

## BRAKES

The brake system is comparatively simple, Fig. 1. The foot or service brakes are of the internal expanding type hydraulically actuated in all 4 wheels. The hand brake is mechanically operated through a cable and conduit to an external type brake mounted at the rear of the transfer case on the propeller shaft. The foot brakes are of the Bendix, two shoe, double anchor type and have nickle-chromium alloy iron drums.

In order to thoroughly understand the operation of the hydraulic brake system, it is necessary to have a good knowledge of the various parts and their functions, and to know what takes place throughout the system during the application and the release of the brakes.

The piston in the master cylinder, Fig. 4 receives mechanical pressure from the brake pedal and exerts pressure on the fluid in the lines, building up the hydraulic pressure which moves the wheel cylinder pistons. The primary cup is held against the piston by the piston return spring which also holds the check valve against the seat. The spring maintains a slight fluid pressure in the line and in the wheel cylinders to prevent the possible entrance of air into the system. The secondary cup which is secured to the opposite end of the piston, prevents the leakage of fluid into the rubber boot. The holes in the piston head are for the purpose of allowing the fluid to flow from the angular space around the piston into the space between the primary cup and the check valve, keeping sufficient fluid in the line at all times. The holes in the check valve case allow the fluid to flow through the case, around the lips of the rubber valve cup and out into the line during the brake application. When the brakes are released the valve is forced off the seat permitting the fluid to return to the master cylinder. The piston assembly is held in the opposite end of the housing by means of a snap ring. The rubber boot that fits around the push rod and over the end of the housing prevents dirt or any foreign matter from entering the master cylinder.

The wheel cylinder is a double piston cylinder, the purpose of the two pistons being to distribute the pressure evenly to each of the two brake shoes. Rubber piston cups maintain pressure on the pistons to prevent the leakage of fluid. The rubber boots over the end of the cylinder prevent dust and dirt or foreign material from entering the cylinder.

When pressure is applied to the brake pedal, the master cylinder forces fluid through the lines and into the wheel cylinders. The pressure forces the pistons in the wheel cylinder outward, expanding the brake shoes against the drum. As the pedal is further depressed higher pressure is built up within the hydraulic system, causing the brake

shoes to exert a greater force against the brake drums.

As the brake pedal is released, the hydraulic pressure is released and the brake shoe retracting spring draws the shoes together, pushing the wheel cylinder pistons inward and forcing the fluid out of the cylinder back into the line towards the master cylinder. The piston return spring in the master cylinder returns the piston to the piston stop faster than the brake fluid is forced back into the line, which creates a slight vacuum in that part of the cylinder ahead of the piston. The vacuum causes a small amount of fluid to flow through the holes in the piston head, past the lip of the primary cup and into the forward part of the cylinders. This action keeps the cylinder filled with fluid at all times, ready for the next brake application. As fluid is drawn from the space behind the piston head it is replenished from the reservoir through the intake port. When the piston is in the fully released position the primary cup clears the bypass port, allowing the excess fluid to flow from the cylinder into the reservoir as the brake shoe retracting springs force the fluid back into the master cylinder.

### Brake Pedal Adjustment

There should always be at least ½" free pedal travel before the push rod engages the piston.

This adjustment is accomplished by the shortening or lengthening of the brake master cylinder eye bolt, No. 59, Fig. 1. This is done so the primary cup will clear the port No. 15, Fig. 4, when the piston is in the off position, otherwise the compensating action of the master cylinder for expansion and contraction of the fluid in the system, due to temperature changes, will be destroyed and cause the brakes to drag.

### Brake Shoe Adjustment—Minor

When the brake lining becomes worn, as indicated by foot pedal going almost to the floor board, necessary adjustment can readily be made as described in the following paragraph; first making certain that there is ½" free brake pedal travel.

Jack up the wheels to clear the floor. Adjustment is made by rotating the eccentric No. 5, Fig. 1. With a wrench loosen lock nut No. 6 for forward brake shoe, hold lock nut and with another wrench turn eccentric towards the front of the car until brake shoe strikes drum, then turning wheel with one hand release eccentric until wheel turns free, holding eccentric tighten lock nut. To adjust reverse shoe, repeat this operation only turn the eccentric towards the back of the car. Do this on all brakes. Check fluid in master cylinder.

FIG. 1—BRAKE SYSTEM

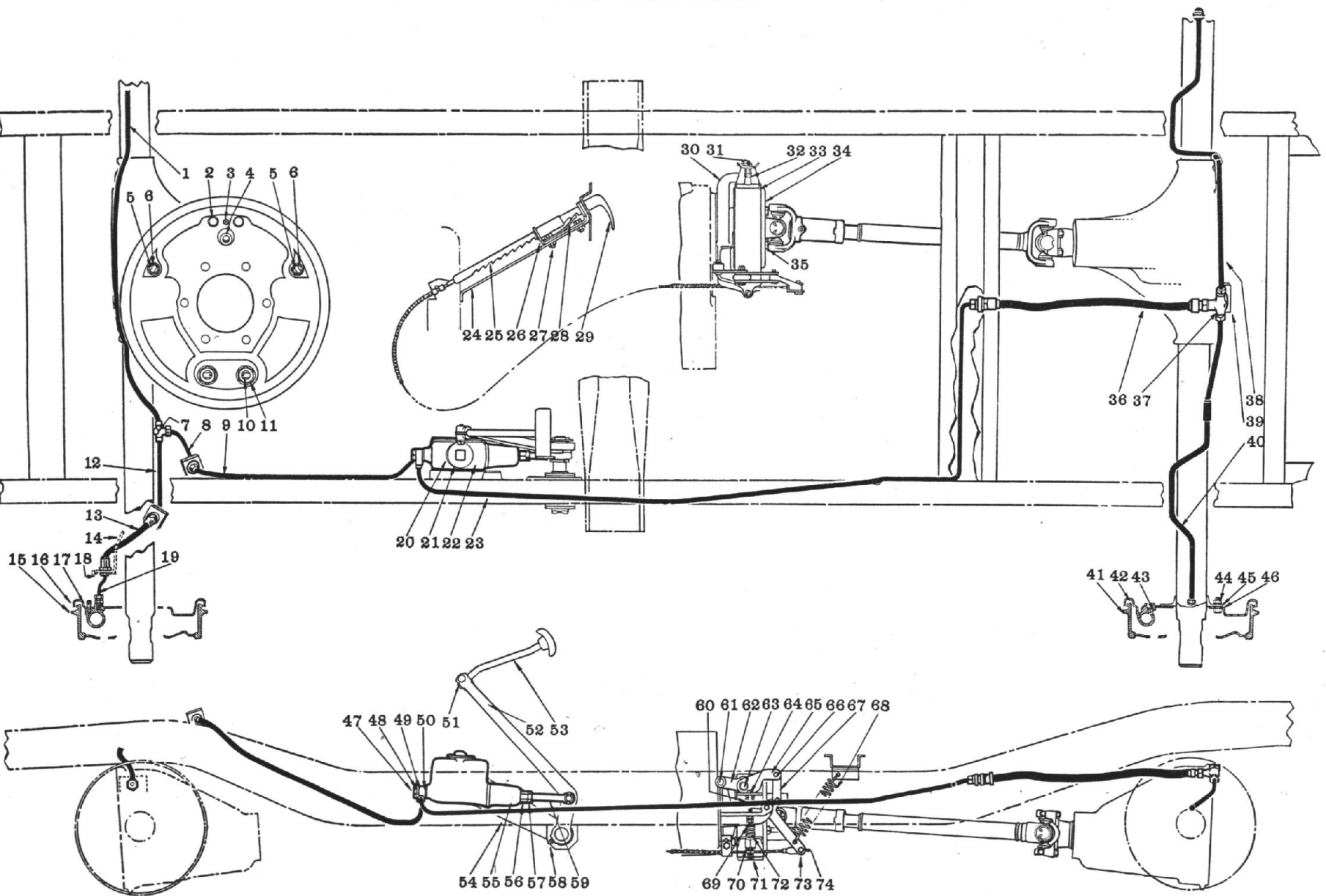


FIG. 1—BRAKE SYSTEM

No.	Willys Part No.	Ford Part No.	Name
1	A-1376	GPW-2266	Brake Tube Assembly (Tee to Front Brake Hose—Right)
2	51738	20300-S7	Hex. Head Screw (Wheel Cylinder to Backing Plate)
3	637540	GP-2208	Wheel Brake Cylinder Bleeder Screw
4	A-1502		Front Wheel Brake Cylinder
5	A-754	GP-2038	Brake Shoe Eccentric
6	A-755	33800-S7-8	Hex. Nut (Eccentric)
7	637432	GP-2074	Axle Tee
8	A-1373	GPW-2078	Brake Hose—Front (Axle to Frame)
9	A-1377	GPW-2264	Brake Tube Assembly (Master Cylinder to Front Hose)
10	637899	91A-2027	Brake Shoe Anchor Pin
11	637924	33846-S7-8	Hex. Nut (Anchor Pin)
12	A-1501	GPW-2263	Brake Tube Assembly (Tee to Front Brake Hose—Left)
13	A-1460	GPW-2079	Brake Hose (Front Axle)
14	A-1457	GPW-2096	Front Wheel Brake Hose Guard
15	A-472	GPW-1125	Front Brake Drum
16	A-450	GP-2013	Front Brake Backing Plate
17	637540	GP-2208	Wheel Brake Cylinder Bleeder Screw
18	637427	78-2814-A	Spring Lock Clip (Brake Hose to Bracket)
19	A-1488	GPW-2298	Brake Tube Assembly (Wheel Cylinder to Axle Hose—Left)
20	637612	GP-2167	Master Cylinder Filler Cap Gasket
21	637608	GP-2162	Master Cylinder Filler Cap Assembly
22	637582	GP-2155	Master Cylinder and Supply Tank
23	A-5224		Brake Tube Assembly (Master Cylinder to Rear Hose)
24	A-2892	GPW-2852	Hand Brake Ratchet Tube Bracket Support
25	A-1242	GPW-2780	Hand Brake Handle Tube and Cable Assembly
26	639010	GPW-2848	Hand Brake Ratchet Tube Bracket Assembly
27	51396	24347-S	Hex. Head Screw (Bracket to Support)
28	635681	GPW-2793	Hand Brake Ratchet Tube Spring
29	639244	GPW-2782	Hand Brake Handle
30	A-1507	GPW-7769	Transfer Case Output Shaft Bearing Cap—Rear
31	A-1020	OIT-2616	Hex. Head Screw (Anchor Clip)
32	A-1021	OIT-2640	Transmission Brake Band Anchor Clip Screw Spring
33	A-1009	GP-2648	Transmission Brake Band and Lining Assembly
34	A-1002	GP-2614	Brake Drum (Transmission)
35	636575	33786-S	Hex. Nut (Brake Drum to Flange and Propeller Shaft)
36	637424	GP-2078	Brake Hose—Rear (Axle to Frame)
37	637432	GP-2074	Axle Tee
38	A-5226		Brake Tube Assembly (Tee to Rear Brake—Right)
39	A-5227		Rear Axle Brake Tube Tee Bracket
40	A-5225		Brake Tube Assembly (Tee to Rear Brake—Left)
41	A-472	GP-1111	Rear Brake Drum
42	A-450	GP-2013	Rear Brake Backing Plate Assembly
43	A-6111		Rear Wheel Brake Cylinder
44	A-903	355578-S	Brake Backing Plate Screw
45	636575	33786-S2	Brake Backing Plate Screw Nut
46	6010	34807-S7-S	Brake Backing Plate Screw Lockwasher
47	637605	GP-2077	Brake Master Cylinder Outlet Fitting Bolt
48	637606	91A-2151	Outlet Fitting Gasket—Large
49	A-557	GP-2076	Outlet Fitting
50	637604	91A-2152	Outlet Fitting Gasket—Small
51	6157	24426-S2	Clamp Screw (Pedal Shank to Pedal)
52	A-1386	GPW-2452	Brake Pedal Assembly
53	A-1359	GPW-2454	Brake Pedal Pad Assembly
54	A-1354	GPW-2138	Master Cylinder Tie Bar
55	637602	GP-2180	Brake Master Cylinder Boot
56	637599	GP-2143-A1-2	Brake Master Cylinder Push Rod Assembly
57	5939	33802-S	Brake Master Cylinder Eye Bolt Lock Nut
58	392909	353027-S7-8	Brake Pedal Hydraulic Fitting
59	A-183	GPW-2462	Brake Master Cylinder Eye Bolt
60	A-1017	OIT-2634	Transmission Brake Releasing Spring (Hand)
61	A-1006	73889-S7	Transmission Brake Support Quadrant Pin (Hand)
62	A-1005	GPW-2630	Transmission Brake Support Quadrant (Hand)
63	A-1004	73928-S7-8	Transmission Brake Cam Pin (Hand)
64	A-1019	31218-S7	Transmission Brake Band Bracket Cap Screw (Hand)
65	A-1003	GPW-2632	Transmission Brake Cam (Hand)
66	311003	73904-S7	Clevis Pin (Link to Cam)
67	A-1228	GPW-2659	Hand Brake Relay Crank Link
68	A-6335	GPW-2635	Hand Brake Retracting Spring
69	6790	33795-S	Brake Band Cap Screw Nut
70	A-1018	OIT-2805	Transmission Brake Band Adjusting Nut (Hand)
71	A-1016	OIT-2642	Transmission Brake Adjusting Bolt (Hand)
72	A-1017	OIT-2634	Transmission Brake Releasing Spring (Hand)
73	392468	357553-S18	Clevis Pin (Cable to Relay Crank)
74	A-1226	GPW 2656	Hand Brake Relay Crank Assembly

## Brake Shoe Adjustment—Major

In the event the minor adjustment does not give adequate brakes or when it is necessary to reline the brakes it will be necessary to reset anchor pins, No. 10. The brake adjustments should be made as follows:

With the shoe and lining assemblies installed and the adjusting fixture or brake drum in place, loosen the anchor pin lock nuts No. 11 on the rear of the backing plate. Adjustment is made by turning the eccentric anchor pins towards each other and down until the shoes are set to the proper clearance, as determined by feeler gauges. The recommended shoe setting is .005" clearance at the heel (lower end), and .008" at the toe (upper end) of brake shoe lining. A slot is provided in the brake drum for checking these clearances.

## Relining Brake Shoes

When necessary to reline the brakes, the car should be raised so that all four wheels are free from the floor.

Remove the wheels and then the hubs and drums which will then give access to the brake shoes.

Install wheel cylinder clamps or keepers to retain the wheel cylinder pistons in place and prevent leakage of brake fluid while replacing the shoes. Turn all eccentrics to the lowest side of the cam, and then remove the brake shoe contracting spring, No. 1, Fig. 2.

Remove anchor pin nuts, lock washers, and anchor pins from backing plate.

Remove rivets holding lining to shoes and install new linings through the use of a brake lining clamp.

Inspect the oil seals in the wheel hubs and if found that grease has been leaking, it is advisable to install new oil seals.

Install brake shoes to the brake backing plate, the shoe with the longest lining is the forward shoe on all four wheels. Install anchor pin No. 12, pin plate No. 2 and pin cam No. 13; then install anchor pins so the punch mark on the ends are facing each other. Install lock washer and nut. Install brake shoe return spring. Remove brake cylinder clamp or keeper.

Install the hubs and drums, then make the major adjustment of the brakes.

If it is found while the wheels are removed that there is brake fluid leakage at any of the wheel cylinders, it will be necessary to recondition that wheel cylinder, and bleed the brake lines. This subject is covered under the heading "Reconditioning Wheel Cylinders" and "Master Cylinder".

NOTE: Whenever the brake lining is renewed in one front or rear wheel be sure to perform the same operations in the opposite front or rear wheel, using the same brake lining as to color and part number, otherwise unequal brake action will result.

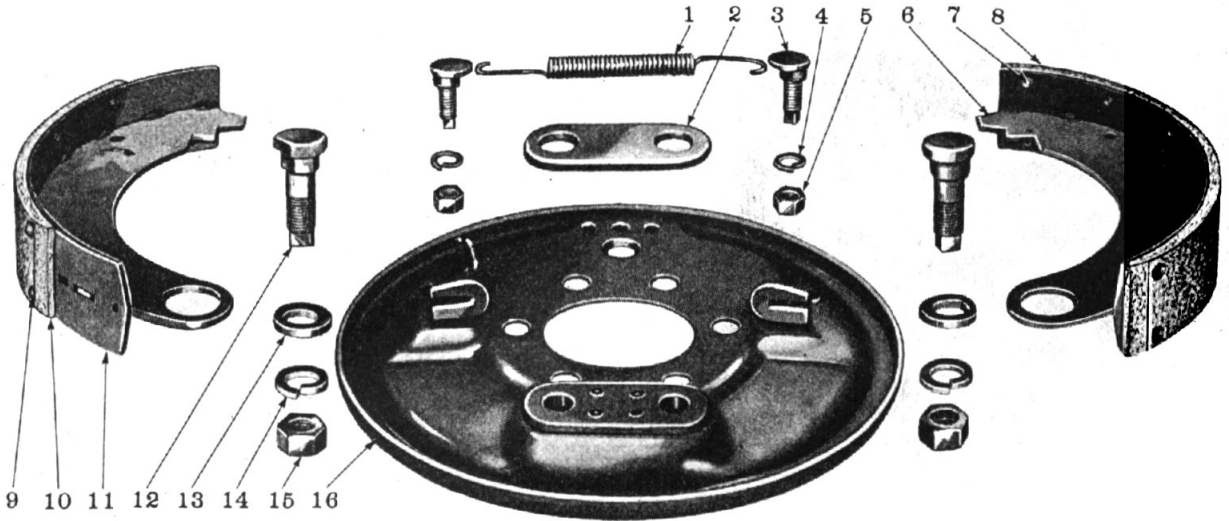


FIG. 2—BRAKE

No.	Willys Part No.	Ford Part No.	Name	No.	Willys Part No.	Ford Part No.	Name
1	637905	GP-2035	Brake Shoe Return Spring	9	374586	351915-S	Brake Lining Tubular Brass Rivet
2	637901	91A-2030	Brake Shoe Anchor Pin Plate	10	116552	GP-2022	Brake Shoe Lining—Reverse
3	A-754	GP-2038	Brake Shoe Eccentric	11	116550	GP-2019	Brake Shoe and Lining Assembly—Reverse
4	5010	34807-S7-8	Brake Shoe Eccentric Lockwasher	12	637899	91A-2027	Brake Shoe Anchor Pin
5	A-755	33800-S7	Brake Shoe Eccentric Nut	13	637900	GP-2028	Brake Shoe Anchor Pin Cam
6	116549	GP-2018	Brake Shoe and Lining Assembly—Forward	14	637923	351406-S24	Brake Shoe Anchor Pin Lockwasher
7	374586	351915-S	Brake Lining Tubular Brass Rivet	15	637924	33846-S7-8	Brake Shoe Anchor Pin Nut
8	116551	GP-2021	Brake Shoe Lining—Forward	16	A-450	GP-2013	Brake Backing Plate Assembly

### Bleeding Brakes

The hydraulic brake system must be bled whenever a fluid line has been disconnected or air gets into the system. A leak in the system may sometimes be evidenced through the presence of a spongy brake pedal. Air trapped in the system is compressible and does not permit pressure applied to the brake pedal to be transmitted solidly through to the brakes. The system must be absolutely free from air at all times. When bleeding the brakes it is advisable that the longest fluid line from the master cylinder be bled first. The proper sequence of bleeding is right rear; right front; left rear; left front. During the bleeding operation the master cylinder must be kept at least  $\frac{3}{4}$  full of hydraulic brake fluid.

To bleed the brakes first carefully clean all dirt from around the master cylinder filler plug. Remove filler plug and fill master cylinder to the lower edge of filler neck. Clean off all bleeder connections at all four wheel cylinders. Attach bleeder hose and fixture to right rear wheel cylinder bleeder screw and place end of tube in a glass jar, end submerged in fluid. Open the bleeder valve  $\frac{1}{2}$  to  $\frac{3}{4}$  of a turn. See Fig. 3.

Depress the foot pedal by hand, allowing it to return very slowly. Continue this pumping action to force the fluid through the line and out the bleeder hose which carries with it any air in the system.

When bubbles cease to appear at the end of the bleeder hose, tighten the bleeder valve and remove the hose.

After the bleeding operation has been completed at all four wheels, fill the master cylinder reservoir and replace the filler plug.

It is not advisable to re-use the fluid which has been removed from the lines through the bleeding process.

### Master Cylinder

When necessary to remove the master cylinder No. 22, Fig. 1 for reconditioning, the following procedure should be followed:

1. Raise front end of car with jack because the removal operation must all be performed from the under side of the vehicle.
2. Remove stop light switch wires.
3. Remove fitting bolt and switch No. 47.
4. Remove front bolt holding master cylinder to frame which is installed from the outside of the frame and screws into master cylinder body.
5. Remove master cylinder tie bar cap screw which is the front inside screw on master cylinder.
6. Remove rear master cylinder bolt which has nut on inside of frame bracket.
7. Remove master cylinder boot No. 55.
8. Remove master cylinder.

The installation of master cylinder to frame is the reverse of the above operations.

After the master cylinder has been removed it should be dismantled and thoroughly washed in alcohol. (Never wash any part of the hydraulic braking system with gasoline (petrol) or kerosene.)

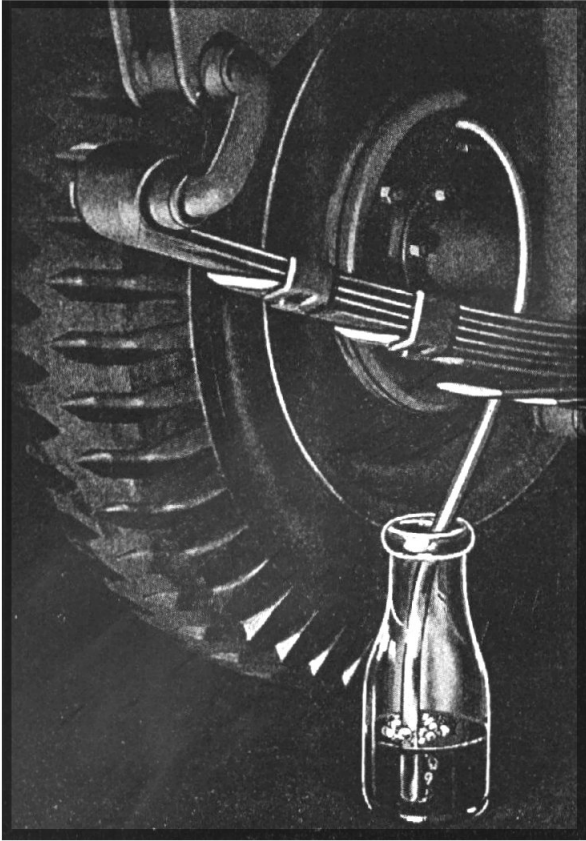


FIG. 3—BLEEDING BRAKE

After the parts have all been thoroughly cleaned with alcohol, make careful inspection, replacing those parts which show signs of being deteriorated. Inspect cylinder bore and if found to be rough it should be honed out. The clearance between the piston and the cylinder bore should be .001" to .005". During the honing operation use hydraulic brake fluid on the hone, in order to obtain a polished surface in the cylinder bore. Wash out cylinder with alcohol and with a wire passed through the ports No. 14 and No. 15 that open from the supply reservoir into the cylinder bore, make sure that these passages are free and clear of any foreign matter. It is our recommendation that a new piston, primary cup, valve and valve seat be installed when rebuilding the master cylinder. See Fig. 4.

Install valve seat No. 10 in end of cylinder with flat surface toward valve. Install valve assembly No. 9. Install piston return spring No. 8. Install primary cup No. 7. Face of cup goes towards piston. Install piston No. 6, stop plate No. 1 and lock wire No. 2. Install fitting connection with new copper gaskets. Fill reservoir half full of brake fluid and operate the piston with piston rod until fluid is ejected at fitting. Install master cylinder to frame and make necessary connections and adjust pedal clearance to ½" free play.

Bleed lines as instructed under the heading, "Bleeding Brakes". See Fig. 3.

Recheck entire system to make sure that there are no leaks and if necessary make brake adjustments in order to have adequate brakes.

### Filling Master Cylinder

The Master Cylinder reservoir should be checked each 1000 miles when vehicle is lubricated, be sure that there is a sufficient supply of brake fluid. The master cylinder can be reached by removing the five screws in the inspection cover on the toeboard below the steering post. After removing the cover thoroughly clean any dirt away from the filter cap on the master cylinder to prevent it from entering the brake system where it might cause a scored cylinder or possible failure of the brakes.

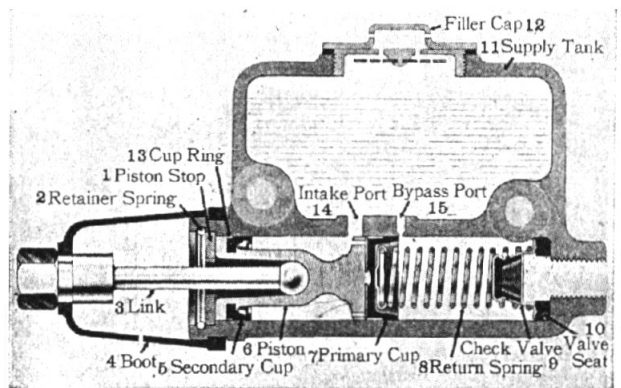


FIG. 4—MASTER CYLINDER

### Wheel Cylinders

To remove a hydraulic brake wheel cylinder Fig. 5, jack up the vehicle and remove the hub and drum. Disconnect brake line at fitting on brake backing plate. Remove brake shoe retracting spring which allows the brake shoes at the toe to fall clear of the brake cylinder. Remove two cap screws holding wheel cylinder to backing plate.

Remove rubber dust covers on end of cylinders, then pistons, piston cups and spring.

Wash the parts in clean alcohol. Examine the cylinder bore for roughness or scoring. Check fit of pistons to cylinder bore by using .002" feeler gauge.

In reassembling cylinder dip spring, pistons and piston cups in brake fluid. Install spring in center of wheel cylinder. Install piston cups with the cupped surface towards the spring so that the flat surface will be against piston. Install pistons and dust covers. Install wheel cylinder to backing plate, connect up brake line and install brake shoe retracting spring. Replace wheel hub and drum, then bleed the lines as instructed under "Bleeding Brakes."

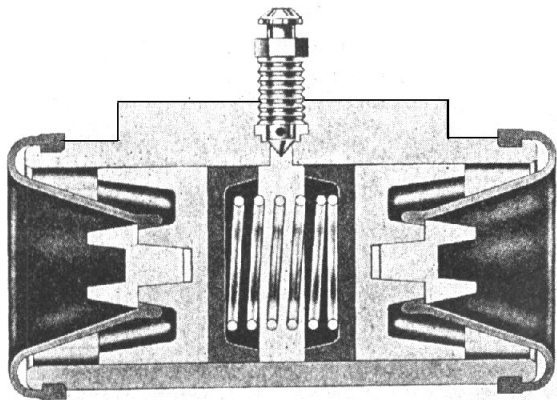


FIG. 5—WHEEL CYLINDER

### Brake Hose—Front

To remove brake hose at the wheels the following procedure should be followed to prevent damage to hose and fitting. See Fig. 6.

1. Remove brake line connections at each end.
2. Slip brake hose spring lock clip off ends of hose fitting and remove brake hose from brackets.

To remove front brake hose, frame to axle the following procedure should be followed:

1. Remove brake line connection on frame bracket, top connection.
2. Remove brake hose spring lock clip from brake hose fitting at bracket.
3. Remove brake hose from bracket.
4. With open end wrench unscrew brake hose from tee connection on axle and remove.

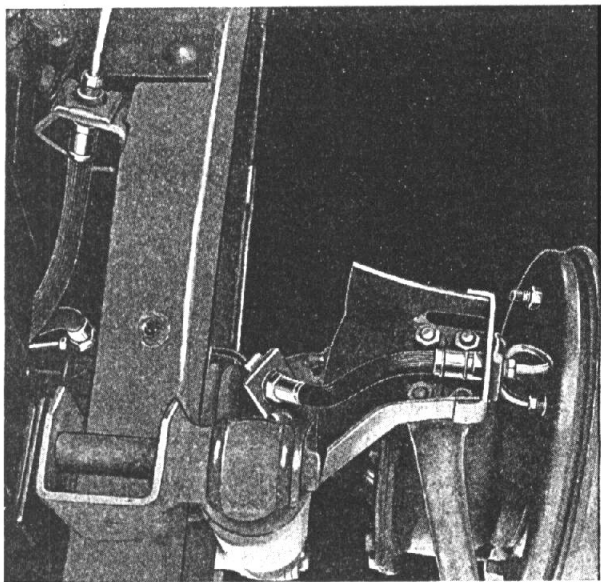


FIG. 6—BRAKE HOSE

### Brake Hose—Rear

To remove the rear brake hose, the following procedure should be followed:

1. Remove brake line from hose connection at frame.

2. Slip brake hose spring lock clip off of brake hose fitting.
3. Remove brake hose from frame.
4. With open end wrench unscrew brake hose from fitting on axle housing.

Whenever a brake line has been disconnected, it will be necessary to bleed the brakes. The bleeding of the brakes should be done in accordance with instructions given under "Bleeding Brakes".

### Transmission Hand Brake

The hand brake is applied to the rear propeller shaft at transfer case, see Fig. 1. The operation of the brake is positive through a cable connection.

To adjust the hand brake Fig. 7, the following operations should be performed.

Have hand brake lever on dash in the released position. Adjust anchor screw No. 1, so that there will be .005"—.010" clearance between the band and the drum. Tighten nut No. 2 until band is brought tight against the drum. Adjust bolt No. 3 so that the head just rests on upper half of the band. Back off two turns on adjusting nut No. 2.

The length of the cable from the hand grip to the brake levers is of a predetermined length and cannot be changed. At the regular lubrication periods of 1,000 miles it is advisable to put a few drops of oil in the upper end of conduit tube at cable to keep it free to slide within the conduit.

This brake is designed for holding the car while parked.

To reline brake band, remove from bracket and adjusting linkage. Cut off rivets and remove lining, care being taken not to distort the band. Hold end of new lining flush with end of band, make lining hug band inside and cut off about  $\frac{5}{16}$ "- $\frac{1}{2}$ " long. Bring lining ends even with ends of band and install end rivets only. Then remove center bulge in lining with hammer, so lining will hug band tightly, then install balance of rivets and form band to drum, making regular adjustments.

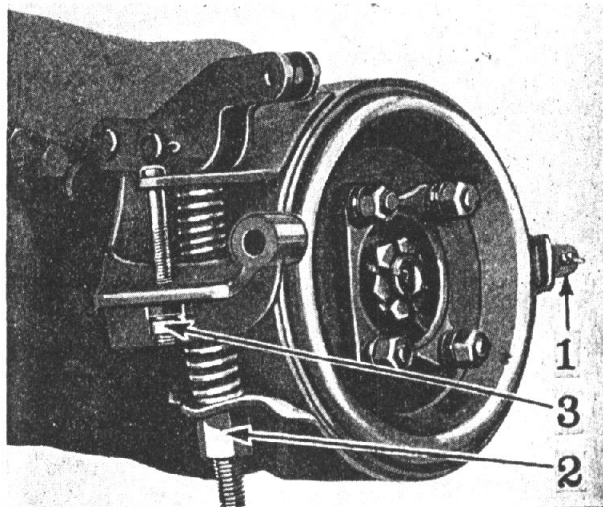


FIG. 7—TRANSMISSION BRAKE

# BRAKE TROUBLES AND REMEDIES

## SYMPTOMS

## PROBABLE REMEDY

### Brakes Drag

Brake shoes improperly adjusted.....	Readjust
Piston cups—Enlarged.....	{ Flush all lines with alcohol—Install new cups in Wheel and Master cylinders
Mineral oil or improper brake fluid in system... }	
Improper pedal adjustment.....	Adjust master cylinder rod
Clogged master cylinder compensating port.....	Clean master cylinder

### One Brake Drags

Brake shoe adjustment incorrect.....	Adjust
Brake hose clogged.....	Replace
Retracting spring broken.....	Replace
Wheel cylinder piston or cups defective.....	Replace
Loose or damaged wheel bearings.....	Adjust or replace

### Brake Grabs—Car Pulls to One Side

Brake anchor pin adjustment incorrect.....	Adjust
Oil or brake fluid on lining.....	Replace lining
Dirt between lining and drum.....	Clean with wire brush
Drum scored or rough.....	Turn drum and replace lining
Loose wheel bearings.....	Adjust
Axle spring clips loose.....	Tighten
Brake backing plate loose.....	Tighten
Brake lining.....	Different kinds on opposite wheels
Brake shoes reversed.....	Primary and secondary shoes reversed in one wheel
Tires under-inflated.....	Inflate to 30 lbs. pressure
Tires worn unequally.....	Replace or change around to opposite wheels

### Excessive Pedal Travel

Normal lining wear.....	Adjust
Lining worn out.....	Replace
Leak in brake line.....	Locate and repair
Scored brake drums.....	Replace or regrind
Incorrect brake lining.....	Replace
Air in hydraulic system.....	Fill master cylinder and Bleed lines

### Spongy Brake Pedal

Air in lines.....	Bleed lines
Brake shoe adjustment incorrect.....	Adjust

### Excessive Pedal Pressure

Oil or brake fluid on lining.....	Replace lining
Shoes improperly adjusted.....	Major adjustment
Warped brake shoes.....	Replace
Distorted brake drums.....	Replace or regrind

### Squeaky Brakes

Brake shoes warped or drums distorted.....	Replace
Lining loose.....	Replace
Dirt imbedded in lining.....	Clean with wire brush or replace
Improper adjustment.....	Adjust

# BRAKE SPECIFICATIONS

### Service Brakes:

Type.....	4 Wheel Hydraulic
Size.....	9" x 1¾"
Fluid Capacity Pts. See Lubrication Chart, Pg. 12	

### Master Cylinder:

Size.....	1"
Mounted.....	L.H. Frame Side Rail

### Wheel Cylinder:

Size.....	Front 1" Rear ¾"
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### Brake Shoes..... Bendix

Size.....	9" x 1¾"
Lining area.....	117.8 Sq. in.
Length Lining-Forward shoe.....	10 <sup>7</sup> / <sub>32</sub> "
Length Lining-Reverse shoe.....	6 <sup>39</sup> / <sub>64</sub> "
Width.....	1¾"
Thickness.....	9/16"

### Hand Brake

Type.....	Mechanical
Size.....	6"
Lining.....	Woven
Length.....	18 <sup>9</sup> / <sub>16</sub> "
Width.....	2"

### Brake Return Springs:

Brake Pedal	
Free Length.....	5 <sup>7</sup> / <sub>8</sub> "
Load when extended to 7 <sup>9</sup> / <sub>16</sub> ".....	23 lbs.
Brake Shoe Return Spring	
Free Length.....	5 <sup>13</sup> / <sub>16</sub> "
Load when extended to 6 <sup>3</sup> / <sub>16</sub> ".....	40 lbs.
Wheel Cylinder Spring	
Length.....	1 <sup>7</sup> / <sub>16</sub> "
Load when compressed.....	1 to 1¼ lbs.