MOTOR MECHANICS

By C. E. PACKER, Editor

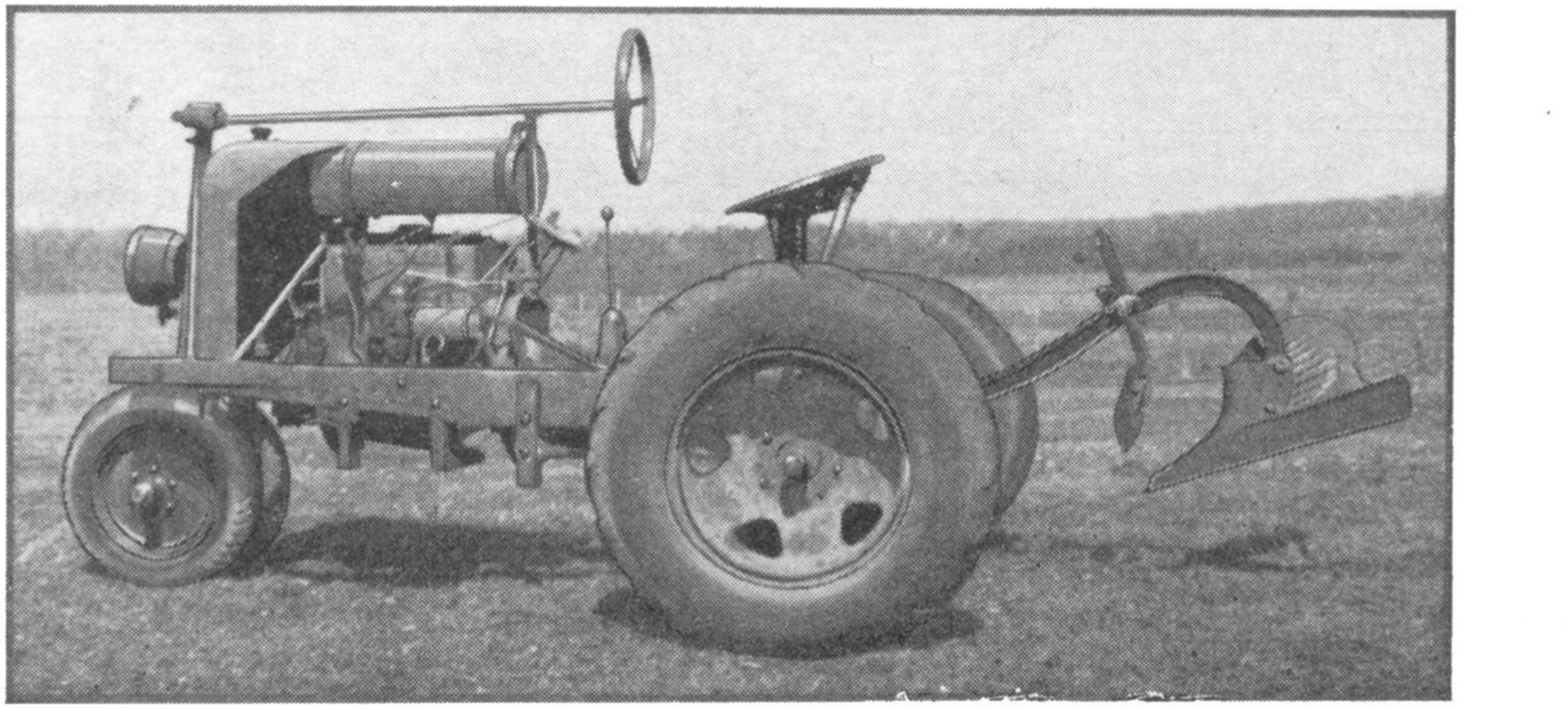

Fig. 1. Finished tractor complete, with plow attached, ready to drive into the field.

Make Your Own Farm Tractor

From Salvaged Automobile Parts

Only a few days' time and a few low-cost parts are needed for the assembly of a tractor that can handle all sorts of heavy work on the farm in all seasons.

Craft Print Project No. 87

PART I

The designer and constructor of this tractor, Mr. Elmer L. Johnson, of Niobe, N. Y., does all the plowing, harrowing and general hauling on his one hundred and nineteen acre farm with the equipment here described. A ten-year-old boy manipulates and controls the machine with ease, including the attaching of the plow.

PLOWING, harrowing, cultivating and general hauling can be handled promptly and easily by the use of a farm tractor which can be made quickly and at low cost by the farmer himself. Figure 1 pictures such a tractor.

It is made of salvaged automobile parts which may be obtained from almost any dealer in used parts. Certain alterations are necessary, but these can be made of standard sizes of bar iron and steel, stocked by most blacksmiths and hardware merchants.

Although the dimensions and shapes of parts illustrated here are specified for use with the units named, it is obvious that similar units of other makes can be substituted with equally good results. It will be necessary to modify and alter only those parts which are directly affected by the substitutions mentioned above.

The designer used the motor, radiator, frame and steering gear from a four-cylinder Dodge, one of the older models in which the worm wheel turns all the way around, preferably equipped with a six-volt

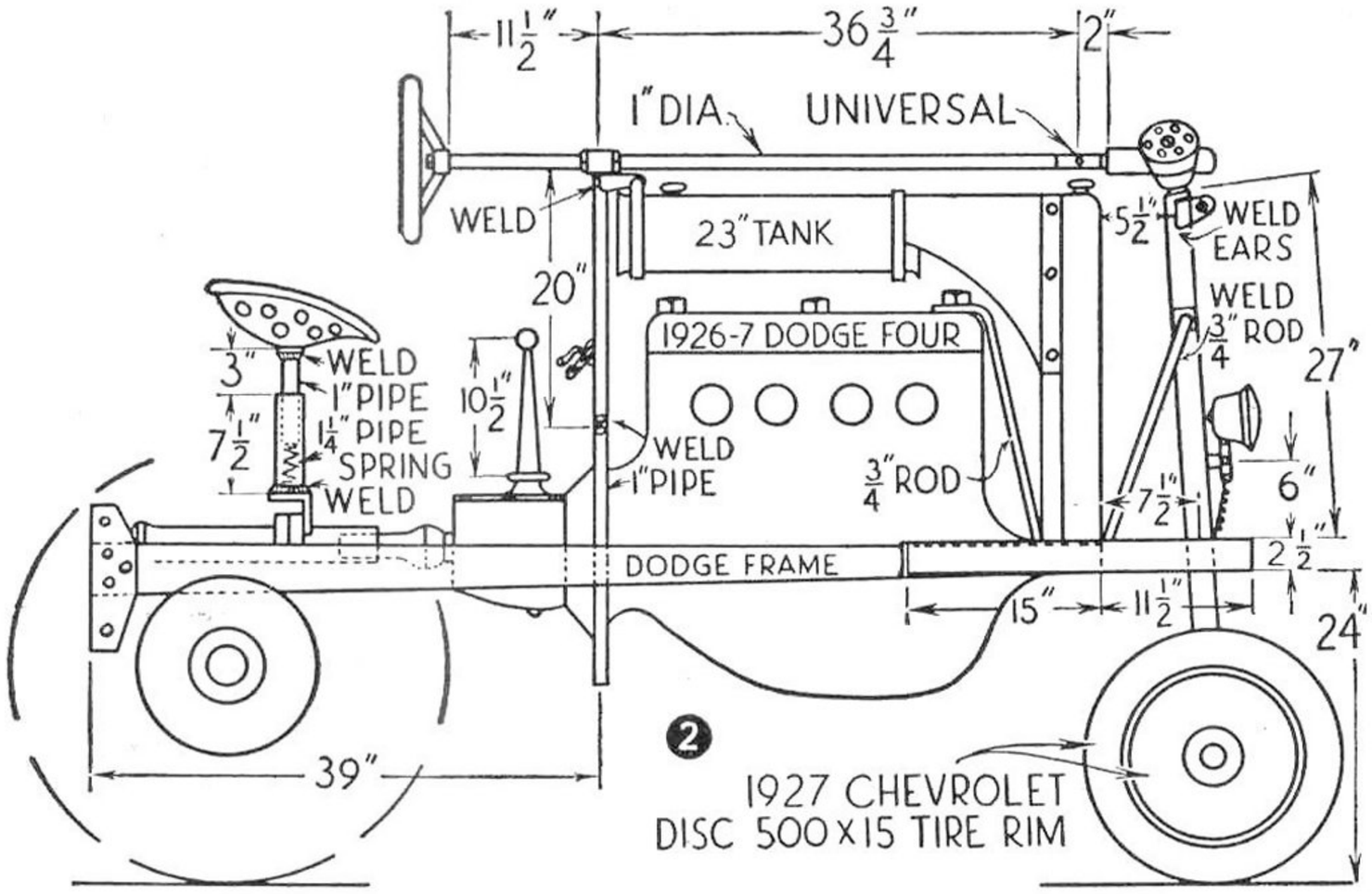

Fig. 2. Side view of assembled tractor, showing enough dimensions to lay out the positions of the major parts.

MATERIAL AND PARTS LIST

Quantity	Size and Shape	Kind of Material
5′ 4″	2½″ x 2½″ x ¼″	Angle iron
1′ 8″	5″ x .325″ thick	Channel iron (structural)
2′	5/16″ x 3½″	Mild steel bar stock
5′ 6″	½″ x 2½″	Mild steel bar stock
9′	½″ x 2″	Mild steel bar stock
1′ 8″	½″ x 1½″	Mild steel bar stock
4′	½″ round	Mild steel bar stock
5′	⅝″ round	Mild steel bar stock
15′	¾″ round	Mild steel bar stock
6″	1″ round	Mild steel bar stock
3′ 6″	1⅛″ round	Mild steel bar stock
1′ 2″	⅝″ square	Mild steel bar stock
1′ 2″	¼″ x ⅝″	Mild steel bar stock
3′ 1¼″	2″ extra heavy	Iron pipe
6″	1½″ standard	Iron pipe
6′	1″ standard	Iron pipe
10′	¾″ standard	Iron pipe

Miscellaneous machine bolts, nuts and lock washers as indicated on drawings.

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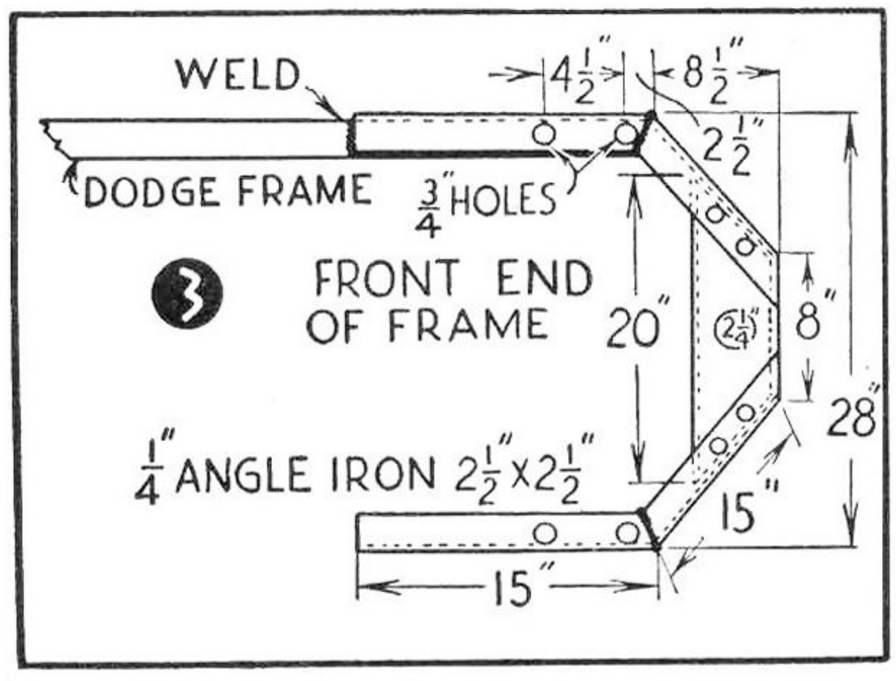
SALVAGED PARTS LIST

Number	Description
One	Automobile engine (preferably Dodge four cylinder with six-volt electrical system).
One	Automobile radiator.
One	Automobile frame.
One	Instrument panel with ignition switch.
One	Steering gear (preferably older Dodge, with full worm wheel, so steering shaft can turn all the way around).
One	Universal joint (to fit whatever transmission is used).
One	Torque tube (drive shaft housing) preferably Ford model "T," complete with roller bearing housing, sleeve, and all bearings, including thrust bearing.
One	Rear axle shaft, key and nut, preferably model "T."
One	Rear wheel hub to fit above listed axle shaft.
Two	Front wheel hubs, complete with bearings, steering spindles, washers and lock nuts.
Two	Disc wheels, cut down and fitted with 15″ x 5.00″ rims and tires, to fit hubs and spindles listed above. Chevrolet "1927" preferred.
One	Worm drive rear axle, low ratio 7½ to 1, such as Ford truck model "TT" or Ruxtell two speed axle.
Two	20″ disc wheels and tires, from a Chevrolet truck, for instance.
Two	"U" shaped clip bolts and nuts, such as are used to hold rear axle to spring.

Fig. 3. Details of reconstructing front end of frame to receive new type steering gear and braces.



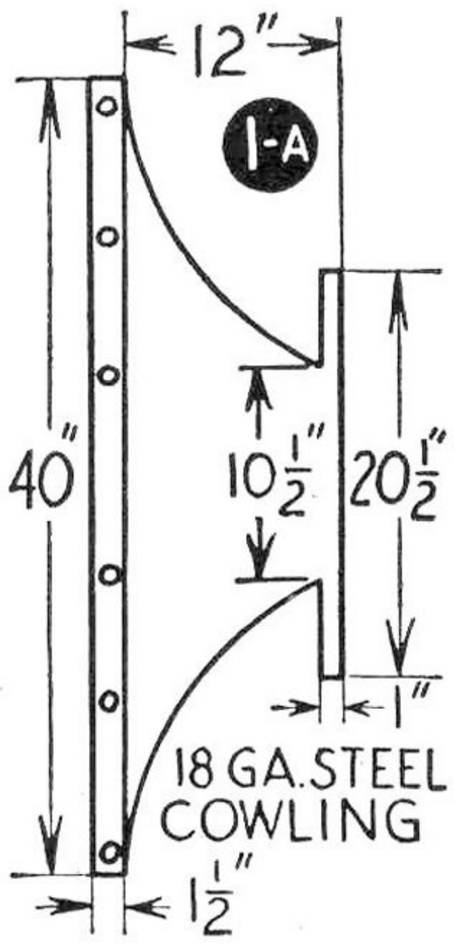


Fig. 1-A. Pattern for sheet metal cowling to support gas tank.

electrical system. The front system is largely built of model "T" Ford drive shaft and rear axle parts, plus steering spindles and disc wheels from a 1927 Chevrolet. The gas tank can be cut down from a model "T" oval or its equal. It is attached to the radiator with sheet steel cowling shown in Fig. 1-A.

In order to obtain the required speed reduction, a worm drive rear axle is used, such as the 7½ to 1 ratio furnished with the model "TT" Ford truck, or the two-speed Ruxtell axle which was made to replace the regular Ford axle because it gives a wider range of speed selections. The universal joint was also obtained from the Dodge chassis and the drive shaft from a Ford.

The motor should be cleaned, overhauled and repainted before installing in frame. The exhaust manifold should be cut off behind the rear exhaust port and the opening closed by welding on a steel disc. Then an iron pipe is welded into the center of the manifold so as to direct the exhaust away from the feet. Although not imperative, a muffler may be fitted to minimize the exhaust noise. A governor added to the engine will prevent stalling under sudden overloads, but is not absolutely necessary. This is the only work necessary before installing the motor in the frame, ready to attach to rear axle.

Cut off the frame just in front of the radiator support and also at the rear, 39 inches behind the rear motor mount, as shown in Fig. 2 at the top of this page.

File or grind the cut edges smooth and square with the upper side of the frame.

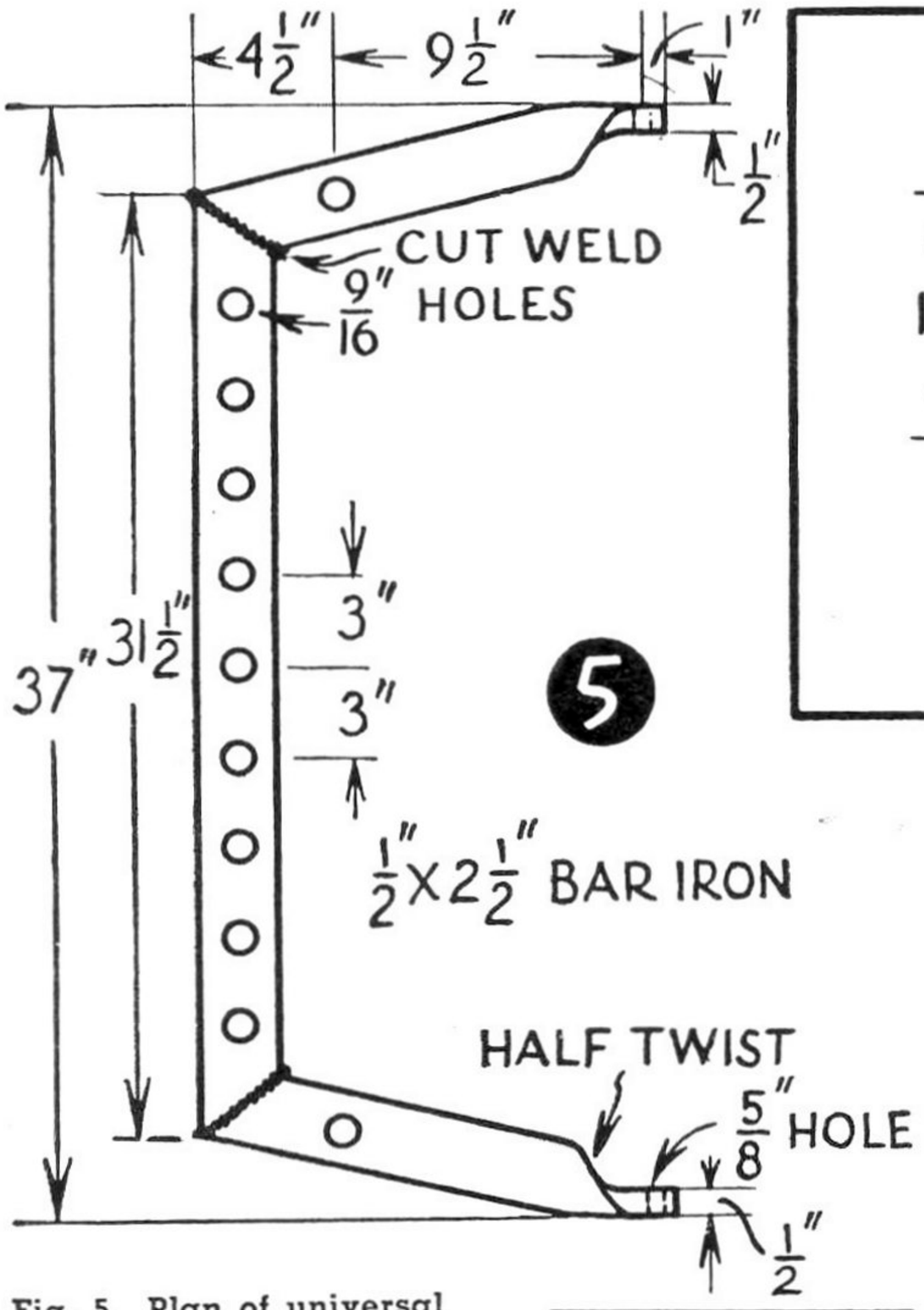


Fig. 5. Plan of universal drawbar, showing how to build it up by bending and welding a piece of bar stock.

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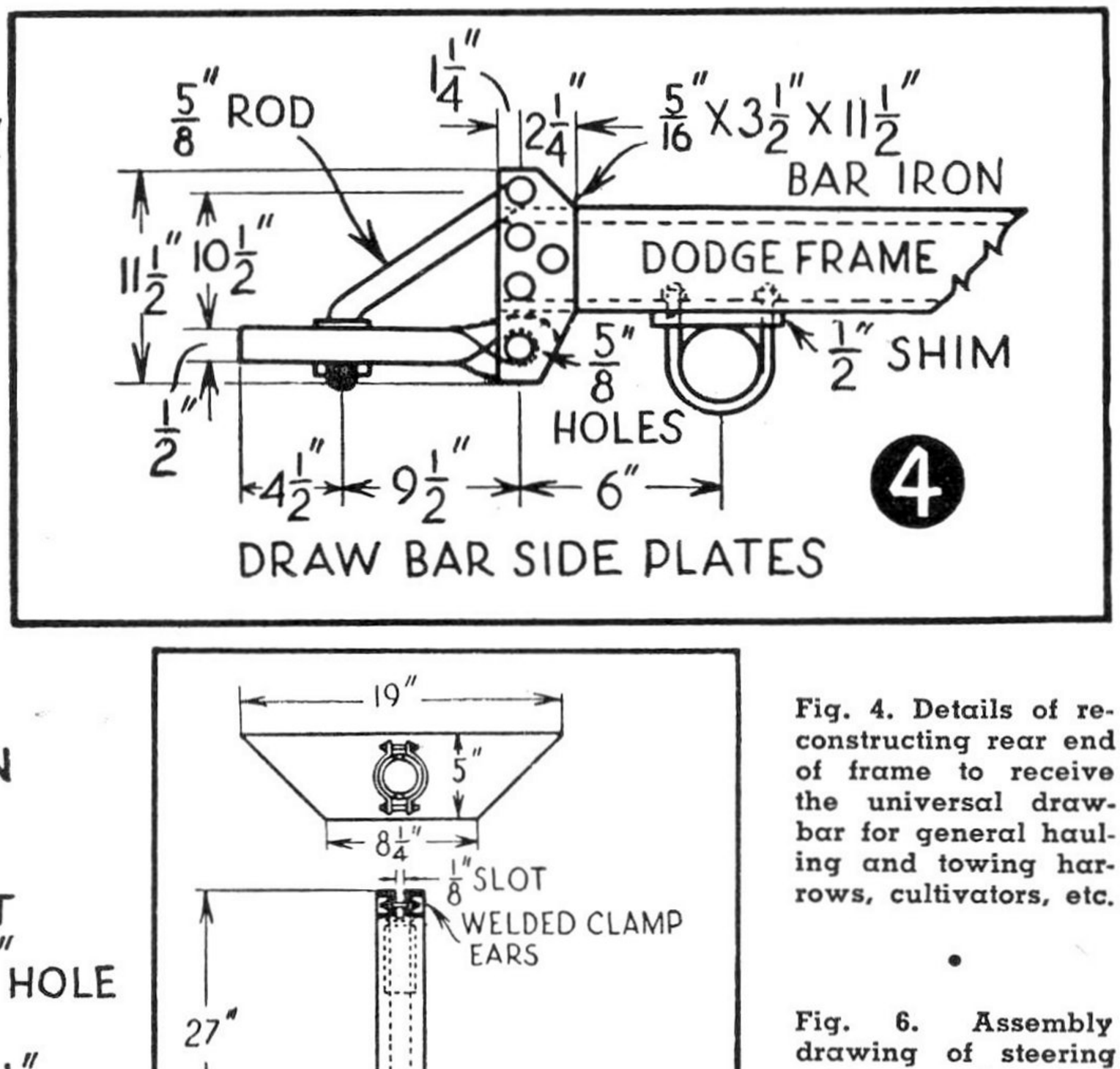
Fig. 7. Details of vertical steering shaft, showing changes necessary to construct it from a model "T" axle shaft.



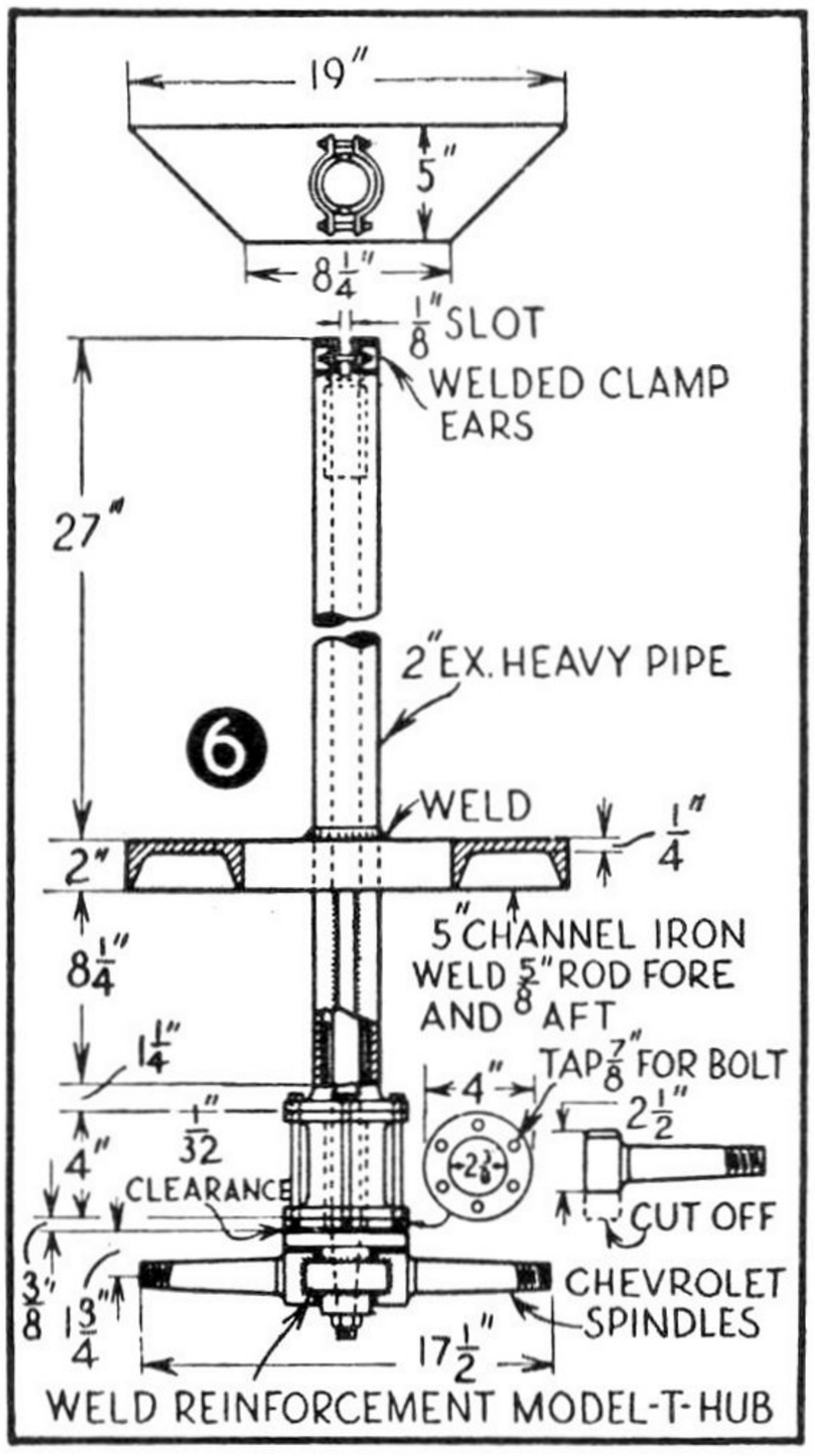


Fig. 4. Details of reconstructing rear end of frame to receive the universal drawbar for general hauling and towing harrows, cultivators, etc.

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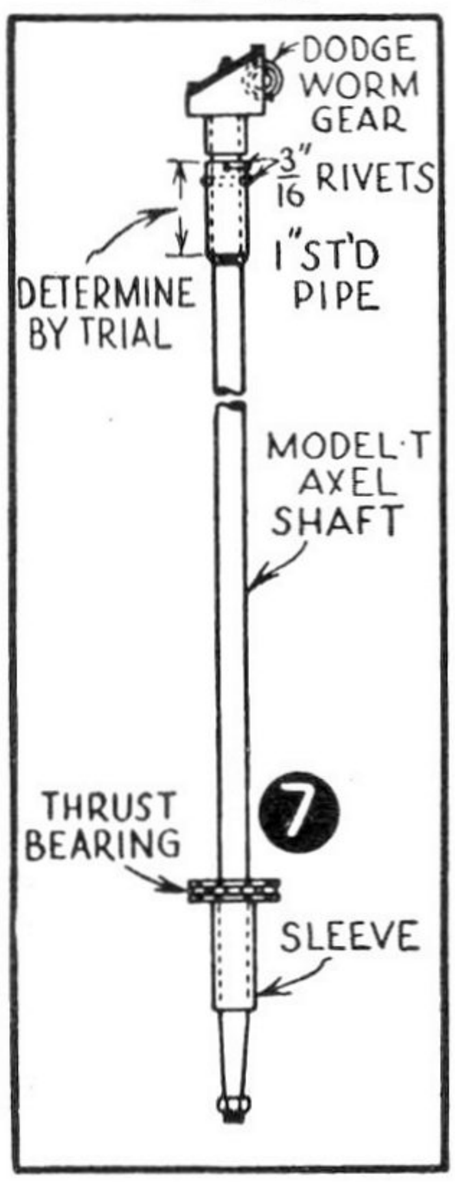
Fig. 6. Assembly drawing of steering system welded in place in channel iron crosspiece.



Rebuilding the Frame

The front end of the frame is reinforced and reconstructed as shown in Fig. 3 to provide a support for the front wheels and steering system. Two pieces of angle iron, 2½" x 2½" x ¼", 32 inches long, are notched, bent to required shape, and the notch welded shut. Clamp angle irons to the frame and weld in position. Cut and fit the 5-inch channel into place. Drill both side frames and channel for ½-inch bolts, but do not fasten permanently yet, as it is easier to build up the steering system on this channel before attaching to the frame. Also, drill four holes at the front sides of the frame, as shown, to take four ¾-inch round iron braces to steering gear and to cylinder head, as shown installed in Fig. 2, at front end of frame.

The rear end of the frame is filed up square and finished off with drawbar side plates of 5/16" x 3½" mild steel 11½" long, beveled and drilled as shown in Fig. 4, to provide a substantial support for the drawbar. The drawbar (Fig. 5) is made of ½" x 2½" bar steel. It can be forged to the required shape, or cut on an angle and welded together, as preferred. Fig. 9-A illustrates the drawbar fastened in position at rear end of frame.

A row of nine bolt holes for 9/16-inch bolts is drilled on 3-inch centers for attaching various implements at required spacing from the track. The drawbar is anchored in its horizontal position by two 45° braces made out of 5/8-inch round steel rod, also shown in Fig. 4.

Front Axle, Wheels and Steering System

The front system consists of two major assemblies, the housing and the shaft assembly, shown in Figs. 6 and 7, on this page.

The housing is made by cutting off the flange end of a model "T" drive shaft housing (or torque tube, as it is sometimes called) at a point 1¼ inches back from the face of the flange, and welding it onto a piece of 2-inch *extra heavy* iron pipe exactly 37¼ inches long. Do not substitute standard pipe, as it is not strong enough

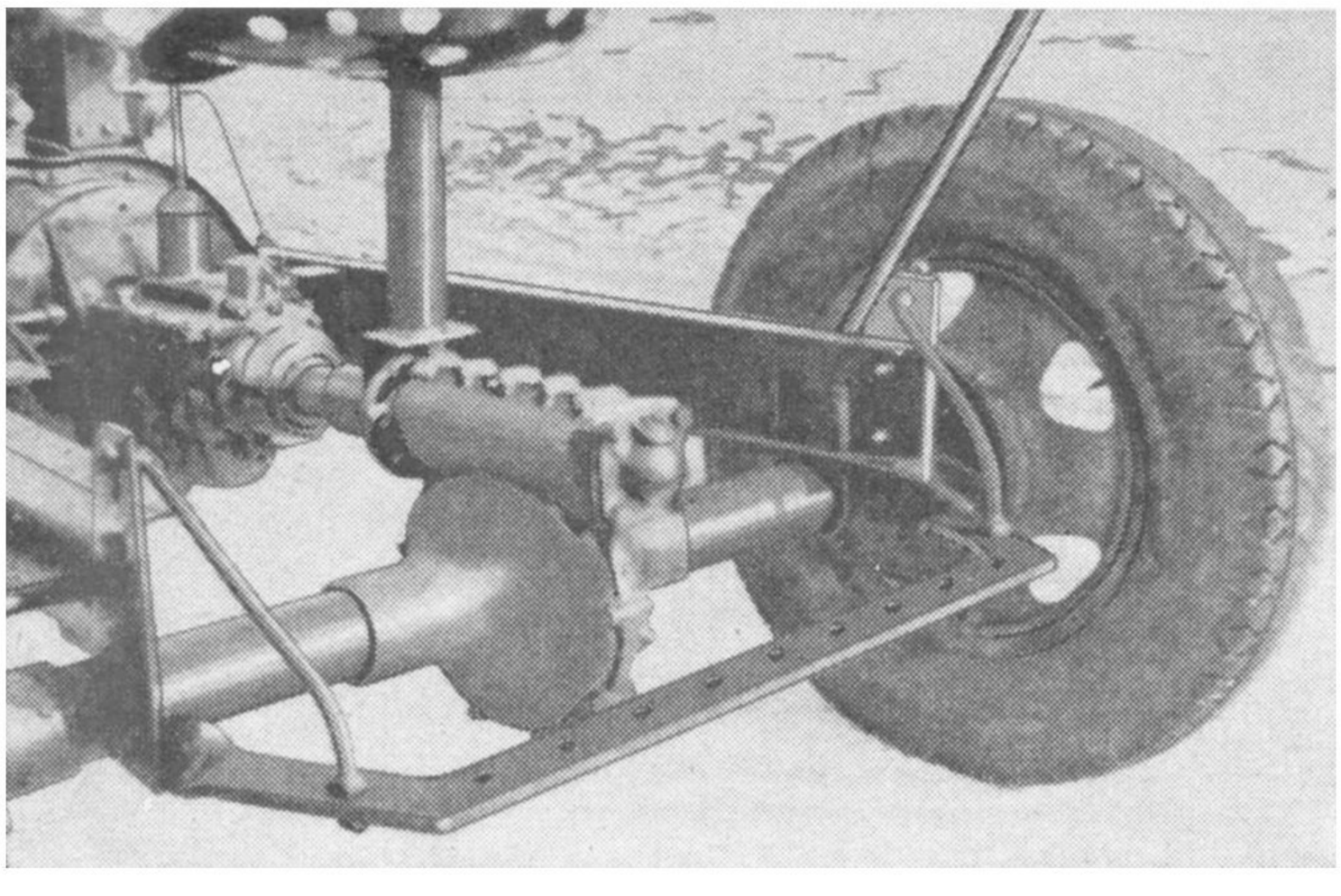


Fig. 9-A. Close-up of rear end with drawbar attached, showing pipes and bolts in place to maintain axle alignment; also pipe for brake handle.

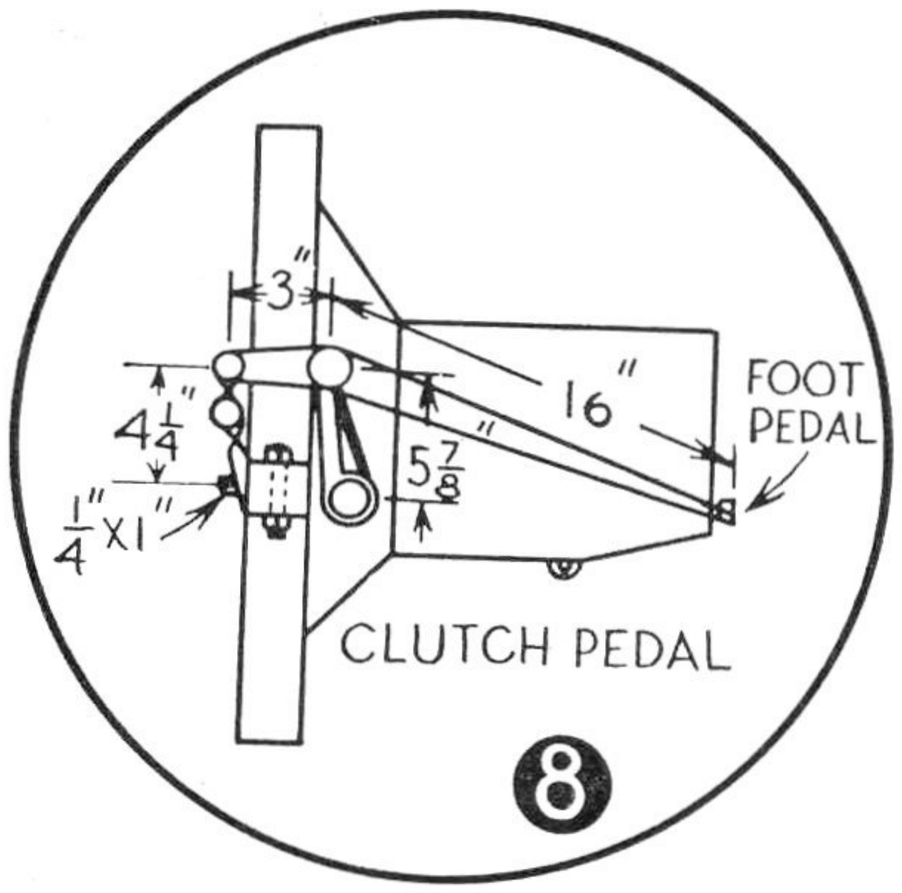


Fig. 8. Suggested method of reconstructing clutch pedal and lever to work from driving seat position.

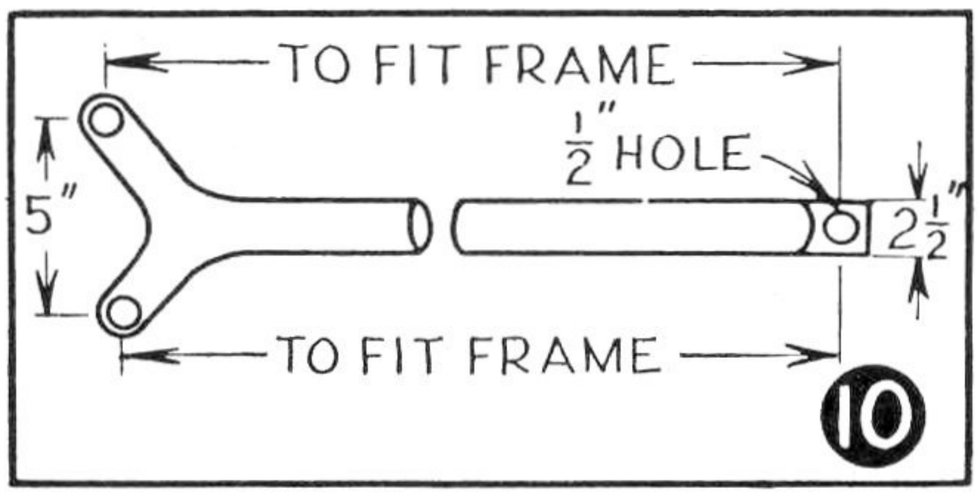


Fig. 10. Rear brace rods cut down and flattened to fit against outside of Dodge frame to brace the axle firmly in its new position.

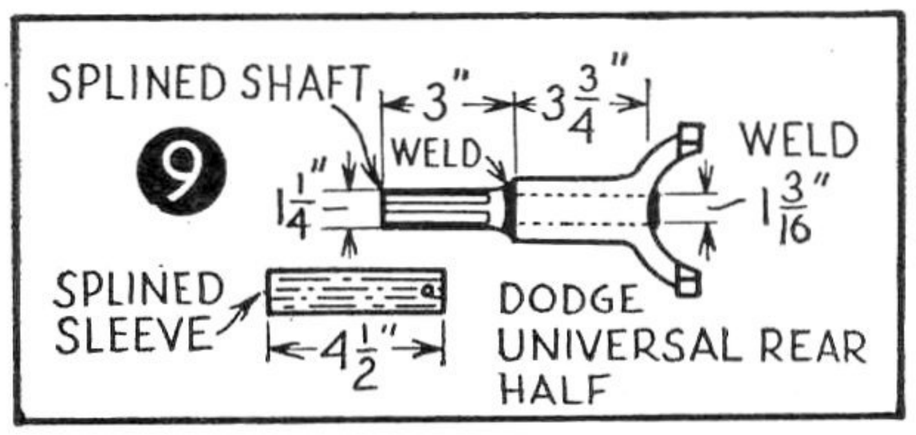


Fig. 9. Details of short drive shaft rebuilt from old Dodge universal joint and end of model "T" drive shaft.

for the strains of steering. These two parts are held in alignment and the joint reinforced by inserting a piece of 1½-inch iron pipe in the torque tube flange and welding it in place before adding the 2-inch pipe. The ends are prepared for welding by filing or turning to a 45° angle to insure penetration of the weld. Next weld the 5-inch channel iron in place at an angle of 86° with the 2-inch pipe. The projecting end of the roller bearing housing which originally fitted into the differential is turned or cut off and a steel ring ⅜ inch thick takes its place to hold the roller bearing in place. This ring is drilled and tapped so the original long bolts can be used to hold the assembly together.

The original clamp which held the steering gear in place is cut in two and ground to fit the 2-inch pipe. A ⅛-inch slot is cut as shown in Fig. 6, and then the clamp ears are welded in place. The pipe is further reinforced between the channel and bearing housing by welding ⅝-inch round steel rods on the front and rear. Now attach the assembled housing to the front end of the frame. Next cut and thread the two ¾-inch rods, which are to act as braces; bolt their lower ends into the frame to obtain perfect alignment; and weld their upper ends to the sides of the pipe steering column, as shown in Fig. 2.

The Vertical Steering Shaft Assembly

Turn down the model "T" axle shaft at the tapered end so it will receive the drive shaft sleeve with a light press fit. Turn down the other end so that it fits snugly inside a 1-inch standard iron pipe. On the Dodge steering gear, cut back the housing and bearing around the large shaft so as to expose more of the large shaft, because a length of 1-inch pipe about three inches long is riveted and welded to this shaft at one end and to the axle shaft at the other, as shown in Fig. 7. The exact length of this piece of pipe must be such that the worm gear housing sets down in the 2-inch pipe and comes just flush with the clamp end. This is easily determined when assembling these parts. When assembled there should be 1/32-inch to 1/16-inch clearance between the Ford hub, which is at the bottom, and the special ring, so that the weight of the front end will rest against the ball thrust bearing, as intended, instead of rubbing against end of housing.

Steering Gear, Front Wheels and Spindles

The front wheel spindles are obtained from a 1927 Chevrolet front axle. These are cut off at right angles to the spindle bolt to a length of 2½ inches and welded at an angle of 92° or 93° to a model "T" Ford rear hub on which the flange has been turned down to the same diameter as the drive shaft roller bearing housing, as shown in Fig. 6. The exact angle of camber is not so important, but it must be equal on both sides. If correct, the tires will be about two inches farther apart at the top than at the bot-

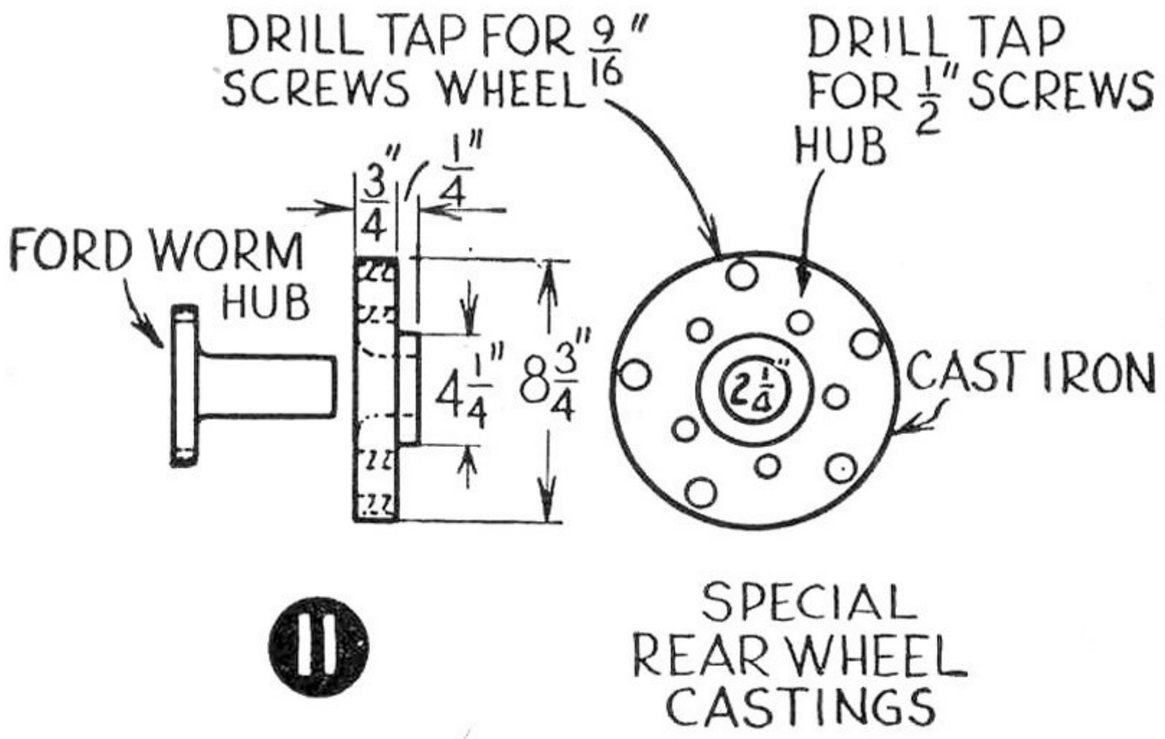


Fig. 11. Special rear wheel castings to adapt Chevrolet truck wheels to the Ford truck axle hubs used with this tractor.

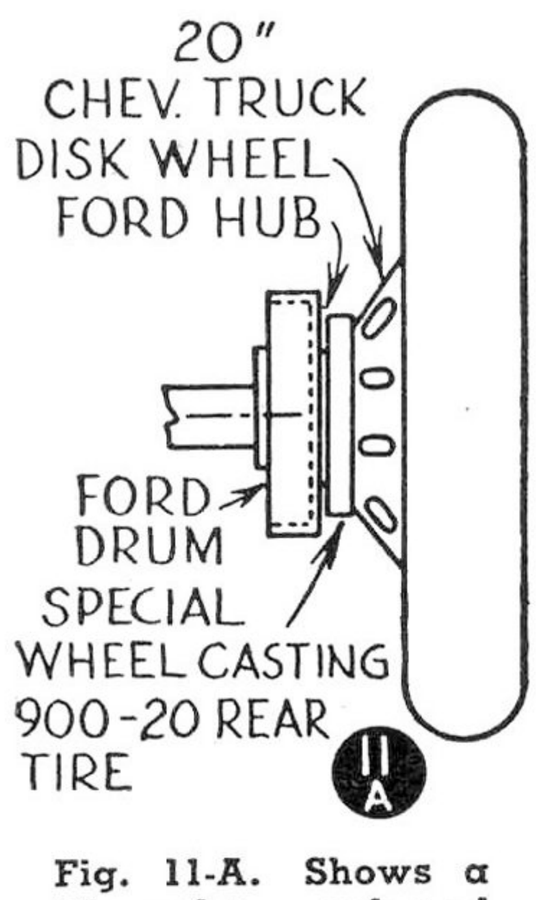


Fig. 11-A. Shows a Chevrolet wheel mounted in place on a Ford hub by means of the special castings shown in Fig. 11.

tom, thus making easy steering. Brace the spindles with a welded ring as shown in Fig. 6. The front wheels are made from 1927 Chevrolet wheel discs cut down to fit 15-inch rims, which are welded in place to avoid distortion.

The original steering wheel shaft is not long enough to fit, but it is tubular and can be lengthened by cutting it in the middle and then inserting a length of 1-inch rod which has been turned down on both ends to fit inside the tube, after which these parts are welded back together. A universal joint from a socket wrench set is fitted between the steering shaft and the worm of the steering gear. Fit the worm shaft into the hollow square of the universal. Fit the steering shaft onto the solid square. Line the parts up and weld them together. The wheel end of the shaft is supported in a bearing made from a short length of 1-inch pipe supported on a standard. This standard is also made of 1-inch pipe (shown in Fig. 2), and supports the rear end of the gas tank, which is cut down from a model "T" oval tank.

Attaching the Rear Axle

The rear axle system may be made from either a model "T" Ruxtell axle using 20" x 9" tires or a model "T" plain worm driven axle with a low speed ratio of 7½ to 1, and using 8.25" x 20" tires.

The splined end of a model "T" drive shaft is cut off as indicated in Fig. 9 and turned down to make a tight drive fit in the Dodge universal joint, after which it is welded in position at both ends, as shown in Fig. 9. The axle should be lined up perfectly square with the frame and exactly in line with the center line of the transmission and engine before the holes are marked on the frame for the "U" bolts, then removed so that the holes may be drilled more carefully. "U" bolts may be obtained from the rear system of the old Dodge, at the spring to axle seat assembly.

Maintain Rear Axle Alignment

To keep the rear axle from shifting sideways in the "U" bolts, first remove both spring perches from the brake support plates. Fit a length of ¾-inch pipe horizontally between the frame and brake plate at the perch hole. Fit another similar pipe at the opposite side. Two long ½-inch bolts will hold these pipes in place and prevent shifting. The original Ford rear brace rods must be cut down, as in Fig. 10, and flattened at the front end to fit against the outside of the frame, to brace the axle firmly in its new position.

Castings for Disc Drive Wheels

Special adapter castings may be obtained to accommodate Chevrolet truck disc wheels, if desired, as shown in Fig. 11, also shown attached to axle in Fig. 11-A. Lengths of ¾-inch iron pipe (not shown in drawing) may be welded directly onto the brake levers, one on either side, and will be found very handy when turning with a load where space is limited.

Provision is also made for a spring cushioned driver's seat, as well as a sheet steel cowling to support the front end of the gas tank.

Instrument Panel and Foot Throttle

The instrument panel used is the center section of the original Dodge equipment. The switch replaces the speedometer. The starter button is attached in any convenient place. The battery should be placed next to the frame below the starting motor. The foot throttle is placed where it can be operated with the right foot as it rests on the right-hand motor mount. Fig. 8 shows how to fit a pedal which will operate the clutch lever easily from the new driving position.

(To be concluded in next issue)

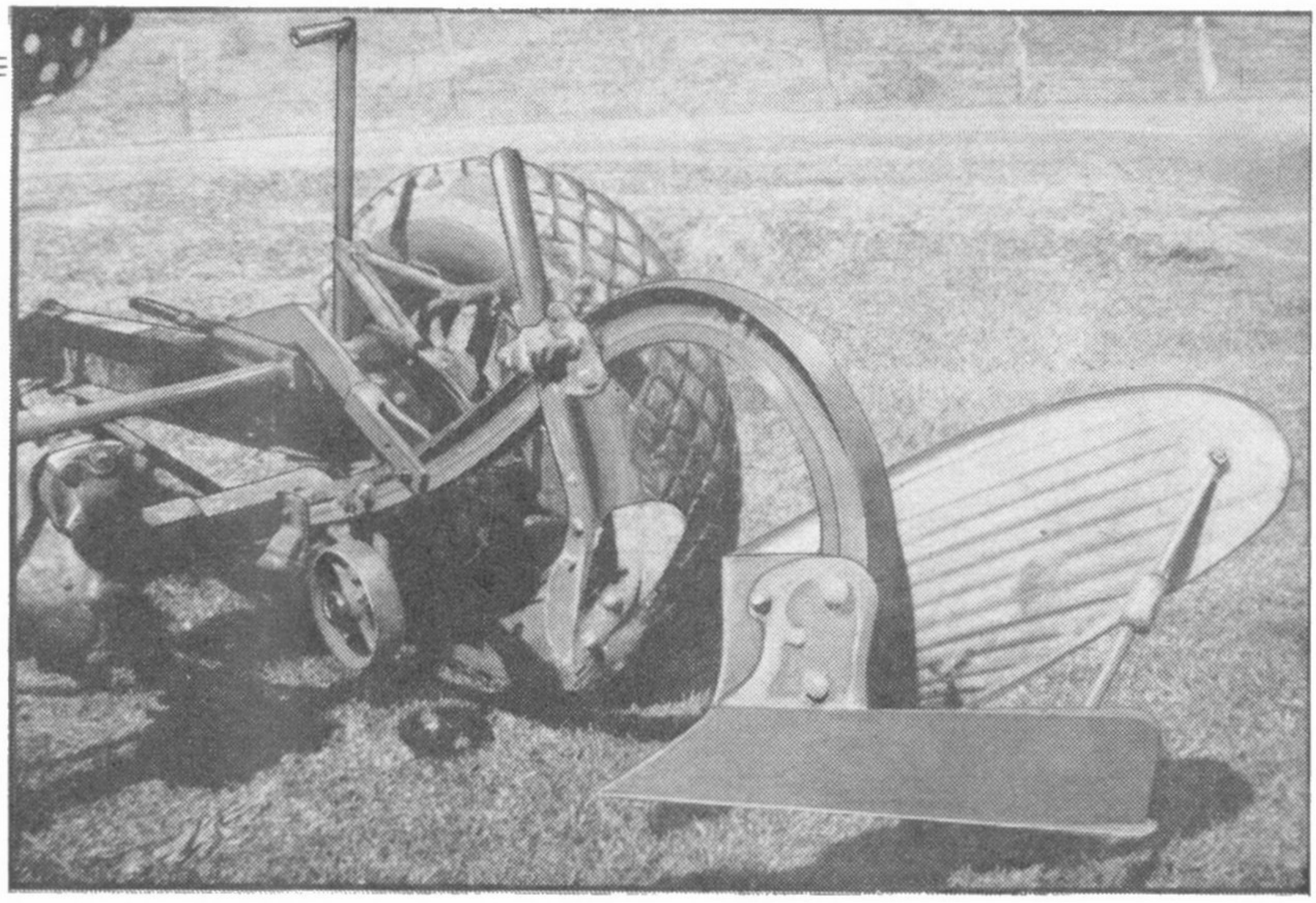


Fig. 12-A. Gives a close view of the working parts of the plow drawbar and lifting attachment. The plow is raised by power from the right-hand drive wheel as the wheel revolves forward about one-third of a turn. The lift is automatically thrown out and locked, thus avoiding injury to parts.

Making Your Own Farm Tractor

—Adding the Plow Attachment

Your standard walking plow can be converted for hauling by the tractor, which is able to do the plowing easily.

Craft Print Project No. 87

PART 2

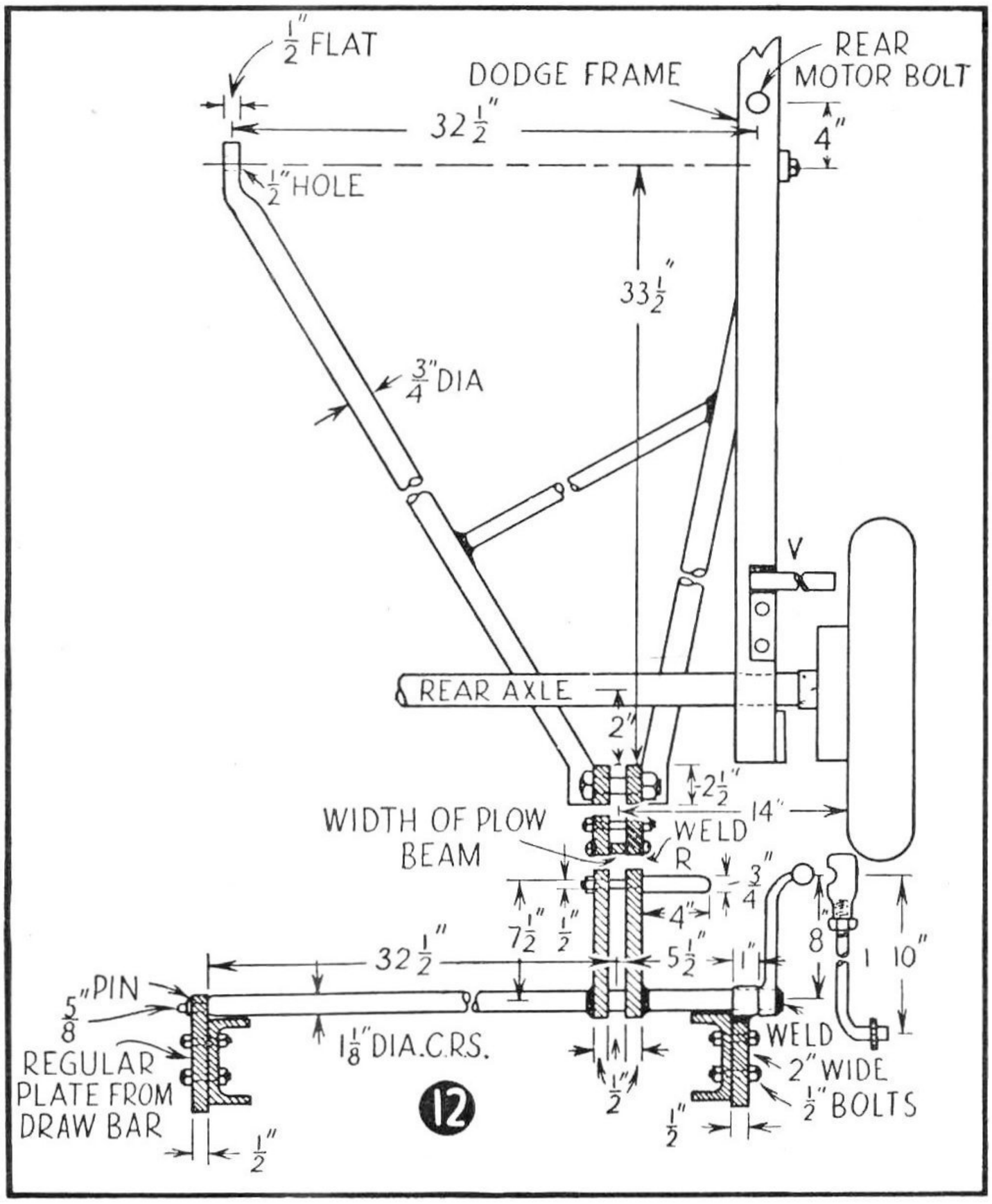


Fig. 12. Plan of plow drawbar system and plow lifter cross-shaft.

THE construction of a useful farm tractor from salvaged automobile parts was described in the July-August, 1940, issue of SCIENCE AND MECHANICS. In this issue, the author describes the changes necessary to convert the common walking plow into a power-operated riding plow to be drawn by the tractor mentioned above. All parts are made of standard sizes of iron and steel bars, which can be obtained readily from the average blacksmith or heavy hardware store.

Instructions and dimensions given herewith provide for the attachment of a 12-inch bottom, right-hand walking plow with an adjustable

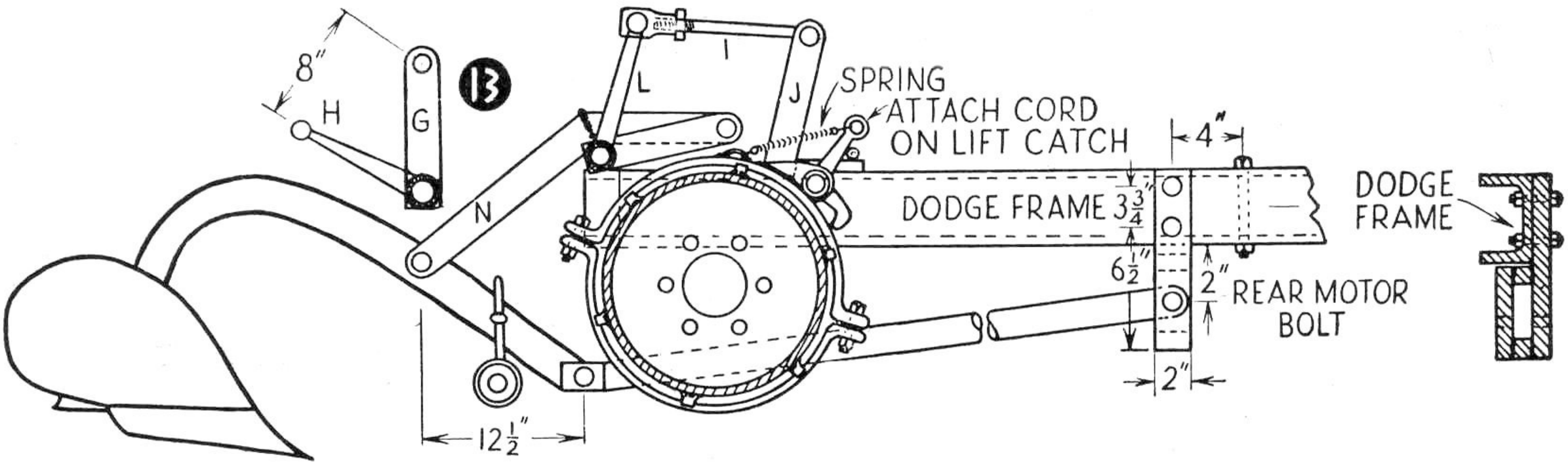


Fig. 13. Side view of the plow drawbar and lifting device attached to the tractor frame.

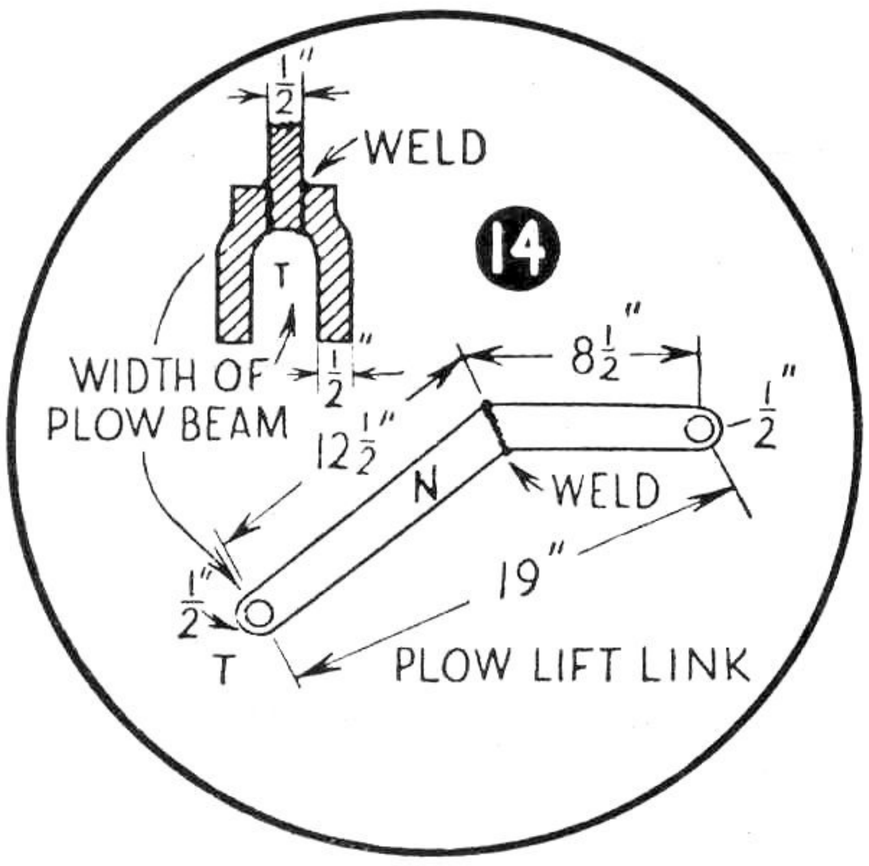


Fig. 14. Details of the plow lift link, showing how clevis end (T) is made to receive the plow beam.

gauge wheel for furrow depth. Fig. 12-A gives a close view of the working parts of the plow, drawbar, and lifting attachment. The plow is raised by power from the right-hand drive wheel as the wheel revolves about one-third of a turn. The lift is automatically thrown out and locked, thus avoiding injury to parts.

In order to use the plow it is necessary to remove the regular drawbar from the tractor, leaving only the left-hand side plate in place. The right-hand plate is replaced with the special bearing bracket plate as shown in position in Fig. 12. This bracket is made by welding a piece of tubing onto an iron plate ½" x 2" x 5" long. The tubing acts as bearing for the 1⅛-inch cold rolled steel cross-shaft, which is provided with a turned down stud to fit the ⅝-inch hole in the left-hand side plate, as shown in Fig. 12.

The cross-shaft is built by welding an old Dodge steering arm onto the end of a 1⅛-inch round shaft 42 inches long. Slip the lift lever "G" in position as shown in Fig. 13. The angle between arm "H" and lift lever "G" may be established by measuring eight inches between

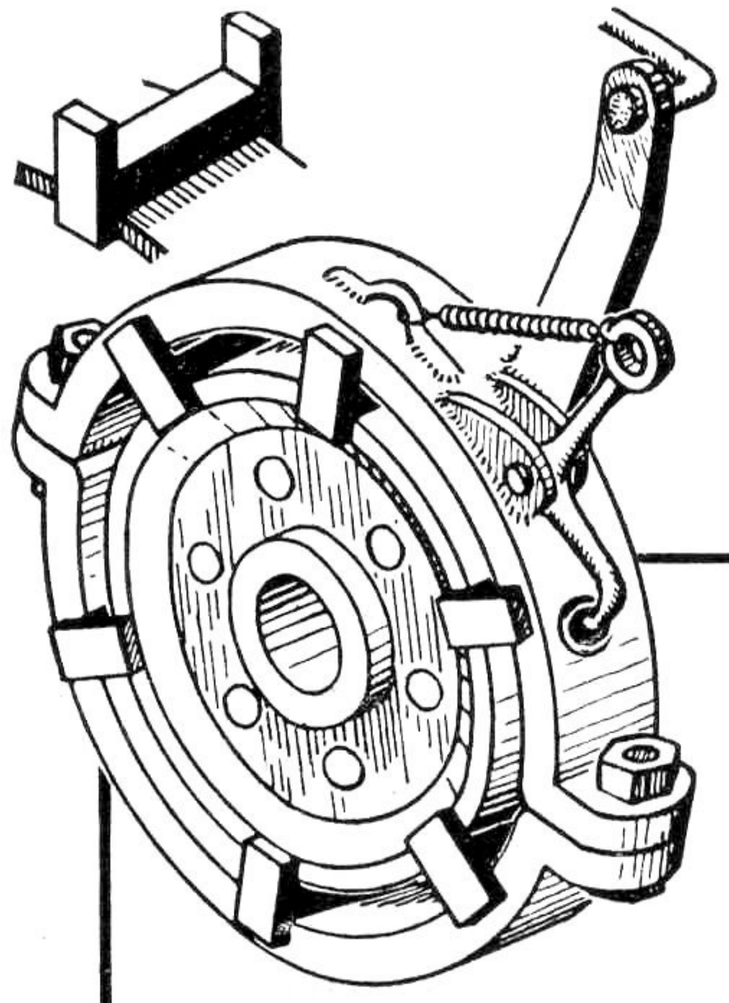
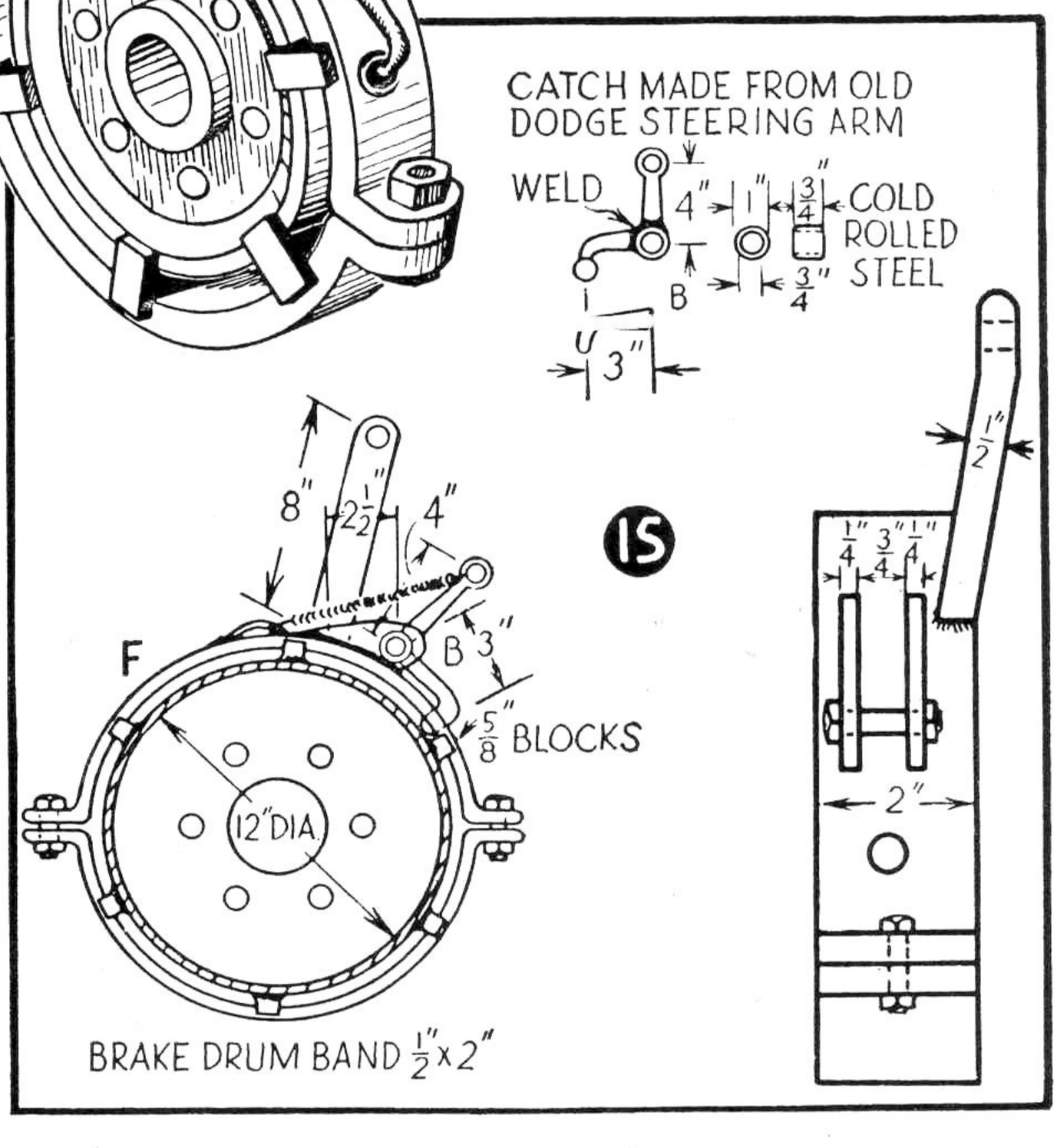


Fig. 15. Details and perspective drawing of lifting ring, blocks and catch, all in position for operation.



centers on an angle. The lift lever is made of two pieces of hot rolled bar steel ½" x 1½" x 10" long, drilled 1⅛ inches and welded to the cross-shaft. The other end is drilled ½ inch and fitted with handle bolt "R" to receive lift link "N."

Making the Plow Lift Link

The plow lift link is made of a steel bar ½" x 2" x 23" long bent to an angle (or cut and welded) as shown in Fig. 14. The end at "T" is built into a clevis jaw as shown, by welding two pieces onto the sides of the link, spaced

far enough apart to receive the plow beam.

Lock link "I" is made from an old Dodge steering drag link, cut off and bent, as shown in Fig. 13, to a length of ten inches from the center of the ball socket to the center of the bent end. The link lifts arm "J" to lock arm "L."

Lifting Mechanism

The lifting mechanism is built onto the right-hand brake drum. Six iron blocks, ⅝" square by two inches long, are welded to the outside face of the right rear brake drum, spaced evenly (60° apart) around the drum, as shown in Fig. 15. At the ends of these blocks, weld twelve short pieces of ¼" x ⅝" x 1" band iron to hold the lifting ring in place. Make an iron ring "F" out of ½" x 2" iron, in two halves, fitted with clamp bolts so it can be removed, if desired, when the plow is not needed. To the ring is welded a ½" x 1½" x 8¾" iron arm "J" offset about ½ inch toward the frame to line up with the lift arm as needed. The lift catch "B" (also made from an old Dodge steering arm) is pivoted in a bracket which is welded to the ring as shown. The lift catch projects through a hole in the ring "F" and engages the square blocks to lift the plow.

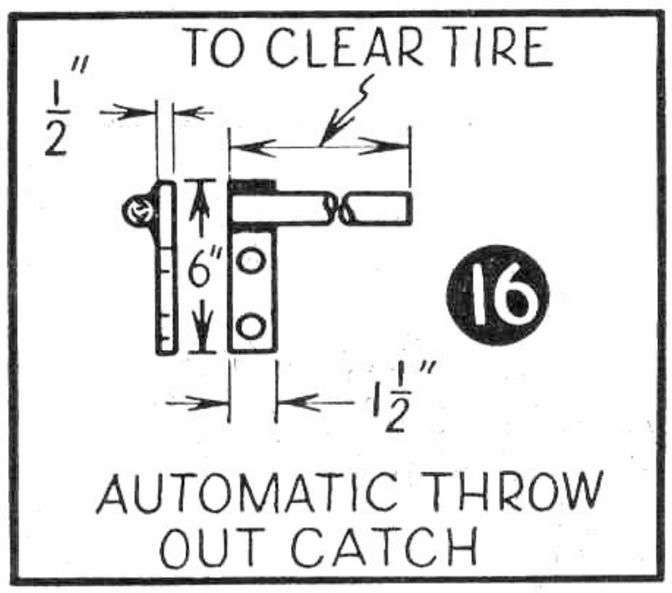


Fig. 16. Method of attaching lifter release bar to frame, to release plow lifting mechanism at the correct time.

When not in use, the ring floats loosely on the outside of these square blocks. A light rope is fastened to the catch through the spring eye. The other end is anchored conveniently to the driver's hand. To work the lift, the driver pulls the rope and causes the catch dog to engage one of the blocks on the brake drum. Then the ring will revolve with the wheel, lifting the plow out of the furrow. As the plow lift link passes center it locks, just as the automatic throwout bar, shown attached to the frame at "V" in Fig. 12, releases the lift catch and permits the brake drum to revolve freely again. To lower the plow, pull release handle "R" up, whereupon the plow drops of its own weight. Dimensions of the throwout catch are given in Fig. 16. The spring attached to the catch dog prevents engagement accidentally or unintentionally.

Dimensions of parts may vary somewhat according to variations in the equipment which you are able to secure. However, such changes may be allowed for as the construction progresses.