

deflection of the car which would be dangerous and might easily cause accidents. On the other hand, if the ratio is too low the car would be slow to respond to the wheel and therefore difficult to manage in dense traffic.

### Epicyclic Reduction Gear

The gear reduction is effected in various ways, but as already indicated a worm of fairly large pitch forms the basis of the more usual types of gearing. In some cars a small epicyclic reduction gear is incorporated in the steering column. The Ford car uses the latter type, the gear casing being mounted directly beneath the steering wheel.

The reduction gear adopted in the Meccano model is based on the epicyclic principle, and to make its operation quite clear the photograph may be supplemented by the following brief explanations:—

The  $1\frac{1}{2}$ " Contrate Wheel 6 is bolted rigidly to the steering post 7, the extreme end of which is free to rotate in the Coupling 8. The latter is secured to a 3" Rod 9 and carries two 25-teeth Pinions journalled on Pivot Bolts. These bolts are inserted in opposite threaded holes of the Coupling and their ends grip the extremity of the Rod 9. Another  $1\frac{1}{2}$ " Contrate Wheel 10 (without set-screw) is placed on the shaft 9 and prevented from turning by the  $\frac{1}{2}$ " Bolts 11, the ends of which enter two of the holes in the face of the wheel. It will be noticed that these bolts serve to secure two  $1\frac{1}{2}$ " Strips 19, which are spaced apart by Washers and serve as a reinforced bearing for the Rod 9. The Angle Brackets supporting the  $1\frac{1}{2}$ " Strips are bent slightly to conform with the angle of the steering column. A Collar and set-screw is placed on the steering post 7 where the latter passes through a further bearing, formed by a hole in the plate 20. The Collar is placed against the inner side of the bearing—i.e., the side nearest the Contrate Wheel 6—and so serves to hold the various components of the reduction gear in position.

Rotation of the steering wheel causes the  $\frac{3}{4}$ " Pinions to roll round the teeth of the fixed Contrate Wheel 10, and the movement of the Pinions imparts motion, in turn, to the Coupling 8 secured to the Rod 9 (which carries the steering drop lever 12, consisting of a Meccano Crank reinforced by a Flat Bracket). With this particular gearing a reduction ratio of one in two is obtained between the steering wheel and the shaft 9. In actual practice the reduction is greater, owing to variations in the design and number of teeth in the gearing, but a much more complicated mechanism would be required in the Meccano model in order to increase still further the difference in speed between the shafts 4 and 9.

The steering gear illustrated will be found to work very well in Meccano models, for its reversibility is neither too great nor too small, and a reasonable speed reduction is provided between the steering wheel and the road wheels.

### Further Details of the Model

The construction of the remainder of the Meccano model of Ackermann steering gear will no doubt be clear from the illustrations, but further particulars regarding the mounting of the front wheels, etc., may be useful. Fig. 4 is a detailed view of one of the stub axle units. The  $1" \times \frac{1}{2}"$  Reversed Angle Bracket 13 is bolted to the second hole of the fixed front axle 21 (see Fig. 2) and supports a  $\frac{1}{2}"$  Bolt 14, which is gripped by the upper set-screw of the Coupling 16. The lower pivot of the Coupling consists of a 1" Axle Rod 15, secured by means of the lower set-screw.

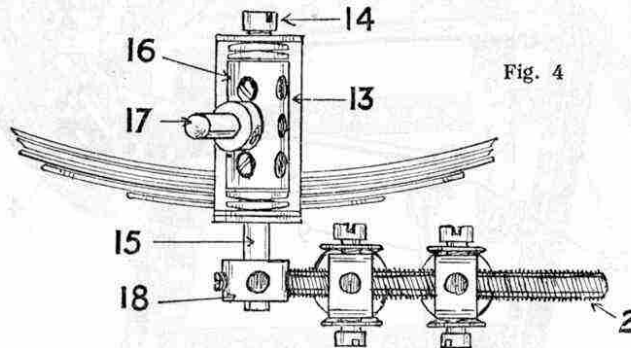


Fig. 4

The stub axle 17 (a  $1\frac{1}{2}"$  Rod) is fixed in the centre transverse hole of the Coupling 16. Each front road wheel must be free to turn about its axle but should be held in place by two Collars, mounted one on either side of the wheel boss.

It will be noted that 18 is the centre collar, or "spider," extracted from a Meccano Universal Joint (Part No. 140). This has been used in place of an ordinary Collar because a better grip on the Rod 15 can be obtained by inserting one, two, or even three set-screws in the threaded borings of the special collar in addition to the 2" Threaded Rod 2. The latter is of course screwed tightly into the collar. Two Washers are placed at top and bottom of the Coupling 16 to take up play in the bearings.

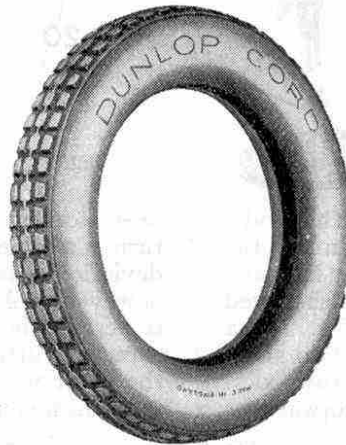
The several joints in the linkage consist of portions of Universal Joints, the various set-screws of which should be screwed up very tightly. The lever 1 consists of a  $\frac{3}{4}"$  Bolt, and the tie-rod 3 is composed of one  $3\frac{1}{2}"$  and one  $2\frac{1}{2}"$  Axle Rod joined together by the Coupling shown. The  $4\frac{1}{2}"$  Rod 22 carries a Collar 23 secured in place by an ordinary bolt, the shank of which, before entering the Collar, passes through the end hole in the Crank 12 and through the round hole of the Flat Bracket bolted thereon.

### Various Types of Steering Gear

There are several kinds of steering gears in common use in addition to the worm and bevel types already mentioned (the latter type being represented in Meccano by means of Pinion and Contrate Wheel gear, as in the well-known Meccano model Motor Chassis).

One form of steering mechanism sometimes met with makes use of plain rack-and-pinion gear, wherein a spur pinion engages with a rack that, in turn, is connected to the steering arm by means of a link-rod.

A crude form of steering apparatus used in the early days of motoring was operated by a wire cable attached to the front wheels and passed around a bobbin secured to the steering wheel shaft. On rotation of the steering wheel, the cable was wound on and off the bobbin, thereby imparting the turning movement to the road wheels.



The new Miniature Dunlop Tyre used in this model. See announcement on page 155