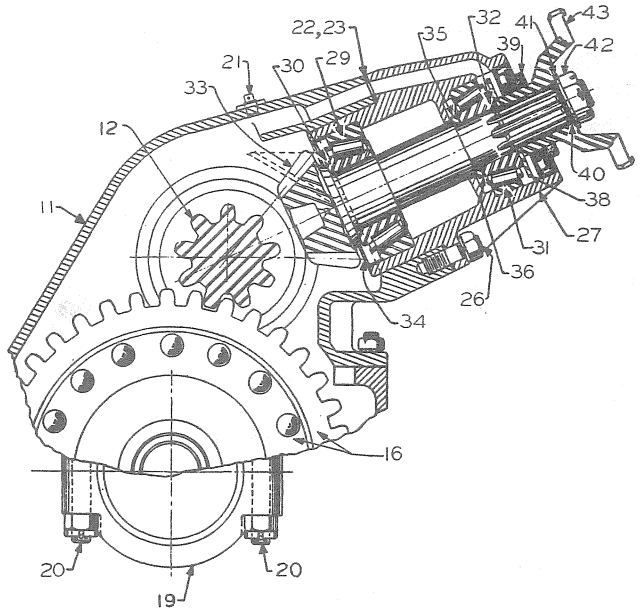
h. If you desire to remove the bull pinion and bevel gear hub, Ref. 12, this should be done before reinstalling the pinion shaft assembly, following the steps below:

1. Remove the twelve nuts and washers from studs, Ref. 2.

2. Remove the bearing cap, Ref. 5. Save the gasket, Ref. 6, and all shims, Ref. 7. Wire these to the cap so they will be replaced in original position. Threaded draw screw holes are provided to remove this cap if it sticks.

3. Remove bearing cap, Ref. 15, saving the gasket, Ref. 6, and shims, Ref. 7. Wire them to the cap to prevent mix-up. Threaded draw screw holes are provided for easy removal of this cap.





Cross section at A-A

REF.	DESCRIPTION
2.	Stud
3.	Bearing cup
4.	Bearing cone and rollers
5.	Bearing cap
6.	Gasket
7.	Shim
11.	Gear carrier
12.	Pinion and gear hub
13.	Bevel gear
14.	Bevel gear cap screw
15.	Bearing cap
16.	Differential group
17.	Ball bearing
18.	Bearing washer
19.	Bearing cap
20.	Stud
21.	Vent plug
22.	Gasket
23.	Shim
26.	Stud
27.	Pinion carrier
29.	Bearing cup

REF.	DESCRIPTION
30.	Bearing cone and rollers
31.	Bearing cup
32.	Bearing cone and rollers
33.	Bevel pinion
34.	Oil retainer
35.	Bearing washer
36.	Shim
38.	Washer
39.	Oil seal
40.	Gasket
41.	Washer
42.	Slotted nut
43.	Fitting yoke
44.	Axle shaft
45.	Oil seal
46.	Gasket
47.	Taper dowel bushing
48.	Axle housing
49.	Stud
50.	Drain plug
51.	Hex nut

Figure 25. Front Axle Gear and Pinion Carrier

4. Slip the pinion sidewise out through side of case and remove the six cap screws, Ref. 14, holding the bevel gear, Ref. 13.

5. Remove the bearing cone and roller assembly, Ref. 4, from bull pinion end of shaft, Ref. 12. Sometimes, due to steel casting variation, it is necessary to remove the bearing cone and roller assembly from the other end also. If bearing cone, Ref. 4, cannot readily be driven from shaft, pour hot oil over bearing only to expand it for easier removal.

NOTE: Keep the shaft, Ref. 12, cold.

6. Slip the bevel gear off its splined hub so that it can be cocked and pinion shaft with loose bevel gear still over it can be removed from carrier. Be sure to wire bevel gear screw heads in reassembling.

7. If inspection shows chipping or flat spots on either bearing, replace both the cone and cup of that bearing.

8. Clean and check all parts carefully before reassembling.

19. *FRONT AXLE GEAR AND PINION CARRIER REASSEMBLY. (See Fig. 25 for all References)*

a. If you are installing a new bevel gear, Ref. 13, or a new bull pinion shaft, Ref. 12, be sure to assemble the two together, temporarily, before putting them into gear carrier. By doing this, you will be sure that they fit together properly at splines. The bevel gear fits over the splined hub, near one end, of the bull pinion shaft. It is held firmly in place by six cap screws, Ref. 14, through the backing flange.

> CAUTION: The splines in the bore of the bevel gear will permit the cap screw holes to align in two positions only. It is, therefore, best to mark (with paint) the bevel gear and hub flange to make alignment easy after parts are put in the gear carrier housing. The bevel gear should be a snug fit on the hub splines and will usually require driving into place. Be careful not to damage parts in assembly.

b. Position the bevel gear, Ref. 13, loosely and slightly cocked, over the middle of bull pinion shaft, Ref. 12.

c. Have the housing securely blocked upside down while reassembling. Insert both bevel gear and shaft (with bearings off) into the gear carrier housing, it may take a little manipulation to get the gear and shaft to drop into place.

d. Align the bevel gear holes with flange holes and drive the gear into place tightly against the flange. Be careful not to damage the gear teeth. Use a hardwood block or babitt hammer.

e. Insert and tighten the six cap screws, Ref. 14, and run a lock wire through holes in their heads.

f. Heat the bearing cones, Ref. 4, in hot oil (not over 300° F.) and tap them into place against the hub shoulders. Whenever you install a new cone, always install a new cup for it to run in.

g. Replace the bearing cap, Ref. 15, together with the gasket, Ref. 6, and the shims, Ref. 7, but first make sure that the bearing cup, Ref. 3, is in good condition. If otherwise, replace it and bearing cone. Check the position of the gasket, Ref. 6, and the shims, Ref. 7, and the bearing cap, Ref. 15. Oil ports in case and cap must align and the shims must be properly placed or the flow of oil will be cut off and the lubrication of the bearing will then be insufficient.

h. Replace bearing cap, Ref. 5, with gasket, Ref. 6, and shims, Ref. 7.

i. If end play exists in the bull pinion and bevel gear shaft, Ref. 12, (after the caps, Ref. 5 and 15 are tightened) it can be eliminated by removing shims at Ref. 7. Bevel gear side adjustment (after end play has been removed) can be made by transferring shims from underneath the bearing cap on one side to the cap on the other side. Be sure that the bull pinion shaft has only a slight drag when both caps are tight.

j. Install the bevel pinion carrier assembly. Be sure the gasket, Ref. 22, and the shims, Ref. 23, are replaced.

> CAUTION: The gasket and shims at Ref. 22 and 23 have holes that must be aligned with oil ports in the housing, or the pinion bearings will not be lubricated sufficiently.

k. If pinion, Ref. 33, needs to be adjusted for proper mesh with bevel gear, add or remove shims at Ref. 22 and 23. The contact at the toe end (small end) of bevel gear teeth should be between 1/4" and 3/8" from edge and at heel end (large end) from 1/2" to 3/4" from edge. Gear and pinion are sold in matched sets only and they are marked showing the area of contact for proper adjustment with correct backlash of .005" to .010".

l. Place the large spur gear and differential group, Ref. 16, in position after installing the two hub bearings, Ref. 17.

> CAUTION: The spur gear is offset to clear the bevel gear, so be sure that you do not try to install it with the wrong side toward the bevel gear.

m. Replace the bearing caps, Ref. 19, and tighten the nuts on studs, Ref. 20, and wire them to prevent their loosening.

n. Install a new gasket, Ref. 46.

o. Lower the now completely assembled gear carrier down into front axle housing, Ref. 48.

p. Put the tapered dowel bushing, Ref. 47, in proper place and tighten this stud nut first; then tighten the rest of the nuts, Ref. 51.

q. Carefully push the axles and wheels back into axle housing and replace and tighten the slotted nuts, Ref. 46, Fig. 22. Do not neglect to run a wire through stud ends to keep nuts from loosening.

r. Check the toe-in adjustment. (See paragraph 15).

s. Grease all fittings well before operating. Fill axle housing with recommended oil. Pour about a pint of this oil into small hole in pinion carrier, Ref. 27. This hole has a 1/8" pipe plug in it. Be sure to replace this plug after pouring in the oil. This oil prevents the bearings, Ref. 30 and 32, from insufficient lubrication when first starting newly assembled axle.

20. PROPELLER SHAFTS.

The propeller shaft universal joints are all of the needle bearing type and are non-adjustable. Telescopic joints are provided in shafts connecting with front and rear axles. The center section of the front propeller shaft is mounted in, and rotates on, anti-friction bearings. No bearing adjustment is necessary for this center section of the front propeller shaft. Both bearing housings of this center section of front propeller shaft are fitted for Alemite lubrication. Excessive lubrication will force the oil seals out of housing ends.

Grease fittings are provided in each joint group. The needle bearings are packed with lubricant at time of assembly. The joints should be dismantled and inspected every 2000 hours of operation. Worn parts should be replaced at that time. The needle bearings should be repacked before reassembling.

See lubrication chart for frequency and type of grease. Telescopic propeller shafts at front and rear axles are provided for disassembly purposes and to permit oscillation or movement of the axle assemblies.

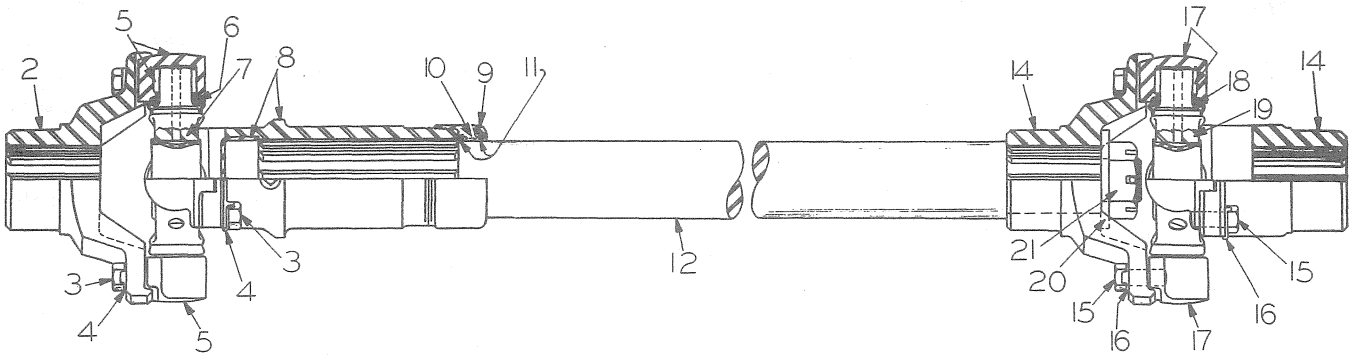
The slip yoke group, Ref. 8, Fig. 26, must be installed at the rear end of furthest from the front axle.

The slip yoke group, Ref. 9, Fig. 29, must be installed nearest to the rear axle.

The 4 seals, Ref. 8, Fig. 27, should be assembled with the lip of the seals turned outward.

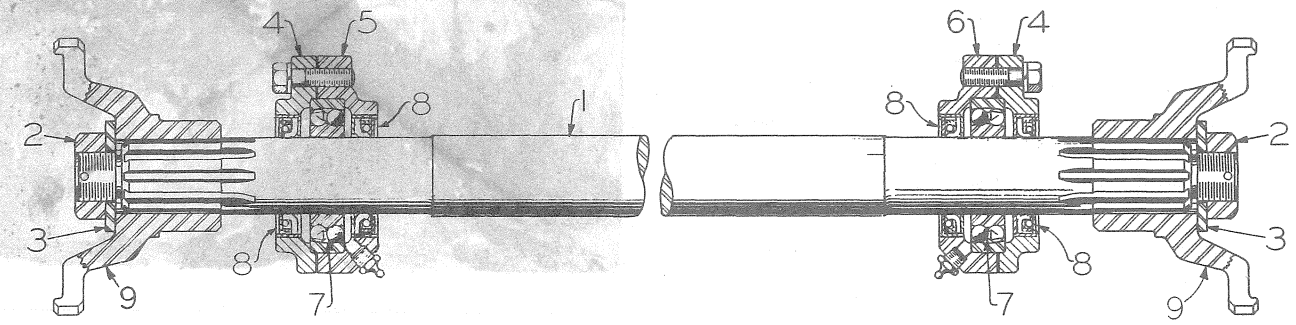
21. CLUTCH ADJUSTMENT.
(See Fig. 30 and 31 for all References)

As wear in the clutch facings, Ref. 2



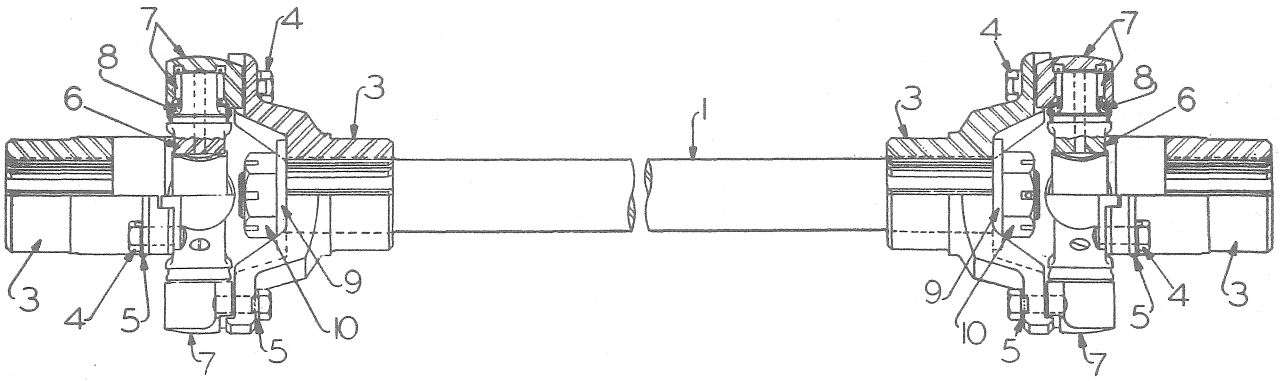
REF.	DESCRIPTION
2.	Fitting yoke
3.	Cap screw
4.	Lock plate
5.	Bearing group
6.	Trunnion washer-cork
7.	Spider group
8.	Slip yoke group
9.	Felt retainer
10.	Felt washer
11.	Retainer washer
12.	Shaft
14.	Fitting yoke
15.	Cap screw
16.	Lock plate
17.	Bearing group
18.	Trunnion washer-cork
19.	Spider group
20.	Washer
21.	Nut

Figure 26. Front Section of Front Propeller Shaft



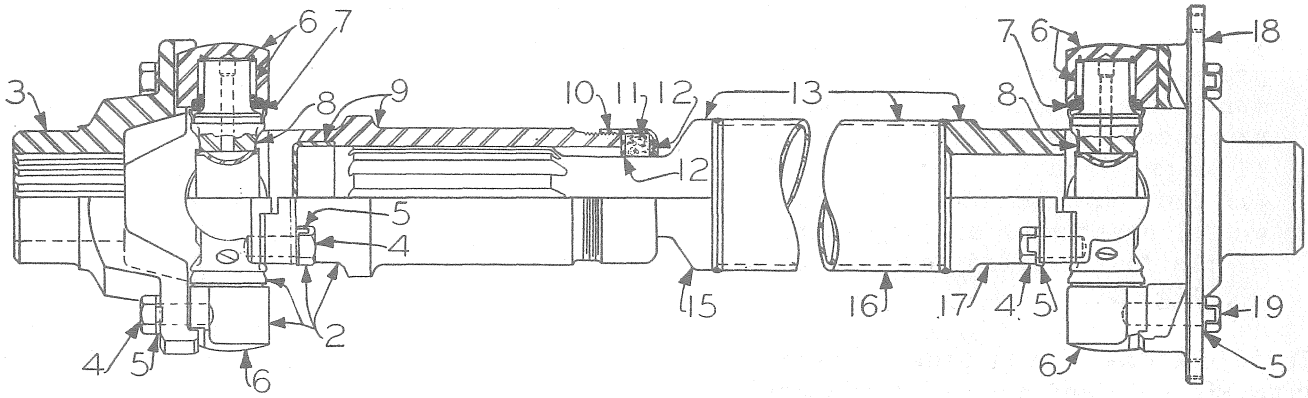
REF.	DESCRIPTION
1.	Shaft
2.	Nut
3.	Washer
4.	Bearing cap
5.	Bearing housing-rear
6.	Bearing housing-front
7.	Ball bearing
8.	Oil seal
9.	Fitting yoke

Figure 27. Center Section of Front Propeller Shaft



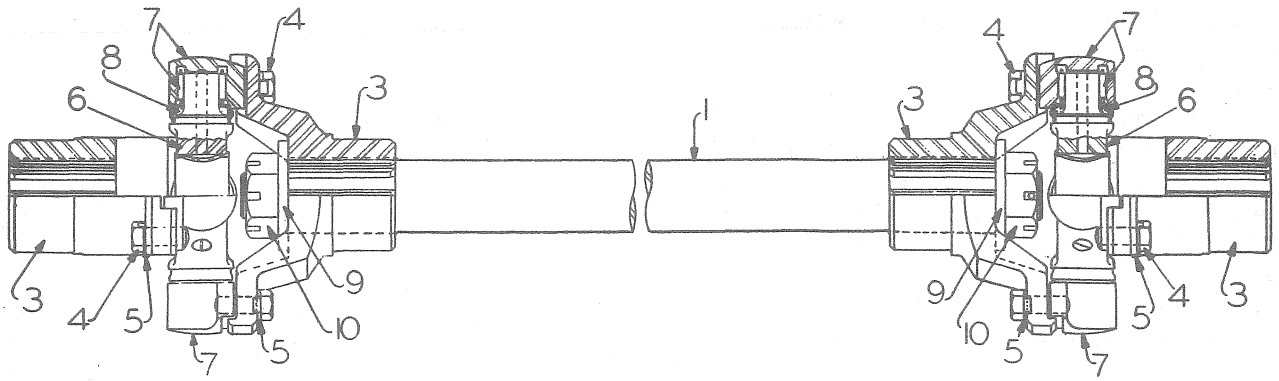
REF.	DESCRIPTION
1.	Shaft
3.	Fitting yoke
4.	Cap screw
5.	Lock plate
6.	Spider group
7.	Bearing group
8.	Trunnion washer-cork
9.	Washer
10.	Nut

Figure 28. Rear Section of Front Propeller Shaft



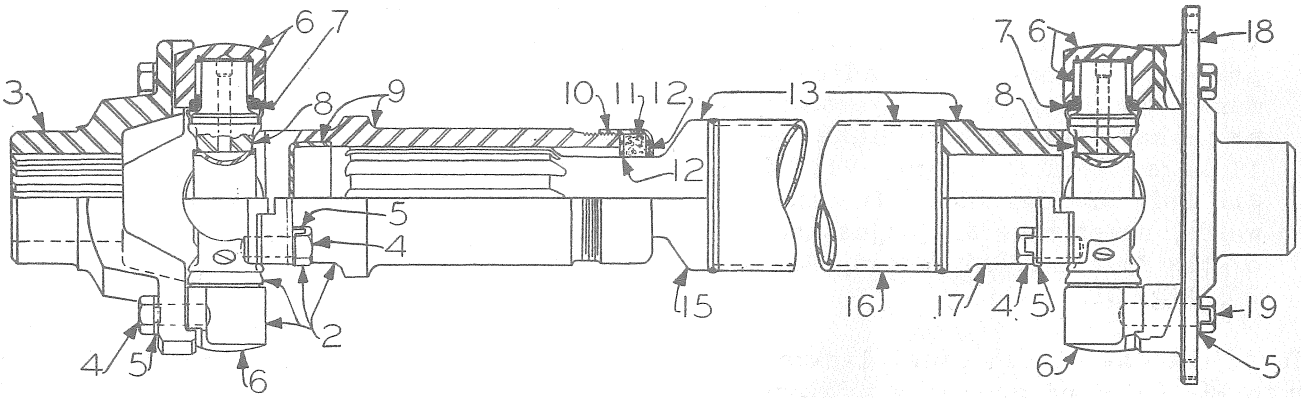
REF.	DESCRIPTION
2.	Joint group
3.	Fitting yoke
4.	Cap screw
5.	Lock plate
6.	Bearing group
7.	Trunnion washer-cork
8.	Spider group
9.	Slip yoke group
10.	Felt retainer
11.	Felt washer
12.	Retainer washer
13.	Propeller tube and joint group
15.	Stub end
16.	Tube
17.	Weld yoke
18.	Brake flange
19.	Cap screw

Figure 29. Rear Propeller Shaft



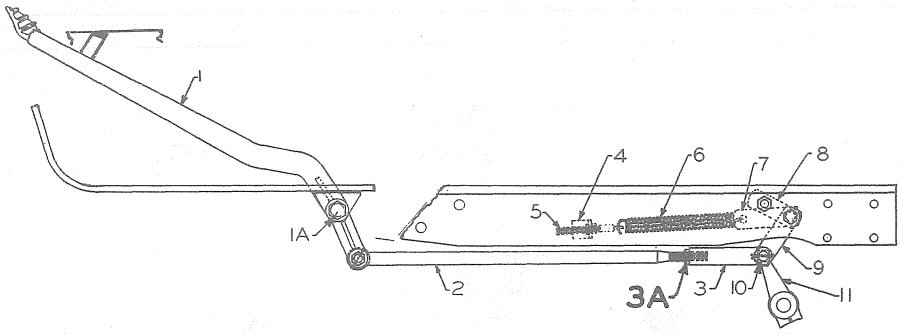
REF.	DESCRIPTION
1.	Shaft
3.	Fitting yoke
4.	Cap screw
5.	Lock plate
6.	Spider group
7.	Bearing group
8.	Trunnion washer-cork
9.	Washer
10.	Nut

Figure 28. Rear Section of Front Propeller Shaft



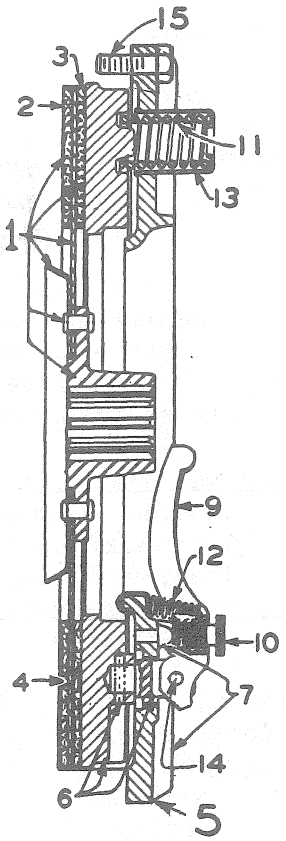
REF.	DESCRIPTION
2.	Joint group
3.	Fitting yoke
4.	Cap screw
5.	Lock plate
6.	Bearing group
7.	Trunnion washer-cork
8.	Spider group
9.	Slip yoke group
10.	Felt retainer
11.	Felt washer
12.	Retainer washer
13.	Propeller tube and joint group
15.	Stub end
16.	Tube
17.	Weld yoke
18.	Brake flange
19.	Cap screw

Figure 29. Rear Propeller Shaft



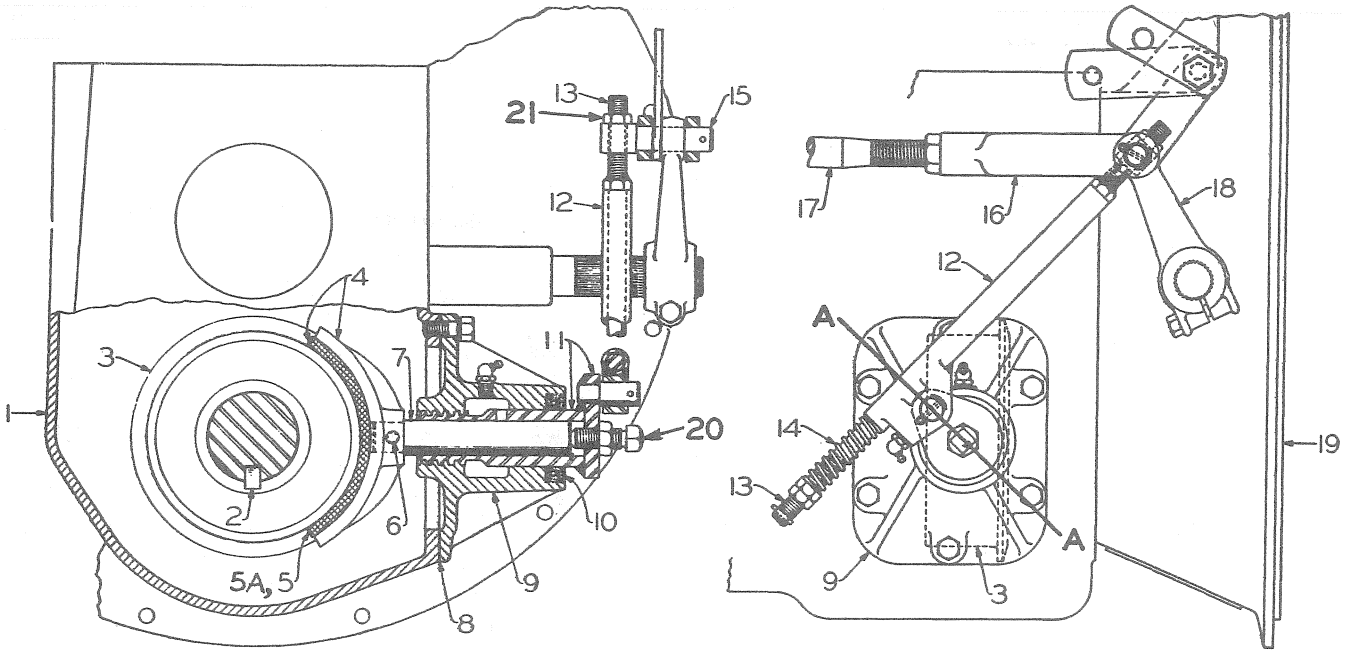
REF.	DESCRIPTION
1.	Lever
1A.	Cap screw
2.	Rod
3.	Rod end fork
3A.	Lock nut
4.	Bracket
5.	Eye bolt
6.	Spring
7.	Spring connection
8.	Link-offset
9.	Link-long
10.	Pin
11.	Release lever

Figure 30. Clutch Operating Mechanism



REF.	DESCRIPTION
1.	Drive member group
2.	Facing
3.	Facing
4.	Facing rivet
5.	Cover group
6.	Front plate group
7.	Back plate group
9.	Lever or finger
10.	Screw
11.	Spring
12.	Spring
13.	Spring cup
14.	Lever pin
15.	Cap screw

Figure 31. Clutch



REF.	DESCRIPTION
1.	Transmission
2.	Woodruff key
3.	Brake drum
4.	Brake shoe with lining
5.	Lining
5A.	Tubular rivet
6.	Pin
7.	Shaft
8.	Gasket
9.	Bracket
10.	Oil seal

REF.	DESCRIPTION
11.	Screw
12.	Tube
13.	Pull rod
14.	Spring
15.	Pin
16.	Rod end fork
17.	Rod
18.	Release lever
19.	Bell housing
20.	Set screw
21.	Lock nut

Figure 32. Clutch Brake

bringing about the desired synchronization. It will be necessary to change these from time to time as the main clutch discs and the clutch brake lining, Ref. 5, wear. (Adjusting points are rod, Ref. 13, and set screw, Ref. 20).

23. HOW TO ADJUST CLUTCH BRAKE LINKAGE. (See Fig. 32 for all References)

a. The proper position for the line A-A (drawn through shaft centers) is approximately at right angles with the tube, Ref. 12, when the brake lining just touches the drum, Ref. 3, (located on the lower countershaft inside the transmission).

b. As the main clutch disc linings wear it will be necessary to adjust the clutch pedal free play. This adjustment will change the angle of line A-A. It will then be necessary to shorten the tube, Ref. 12, by loosening the lock nut, Ref. 21, and revolving the rod, Ref. 13, in the proper direction to shorten it. (Rod, Ref. 13, is threaded into pin, Ref. 15).

c. Checking the wear on brake lining is done from the outside by adjusting the set screw, Ref. 20, inward until the lining contacts the drum, and then backing the set screw enough to prevent constant drag on the drum inside the transmission.

d. The spring, Ref. 14, should always be slightly loose lengthwise when the main clutch is engaged. The purpose of this spring is to care for the over-run of lever, Ref. 18, after the brake has been fully seated. If it is adjusted too tightly it will prevent sufficient anti-clockwise rotation of the screw, Ref. 11, which would result in excessive lining wear.

24. CLUTCH LUBRICATION.
(See Page 7 for Lubrication)

Clutch throw-out bearing is lubricated through the exposed high pressure fitting extending through the side of the clutch housing. Do not over-lubricate this clutch throw-out bearing. Usually it only takes one and not more than two strokes of pressure gun to replenish grease. Over-greasing has been the cause of many clutch failures. This excessive grease is thrown out into the clutch housing and eventually finds its way down on the clutch lining itself, causing slippage and eventual failure.

Clutch pilot bearing is lubricated through an inspection opening located in the bottom of the flywheel housing on both gas and diesel engines. Rotate flywheel until lubrication fitting is visible in the flywheel. Lubricate sparingly, for over-greasing will contaminate the clutch and cause slippage and ultimate failure. Consult lubrication chart for frequency of servicing operation.

Warped and cracked pressure plates and prematurely worn facings indicate excessive heat and are generally caused by over-greasing. No free parts replacements will be made if evidence of over-greasing is found. In cases where too much lubricant has been applied accidentally, causing temporary slippage, wash the entire clutch compartment with kerosene to remove all traces of grease. When doing this, always idle the engine. To ventilate housing, remove (by unscrewing) one of the breathers, Ref. 120, Fig. 34A. Do not use gasoline for washing as it may cause explosion and fire.

25. CLUTCH REMOVAL.

To remove or replace the clutch in the "99-M" power grader, the engine, radiator and engine accessories need not be disturbed. It is only necessary to separate the transmission bell housing from the engine bell housing following the procedure outlined below. Certain equipment such as a set of chain blocks and the necessary wood blocking, jacks, etc., are needed before starting this operation. To remove the clutch, follow the procedure outlined as follows:

1. Remove the propeller drive shaft guard, mat and rear floor heel sheet of the operator's cab.

2. Remove the four cap screws from universal joint fitting yoke located directly in front of transfer case.

3. Remove the four cap screws from universal joint fitting yoke located on other end of same shaft, and remove the shaft. It may be necessary to loosen the bearing housings (on the center section of front propeller shaft) from the frame to facilitate removal.

4. Loosen brake cable from seat box.

5. Remove heater hoses (if machine is equipped with heater).

6. Remove battery cable in order to remove false bottom of seat box.

7. Remove transmission shift lever.

8. Disconnect fork, Ref. 16, from lever, Ref. 18, Fig. 32.

9. Remove hydraulic brake hose (master cylinder end).

10. Remove circle "A" frame support.

11. Remove four cap screws in rear axle propeller drive shaft.

12. Secure a 4" x 4" timber - 5 ft. long and place across tank support and windshield sill. Place suitable wood blocking in front of and also behind tire, for safety purposes.

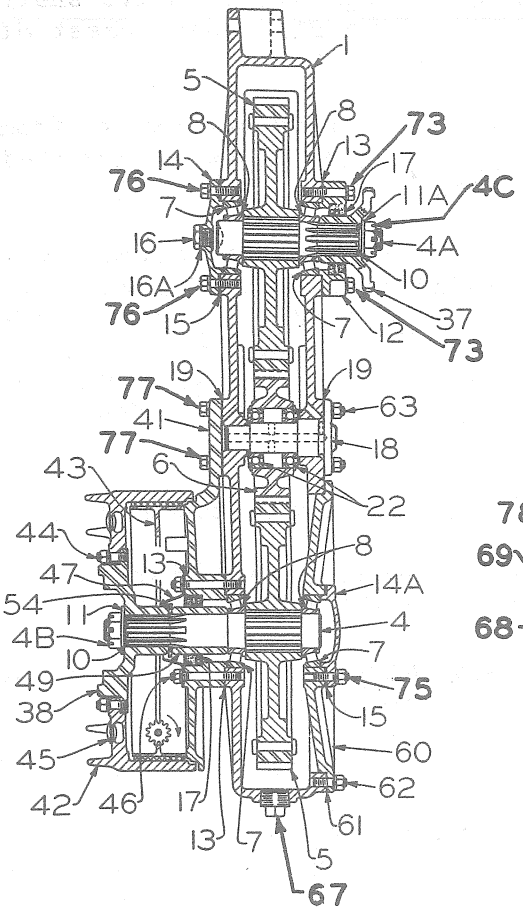
13. Attach a chain hoist (at Ref. 72, Fig. 33) to transfer case and support it from the 4 x 4.

14. Block up under flywheel bell housing of engine with suitable wood blocks.

15. Remove the three screws from the rear end of transfer case support angles.

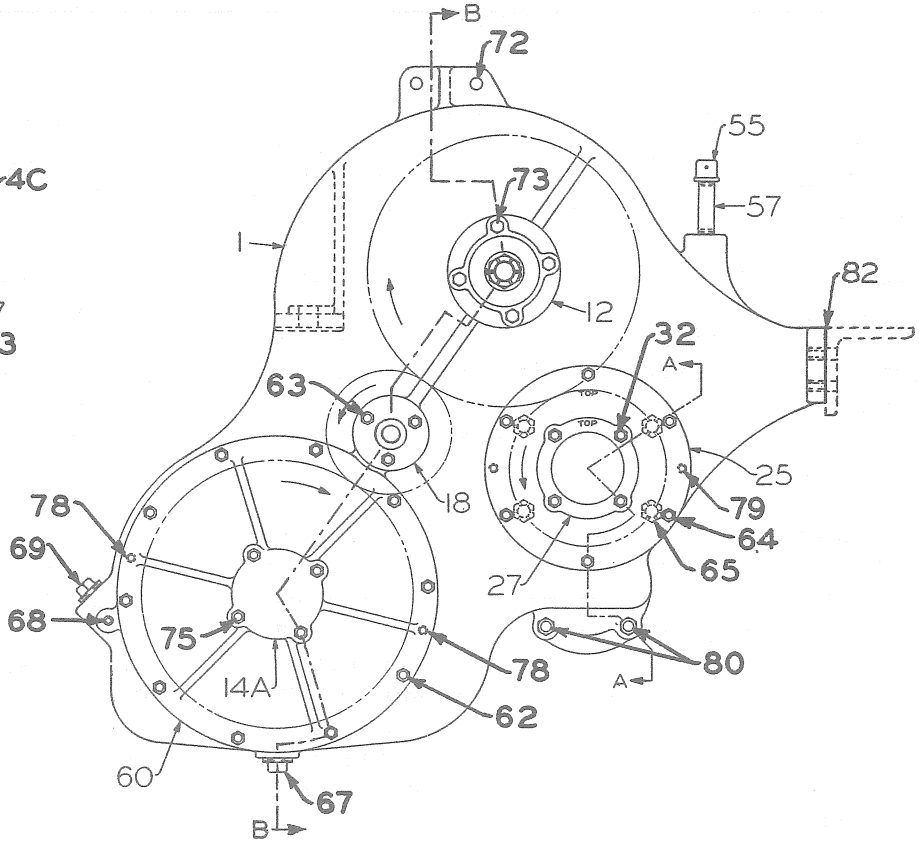
16. Remove twelve 3/8" cap screws which attach the transmission bell housing to the engine flywheel bell housing.

17. Block up under the transmission

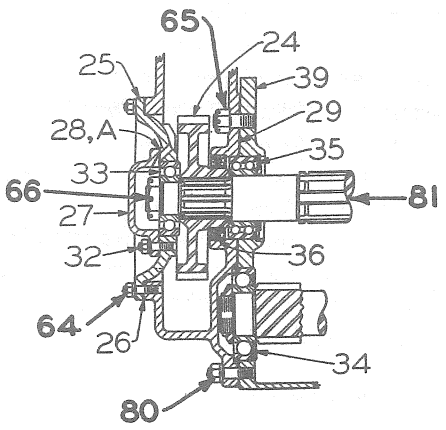


Section B-B

This cross section view shows transfer case cut in two along line B-B as illustrated in front view.



Front View (as assembled on machine)



Section A-A

This cross section view shows transfer case cut in two along line A-A as illustrated in front view.

Figure 33. Transfer Case

Key to Transfer Case - Refer to Figure 33

REF.	DESCRIPTION
1.	Gear housing
4.	Lower shaft
4A.	Upper shaft
4B.	Slotted nut
4C.	Slotted nut
5.	Gear
6.	Idler gear
7.	Bearing cup
8.	Bearing cone and rollers
10.	Gasket
11.	Washer
11A.	Washer
12.	Bearing retainer ring
13.	Gasket
14.	Cap
14A.	Cap
15.	Shim
16.	Plug
16A.	Gasket
17.	Oil seal
18.	Idler pin
19.	Gasket
22.	Ball bearing
24.	Gear
25.	Cover
26.	Gasket
27.	Cap
28.	Gasket
28A.	Shim
29.	Gasket
32.	Stud
33.	Ball bearing
34.	Ball bearing
35.	Ball bearing
36.	Oil seal
37.	Fitting yoke
38.	Brake flange
39.	Transmission case
41.	Backing plate
42.	Brake drum
43.	Hydraulic brake group
44.	Stud
45.	Rubber plug
46.	Stud
47.	Oil collector
49.	Spacer
54.	Washer
55.	Breather cap
57.	Nipple
60.	Housing cover
61.	Gasket
62.	Stud
63.	Stud
64.	Stud
65.	Stud
66.	Slotted nut
67.	Drain plug
68.	Oil level plug
69.	Filler plug
73.	Cap screw
75.	Stud
76.	Cap screw
77.	Cap screw
80.	Stud
81.	Transmission mainshaft
82.	Shim

clutch bell housing.

18. Pull unit out of flywheel; clutch will remain intact, bolted to flywheel.

19. Carefully lower unit to ground, removing the blocking under transmission clutch bell housing as you lower it.

20. Any clutch replacement parts can be installed at this point and the entire unit put back together again by following the reverse of the above procedure.

26. *TRANSFER CASE.*
(See Fig. 33 for all References)

The transfer case attached to the machined rear face of the transmission is the power division gear case and contains four spur gears. This case pilots over the outer race of the end bearings, Ref. 34 and Ref. 35, both top and bottom transmission shafts. Four large studs, Ref. 65, accessible only from the inside of the case, and two smaller ones, Ref. 80, accessible from the outside, hold the transmission and transfer cases together with an oil-tight gasket, Ref. 29, in between.

27. *TRANSFER CASE REMOVAL AND DISASSEMBLY. (See Fig. 33 for all References)*

Before dismantling, if the machine is in operating condition, it is best to drain the gear oil from the transfer case and refill it with kerosene or diesel fuel and run the machine backward and forward several minutes. It is best to drain this first wash-out, and refill with clean

kerosene or diesel fuel, and repeat. In this way, a second washing will usually get everything clean and free of oil.

CAUTION: Do not use gasoline as there is danger of explosion and fire.

To remove the transfer case from the transmission it is necessary to first follow the procedure outlined in paragraph 25 with respect to clutch removal, and then both the transmission and transfer case can be removed from the grader as a unit, it being more practical to disassemble the transfer case from the transmission on the ground, rather than when the unit is in the machine.

After these two units are out of the power grader, proceed as follows:

1. Remove outer bearing cap, Ref. 27. There are shims, Ref. 28A, under this cap to adjust position of bearing, Ref. 33, so that no end play (in shaft, Ref. 81) exists.

2. Remove nut, Ref. 66, on end of upper transmission shaft, Ref. 81.

3. Remove outer bearing housing cover, Ref. 25. (This has threaded holes, Ref. 79, for draw screws for removing). The ball bearing, Ref. 33, and likewise drive gear, Ref. 24, can be removed through the opening thus provided.

4. Remove nuts from four large studs, Ref. 65, holding transfer case to transmission, which are now accessible since removing gear, Ref. 24.

5. Remove two lower nuts outside the transfer case, Ref. 80.

6. Transfer case can now be detached from transmission and, if you do not have a new gasket, use extreme care in separating them so as not to destroy gasket, Ref. 29.

7. Remove nut, Ref. 4B, from lower drive shaft, Ref. 4, and the brake drum and hub, Ref. 42 and Ref. 38, can be pulled off as a unit.

8. Remove lower gear cover, Ref. 60. (This is also provided with threaded holes, Ref. 78, for pulling it). Use set screws for pulling.

9. Remove lower drive gear, Ref. 5, with lower shaft, Ref. 4, as a unit.

10. Remove idler pin, Ref. 18, and then idler gear assembly can be taken out through bottom or center opening.

11. Remove nut, Ref. 4C, on upper drive shaft, Ref. 4A, also universal joint fitting yoke, Ref. 37, and seal ring, Ref. 12, and then shaft, Ref. 4A, can be removed, thus permitting the removal of upper drive gear, Ref. 5. Should the shaft stick, it will be best to remove the rear bearing cap, Ref. 14, keeping the shims, Ref. 15, with the cap. Then drive the shaft, Ref. 4A, out from this end with bronze drift.

12. In reassembling or reattaching the transfer case to the transmission again, it is very essential to provide a uniform tightness to all of the six nuts which attach transfer case to transmission so as to obtain a uniform compression on gasket, Ref. 29. If in doing so, caution is not exercised, it is possible to throw the outer bearing, Ref. 33, for the upper transmission shaft out of line and cause shaft or bearing failure.

13. We strongly recommend the use of a dial indicator attached to the end of upper transmission shaft, Ref. 81, and indicating in the bore of the transfer case at the point where the cover, Ref. 25, enters the bore, in order to be sure of perfect alignment between shaft, Ref. 81, and the transfer case itself. This is a very important operation. The indicator must not show a greater eccentricity than .002". If no dial indicator is available, be sure that the bearing housing cover, Ref. 25, slides over the bearing, Ref. 33, without striking surrounding edge of transfer case heavily on one side so that it has to be forced sideways to enter the case. In other words, the shaft, Ref. 81, must be exactly in the center of the hole (for bearing housing cover, Ref. 25) in transfer case. If difficulty is experienced entering bearing housing cover, Ref. 25, into the bore of gear housing, Ref. 1, first loosen nuts on studs, Ref. 65 and

Ref. 80, and retighten. If this fails, remove transfer case from transmission and clean machined faces on back of where gasket, Ref. 29, is located. Then install a new gasket. Reassemble, using care to tighten all nuts evenly on studs, Ref. 65 and 80. Be sure to wire the four nuts on studs, Ref. 65, after they have been properly tightened.

14. A low oil level plug, Ref. 68, is furnished on the transfer case. Keep this transfer case filled above this level at all times. Pour the oil into the upper level plug, Ref. 69, until full. Check oil level after machine has stood at least one hour. Be sure the small drilled hole in the cap, Ref. 55, is open so as to vent the case at all times.

15. Never attempt to disassemble or make repairs to the transfer case without thoroughly studying over the cross section diagrams shown in Fig. 33.

28. TRANSMISSION.

The "99-M" power grader is equipped with a five speed transmission which will give excellent results if the operator keeps it well lubricated. The oil level and filler plug is on the right hand side of the transmission. Use a good grade of transmission lubricant SAE-140 for summer time and SAE-90 in the winter. The lubricants must further be of the extreme pressure type. See lubrication chart for lubrication data and the approved list of lubricants.

> CAUTION: Damage to the transmission gears will surely result if the clutch is not allowed to stop when shifting from one gear to the other. Clashing of gears will chip the end of the sliding gear teeth and these fine steel chips can ruin a transmission in a short time. A few seconds taken before completing each gear shift will save many dollars in expensive repairs and replacements. Care must also be taken to be sure that the gear shift lever is moved its full amount so that the two gears are in complete engagement. A gear in two-thirds or one-half engagement increases the tooth load tremendously.

Get the "feel" of all shifting positions, and be sure to "feel" the spring loaded ball, Ref. 32, Fig. 34A, drop down into the notch on the shifter rail inside the transmission. Then, and only then, will you know that complete tooth engagement has been obtained. There are no adjustments necessary, as on this transmission, all operating mechanisms have been properly set at the factory and by proper lubrication and reasonable amount of care exercised in shifting, you should experience no difficulty with the transmission.

29. TRANSMISSION GEAR SHIFT.

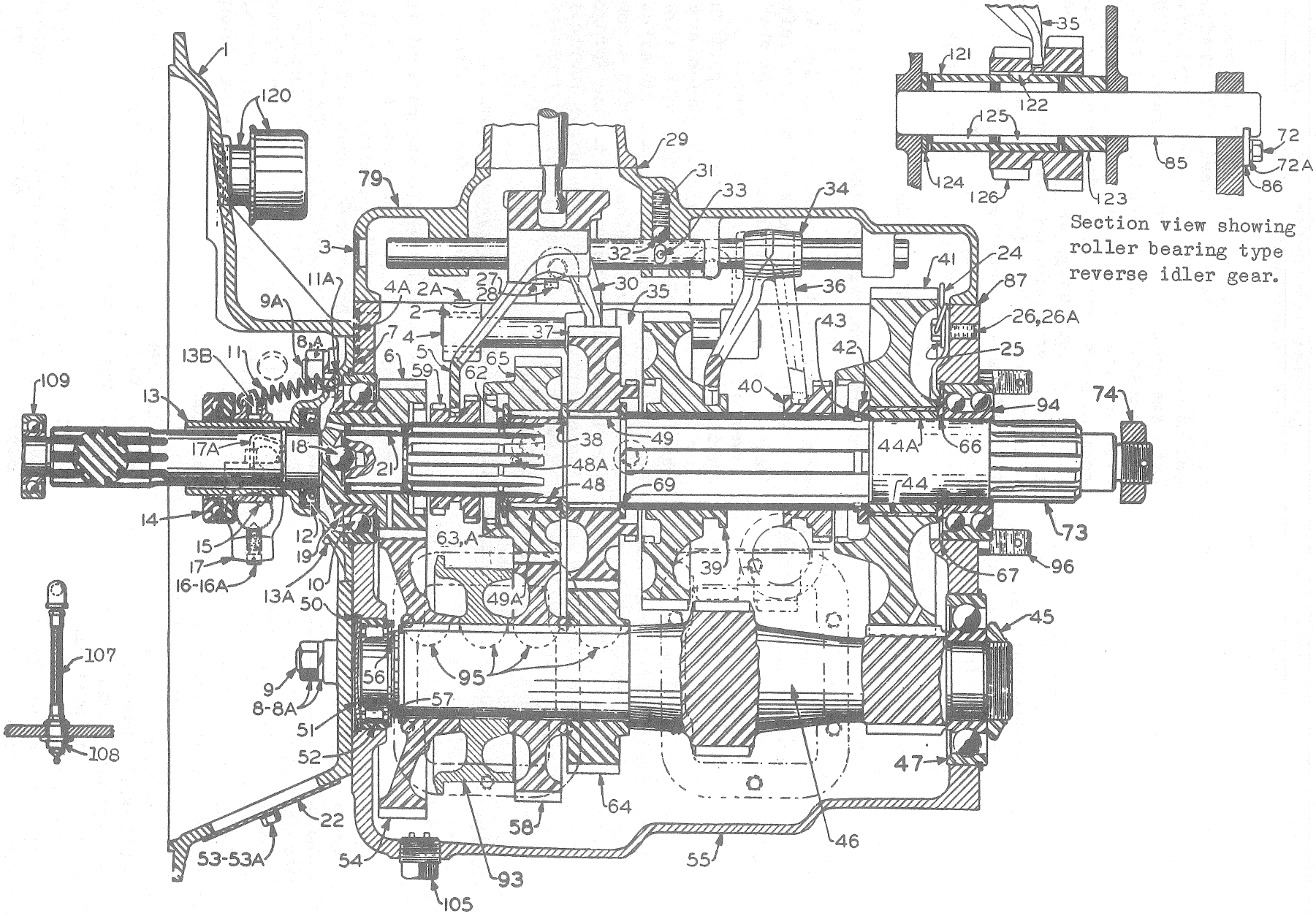
The gear shifting on this transmission is accomplished through a remote control mechanism. This is a simple device and the shift lever is located on the left-hand side, and is connected to the shift tower of the transmission by means of a tubular member. No adjustment or particular instructions should be necessary. Should wear develop, steps should be taken to remedy this condition, as incomplete shifting may result along with its accompanying troubles described in the foregoing paragraph. Keep these parts lubricated with a few drops of oil at frequent intervals.

30. TRANSMISSION DISASSEMBLY.
(See Fig. 34A and 34B for all Ref.)

In order to disassemble any part of the transmission, follow the instructions under "Clutch Removal", paragraph 25, which will permit the transfer case and transmission being removed from the machine. Now, remove transfer case from transmission by following the instructions given under "Transfer Case Removal", paragraph 27. You should now disassemble the transmission as follows:

1. Remove cap screws holding large cover, Ref. 79, with shift rods and lift it off top of transmission.

2. Remove the two retaining screws, Ref. 16, (in clutch compartment) holding clutch release yoke, Ref. 17, to cross shafts ends. These retainer screws with square heads are drilled and wired to pre-



Section view showing roller bearing type reverse idler gear.

Figure 34A. Transmission

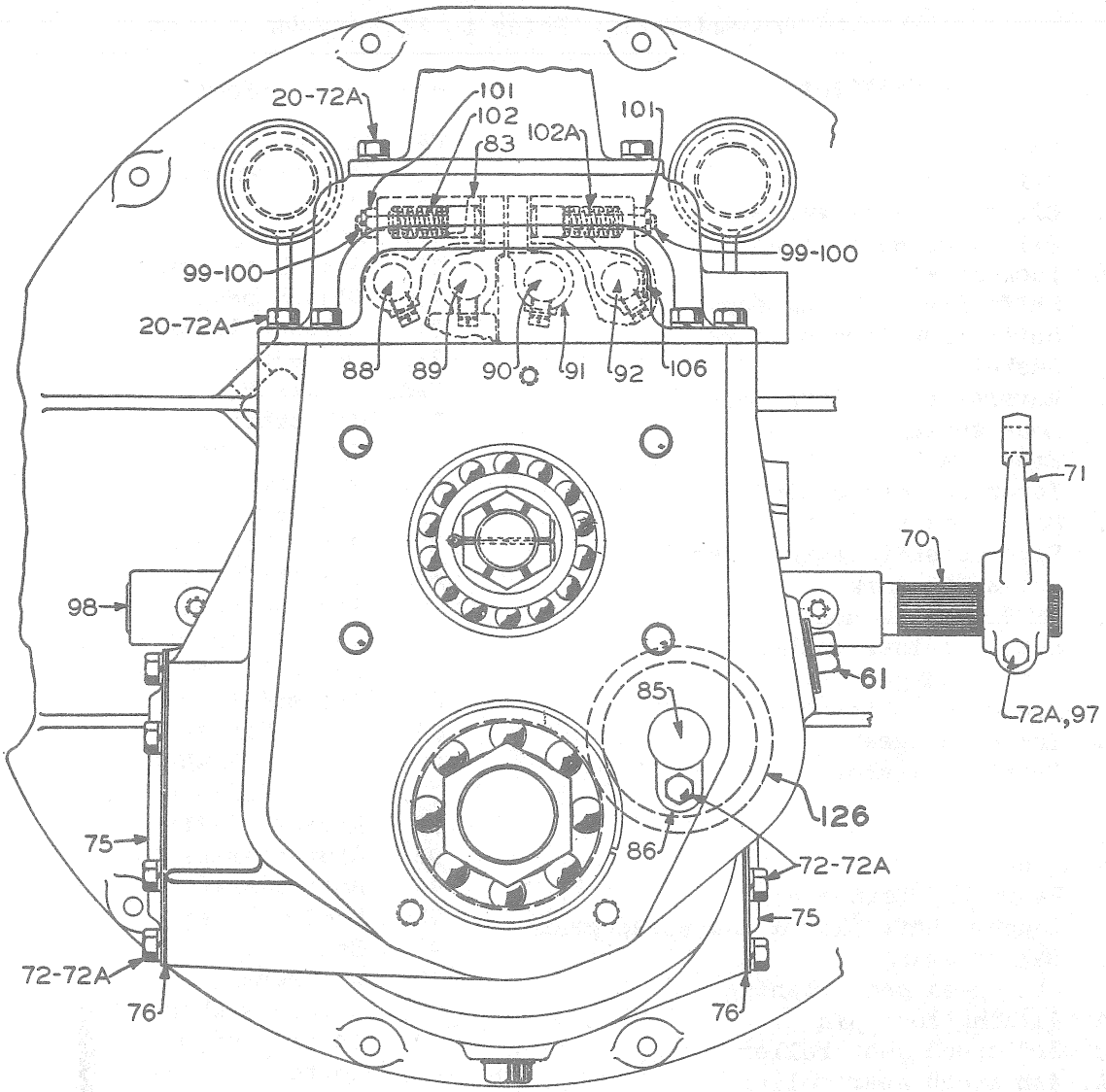


Figure 34B. Transmission (Rear View)

Key to Transmission - Refer to Figures 34A and 34B

REF.	*DESCRIPTION*
1.	Bell housing
2.	High reverse position bushing
2A.	Shift rail locating pin
3.	Shift rod hole welch plug
4.	Reverse shift rail
4A.	Welch plug
5.	4th and 5th shift fork
6.	Main drive gear
7.	Cover gasket
8.	Nut
8A.	Lock washer
9.	Stud-long
9A.	Stud-short
10.	Ball bearing
11.	Release spring

REF.	*DESCRIPTION*
11A.	Spring clip
12.	Oil seal
13.	Bearing cap
13A.	Cap screw
13B.	Brg. carrier or release sleeve
14.	Clutch release bearing
15.	Woodruff key
16.	Shaft retainer screw
16A.	Locking wire
17.	Clutch release yoke
17A.	Throw-out yoke spring clip
18.	Mainshaft retainer ball
19.	Bearing retainer nut
20.	Cap screw
21.	Spigot roller bearing

(Continued)

Key to Transmission - Refer to Figures 34A and 34B

REF.	DESCRIPTION
22.	Cover
24.	Oil guide wire
25.	Oil guide wire washer
26.	Oil guide wire screw
26A.	Locking wire
27.	Shift fork locking screw
28.	Shift fork locking wire
29.	Gasket
30.	Reverse shift fork-upper
31.	Lock spring
32.	Steel ball
33.	Interlock cross pin
34.	2nd & 3rd shift fork
35.	Reverse shift fork-lower
36.	1st shift fork
37.	MS 3rd speed gear
38.	Gear retainer washer
39.	2nd speed gear
40.	Low speed shift hub
41.	Low speed gear
42.	Retainer washer
43.	Snap ring
44.	Bushing
44A.	Sleeve
45.	Bearing retainer nut
46.	Countershaft (low & 2nd speed gear)
47.	Ball bearing
48.	4th speed gear bushing
48A.	Bushing lock pin
49.	3rd speed gear roller
49A.	4th speed gear roller
50.	Retainer ring
51.	Welch plug
52.	Roller bearing
53.	Cover screw
53A.	Lockwasher
54.	Drive gear
55.	Transmission case
56.	Bearing spacer
57.	Snap ring
58.	CS 4th speed gear
59.	4th & 5th speed shift hub
61.	Filler pipe plug
62.	Retainer washer
63.	Roller bearing retainer ring
63A.	4th speed gear shim

REF.	DESCRIPTION
64.	CS 3rd speed gear
65.	MS 4th speed gear
66.	Washer
67.	Snap ring
69.	Gear lock washer
70.	Clutch pedal shaft
71.	Release lever
72.	Cap screw
72A.	Lockwasher
73.	Mainshaft
74.	Slotted nut
75.	PTO cover plate
76.	PTO cover plate gasket
79.	Shift bar housing
83.	Low shift lug
85.	Reverse idler shaft
86.	Reverse idler shaft lock
87.	Control cover gasket
88.	1st shift rod
89.	4th & 5th shift rod
90.	2nd & 3rd shift rod
91.	2nd & 3rd shift lug
92.	Reverse shift rod
93.	Clutch brake drum
94.	Ball bearing
95.	Woodruff key
96.	Stud
97.	Cap screw
98.	Clutch stub shaft
99.	Latch plunger
100.	Cotter
101.	Adjusting nut
102.	Low latch plunger spring
102A.	Reverse latch plunger spring
105.	Drain plug
106.	Interlock hole welch plug
107.	Grease hose
108.	Hose connection
109.	Pilot bearing
120.	Breather
121.	Reverse idler sleeve
122.	Reverse idler sleeve key
123.	Reverse idler sleeve spacer
124.	Reverse idler sleeve washer
125.	Reverse idler roller bearing
126.	Reverse idler gear

vent their loosening.

3. Pull out the clutch lever cross shafts.

4. Remove the release yoke, Ref. 17.

CAUTION: Do not lose the two "C" shaped spring clips, Ref. 17A, which hold the yoke, Ref. 17, to release sleeve, Ref. 13B.

5. Remove the cap screws holding the front drive gear bearing cap, Ref. 13, and remove the release sleeve, Ref. 13B. Be sure to note the position of the clutch release spring clip, Ref. 11A, so that you will know how to get it back into its correct position. (It should point slightly upward and toward center).

6. Remove the drive gear bearing cap, Ref. 13. This cap has a seal, Ref. 12, in backside, and if seal appears worn or if there is any evidence of its having leaked, it should be replaced with a new one before reassembling.

7. Pull the main drive gear, Ref. 6, (integral with clutch shaft) and its bearing, Ref. 10, out of case. Examine the roller bearing, Ref. 21, and replace it with new one if worn or chipped.

8. Examine the steel ball, Ref. 18, and replace it if rough.

9. Slip the fourth and fifth speed shift hub, Ref. 59, off at front end of mainshaft, Ref. 73.

10. Slip the low speed shift hub, Ref. 40, forward as far as possible, to get it out of the way.

11. Pry the snap ring, Ref. 43, out of its groove and forward about 2 inches on splines on mainshaft.

12. Tap the splined mainshaft, Ref. 73, backward until bearing, Ref. 94, is out of the case and remove bearing, Ref. 94, and the washer, Ref. 66, from the shaft.

13. Lift up on clutch end of mainshaft, Ref. 73, and moving it toward clutch housing, lift it out of case with gears mounted on it.

14. Pry the roller bearing retainer snap ring, Ref. 63, out of its groove and forward off front end of mainshaft.

15. Remove the retainer washer, Ref. 62, from front end of mainshaft.

16. Remove the fourth speed gear, Ref. 65. Be careful not to lose any of the 38 needle roller bearings, Ref. 49A, inside of gear.

17. Remove the inner race sleeve, Ref. 48.

CAUTION: There is a small anchor pin, Ref. 48A, inside of this race. Do not lose this pin as it must be used in reassembly.

18. Remove the retainer washer, Ref. 38.

19. Remove the third speed gear, Ref. 37. Again be careful not to lose any of the 38 needle roller bearings in this gear.

20. Remove gear lock washer, Ref. 69.

21. Remove low gear, Ref. 41, from other end of shaft.

22. Press off bearing sleeve, Ref. 44A.

23. You can now remove retainer washer, Ref. 42, and snap ring, Ref. 43, if desired.

24. Remove the (bell to case) stud nuts, Ref. 8, and remove the bell housing, Ref. 1.

25. Remove the rear bearing retainer nut, Ref. 45. It is usually best to disregard the lock on this nut and shear it by unscrewing the nut forcibly.

26. Slip the countershaft, Ref. 46, back until bearing, Ref. 47, is entirely out of case. Pull bearing off end of shaft.

27. The countershaft assembly can now

be lifted up at front end and moved forward out of top of case.

28. Remove the snap ring, Ref. 50, in the transmission case, at front end of the lower countershaft.

29. Drive out (from inside of case), the countershaft hole welch plug, Ref. 51.

30. Drive out (from outside of case) front roller bearing, Ref. 52.

31. Remove the countershaft gear snap ring, Ref. 57.

32. The countershaft gear, Ref. 54, can now be pressed off the countershaft, Ref. 46. Also, the third speed, Ref. 64, and fourth speed, Ref. 58, gears, if necessary. Be careful to align keys and keyways when pressing the gears back on. Note that the long hub end of the third speed gear, Ref. 64, the long hub side of fourth speed gear, Ref. 58, and long hub side of countershaft gear, Ref. 54, all go onto the shaft first.

33. A clutch brake drum, Ref. 93, is used on all of our standard transmissions between the fourth speed gear, Ref. 58, and the countershaft gear, Ref. 54. On special transmissions equipped for power take-off (such as tire pump, etc.), a power take-off gear is used in place of this clutch brake drum.

34. The reverse idler gear, Ref. 126, is mounted upon its shaft, Ref. 85, by means of roller bearings, Ref. 125. The reverse idler can be removed by removing the lock screw, Ref. 72, lock washer, Ref. 72A, and the shaft lock, Ref. 86. The shaft, Ref. 85, can then be driven or pulled from case and gears lifted out.

NOTE: The sleeve, Ref. 121, should be installed with the slot for key, Ref. 122, also spacer, Ref. 123, assembled nearest to the shaft lock plate, Ref. 86.

35. Clean and inspect all parts carefully. Reverse above procedure for reassembly.

31. REAR AXLE.

The rear axle unit of the "99-M" power grader is of the double reduction type. The drive from the propeller shaft to the rear axles is made first through a spiral pinion and bevel gear, and then through a pinion and spur gear fully enclosed, running in oil. It is equipped with dust-proof oil seals and mounted on anti-friction bearings throughout.

The oil level is the 3/8" pipe threaded hole with square head pipe plug. It is located on center-line of axle on right-hand side of grader, a few inches below the large (1-1/4" pipe plug) filler opening.

Keep this filled with oil as recommended in the lubrication instructions.

In making repairs to parts located at either end of main axle housing, Ref. 49, Fig. 37, including replacing of the drive shafts, it is unnecessary to remove the main axle housing from the rear end of power grader frame. In fact, it is possible to remove the gear carrier, Ref. 2, Fig. 37, from axle housing without rolling the rear end from under the frame. (See instructions for gear carrier removal).

If the machine is in operating condition it is best to drain the gear oil from the rear axle and refill it with kerosene or diesel fuel, and run the machine backward and forward several minutes. It is best to drain this first wash-out, and refill with clean kerosene or diesel fuel, and repeat. In this way, a second washing will usually get everything clean and free of oil.

> CAUTION: Do not use gasoline as there is danger of explosion and fire.

32. REAR WHEEL REMOVAL.
(See Fig. 35 for all References)

Both wheels are attached in the same manner, so the following will apply to either right or left hand wheel:

1. Remove the eight nuts, Ref. 39, from the drive flange studs.

2. Remove the drive flange, Ref. 2. There are four tapered dowel bushings, Ref. 1, placed over four of the studs

holding the flange in place. These dowel bushings may stick to the studs or bind in tapered holes. They can usually be jarred loose by striking the drive flange sharply near each dowel. This should cause them to loosen and pop out slightly. You can then remove them with a pair of pliers.

If the drive flange still sticks too tightly to be pulled off by hand, secure a couple of 1/2" hardened set screws to remove the flange. Lubricate the threads of hardened set screws well before inserting them in the threaded holes provided in the drive flange. Be sure to clean the threaded holes carefully and blow out all dirt present. The flange can then be forced off by screwing the set screws in through the flange against the wheel face.

3. Unlock the bent over edge of lock washer, Ref. 6, and remove the hub bearing lock nut, Ref. 5.

4. Remove the lock washer, Ref. 6.

5. Remove the drilled washer, Ref. 7.

6. Remove the adjusting nut (with pin), Ref. 8.

7. Jack up on axle housing inside of wheel till wheel clears ground.

8. Place a well greased metal plate under the tire, and lower jack until weight of wheel only rests on plate.

9. Slide the wheel off. Be sure to catch the Timken cone, forced off by wheel, so it does not fall on the ground and become dirty.

10. If the hub bearing felt, Ref. 13, is worn or damaged, replace it by prying off the inner Timken bearing and removing the washer, Ref. 12, and felt, Ref. 13.

11. Be sure to wash all the old grease from inside the wheel and from axle end and bearings. Re-pack the bearings with wheel bearing grease when reassembling. If bearings show any flat spots or chipping, replace both cone and cup.

12. In reassembly after replacing the wheel and outer Timken bearings, replace the adjusting nut, Ref. 8, (with pin on outside). Tighten this nut up snugly. (Do not back it up for bearing clearance, as none is needed or desirable). The slight pre-load thus put on the wheel bearings will prevent any load misalignment due to working strains.

13. Replace the drilled washer, Ref. 7. Be sure one of the holes aligns with the pin protruding from the adjusting nut, Ref. 8. If they fail to align, try taking the washer off and turning other side inward. If this fails to align the pin and a hole in washer, then the nut will have to be loosened slightly.

14. Replace the lock washer, Ref. 6.

15. Replace and securely tighten the lock nut, Ref. 5.

16. Bend one edge of the lock washer, Ref. 6, so as to firmly fix the lock nut, Ref. 5.

17. Replace the drive flange, Ref. 2. Be sure the hole provided for greasing aligns with grease passage in wheel hub.

18. Replace the four tapered split dowel bushings on proper studs.

19. Replace lock washers and nuts on all studs.

20. Tighten the four nuts on dowel bushing studs first.

21. Tighten remainder of stud nuts.

22. Check all nuts and retighten if necessary after operating grader about an hour and again after a day's operation.

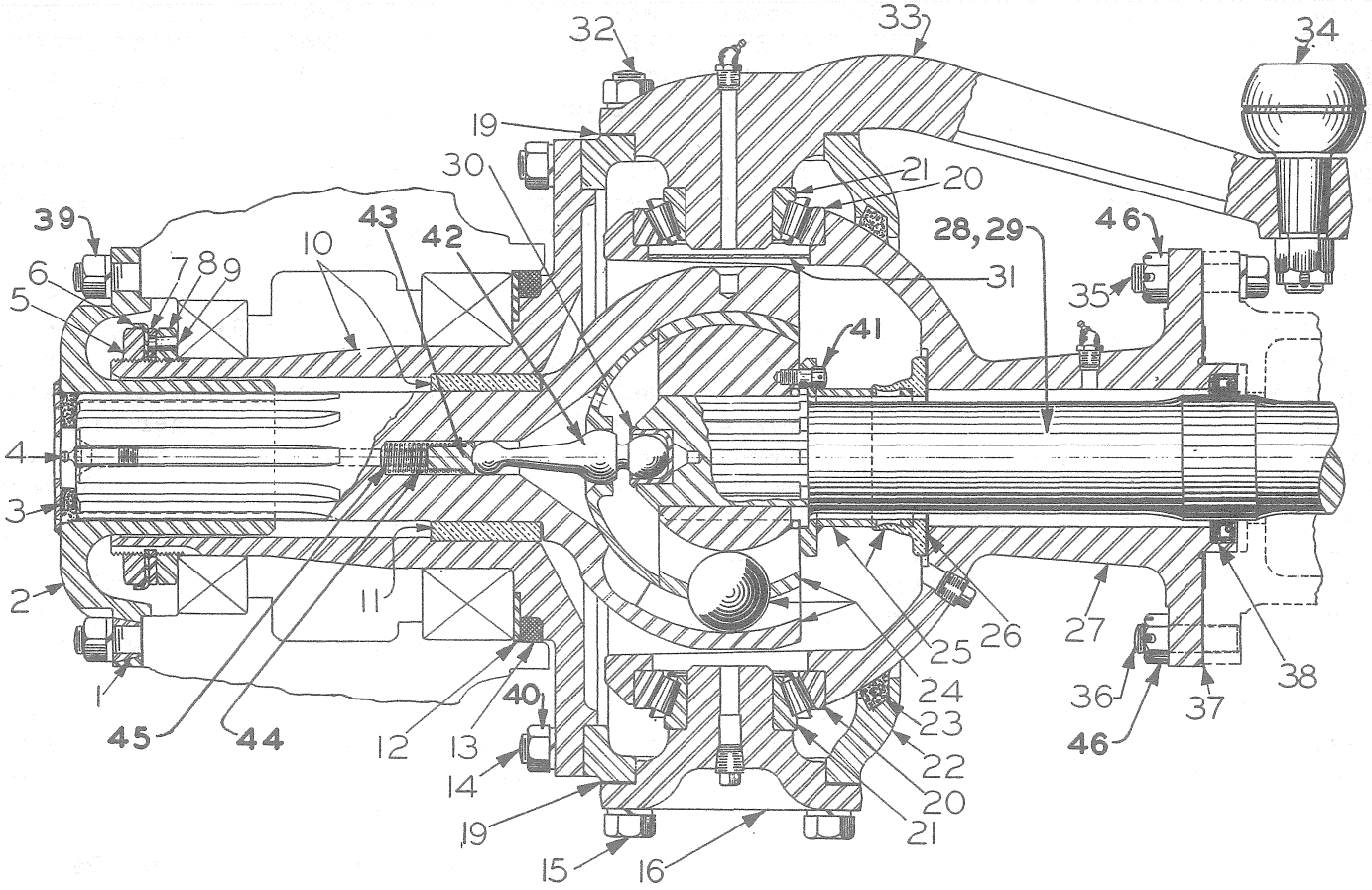
33. REAR UNIVERSAL JOINT WITH AXLE SHAFT REMOVAL. (See Fig. 35 for all Ref.)

a. Follow the instructions in paragraph 32 covering wheel removal.

b. Remove the twelve nuts, Ref. 40, and lockwashers from studs, Ref. 14.

c. Loosen the four cap screws, Ref. 15.

d. Remove the steering knuckle, Ref.



REF.	DESCRIPTION	REF.	DESCRIPTION
1.	Dowel bushing	25.	Joint and shaft retainer
2.	Drive flange	26.	Thrust washer
3.	Felt	27.	Trunnion socket
4.	Grease fitting	28.	Axle shaft-long
5.	Lock nut	29.	Axle shaft-short
6.	Lock washer	30.	Pilot pin seat
7.	Washer	31.	Grease retainer
8.	Adjusting nut	32.	Stud
9.	Adjusting nut pin	33.	Steering arm (L.H. side only)
10.	Steering knuckle	34.	Steering arm ball
11.	Steering knuckle bushing	35.	Cap screw
12.	Washer	36.	Stud
13.	Felt	37.	Gasket
14.	Stud	38.	Oil seal
15.	Cap screw	39.	Hex nut
16.	Pivot bearing cap	40.	Hex nut
19.	Shim	41.	Joint retainer screw
20.	Bearing cup	42.	Pilot pin
21.	Bearing cone and rollers	43.	Pilot pin plunger
22.	Knuckle flange	44.	Plunger spring-large
23.	Felt	45.	Buffer spring-small
24.	Drive joint group	46.	Slotted nut

Figure 35. Rear Axle Steering Knuckle and Universal Joint

10.

e. Grasp the splined end of universal joint now exposed and carefully pull the joint, with axle shaft attached, out of housing. Be especially careful not to damage the oil seal, Ref. 38. There is another seal at inner end of axle shaft near the bull gear, see Fig. 37, Ref. 52. Use care not to damage these seals when reassembling.

f. Place the universal joint and axle assembly on a bench (or a box if bench is not available) and remove the lock wire and six cap screws, Ref. 41. Be sure to lock these screws with a new wire when reassembling.

g. The universal joint can now be slid off the end of axle shaft. Be careful not to lose the pilot pin, Ref. 42, the plunger, Ref. 43, or the springs, Ref. 44 and 45. When the axle is out of joint, these parts are loose, and may fall out.

h. The joint shaft retainer, Ref. 25, can now be removed from axle shaft by sliding it off the inner end.

i. Wash all parts carefully with kerosene and check them carefully before reassembly.

j. When reassembling, be sure that the pilot pin seat, Ref. 30, is in place in end of shaft, and that the springs, Ref. 44 and 45, the plunger, Ref. 43, and the pilot pin, Ref. 42, are properly in place inside of the universal joint as shown.

34. *REAR AXLE UNIVERSAL JOINT DISASSEMBLY. (For Cleaning and Inspection Purposes Only) (See Fig. 23)*

a. Whenever the joint is removed from its housing for any purpose, it is a good idea to wash it and inspect it. If it is desired to disassemble it, study Fig. 23 and follow the procedure outlined below.

b. By pushing down on one side of inner race, the opposite side will automatically come up, Illustration 4, and one ball can then be removed. By pressing down at another point, another ball can be removed, and so on until all balls are removed.

c. Straighten the cage and inner race and roll them upside down, Illustration 3.

d. Lift off the pilot, Illustration 3.

e. Continue rolling the cage and inner race until they are standing on edge, Illustration 2. If the rectangular slots are not aligned with outer race, revolve the cage slightly to align. Then lift inner race and cage out.

f. Roll the inner race at right angles to the cage so that one lug projects through one rectangular slot in cage. Remove inner race from cage, Illustration 1.

g. Clean and inspect all parts. If excessively worn, chipped or cracked, procure a new drive joint group from your nearest Austin-Western Distributor and return the old one to the distributor. It is not practical to replace any parts in a used joint with new parts. Therefore, the entire joint group must be replaced as a unit.

35. *REAR WHEEL STEERING KNUCKLE DISASSEMBLY. (See Fig. 35 for all References)*

a. Follow the instructions in paragraph 33 covering universal joint with axle shaft removal.

b. Remove the lock wire and nuts, Ref. 46, from studs, Ref. 36, and capscrews, Ref. 35, in outer end of axle main housing.

c. Remove the bolt through tie rod fork at Ref. 31 or 32, Fig. 36. If the left knuckle is removed, it will be necessary to remove the cap on the end of steering ram rod. This cap holds the ram rod to ball, Ref. 34.

d. Pull the entire trunnion and knuckle flange off the studs. It may stick and require force to remove it. At this point, it is well to check the seal, Ref. 38, in end of trunnion socket, and replace it if necessary. Be sure to oil it well before reassembling.

e. Remove the four cap screws, Ref. 15, from bottom pivot bearing cap, Ref. 16, and remove the cap and shims, Ref. 19.

Keep the cap and shims together. (It will be well to tie them together so they can be reinstalled exactly in original position).

f. Now remove the upper pivot bearing cap, keeping shims with the cap.

NOTICE: This only applies to the right hand side. The left side has a steering arm, Ref. 33, and uses studs, Ref. 32, in place of cap screws. However, treat this steering arm, Ref. 33, just as though it were a bearing cap.

g. Slip the knuckle flange, Ref. 22, off flanged (inner) end of trunnion socket, Ref. 27.

h. The felt, Ref. 23, can now be removed and replaced with a new one, if necessary.

i. For reassembling, reverse the above procedure.

> CAUTION: Before reassembling, be sure to wash and inspect all parts carefully. Cleanliness is most essential in preventing wear. Be sure to read the caution note at end of operation g in paragraph 36 following.

36. *REAR WHEEL PIVOT BEARING ADJUSTMENT. (Ref. 20 and 21) (With the Wheel Removed but Steering Knuckle Still on the Power Grader) (See Fig. 35 for all References)*

a. Remove the four cap screws, Ref. 15, from lower pivot bearing cap, Ref. 16, and remove the cap and shims, Ref. 19. Keep the cap and shims together. (It will be well to tie them together so they can be easily assembled in the original position). Mark the cap, Ref. 16, so that it can be put back in the original position.

b. Carefully wash out the bearing cup, Ref. 20, and its compartment. Be sure to remove all grit and chips present. Wash bearing cone and rollers carefully. If bearings show signs of chipping or flat spots, replace both the cup and the cone with new ones.

c. Remove the four nuts from the studs, Ref. 32, holding the top cap in place. This cap is a part of the steering arm, Ref. 33, used on the left side only. The cap on the right side is similar to the lower one and has cap screws in it. Again be sure to keep the shims with the cap.

d. Wash the bearing cone and cup carefully. If there are any signs of chipping or flat spots in either one, replace both cup and cone with new ones.

e. Pack the bearings with grease and reassemble both caps with shims in original positions.

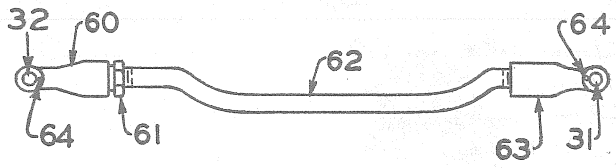
f. Tighten the cap screws, Ref. 15, and nuts on the studs, Ref. 32, evenly on both caps.

g. If there is any end play in bearings, they will have to be adjusted by removing equal amounts of shim thickness from both top and bottom. If too tight, add new shims to both top and bottom of same thickness. Continue this adjustment until the play is just out of bearings when screws are tight, then remove a thin shim (.007") from under both the top and the bottom bearing cap. This will bind the bearings slightly and is called preloading. This is done to eliminate slight play from existing when these bearings are actually carrying the weight of machine while at work. The shims are of three different thicknesses, namely, .005", .007" and .020".

> CAUTION: The cap screws, Ref. 15, holding top and bottom pivot bearing caps, Ref. 16, and the nuts on the four studs, Ref. 32, holding steering arm, Ref. 33, must be left loose until the axle and knuckle drive joint group have been put in place and knuckle, Ref. 10, has been securely tightened down in place by the twelve studs and nuts, Ref. 40. Otherwise, knuckle flange, Ref. 22, will distort and the pre-loading effect will be destroyed.

37. *REAR WHEEL TOE-IN ADJUSTMENT.*

The "99-M" power grader is equipped with a tie rod adjusting nut, Ref. 61, Fig. 36.



REF. *DESCRIPTION*

31. Fork bolt
32. Fork bolt
60. Fork
61. Adjusting nut
62. Tie rod
63. Fork
64. Pin

Figure 36. Rear Axle Tie Rod

(which has both right and left hand threads). Loosen the clamping bolts and adjust so that there is no toe-in and not more than 1/16" toe-out. Check this monthly and after overhauling axle. Measurements to be made at side wall of tires as close to the height of center-line as possible.

No toe-in should be tolerated. Failure to comply with the above will cause excessive tire wear.

38. REMOVAL OF REAR AXLE ASSEMBLY FROM FRAME. (See Fig. 37 for all Ref.)

It is not essential to roll the rear axle from under grader to remove the gear carrier.

1. Place machine on level place.

2. Revolve blade until it is square across and lock circle latch.

3. Block both front wheels securely to prevent possibility of machine rolling forward or backward.

4. Remove the lower nuts from the two long axle studs, Ref. 55.

5. Remove the short bolt running crosswise through the frame, Ref. 59.

6. Disconnect the steering ram rod cap and tie the ram up out of the way.

7. Remove the two bolts, Ref. 60, holding the cap, Ref. 58. Be sure to mark the cap and axle bracket to facilitate re-assembly.

8. Unlock and remove the four cap screws from rear propeller shaft universal joint fitting yoke.

9. Start the engine and raise blade as high as possible. Place blocking under each end of blade about a foot from the ends.

10. Force blade downward lifting the front end. It will still be necessary to jack up under the rear bumper to lift the frame off the rear axle, but by lifting the front end first, it makes the lifting easier and keeps the power grader from tipping.

11. Roll rear axle back toward the rear bumper and block under the axle bracket, Ref. 57, on left side and under the frame on opposite side.

12. Remove the jack from under bumper.

13. Roll the rear axle out from under the power grader.

39. REAR AXLE GEAR CARRIER REMOVAL. (Without Rolling the Rear Axle Out From Under the Grader) (See Fig. 37 for all References Unless Indicated)

Some operators prefer to remove and roll the rear axle from under the grader, but it is easier to proceed as follows:

1. Place machine on level place.

2. Start the engine and revolve the blade until it is square across. Be sure the latch is locked securely.

3. Raise the blade as high as possible and place firm blocking under each end about a foot from the ends.

4. Force the blade downward. This will lift the front wheels off the ground and make the rear end lighter. It also firmly anchors the grader on blocking and prevents its tipping.

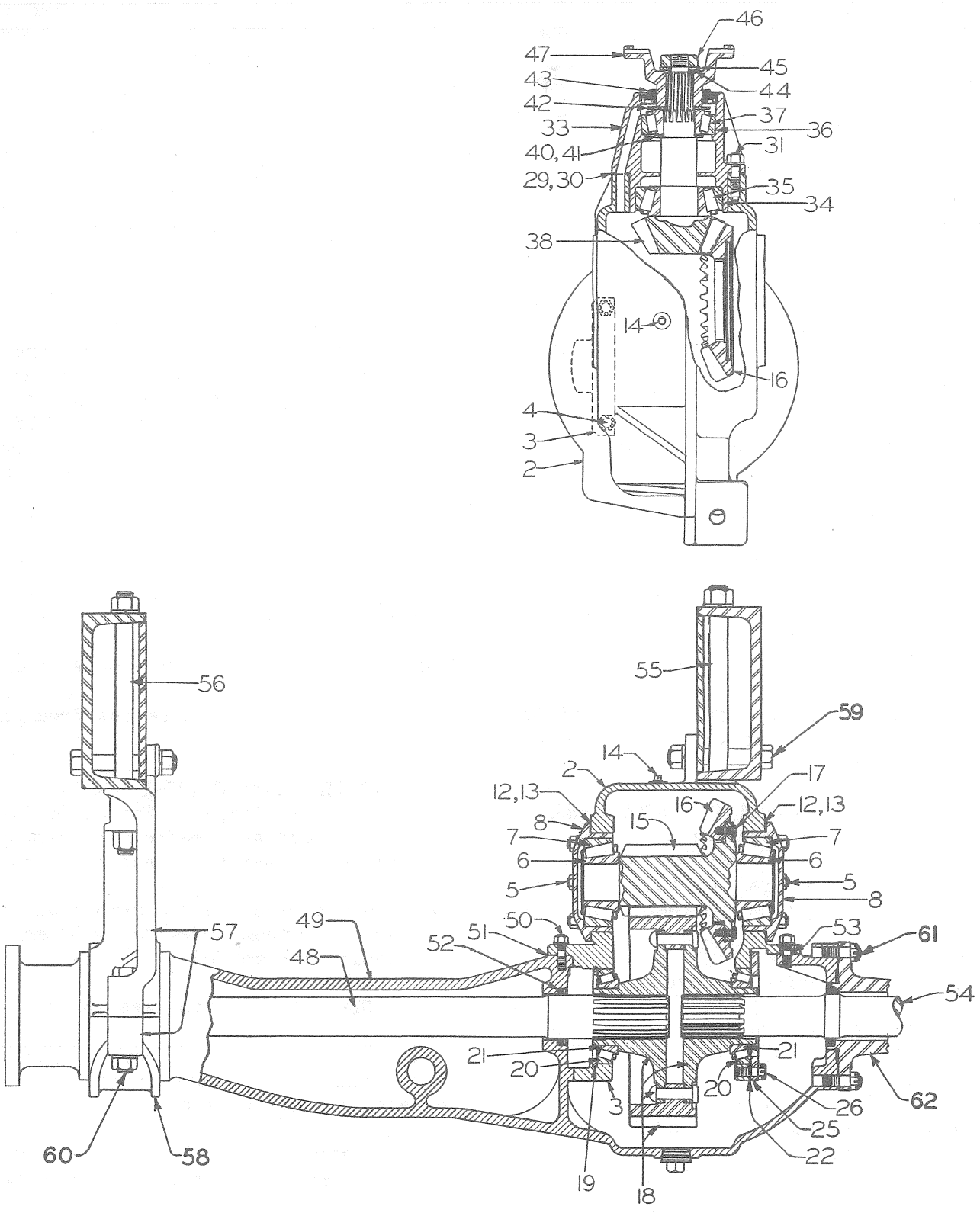


Figure 37. Rear Axle Gear and Pinion Carrier

Key to Rear Axle Gear and Pinion Carrier - Refer to Figure 37

REF.	DESCRIPTION
2.	Gear carrier
3.	Bearing cap
4.	Bearing cap stud
5.	Stud
6.	Bearing cone and rollers
7.	Bearing cup
8.	Bearing cap
12.	Shim
13.	Gasket
14.	Vent plug
15.	Pinion and gear hub
16.	Bevel gear
17.	Bevel gear cap screw
18.	Gear and hub
19.	Washer
20.	Bearing cup
21.	Bearing cone and rollers
22.	Shim
25.	Bearing retainer
26.	Cap screw
29.	Shim
30.	Gasket
31.	Stud
33.	Pinion carrier
34.	Bearing cup
35.	Bearing cone and rollers
36.	Bearing cup
37.	Bearing cone and rollers
38.	Bevel pinion
40.	Shim
41.	Washer
42.	Washer
43.	Oil seal
44.	Gasket
45.	Washer
46.	Slotted nut
47.	Fitting yoke
48.	Axle shaft-long
49.	Axle housing
50.	Stud
51.	Gasket
52.	Oil seal
53.	Taper dowel bushing
54.	Axle shaft-short
55.	Axle stud
56.	Axle bracket stud
57.	Axle bracket
58.	Axle bracket cap
59.	Bolt
60.	Bolt
61.	Stud
62.	Trunnion socket

5. Place a jack under the center of rear bumper and jack up until both rear tires clear ground at least an inch.

6. Place a well greased plate under the right hand tire.

7. Lower the jack so that the wheel weight only rests on tire.

8. Remove the tie rod fork bolt, Ref. 31, Fig. 36.

9. Remove the lock wire and nine nuts from studs, Ref. 61, on right side.

10. Slide the wheel to right on grease plate until the short axle shaft, Ref. 54, is out of housing, Ref. 49. The trunnion socket, Ref. 62, may stick to axle housing, but lowering and raising the supporting jack under the rear bumper will usually start it coming off. Handling the rear wheel and axle is a two-man job, so be careful. Roll it out of the way.

11. Remove the lock wire and loosen the nine nuts, Ref. 46, Fig. 35, from capscrews and studs, Ref. 35 and 36, Fig. 35, on left side and work the trunnion socket loose so that it can be readily removed later.

12. Remove the bolts, Ref. 60, in axle bracket cap, Ref. 58, and remove the cap.

13. Disconnect the rear universal joint from drive yoke at front of pinion carrier (4 cap screws).

14. Block up under the main axle housing, Ref. 49, directly under the gear carrier. If a floor jack (with wheels) is available, use this, letting the handle stick straight out on right hand side.

15. Remove the two long axle studs, Ref. 55, and the one bolt, Ref. 59, holding the gear carrier to power grader frame.

16. Jack up the rear bumper about two inches more.

17. Lower the main axle housing, Ref. 49, on right hand end to the floor.

18. Remove the nuts, Ref. 46, Fig. 35, holding the trunnion socket, Ref. 27, Fig. 35, to the left end of main axle housing.

19. Slip the main axle housing, Ref. 49, to the right, about five inches so you can lift out the gear carrier; but be careful not to slide it too far or the axle shaft, Ref. 48, will slip out of guide near oil seal, Ref. 52.

20. Remove the twelve nuts and washers from studs, Ref. 50. It is necessary to slightly raise the gear carrier in order to entirely remove some of these nuts. Pay particular attention and fix the location of these in your mind so you remember to start these nuts on first in putting it back together.

21. One of these studs has a split tapered dowel bushing, Ref. 53, on it. Remove this and reinstall it in the same hole (it is tapered) in reassembly.

22. Lift out the gear carrier assembly.

23. In reassembly, reverse the above procedure and use a new gasket, Ref. 51. After starting all the nuts on studs, Ref. 50, tighten first the one with the tapered dowel bushing on it. If oil seal, Ref. 52, is worn or damaged, replace it. The same applies to seals, Ref. 38, Fig. 35, (one at each trunnion).

40. REAR GEAR CARRIER DISASSEMBLY. (After Removing it from Main Housing of Rear Axle) (See Fig. 37 for all References)

a. Place the gear carrier upside down on bench or suitable support. Be sure to block it firmly and nail the blocking so it will stay in place while you are working on the gear carrier.

b. Remove the cotters or lock wire from the two nuts on studs, Ref. 4, and screw off the nuts.

c. Remove the bearing retainer cap, Ref. 3, and remove the washer, Ref. 19, and bearing cup, Ref. 20.

d. Remove the lock wire and the four cap screws, Ref. 26.

e. Remove the bearing retainer, Ref. 25, with shims, Ref. 22. Keep these shims with this bearing retainer. In reassembly, take out any end play present in these bearings by removing shims at Ref. 22. When all play is removed, remove shims to thickness of .010" to .013" more to pre-load these bearings.

f. Lift out bull gear assembly, Ref. 18. It is sometimes necessary to drive off the one bearing cone, Ref. 21, to enable you to lift out bull gear assembly.

g. Remove nuts and washers from studs, Ref. 31.

h. Pull the bevel pinion shaft housing assembly out of gear carrier. Threaded draw screw holes are provided for easy removal in case it sticks. Use set screws for draw screws. Keep the shims, Ref. 29, and gasket, Ref. 30, together with pinion carrier so they can be reassembled in same position. These shims have holes for oil ports. Be sure that you put them back so as to permit oil to flow through ports, otherwise the bearings will be ruined for lack of oil. On top of the pinion carrier is a 1/8" pipe plug. Remove this and pour in one pint of recommended gear oil after reassembling the rear axle into grader before operating it. This will lubricate the bearings until oil gets started circulating. This plug should then be replaced securely and need not be removed until another overhaul operation takes place.

i. For pinion carrier disassembly, see paragraph 41.

j. Next, remove the twelve nuts and lockwashers from studs, Ref. 5, and remove the two bearing caps, Ref. 8. Tie the shims, Ref. 12, and gasket, Ref. 13, to each cap for reassembly in same place. Watch oil ports when reinstalling these shims and gaskets.

k. Slip the bull gear, Ref. 15, out through the opening where you removed the bearing cap, Ref. 8, (on left side) as far as possible and remove the six cap screws, Ref. 17, which hold the bevel gear, Ref.

16, to its flange.

l. Drive the bevel gear, Ref. 16, off its hub.

m. Remove the bearing cone, Ref. 6, from bull gear end of shaft, Ref. 15. Sometimes, it is also necessary to remove the bearing cone at other end in order to get shaft out of gear carrier. If difficulty is experienced in removing these bearings, try heating the bearings only by pouring hot oil (not over 300° F.) over the bearings carefully, so as not to heat the shaft. This will tend to expand them and make them easier to remove.

n. With the bevel gear, Ref. 16, off its seat and slightly cocked, lift the shaft, Ref. 15, out of the carrier. A certain amount of manipulation may be necessary to get it out.

41. REAR PINION CARRIER DISASSEMBLY. (After Removing it From Gear Carrier) (See Fig. 37 for all References)

a. Remove the cotter and nut, Ref. 46.

b. Remove the washer, Ref. 45.

c. Remove the universal joint fitting yoke, Ref. 47.

d. Drive the pinion shaft out of bearing, Ref. 37, by driving on threaded end with a soft drift.

e. Remove the pinion shaft with the bearing cone, Ref. 35, still on it. If bearing is chipped or badly worn, drive it off and replace it. Be sure to replace the cup, Ref. 34, at the same time.

f. With a long drift, stuck into pinion housing (where pinion was removed), you can now drive the other bearing cone, Ref. 37, with washer, Ref. 42, and oil seal, Ref. 43. Replace any worn or damaged parts.

g. If bearing cone, Ref. 37, is replaced, be sure to replace the cup, Ref. 36, also.

h. There is an adapter washer and adjusting shims under the bearing cone at Ref. 40. These adjust the bearing clearance of the two bearings, Ref. 35 and 37. In reassembling, use the original shims and washer at this point. If bearings are too tight, add shims. If too loose, remove shims. These bearings must have no end play and must not be set with more than a very slight drag. The universal joint fitting yoke must be in place and washer, Ref. 45, with nut, Ref. 46, drawn down tight in order to check the clearance of these bearings.

i. Reverse disassembly procedure for reassembly. Be sure to have all parts clean.

42. POWER UNIT.

The power unit, consisting of engine, clutch, transmission and transfer case, all bolted together, is mounted as a unit in the main frame. The motor is supported at the front on a trunnion type of bearing which permits free movement of the power unit to compensate for any possible frame misalignment. The transmission end of the power unit is likewise rubber mounted by means of two angle iron brackets mounted on the frame, which support two angle sills connecting the flywheel housing and the transfer case. There is no adjustment in this engine mounting. The rubber cushion blocks have been pre-loaded at the factory to the proper amount of resiliency and the method of mounting provides for any possible misalignment and distortion taking place under normal or extreme operating conditions.

The radiator is likewise mounted on angle brackets and cushioned by means of two rubber mounting blocks to dampen out vibration as much as possible. The back panel is securely mounted to the main frame and it may be necessary, particularly in the diesel engine installation, to frequently inspect the radiator as well as the back panel mounting bolts and likewise all of the hood bolts at both back panel and radiator end. Flexible connections between the engine and the upper and lower tanks of the radiator absorb any uneven movement between these two members. However, frequent inspection of the hose clamps is advisable.

43. *HYDRAULIC BRAKE SYSTEM.*

a. General.

The hydraulically controlled Bendix Duo Servo Brakes utilize a standard hydraulic actuating system having a compensating type master cylinder operated by a foot pedal and a brake actuating cylinder at brake drum together with the required piping, hose and operating fluid. When a push is exerted on the foot pedal, pressure is created with the master cylinder, causing the column of fluid contained in the master cylinder, piping, etc., to move the drum cylinder pistons which in turn force the brake shoes into contact with the brake drum.

When the foot pedal is released, the brake shoe return springs retract the brake shoes and return the drum cylinder pistons to their normal or "off" position thereby reversing the movement of the column of fluid within the system so that it flows back into the master cylinder.

b. Foot Pedal Adjustment.

The foot pedal should be adjusted so that there is approximately 1" of free movement at the tread portion of the pedal before the pressure stroke begins. Should the master cylinder link be adjusted so that there is no back-lash in the front pedal, the master cylinder piston and cup may not return sufficiently to uncover the master cylinder compensating port, which may cause failure of the brake to fully release. If the brake does not fully release the frictional drag will cause the fluid to further expand as its temperature is raised. This expansion of fluid will cause an increase in brake drag and may, in extreme cases, result in self-application of the brake to the point where the grader cannot be moved until the pressure is relieved either by bleeding or allowing the fluid to cool.

c. Bleeding the Hydraulic Brake System.

Whenever a hydraulic line is disconnected from the master cylinder, it is usually necessary (after reconnecting the line) to bleed the entire hydraulic system at drum cylinder, to expel any air that may have been taken into the system. Fill the master cylinder reservoir with genuine Lockheed or Delco brake fluid before bleeding the line. Keep the reservoir at least half full of fluid at all times. To bleed a line, remove the slotted screw from bleeder screw and screw in standard bleeder drain tube. Allow tube to hang down into a clean container such as a pint mason jar. Unscrew the hex shouldered portion of bleeder screw three-quarters of a turn to the left and push pedal down slowly. Allow the foot pedal to return to the off position. This produces a pumping action which forces fluid through the tubing and drum cylinder, carrying with it any air that may be present in the line. Watch the flow of fluid from the hose, the end of which should be kept below the surface of fluid in the jar, and when air bubbles cease to appear and the fluid stream is a solid mass, close the bleeder screw, remove the drain tube and replace the slotted screw.

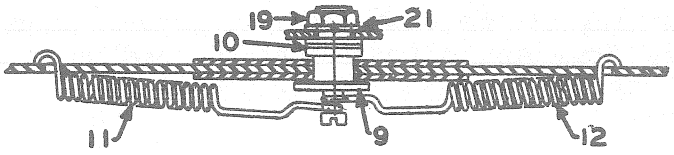
Fluid drained out of the system during the bleeding operations should not be used again as it may contain dirt or foreign matter which may be injurious to the system. After drum cylinder is bled the supply of fluid in the reservoir should be replenished.

> CAUTION: Be sure to keep the reservoir half full of brake fluid when bleeding the brake system. Should the reservoir be drained during the bleeding operations, air will again enter the system and re-bleeding will be necessary.

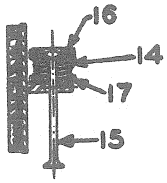
d. Brake Adjustments.

Do not adjust brake when drum is hot. If brake is adjusted when drum is hot and expanded, the shoes may drag when the drum cools and contracts.

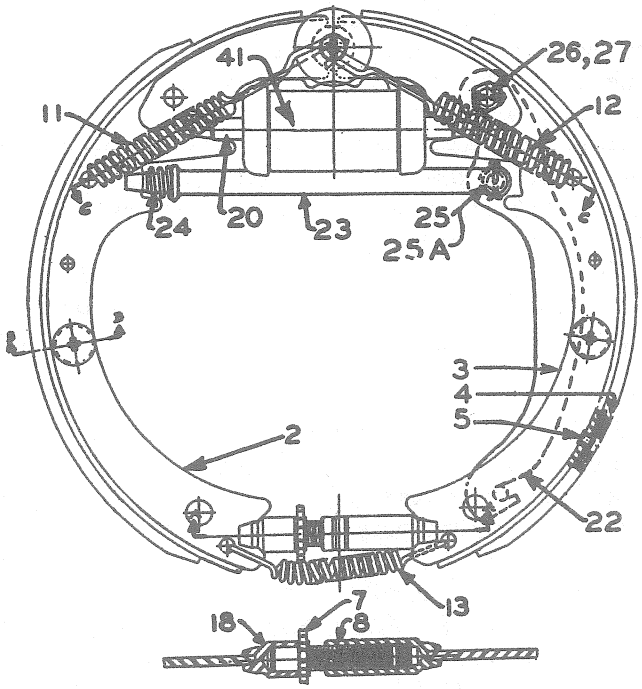
There are two points for adjustment in a brake system of this type to compensate for normal brake lining wear. These points are the adjusting screw, Ref. 7, Fig. 38, and the anchor pin, Ref. 10, Fig. 38. The adjusting screw takes up the clearance between the brake lining and the brake drum. The anchor pin serves to centralize the shoes.



Section C-C



Section B-B



Section A-A

REF.	DESCRIPTION
2.	Shoe with lining
3.	Shoe with lining
4.	Lining
5.	Tubular rivet
7.	Adjusting screw
8.	Adjusting screw pivot nut
9.	Anchor pin shoe guide
10.	Anchor pin
11.	Anchor to shoe spring
12.	Anchor to shoe spring
13.	Adjusting screw spring
14.	Shoe hold down spring
15.	Spring pin
16.	Spring cup
17.	Centralizing cup
18.	Adjusting screw socket
19.	Anchor pin nut
20.	Connecting link
21.	Anchor pin lockwasher
22.	Lever
23.	Strut
24.	Spring
25.	Spring
25A.	Washer
26.	Pin
27.	Spring washer
41.	Drum cylinder

Figure 38. Hydraulic Brake

e. To Adjust Brakes to Compensate for Wear. (See Fig. 38 for all References)

1. Jack up both rear wheels and one front wheel clear of the floor.

2. Remove the four 3/8" pipe plugs from brake drum, Ref. 42, Fig. 33.

3. With the brake in fully released position, revolve one rear wheel causing brake drum to rotate until arrow that is cast into the brake drum, Ref. 42, Fig. 33, points down.

4. Through lower right hand 3/8" pipe plug hole, (in brake drum) insert a pry

between the lining of the shoe, Ref. 3, and the brake drum and move the shoe assembly until the other shoe, Ref. 2, is against the drum.

5. Insert a .015" feeler gauge between the lining and the drum at lower end of shoe, Ref. 3. Turn the adjusting screw with a screw driver or other suitable tool, moving the handle downward which causes the adjusting screw to force the brake shoes against the drum until .015" clearance between lining and drum is obtained. Now check the clearance at the upper end of the shoe, Ref. 3. .015" clearance at each end of this shoe, indicates correct anchor pin position and insures proper brake lining contact with drum.

6. In the event .015" clearance at each end of the shoe, Ref. 3, is not found in checking, it will be necessary to move the anchor pin to the correct position.

7. To adjust the anchor pin, loosen the anchor pin nut, Ref. 19, just enough to permit turning the anchor pin with a screw driver (inserted through adjusting hole in the upper face of the drum). To decrease clearance between the drum and lining at the anchor pin end of the shoe, Ref. 3, turn the screw driver to the right. With the shoe, Ref. 2, against the drum, turn the adjusting screw and anchor pin in the necessary direction to obtain .015" lining to drum clearance at both ends of shoe, Ref. 3.

8. Tighten anchor pin nut securely with a wrench while holding the anchor pin with a screw driver to prevent the pin from turning during the nut tightening operation. After tightening the nut, again check the shoe clearance to be certain the anchor pin has not moved.

9. Install the four 3/8" pipe plugs into brake drum.

f. Precautions.

Use only genuine Lockheed or Delco brake fluids. Substitutes may do considerable damage to the hydraulic system.

Use only alcohol to clean rubber parts and the insides of master and drum cylinders. Kerosene or gasoline may cause damage to or failure of the hydraulic system.

Do not allow grease, oil, paint, brake fluid, or foreign matter to come in contact with the brake lining.

Do not allow the master cylinder reservoir to become less than one-half full of brake fluid at any time.

Keep filler cap clean on master cylinder to prevent air vent being plugged with dirt.

If brake shoes are not properly lined, poor braking will result. It is better to install new brake shoe and lining groups when linings are badly worn.

44. DELCO-REMY ELECTRICAL EQUIPMENT.

a. Adjustment.

Improper adjustment of any of the electrical units may result in serious damage to the equipment. It is recommended that unless the operator is familiar with the operation and adjustment of the units, he make no attempt to do this work. If repair or adjustment is required, it is suggested that the operator contact his nearest Austin-Western Distributor or United Motors service station as they will have the necessary testing equipment and technical information required to perform this job.

b. Ignition Distributor. (For Gas Engine Only)

An automatic centrifugal advance mechanism, located in the distributor bowl, provides a spark advance directly related to the engine speed. The centrifugal mechanism consists of weights which throw out against weight springs to advance the distributor breaker cam in the direction of the distributor shaft rotation. The amount of advance depends on engine speed.

The distributor should be properly timed to the engine so as to deliver the spark to the cylinder for the correct position of the piston. Poor timing will decrease engine performance and cause a loss of power. The recommended procedure for timing the engine is as follows:

1. Rotate flywheel until mark on flywheel "#1 top dead center" appears opposite the inspection hole in lower portion of flywheel housing.

2. Insert distributor with clamp type advance arm and degree angle plate attached.

3. Clamp outer end of advance arm with pointer set at zero (body clamp must be loose).

4. Rotate distributor clockwise until the points just break.

5. Clamp advance arm securely to distributor body. Assemble the distributor head and start the engine.

The engine will now fire, at low idle, on top dead center (for either hand or electric starting) and will fire at 20 degrees before top dead center at 1300 R.P.M.

NOTE: This distributor setting is proper for 72 octane, or regular gasoline. By loosening outer clamp screw, ignition can be advanced or retarded from the above setting "if desired" because of variations in octane rating of the gasoline used.

Oxidized or burned contact points result from high resistance or loose connections in the condenser circuit, oil or foreign materials on the contact surfaces, or more commonly, high voltage. High voltage results from high resistance, loose or corroded connections in the generator to battery circuit, or an excessive charging rate, caused by high settings. Where burned contacts are experienced, check for these conditions.

c. Generators.

The generator on this machine is a third brush type with cut-out relay and voltage control. This control automatically inserts a resistance into the generator field circuit as the battery reaches a charged condition, and removes it as the battery becomes discharged. In effect, it provides a two stage generator, delivering either a high or a low output, depending upon the battery voltage.

The third brush can be adjusted to vary the charging rate for various conditions. The charging rate should never be set above 10 amps. with gas engine or 8 amps. with diesel.

Heavy duty generators are available on special order only. These have a combination voltage and current regulator which prevents overcharging the battery. Therefore, no adjustment of charging rate is provided or needed.

d. Cranking Motors.

The cranking motor cranks the engine when the circuit between the battery and the cranking motor is closed.

The Bendix Drive Type Cranking Motor employs a pinion mounted on a threaded sleeve. When the armature revolves, the threaded sleeve turns within the pinion, moving it endwise and into mesh with the flywheel ring gear, cranking the engine. A spring takes up the shock of meshing. When the engine starts, the flywheel drives the pinion at a higher speed and the pinion is backed out of mesh with the flywheel ring gear.

e. General Lubrication Data.

Hinge cap oilers - supply with 8 to 10 drops of light engine oil every 50 hours of operation.

Oilless bearings do not require lubrication except when the unit is removed from the engine for repair, cleaning or adjustment, at this time the bearings should be supplied with a few drops of light engine oil.

45. TIRE INFLATION.

ATTACHMENTS	FRONT TIRE SIZE	INFLATION MIN.	INFLATION MAX.	REAR TIRE SIZE	INFLATION MIN.	INFLATION MAX.
Standard	14.00 x 20 12 ply, single	24	28	14.00 x 20 12 ply, single	44	48
Bulldozer or snow plow	14.00 x 20 12 ply, single	44	48	14.00 x 20 12 ply, single	44	48
Conveyor loader	14.00 x 20 12 ply, single	24	28	14.00 x 20 12 ply, single	44	46

46. WATER WEIGHTS FOR FRONT TIRES ONLY.

Where it is found desirable, water for weight may be used inside the front tires of the No. 99-M power grader. During freezing weather calcium chloride solution instead of water should be used, for damage occurs due to the chunks of ice which form on the inside, cutting the inner tube. To add water weight, proceed as follows:

1. Jack up one front wheel until tire is clear of ground.

2. Rotate tire so valve stem is at the top.

3. Put conical valve cap, or equivalent on valve to prevent valve stem from slipping inside rim.

4. Remove valve inside and allow all air pressure to escape.

5. Attach special hose connection (Schrader #8687 or equivalent) to valve and to water or calcium chloride supply line.

6. Insert water or calcium chloride solution. When using Schrader #8687 connection, any back pressure built up inside the tire can be relieved by pressing on the release valve button.

7. Check water level by pressing on release valve and rotating tire until water or solution runs out.

NOTE: Tire should not be filled more than 3/4 full.

8. When using a connection without a release valve, it is necessary to remove same in order to release back pressure inside the tire or check the water level. When doing this, be sure to leave the conical valve cap in place.

9. Allow water to run out or add more as needed to get the desired level. Remove coupling and replace valve inside, still leaving the conical valve cap in place.

10. Inflate tire to about 30 pounds to seat beads and then reduce to pressure 3 or 4 pounds above the recommended figure. Remove conical cap. After a few days operation, re-check the pressure in the tires and reduce to the recommended figure if this has not already occured.

11. Remove jack and repeat operation with other front tire.

12. Never pour the water over the calcium chloride crystals. Always place the water in the container and then add the proper amount of calcium chloride crystals. Never use calcium chloride in car or tractor radiators.

13. By the use of a T or Y hose coupling, it will be possible to make a double connection to permit two tires to be filled at the same time.

CAUTION: Do not use water in the rear tires.

47. TIRE REMOVAL.

Considerable confusion seems to exist as

to proper removal of the tires. Of course, demounting the tire and rim as a unit entails merely removing lug nuts and rim lugs. In replacing a demounted rim, always tighten the lug nuts evenly and be sure the tire runs straight and true.

In removing the casing from the rim, remember that these are drop center rims. The fact that one of the bead seats is removable does not alter the fact that it is a drop center rim. It is therefore necessary to first of all remove all the air pressure from the tube. The best way to do this is to remove the valve core from air valve. Then force the tire bead (on the loose bead seat ring side), in toward the center of rim. When one edge drops into the drop center part of the rim, the opposite edge can easily be pried off rim and by working around the tire, the bead on that side can be gotten off.

Then force the other bead into drop center and pry one edge off first and work all around until it comes off.

Without getting the one edge of tire bead into the drop center channel, it is impossible to pry the tire off without damaging it.

Lubricating the base of the flap and bead, and the inside of the bead (2 to 3 inches up from the toe) will facilitate the assembly of the tire to the rim.

Reverse above procedure to mount.

> CAUTION: Be sure that the removable bead ring on rim is properly in place before inflating. It is best to check this again after putting a small amount of air into tire before inflating to maximum desired pressure.

48. BLADE EXTENSIONS.

Blade extensions are provided to enlarge the usefulness of your machine for light work only. When used for heavier work, a draw chain and bracket are available. The Austin-Western Company will not be responsible for damage occuring while operating without those parts.

SPECIAL ATTACHMENTS

(Refer to 99-M Power Grader Repair Parts Catalog No. 462-A for all Attachments)

49. SNOW PLOW ATTACHMENT.

When assembling "V" type snow plow to 99-M power grader, proceed as follows:

1. Inflate tires to maximum pressure. (See paragraph 45 for tire inflation chart).

2. Put 2" blocks under rear end of snow plow cutting bits with pin out of telescopic push bar.

3. Push nose of plow to the floor and enter pin into telescopic arm.

4. Raise plow and remove blocks.

5. Put plow on floor and adjust runners for height.

50. CONVEYOR LOADER ATTACHMENT.

a. Function.

The 99-M rear loader attachment was designed primarily for loading loose material. It is not a scraper and should not be used as such. We recommend scarifying all other than loose material before trying to pick it up.

b. Attaching.

All 99-M power graders have the necessary holes drilled at the rear of the machine for attaching a conveyor loader. Refer to 99-M power grader repair parts catalog No. 462-A, for hydraulic piping and wiring diagrams. Refer to conveyor loader lubrication chart in this book which shows the conveyor loader completely assembled.

If this attachment comes to you disassembled from the power grader, follow instructions as mentioned in removal instructions except, of course, proceeding in the reverse order.

c. Removing.

The weight of this attachment and its

overhanging load and the nature of its mounting, makes it imperative that it be removed when the 99-M is used for purposes other than loading loose materials.

If this loader attachment comes to you assembled to the grader, it can readily be removed. First, back up to a level spot and install the supporting legs under the conveyor at the projecting lugs provided for that purpose. In removing the conveyor, unbolt the forward vertical channels from the side of the loader box. The next step should be the disassembly of the pin from the upper suspension sheave at the hand crank mechanism which raises and lowers the outer end of the conveyor. This sheave should not be disconnected until after the outer end of conveyor has been lowered down to the supporting horse or frame. Next, remove the bolt which supports the ball to which the lower end of the lifting cylinder piston rods attach.

When the loader is removed from the grader and the power take-off is not removed, it is advisable to use the lock on the clutch lever so that the clutch cannot be engaged. A locking sleeve is provided for this purpose and when placed over the lever, with the prong extending toward the take-off case, will lock the clutch in the disengaged position. When the loader is in use, the lock is put over the lever with the prong extending away from the case. When in this position the clutch can be engaged or disengaged at will.

Be sure the loader clutch handle is locked in disengaged position.

The throw-out bearing and ball bearings located underneath and back of radiator rotate even though clutch is released, therefore do not forget to lubricate them if operating with clutch locked out of engagement.

After the foregoing operations have been performed, the power grader can then be driven away from the loader attachment.

It will not be necessary to remove the two castings on each end of the bumper pipes nor the arch frame and the hydraulic system, unless of course the power grader is not intended for further use with this loader attachment for some time. If, however, some other rear mounted attachment is to be mounted on the rear of this machine, the aforementioned arch frame and bumper castings should be removed.

If it is desired to remove the power take-off entirely, the inner end of the coupling between the crank shaft and the power take-off should be detached from the front fan drive pulley. Then remove the mounting bolts holding the power take-off case to the rear bumper and replace the front cranking support bracket.

d. Starting.

Before starting to use this loader attachment, thoroughly grease same. Consult conveyor loader lubrication chart for data.

e. Operating Suggestions.

The rear wheels of this 99-M power grader should not be used as a steering means, in other words, they should be run straight at all times, as it will be almost impossible for inexperienced truck drivers to keep their trucks under the stream of dirt being discharged by the conveyor.

This conveyor loader was designed for operation at approximately 3/4 (or less) of the governed engine speed. The grader should likewise be operated as slow as possible (in low gear) since the amount of dirt this unit can handle per hour is more than the loader can handle, if operated in any other gear.

The end or tail gate of the truck absolutely must be removed. This is to prevent damage to the carrier and also permit backing under far enough to load the truck at the front end. Avoid the use of very high bodied trucks. Truck drivers will have some difficulty at first in staying under the stream of dirt but after the first half day, they will encounter no further difficulty. Be sure and raise the carrier mechanism up (by means of a hydraulic control lever located at operator's platform) when backing the grader; otherwise the conveyor belt may be ruined.

The cutting edge can be made to make light cuts on sodded shoulders or light dirt. Deep cuts cannot be made in anything but soft material. If carrier support cables have any tendency to slacken, due to either extremely heavy work at the bit or to the truck raising the elevator, declutch at once or breakage will surely result. Using the power grader scarifier to loosen the material is sometimes very necessary.

In order to use this loader on an angle, that is, for sloping or grading shoulders, and work other than picking up windrows, it will be necessary to set this loader at the desired angle and then lock it there. The two globe valves in the hydraulic system near the right hand lift cylinder shut off the supply of oil to the left hand cylinder.

Therefore, to secure the desired angle, proceed as follows: Lower the loader to the ground, then shut off the two valves above referred to which will hold the left hand side or lift cylinder in position. Then the right side may be either raised or lowered until the desired cutting angle is obtained.

It is advisable to first windrow the material by using the power grader blade and then use the loader attachment to pick it up. Do not make the windrows too large. It is advisable to make this loading operation in two stages by picking up windrows of the proper size than trying to do it by having one oversize windrow. The power grader can sometimes be used to blade at the same time the loading operation is taking place at the rear. This frequently will be found convenient to do when cutting a deeper ditch with the point of the blade. The heel of the blade, under these conditions, must be kept quite high so the material will flow out under the central part of the blade in position for the loader to pick it up. This dual operation can also be used if material is being removed from a bank with the end of the power grader moldboard. This cannot be done in extremely hard dirt, however, especially in a primary ditch cut as the overhanging weight of the carrier removes some of the stability of the front end when making heavy ditch cuts.

Very light sod will sometimes load much better if cut and loaded directly with the loader instead of windrowing. It will tend to push ahead of the loader if windrowed first.

Watch the conveyor belt and keep it centered in the carrier. Sticky dirt sometimes builds up on one end of the lower tail roller and is usually the chief cause of the belt shifting suddenly to one side or another and staying there. This dirt must be removed and the tail roller compartment kept free of dirt accumulation. After the material loading job has been completed, we strongly recommend the removal of loader attachment. The grader certainly should not be used except for very light grading if the loader attachment remains attached.

f. Adjustments.

1. Power Take-off:

In the power take-off mechanism, there is only one adjustment necessary, that of the clutch (see clutch). All other adjustments such as bearings, etc., have been made at the factory and should not be altered. All of the bearings in the power take-off attachment are of the ball type and no take up means is provided or necessary. One end of this propeller shaft is fixed and the power take-off end is floating in the splined drive member or clutch plate. See conveyor loader lubrication chart for lubrication instructions.

2. Clutch:

By removing inspection plate from side of power take-off case the toggle type clutch may be adjusted by unlocking adjustment ring and turning clockwise, one notch at a time, until a definite resistance is felt against the engaging lever. Then re-insert the lock in notch to prevent movement between the two threaded members.

Care should be taken to avoid over greasing the three inner bearings on the rear of the power take-off mechanism as grease from this compartment, if over greased, may get on the clutch facings and cause slippage.

3. Bevel Gear Drive:

On the bevel gear or final drive assembly mounted on the conveyor itself, all of the adjustments necessary have been made at the factory and no further adjustments should be required.

Should disassembly of this unit for any reason whatsoever be necessary, be sure to observe the location and the number of shims at all disassembly points as these shims have direct relation to the spiral bevel gear tooth bearings. Wired cap screws at each end are intended to preserve the bearing and gear adjustment. Do not remove the cap screws or destroy the wire connection between the two unless disassembly is absolutely necessary.

Slotted holes and tension screws are provided on the final drive or bevel gear housing outer bearings, likewise on the idler shaft midway on the conveyor frame and also on the conveyor head pulley. Should excessive wear develop in any one of these three runs of chain, taking up this adjustment may be necessary in one or all three of the places described above.

4. Feeder Shaft:

The feed spiral drive shaft is arranged so that either end can float upward independently of the other (approximately 3") and provision has been made for very accurately adjusting the low position of this shaft so that the spiral blades can be made to operate within 1/16 of an inch of the cutting bit, while the floating feature permits the spiral to readily jump upward over a 2-1/2" or 3" stone, or brick, without interfering with the flow of material, or breaking the shear pins. On the outer or sprocket end of this feeder shaft are two shear bolts especially provided for safety purposes in case a large obstacle should jam between the feeder spirals and the conveyor box. These shear bolts are provided with removable and hardened bushings to confine the wear, if any, to the shear bolt itself. If excessive shearing of these bolts occurs, use only soft bolts as hardened bolts will defeat the object of this safety feature. Spare soft shear bolts are shipped with each loader.

Periodic tightening of the U-bolts, holding cutter blades to shaft, may be necessary as constant usage may loosen these bolts. An extra cutter blade is included in the packing list of each loader attachment, should one of them become damaged in service.

5. Runners:

An adjustment for the two runners at the lower end of the conveyor is provided in order to control the height of the cutting bit from the surface. These runners are provided with renewable wearing shoes and with proper attention and renewal of these shoes, damage to and excessive wear on the cutting bit itself can be avoided.

6. Clean Out:

Openings are provided at each side of the lower end of the conveyor frame for cleaning out any accumulated dirt at the tail pulley and periodic inspection at this point may be necessary in order to avoid damage to the belt, as frequently small pebbles will wedge in between the belt and the roller and these should be removed before excessive damage occurs. A clean out tool is shipped with each loader attachment.

7. Conveyor Belt:

The conveyor belt tension is controlled by means of adjusting screws on the conveyor head pulley and care should be exercised in making a uniform adjustment on each side in order that the belt may run true over both head and tail rollers. There is likewise a vertical adjustment on the snub pulley and an unequal adjustment at this point will also cause the belt to run out of true.

Cleats are provided on special order only. They should be placed on the conveyor belt approximately two feet apart. Bolt nuts should be on carrying side of the belt. Excess thread length should be cut off. Cleats will assist conveying sod and large lumps of earth up the inclined belt. The cleats are bolted to the belt itself and the conditions of the cleats must be observed from time to time to be sure that they are securely fastened to the belt as they may cause damage at the tail roller if they become wholly or partly detached.

8. Hand Crank:

The hand crank on the end of the supporting cable should be normally set so that the box (or hopper) is level with the pavement. To obtain slightly sharper or flatter cutting angles adjust hand crank as desired.

51. SHOULDER TRENCHER ATTACHMENT.

a. Function.

The shoulder trencher is used to cut out the shoulder of a concrete road in preparation for laying a widening strip. Used in conjunction with the loader attachment, the material can be cut out and loaded into trucks simultaneously.

b. Attaching.

To attach the shoulder trencher, the grader blade is side shifted to the right the maximum amount and is tilted back as far as possible. The right hand cutting bit is removed to let the material elevated to the pavement by the trencher pass under the blade.

The extension blade bolts to holes in the right hand end of the regular moldboard. The gauging shoe bolts to the lower right hand moldboard bracket with three bolts, one of which is in the bracket and the other two are drilled using the shoe as a template.

The secondary blade goosenecks are connected to the lower moldboard shifter shaft by means of "U" bolts. Its function is to scrape the pavement clean in front of the right rear wheel and to deliver the material in line with the center of the loader. In normal operation, it is held against the pavement by gravity. The box on the blade is for dirt or rock if it is necessary to increase the weight on the blade.

After assembling the shoulder trencher, the blade lifting rams should be adjusted so that the trench cutting bit is parallel to the face of the roadway, and the circle rotated until the landslide is parallel to the edge of the roadway.

A special cutting bit must be installed on the loader when used in conjunction with the trencher, because the regular loader bit is designed for stripping sod and is not satisfactory for picking material from a smooth pavement.

c. Operation.

The gauging shoe is held against the edge of the pavement to insure a straight cut and to prevent material sticking to the edge of the concrete.

It is advisable to scarify the shoulder before using the trencher. This prolongs the life of the attachment and will speed up the trenching operation.

One method of operation is to work on one side of the road only, with a truck following under the loader. When the truck is filled, the grader backs to its starting point and repeats the operation until the desired depth of cut is reached.

Another method is to take a cut down one side of the road for a longer distance, changing trucks as they are filled, and then making a cut on the opposite side on the return trip; repeating the cycle until the cut is of the required depth.

The trencher may also be used without the loader. This leaves the material lying on the pavement about four foot in from the edge. This material may be used for back fill or for building up the shoulders after the widening strip is laid.

52. ROLLER ATTACHMENT.

a. Function.

The roller attachment is very useful for patching, soil-stabilization, resurfacing, and other numerous rolling jobs connected with construction and maintenance.

b. Attaching.

To attach the roller, the pivot brackets are placed over the grader bumper and bolted to the roller frame. The lock collars are clamped on the bumper to prevent side movement of the roller. Drawings are furnished with each roller attachment

covering the installation of same. Refer to 99-M power grader repair parts catalog No. 462-A for hydraulic piping diagram.

c. Operation.

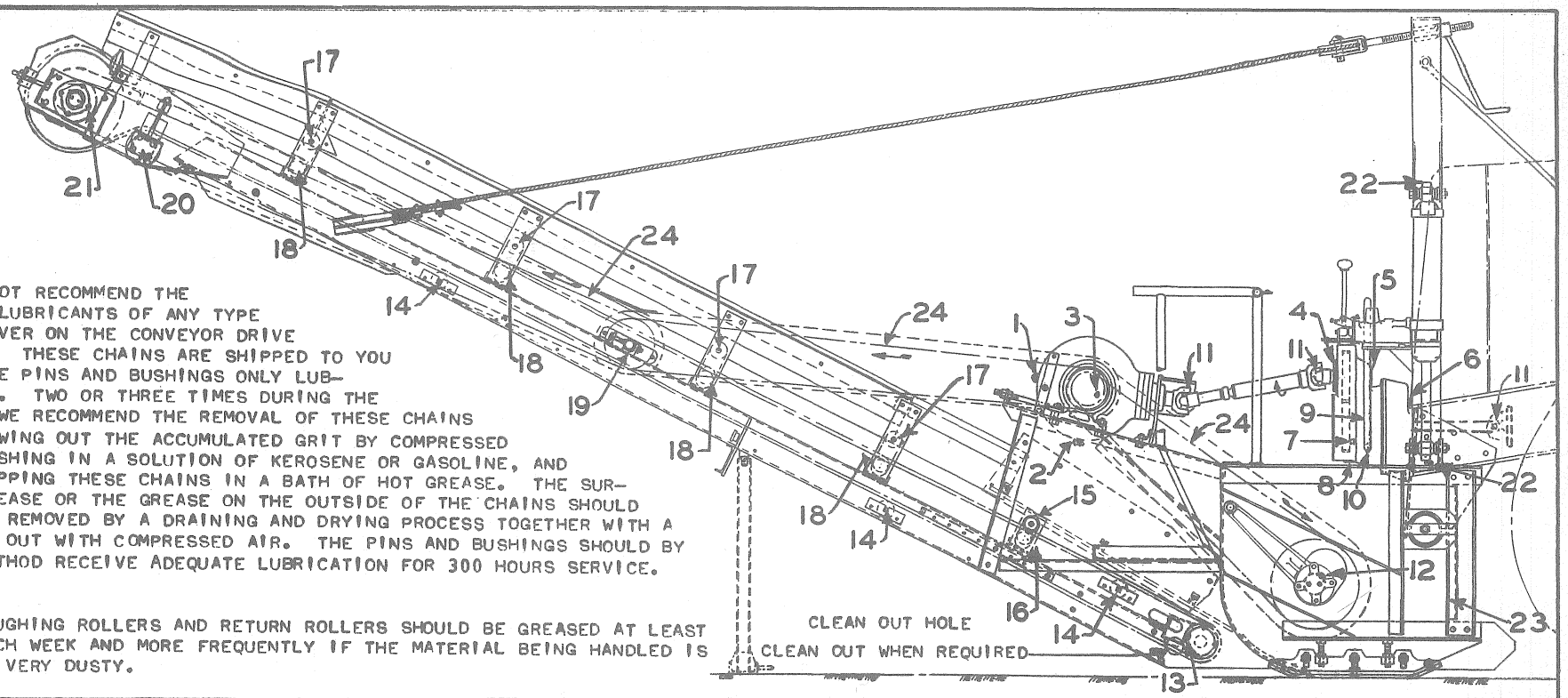
The rolls are spaced so that they roll out the tire marks. In making the first pass over the surface being rolled, we recommend backing onto the work to give the material an initial compression before the tires contact the work. When the grader is reversed, the rolls will iron out wheel marks and leave a smooth surface. Subsequent passes will cover the unrolled strip left between the rolls on the first pass.

Compression on the roller should not be great enough to lift the grader rear wheels off the ground. If this is done, the grader front wheels must furnish all the traction and this might cause scuffing of the surface by the front tires.

d. Lubrication.

The rear roll bushings are lubricated thru four high pressure fittings located at both ends of each roller. The bronze bearings should be greased (using high pressure grease) every four hours of operation. Sufficient lubricant must be injected to a point where the excess lubricant (about 2 teaspoonsful) is forced out of the inner and outer ends of both rolls.

Lubricate all other high pressure fittings on this roller attachment with two (2) strokes of lubricator every 8 to 12 hours of normal operation, or daily.



REF. NO.	LOCATION OR FUNCTION	TYPE OF LUBRICANT USED → FREQUENCY / REMARKS	PRESSURE GUN GREASE: EVERY WEEK	PRESSURE GUN GREASE: EVERY DAY	WHEEL BEARING GREASE: EVERY 300 HR.	EXTREME PRESSURE LUBRICANT SAE 140 OR SAE90 (SEE NOTE-C)
1	BEVEL GEAR DRIVE PINION, GEARS & INNER BEARINGS	FILLER				X (CHECK PERIODICALLY)
2	BEVEL GEAR DRIVE HOUSING	DRAIN				
3	BEVEL GEAR DRIVE SHAFT END BEARINGS	BOTH ENDS	X			
4	POWER TAKE-OFF SHAFT BEARING		X			
5	POWER TAKE-OFF SHAFT BEARING		X			
6	POWER TAKE-OFF SHAFT BEARINGS	GREASE TUBE	X (SLIGHTLY)			
7	POWER TAKE-OFF	FILLER				X (CHECK PERIODICALLY)
8	POWER TAKE-OFF	DRAIN				
9	CLUTCH THROW OUT BEARING		X (SLIGHTLY)			
10	CLUTCH THROW OUT SHAFT	BOTH ENDS	X			
11	PROPELLER SHAFT JOINT NEEDLE BEARINGS	BOTH ENDS			X (PACK)	
12	FEEDER SHAFT BEARINGS	BOTH ENDS	X			
13	TAIL PULLEY SHAFT BEARINGS	BOTH ENDS		X		
14	RETURN ROLLER SHAFT BEARINGS	BOTH ENDS	X (SEE NOTE B)			
15	INTERMEDIATE CARRYING ROLLER SHAFT BEARINGS (OUTER)	BOTH ENDS	X (SEE NOTE B)			
16	INTERMEDIATE CARRYING ROLLER SHAFT BEARINGS (INNER)	BOTH ENDS	X (SEE NOTE B)			
17	UPPER CARRYING ROLLER SHAFT BEARINGS (OUTER)	BOTH ENDS	X (SEE NOTE B)			
18	UPPER CARRYING ROLLER SHAFT BEARINGS (INNER)	BOTH ENDS	X (SEE NOTE B)			
19	COUNTER SHAFT BEARINGS	RIGHT SIDE		X		
20	SNUB ROLLER SHAFT BEARINGS	BOTH ENDS	X			
21	HEAD DRUM SHAFT BEARINGS	BOTH ENDS	X			
22	LIFT RAM CAPS & BALLS	BOTH ENDS	X			
23	GUIDES (2 TO 3 TIMES DAILY)	BOTH SIDES		X		
24	CHAINS				X (SEE NOTE A)	

NOTE-C —
IN SEASON WHEN TEMPERATURES ARE 32 DEGREES F. AND ABOVE USE SAE140 EXTREME PRESSURE LUBRICANT

IN SEASON WHEN TEMPERATURES ARE BELOW 32 DEGREES F. USE SAE90 EXTREME PRESSURE LUBRICANT

NEVER MIX DIFFERENT GRADES OR KINDS OF EXTREME LUBRICANTS. IF IN DOUBT DRAIN, FLUSH AND REFILL.

Figure 39. Conveyor Loader Lubrication Chart