PATENT SPECIFICATION

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537,409

Application Date (in United Kingdom): Dec. 18, 1939. No. 32462/39.

Complete Specification Accepted: June 20, 1941.

COMPLETE SPECIFICATION

Improved Arrangement for Controlling and Locking Displaceable Members which are to be locked in two positions

We, LANCIA & C. FABBRICA AUTOMOBILI-TORINO-S.A., an Italian Company, of Via Monginevro 99, Turin, Italy, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to arrangements serving to lock in a desired position members adapted to be displaced by an external control and has for its object an arrangement for controlling and locking displaceable members which are to be locked in two positions.

The invention is particularly suitable for effecting the engagement, on their shaft, of toothed wheels movable along said shaft.

It is known that during the operation of gear mechanisms, for example in change speed gears, stresses are set up owing to faults in manufacture or assembly and as a result of buckling of the shafts, which stresses have the effect of removing the toothed wheels from their position of engagement.

It is known in order to resist these stresses, to employ locking devices or the same manipulating devices which serve to produce the displacements of the wheels, but these means are not always sufficient when the toothed wheels are subjected to considerable stresses.

The present invention eliminates these difficulties and provides a locking arrangement which maintains the displaceable member securely in the desired position, this locking being established and eliminated spontaneously during the operation for effecting the displacement.

According to the invention, the displaceable member is controlled and locked with the aid of a sliding member and of engaging means interposed between the sliding member and the displaceable member and forming two groups for which the sliding member comprises separate seatings, one of these groups acting in each instance for the locking, while the other group serves to couple the sliding member with the displaceable member in order to remove it from the position in which it is locked.

The accompanying drawings show, by way of example, a constructional form of the arrangement according to the invention.

Figure 1 is an axial section of a toothed wheel which may be axially displaced on its shaft and held fast thereon in two different positions;

Figure 2 is a cross-section on the line 2—2 of Figure 1;

Figure 3 is an internal developed plan view of a portion of the collar serving as the sliding member for displacing the wheel in the direction of its axis;

Figure 4 is a partial section similar to Figure 1, with the parts in one of the locking positions;

Figure 5 is the corresponding cross-section on the line 5—5 of Figure 4;

Figure 6 is a view similar to Figure 3 with the members in the locking position shown in Figure 4;

Figure 7 is a partial section similar to Figure 4, with the parts in the other locking position;

Figure 8 is a corresponding cross-section on the line 8—8 of Figure 7, and

Figure 9 is a view similar to Figure 3, with the parts in the locking position shown in Figure 7.

In these Figures, 1 is a shaft and 2 the toothed wheel, the hub 3 of which is engaged with the aid of corresponding internal channels with longitudinal ribs 4 on the shaft, so that the wheel 2 is locked in rotation with the shaft but may be displaced in the direction of the axis.

The portion of the shaft 1 on which the wheel may be displaced is limited at its two extremities by shoulders 5, 5^1 which may be formed by collars or one or more radial projections.

An annular portion of the hub 3 has in it a number of apertures 6, each of which contains an engagement member (a ball in the example shown), the diameter of which is greater than the thickness of the hub 3. The balls seated in the different apertures 6 are equal in diameter to one another but they form two groups 7 and

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7^1, each of which serves for locking in one position. For this locking the regions situated opposite the apertures 6 when the wheel 2 occupies the desired operative position have, in the outer surface of the shaft, that is to say in the ribs 4, recesses 8, 8^1 intended to constitute seatings for the balls 7, 7^1. These recesses are of such depth that the balls 7, 7^1 which have entered them remain completely sunk in the apertures 6 in the hub 3 and the flanks of the said recesses are inclined so that a lateral thrust on the balls causes them to move out of the recesses.

In the annular region in which the apertures 6 are situated, the hub 3 is encircled by a collar 9 which may be displaced axially on the hub 3 but is engaged in rotation therewith, for example with the aid of a key 10. The collar 9 is traversed on its inner face by a groove 11 having inclined flanks, into which all the balls 7, 7^1 may penetrate. Longitudinal seatings 12, 12^1 (Figure 3), extend on the two sides of the groove 11, the seatings 12 being situated opposite the balls 7 and those 12^1 opposite the balls 7^1.

The collar 9 has on its outer face a groove 13 for the engagement of the operating member constituted, for example, by a fork 14.

Figures 1 to 3 show the inoperative position of the wheel 2, in which it is not in engagement with another toothed wheel. In this position, all the balls 7, 7^1 bear against the crest of the ribs 4 of the shaft 1 and penetrate into the groove 11 of the collar 9, so that they do not offer any resistance to a longitudinal displacement of the hub 3 on the shaft 1.

When the collar 9 is displaced to the right in Figure 1 by a corresponding operation of the fork 14, the balls 7 are driven by the left-hand flank of the groove 11 (see Figure 3) and, since they are engaged in the apertures 6 in the hub 3, they also drive to the right the hub 3 with the wheel 2. When the apertures 6 in the hub 3 are situated opposite the recesses 8 in the ribs 4 of the shaft 1, the balls 7 are forced into the recesses 8 and lose contact with the left-hand flank of the groove 11. Subsequent displacement of the collar 9 to the right is not prevented by the balls 7^1 for which there are no recesses in the shaft 1 and which are consequently always applied against the crests of the ribs 4. In fact, the groove 11 on the left-hand edge of the collar 9 has lateral branches 12^1 into which the balls 7^1 can penetrate. Consequently, when the displacement of the collar 9 to the right is continued the inner surface of its left-hand edge takes up a position above the recesses 8 occupied by the balls 7 which are thus enclosed in these recesses.

This final position, which cannot be exceeded owing to the shoulder 5^1, is shown in Figures 4, 5 and 6, from which it may be seen that the balls 7 are enclosed in the recesses 8 in the shaft 1, while the balls 7^1 are situated in the lateral seatings 12 in the collar 9. Under these conditions, the wheel 2 is locked on the shaft 1 by the balls 7 and cannot be removed from this position by thrusts acting on it because the inner surface of the left-hand edge of the collar 9, which is situated opposite the recesses 8, prevents the balls 7 from leaving.

In order to bring the wheel 2 into the other locking position, starting from the position shown in Figure 1, the collar 9 must be displaced to the left with the aid of the manipulating member, the effect of which is that the right-hand flank of the groove 11 acts on the balls 7^1 and causes displacement thereof, while also driving the hub 3 of the wheel. When the apertures 6 in the hub 3 are situated opposite the recesses 8^1 in the ribs 4, the balls 7^1 enter these recesses and during the subsequent further displacement of the collar 9 to the left the inner surface of its right-hand edge passes over the balls 7^1, while the balls 7 enter the corresponding lateral seatings 12.

This final position, fixed by the stop 5 is shown in Figures 7, 8 and 9, from which it may be seen that the balls 7^1 are enclosed in the recesses 8^1 while the balls 7 occupy the lateral seatings 12 of the collar 9.

In this position also, the wheel 2 is locked on the shaft 1 and cannot be removed by thrusts exerted on the said wheel.

The collar 9 is thus coupled to the hub 3 of the wheel 2 either by the balls 7 or by the balls 7^1 which co-operate with the flanks of the groove 11 in such manner that they are carried along by one or the other flank according to the direction of displacement of the collar 9, the other group of balls remaining inoperative by penetrating into the seatings 12 or 12^1 opposite thereto in the collar 9. The endwise movement of the collar 9 in each direction is controlled by the fork 14 the end positions of which are such as to ensure that the collar 11 will not slide off the balls.

In order to remove the wheel 2 from the two extreme positions in which it is locked and to return it into the inoperative position, the operating fork 14 must be displaced in a direction opposite to that of the previous displacement. This fork first returns the collar 9 with its

groove 11 to a position opposite the recesses 8 or 8^1, in which some of the balls are engaged, and the balls engaged are then obliged to leave the recesses in the shaft by the effect of the thrust exerted on the hub 3 by the collar 9 with the aid of the other balls, and the conditions shown in Figure 1 are re-established.

The balls 7 and 7^1 may also be situated in two separate adjacent grooves and in this case the shaft 1 may have, for the penetration of the balls of each group, an annular groove instead of recesses such as 8 and 8^1, each lying opposite one ball.

In the constructional form described, in which the displaceable wheel 2 may take up two extreme positions in which it is locked on the shaft 1, there are two groups of balls 7, 7^1, each acting successively for the locking and for driving the wheel in the locking position, while the other serves to remove the wheel from the locking position.

In fact, in all positions there is always at least one group of balls engaged in the groove 11 in the collar 9, so that this collar is enabled to effect the displacement of the wheel 2.

In any case, with the arrangement described an absolutely sure locking is obtained with very simple means which do not render difficult the operation for the displacement of the displaceable member.

This arrangement may also be employed in the case of gears having helicoidal teeth without its being necessary to employ a sliding member with helicoidal recesses.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An arrangement for controlling and locking, with the aid of engagement members and a sliding member, displaceable members which are to be locked in two positions, characterised in that the engagement members engaged between the sliding member and the displaceable member form two groups for which the sliding member comprises separate seatings, one of these groups operating in each instance for locking, while the other group serves to couple the sliding member with the displaceable member in order to remove it from the position in which it is locked.

2. An arrangement as claimed in claim 1, characterised in that the sliding member has for the engagement members of the two groups a groove, on each flank of which lateral seatings extend for the engagement members of one group.

3. An arrangement as claimed in claim 1, wherein the displaceable member is constituted by a toothed wheel movable longitudinally on the shaft on which it is keyed, characterised in that the apertures for the accommodation of the engagement members intended to co-operate with the recesses in the shaft are situated in the hub of the wheel, and the sliding member is formed by a collar mounted so as to be movable in the axial direction on the hub of the wheel and subjected to the control, this collar having on its inner face the grooves or seatings for the engagement members and the surfaces intended to close the apertures in the hub.

4. The arrangement for controlling and locking, with the aid of engagement members and a sliding member, displaceable members which are to be locked in two positions, substantially as described with reference to the accompanying drawings.

Dated this 18th day of December, 1939.

LANCIA & C. FABBRICA AUTOMOBILI-TORINO-S.A.

Per: Boult, Wade & Tennant,
111/112, Hatton Garden, London, E.C.1,
Chartered Patent Agents.

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Fig. 1

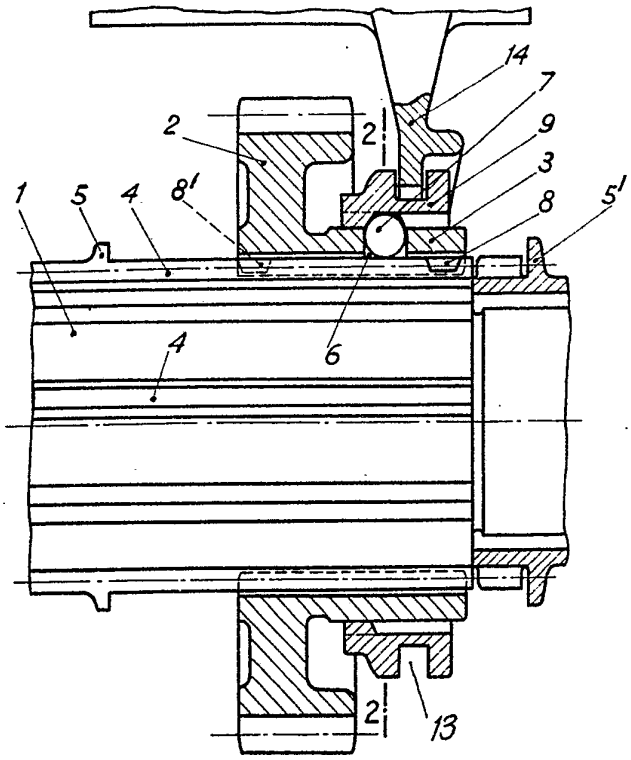


Fig. 4

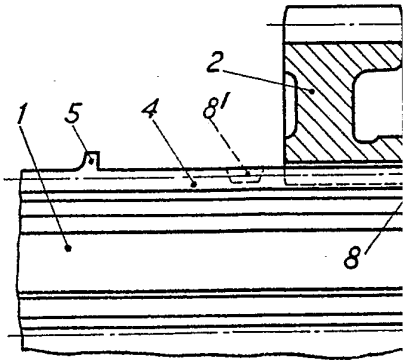


Fig. 3

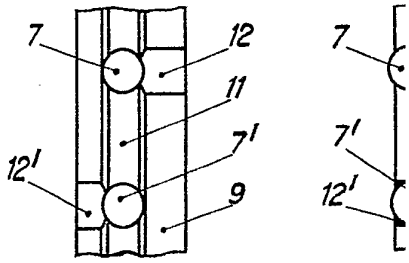


Fig. 2

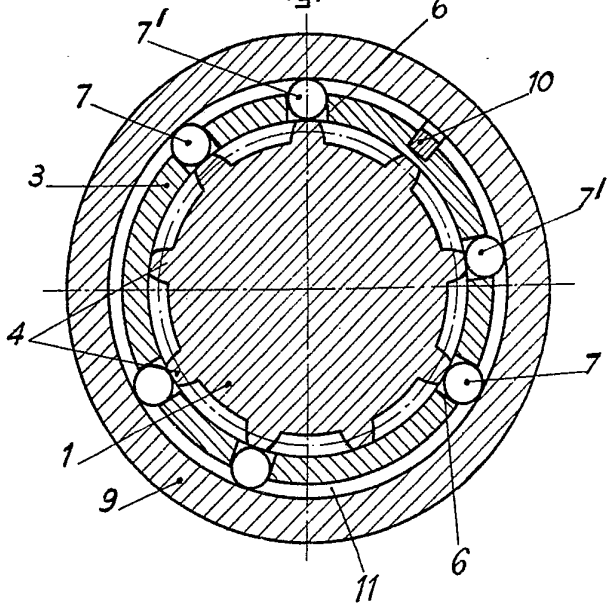


Fig. 5

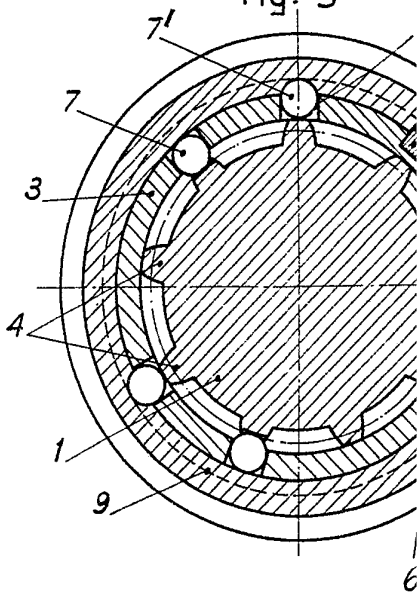


Fig. 4

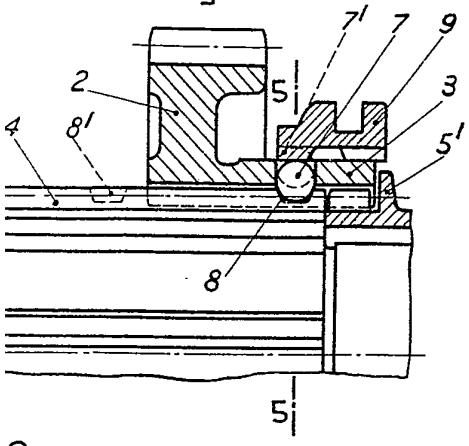
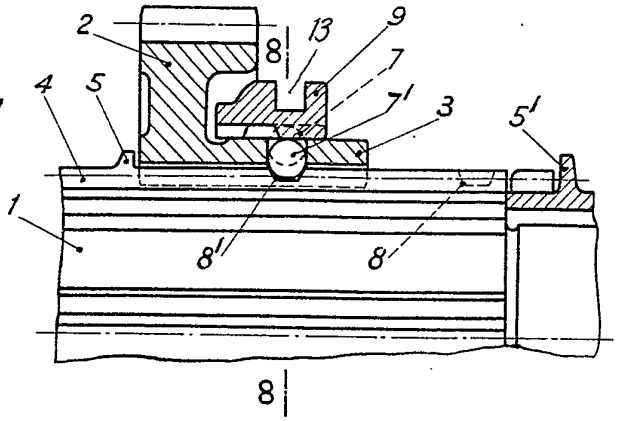


Fig. 7



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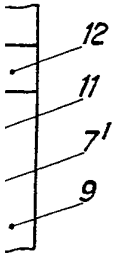

Fig.6

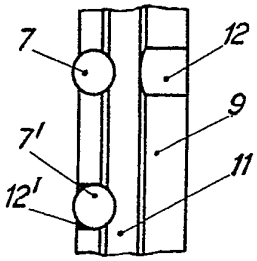

Fig.9

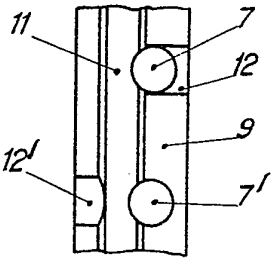

Fig. 5

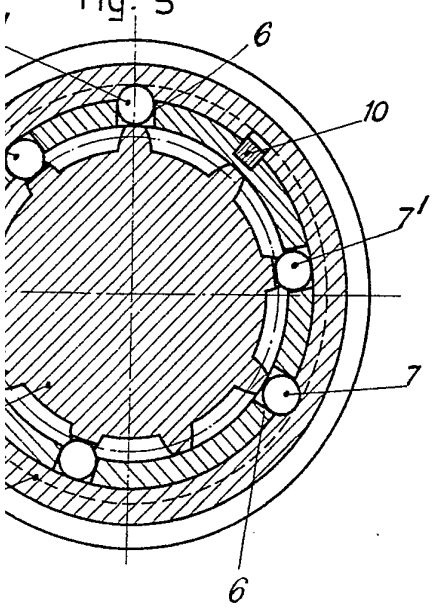

Fig. 8

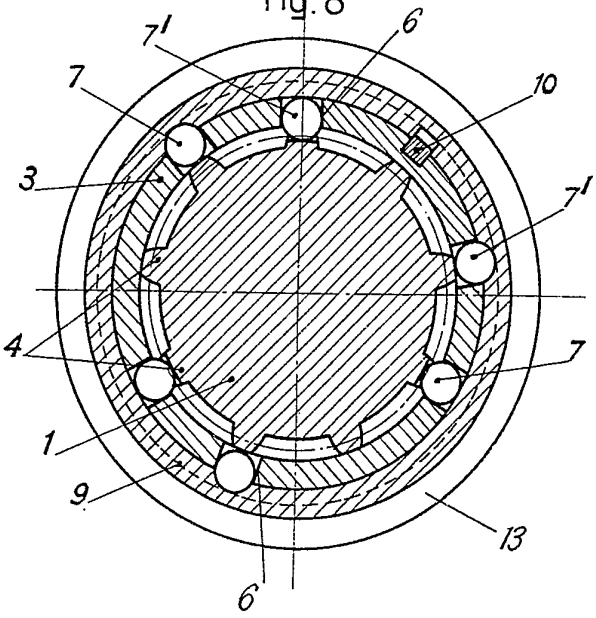

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Fig.1

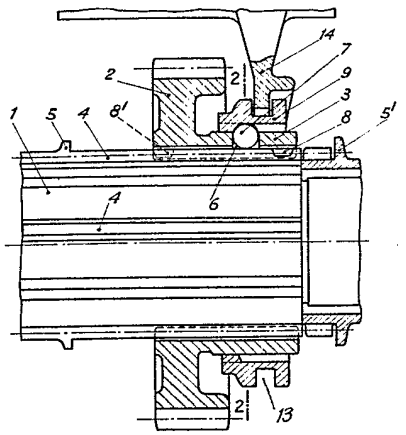


Fig.4

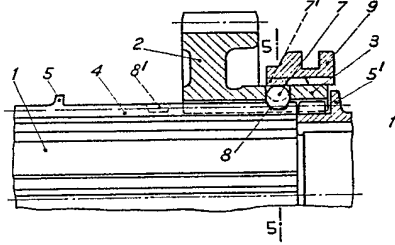


Fig.7

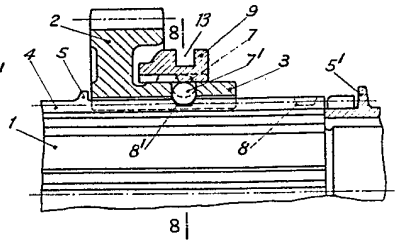


Fig.3

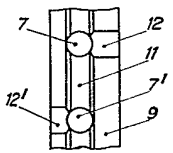


Fig.6

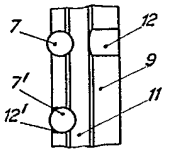


Fig.9

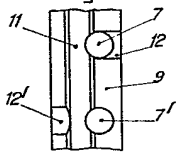


Fig.2

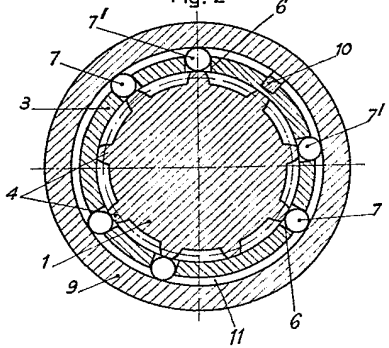
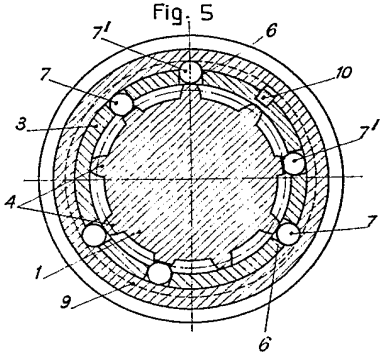


Fig.5



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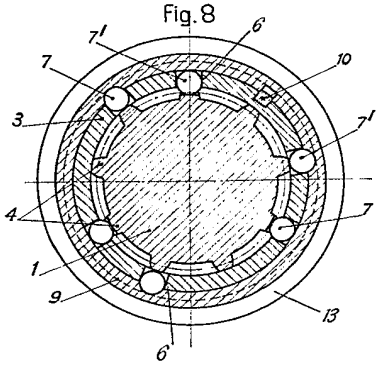

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