May 7, 1957 C. S. LYON 2,791,142

GEAR OPERATED ANGULARLY ADJUSTABLE SOCKET WRENCH

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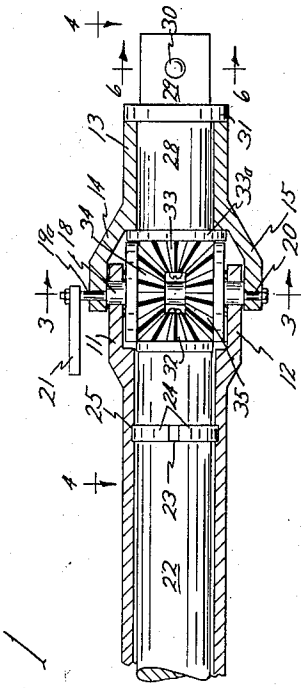


Fig. 1

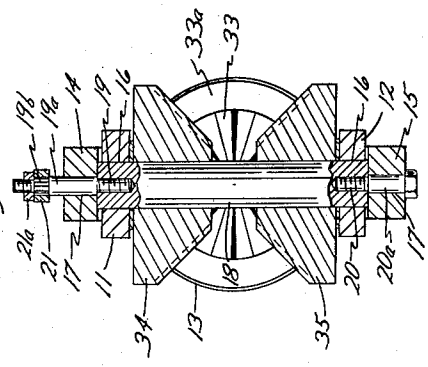


Fig. 3

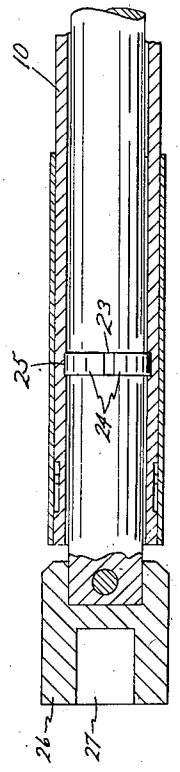
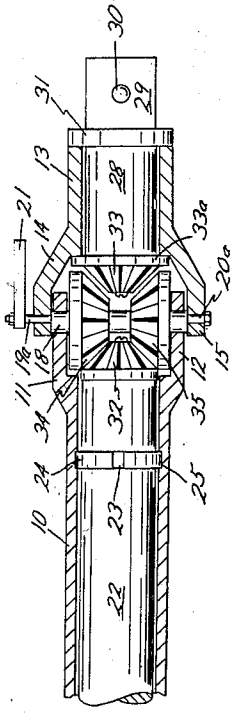


Fig. 2



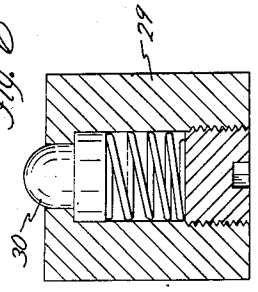


Fig. 6

INVENTOR.
Chester S. Lyon
BY Strickwells
Atty.

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Fig. 4

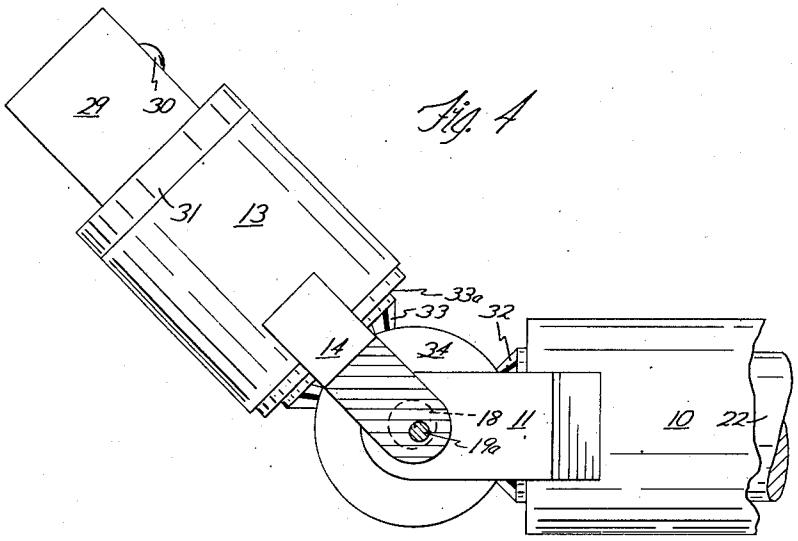
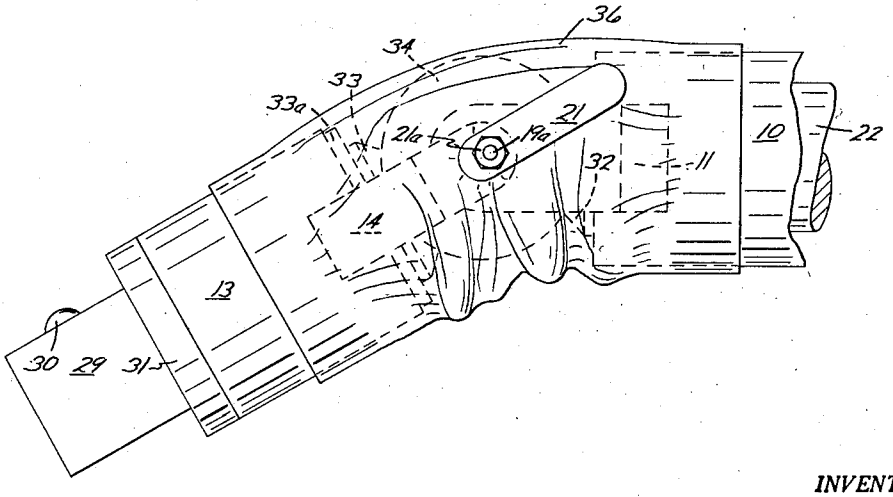


Fig. 5



INVENTOR.
Chester S. Lyon
BY
Attys.

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Fig. 7

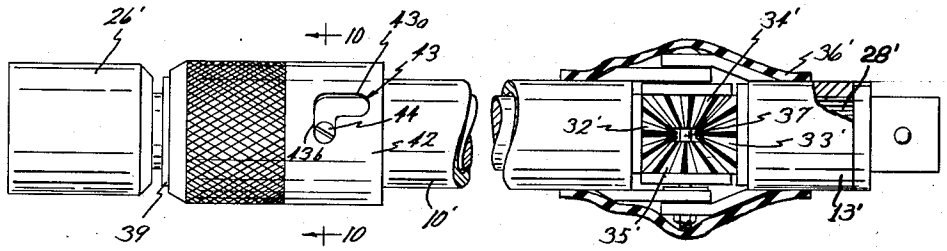


Fig. 8

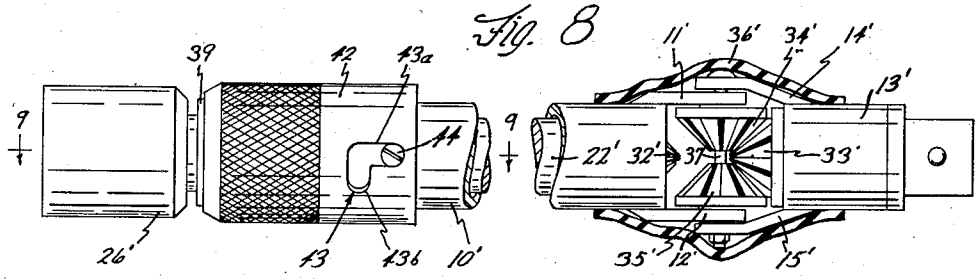


Fig. 9

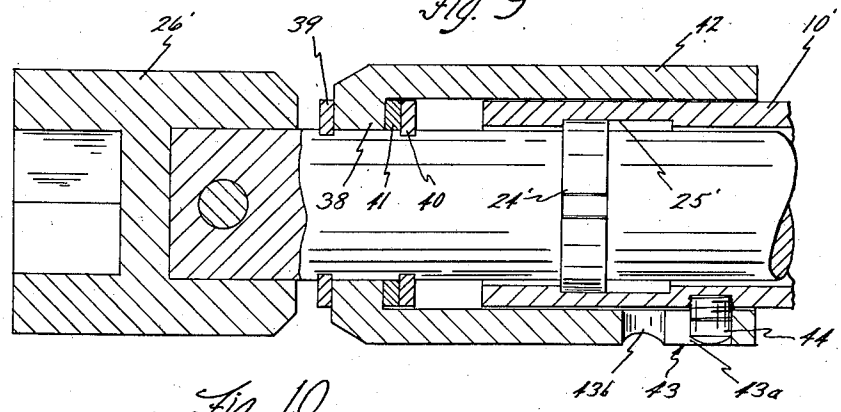
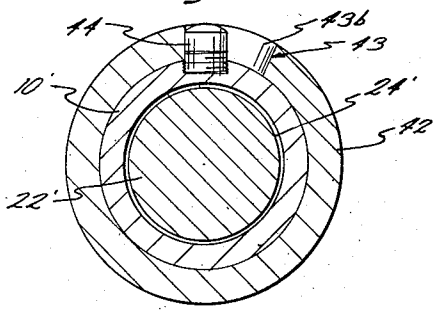


Fig. 10



INVENTOR.
Chester S. Lyon
BY
Greenwells
Atty.

United States Patent Office

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GEAR OPERATED ANGULARLY ADJUSTABLE SOCKET WRENCH

Chester S. Lyon, Boise, Idaho

Application August 29, 1955, Serial No. 531,230

6 Claims. (Cl. 81—57)

The present invention relates to improvements in an angularly adjustable socket wrench.

In performing construction and repair operations on any type of machinery, the mechanic is confronted with the problem of manipulating bolts and nuts which are inaccessible to ordinary wrenches. There are currently on the market many devices which utilize universal joints to facilitate manipulation of such elements from an angle. However, while these devices are capable of operation, their limitations are many. For example, the standard universal coupling utilized by most of these devices tends to lock when used at angles exceeding 50 or 60 degrees, and thus is incapable of operation. Also, such devices do not include any means by which a particular desired angle may be set and fixed into the tool.

It is the principal purpose of the present invention to provide a universal socket wrench which may be adjusted to a specified angle and locked into place, maintaining that angle until reset.

A further purpose of the invention is to provide such a wrench which will operate easily and efficiently at angles up to 90 degrees.

The nature and advantages of my invention will appear more fully from the following description and the accompanying drawings wherein a preferred form of the invention is shown. The drawings and description are illustrative only, however, and are not intended to limit the invention except insofar as it is limited by the claims.

In the drawings:

Figure 1 is a longitudinal sectional view of the invention;

Figure 2 is a fragmentary sectional view similar to Figure 1 except showing the wrench disconnected for angular adjustment;

Figure 3 is an enlarged sectional view taken on the line 3—3 of Figure 1;

Figure 4 is an enlarged fragmentary sectional view taken on the line 4—4 of Figure 1 but showing the wrench adjusted for angular operation;

Figure 5 is a view similar to Figure 4 but showing a shield covering the joint in the wrench;

Figure 6 is an enlarged fragmentary sectional view taken on the line 6—6 of Figure 1;

Figure 7 is a plan view of a modified form of the invention, illustrating a different mechanism for disconnecting the wrench for angular adjustment;

Figure 8 is a view similar to Figure 7 except showing the wrench disconnected;

Figure 9 is an enlarged sectional view taken on the line 9—9 of Figure 8; and

Figure 10 is an enlarged sectional view taken on the line 10—10 of Figure 7.

Referring now to the drawings, and to Figure 1 in particular, my invention comprises an elongated tubular sleeve 10 which has formed at one end, a pair of diametrically opposed ears 11 and 12. A second sleeve 13, having ears 14 and 15 is positioned at the end of the

sleeve 10. The ears 14 and 15 on the sleeve 13 are spread somewhat as shown in Figure 1 so as to have apertures 16 therein, and the ears 14 and 15 have somewhat smaller apertures 17 therein. A transverse pin 18 extends through the apertures 16 in the ears 11 and 12. The pin 18 is drilled and tapped eccentrically at each end to receive eccentric bolts 19 and 20. The bolts 19 and 20 have shaft portions 19*a* and 20*a* which extend through the apertures 17 in the ears 14 and 15. With this construction the sleeve 10 and the sleeve 13 are pivotally attached so that the sleeve 13 is free to swing from side to side. Since the ears 14 and 15 are pivoted to the eccentric bolts 19 and 20, rotation of the pin 18 will move the sleeve 13 endwise toward or away from the sleeve 10. In order to provide for such rotation of the pin 18, the upper eccentric bolt 19 is provided with a splined portion 19*b* near its upper end. An operating lever 21 is fitted on the splined portion and held in place by a nut 21*a*. Rotation of the pin 18 is accomplished by turning the operating lever 21.

Within the sleeve 10, a drive shaft 22 is positioned. The shaft 22 has grooves 23 therein in which split bearing rings 24 are seated. The inner surface of the sleeve 10 has corresponding grooves 25 which receive the split rings 24. With this construction the rings 24 provide bearing surfaces against which the shaft 22 may rotate within the sleeve 10, and also operate to secure the shaft 22 against endwise movement. The shaft 22 extends a short distance out of the free end of the sleeve 10 and has at its end a connecting head 26. As shown in the drawings, the head 26 has a squared socket 27 adapted to receive a ratchet wrench or other similar driving member, but it should be understood that any suitable connecting means may be included without departing from the spirit of the invention.

The second sleeve 13 has rotatably mounted therein a stub shaft 28. The shaft 28 extends a short distance beyond the free end of the sleeve 13 and has at its end a connecting head 29. As shown in the drawings and Figure 6 in particular, the head 29 is squared and has a spring loaded locking detent 30 therein. The head 29 is adapted to receive any of a series of sockets designed to engage nuts or bolt heads. A collar 31 on the stub shaft 28 rides against the end of the sleeve 13 to prevent longitudinal movement of the shaft 28 in the sleeve 13.

Now in order to drive the stub shaft 28 from the drive shaft 22, a gear train is included. A bevel drive gear 32 is secured on the end of the drive shaft 22 adjacent the ears 11 and 12. A second bevel gear 33 is mounted on the adjacent end of the stub shaft 28. The bevel gear 33 has an enlarged collar 33*a* thereon which rides against the end of the sleeve 13 and cooperates with the collar 31 to prevent endwise movement of the shaft 28 in the sleeve 13. A pair of beveled idler gears 34 and 35 are rotatably mounted on the pin 18 between the ears 11 and 12 as best shown in Figure 3. The gears 34 and 35 are in engagement with the drive gear 32 and driven thereby. When the operating lever 21 is turned to move the sleeve 13 toward the sleeve 10, the gears 34 and 35 also engage the gear 33 on the stub shaft 28. When the operating lever 21 is so moved, rotation of the drive shaft 22 causes the drive gear 32 to drive the idler gears 34 and 35 which in turn drive the gear 33 and consequently the stub shaft 28. In order to protect the gears 32—35, a flexible sheath 36 (shown in Figure 5) is fitted over the joint. The sheath 36 keeps out dust and dirt and yet is flexible enough not to hamper proper operation.

Now it may be seen that the gears 34 and 35 remain constantly engaged with the drive gear 32 since they are mounted on the pin 18 and held by the ears 11 and 12. When the lever 21 is turned so that the gear 33 is engaged

with the gears 34 and 35, the angular relation of the sleeves 10 and 13 is fixed. To alter the angular relation when the gear 33 is engaged would necessitate rotation of the gears 34 and 35 in the same direction which is prevented by their engagement with the drive gear 32. Therefore in order to adjust the angle of the sleeve 13 with the sleeve 10, it is necessary to move the operating lever 21 so as to rotate the eccentric bolts 19 and 20 and consequently the sleeve 13 away from the sleeve 10. This disengages the gear 33 and allows the sleeve 13 to swing free.

In the modified form of the invention shown in Figures 7–10, a somewhat different method of disconnecting the wrench is used. The modified wrench is similar in construction to the first described form, having sleeves 10' and 13', ears 11', 12', 14' and 15', shafts 22' and 28', and cooperating bevel gears 32', 33', 34' and 35'. However, in this form of the invention, the ears 11' and 12' are connected to the ears 14' and 15' by a pin 37 which has no eccentric portions. In order to provide for disengaging the gears 32'–35' for angular adjustment of the shaft 28' with respect to the shaft 22', means are provided to move the shaft 22' and its gear 32' endwise in the sleeve 10'. This endwise movement removes the gear 32' from engagement with the gears 34' and 35' and attains the same result as moving the gear 33 in the main form.

As in the main form of the invention, the shaft 22' is rotatably mounted within the sleeve 10' by split bearing rings 24'. However, since the shaft 22' must move endwise, the grooves 25' in the sleeve 10' are considerably wider than the rings 24'. In order to provide means for moving the shaft 22' endwise when desired, a collar 38 is rotatably mounted on the shaft 22' at the end of the sleeve 10' adjacent the connecting head 26'. The collar 38 is held against endwise movement on the shaft 22' by a pair of snap rings 39 and 40. A thrust bearing 41 is interposed on the shaft 22' between the ring 40 and the collar 38. The collar 38 is integral with a retracting sleeve 42 which is loosely mounted on the sleeve 10'.

As may be seen in Figures 8 and 9, movement of the retracting sleeve 42 toward the head 26' will cause the collar 38 to bear against the snap ring 39 and move the shaft 22' outwardly disengaging the gear 32' from the gears 34' and 35'. Movement of the sleeve 42 in the opposite direction will engage the gear 32'. In order to provide a latching means to prevent endwise movement of the sleeve 42 during operation of the wrench, an L-shaped slot 43 is formed in the sleeve 42 as shown best in Figures 7 and 8. A small set screw 44 is threaded into the sleeve 10' and is received in the slot 43. When the retracting sleeve 42 is moved so as to engage the gear 32', the screw 44 is positioned at the junction of the longitudinal portion 43*a* and the lateral portion 43*b* of the slot 43. By rotating the sleeve 42, the slot 43 may be moved until the screw 44 seats at the closed end of the lateral portion 43*b*. With the screw 44 so positioned, the retracting sleeve 42 may not move to disengage the gear 32'. The thrust transmitted to the gear 32' by the idlers 34' and 35' acts against the thrust bearing 41 and through it to the collar 38 and sleeve 42. This thrust is then transmitted to the screw 44 by the edge of the portion 43*b* of the slot 43 and hence to the sleeve 10'.

When it is desired to retract the shaft 22' and disengage the gears 32', the retracting sleeve 42 is rotated until the screw 44 reaches the longitudinal portion 43*a* of the slot 43. The sleeve 42 may then be moved endwise to the position shown in Figure 8 to disengage the gear.

The operation of either form of the wrench is very simple. The operator first disengages the gear 33 or 32' as described, and then determines what angle is necessary to reach the bolt or nut to be turned. When the angle is determined, the wrench is manipulated as described to engage the gear 33 or 32' and the angle becomes fixed. All that remains is to fit the head 29 with the proper socket, and fit the head 26 with a turning tool. Since the rotational force is transmitted through the idler gears 34 and 35, the stub shaft 28 rotates in the opposite direction to the drive shaft 22 so the operator must reverse his direction of rotation from that he wishes to impart to the nut or bolt. The angle between the sleeves 10 and 13 is fixed, so manipulation of the wrench in changing sockets, etc. does not necessitate further juggling to again find the proper relation. Now since the drive train from the shaft 22 to the shaft 28 consists of cooperating bevel gears, it will operate just as efficiently when the shafts are in quadrature as it will when they are aligned. The locking tendency of a universal joint at large angles is not present.

It is believed that the nature and advantages of my invention appear clearly from the foregoing description.

Having thus described my invention, I claim:

1. In an angularly adjustable power transmitting mechanism, a pair of sleeves each having axially extending ears at one end thereof, a transverse pin pivotally connecting the ears of one of said sleeves to the ears of the other of said sleeves, each of said sleeves having a shaft rotatably mounted therein, each of said shafts having a gear fixed thereon at the end thereof adjacent said pin, two idler gears rotatably mounted on said pin and drivingly engaged with each of said gears on the shafts, and means to move one of the shafts endwise whereby to disengage the gear thereon from said idler gears.

2. In an angularly adjustable power transmitting mechanism, a pair of sleeves each having axially extending ears at one end thereof, a transverse pin pivotally connecting the ears of one of said sleeves to the ears of the other of said sleeves, each of said sleeves having a shaft rotatably mounted therein, each of said shafts having a gear fixed thereon at the end thereof adjacent said pin, two idler gears rotatably mounted on said pin and drivingly engaged with each of said gears on the shafts, and means to move one of the shafts endwise whereby to disengage the gear thereon from said idler gears, said means comprising eccentric portions on said transverse pin engaging the ears of one of said sleeves and operable to move the sleeve endwise on rotation of the pin.

3. A socket wrench comprising a pair of sleeves each having axially extending ears at one end thereof, the ears on one of said sleeves being pivotally connected to the ears on the other sleeve by a transverse pin, said pin having eccentric portions thereon engaging the ears of one of said sleeves whereby to move the sleeves endwise toward and away from each other upon rotation of the pin, a drive shaft rotatably but non-slidably mounted in one of said sleeves, a stub shaft rotatably but non-slidably mounted in the other of said sleeves, said drive shaft and said stub shaft each having a bevel gear secured to the end thereof adjacent the transverse pin, a pair of bevelled idler gears rotatably mounted on the transverse pin and engaging the bevel gears on the drive shaft and the stub shaft when the transverse pin is rotated to move the sleeves toward each other, means on the free end of the drive shaft to connect a driving member thereto, and socket connecting means on the free end of the stub shaft.

4. A socket wrench comprising an elongated tubular sleeve having diametrically opposed ears at one end thereof, a second tubular sleeve having diametrically opposed ears at one end thereof, the ears on the first named sleeve and the ears on the second sleeve being pivotally connected by a transverse pin, said pin having eccentric portions thereon engaging the ears on said second sleeve whereby to move said second sleeve endwise of the elongated sleeve upon rotation of the pin, a drive shaft rotatably but non-slidably mounted within the elongated tubular sleeve, said drive shaft having a gear secured at the end thereof adjacent the transverse pin and having means at its opposite end for connecting a driving member, a second shaft rotatably but non-slidably mounted in the second sleeve and having a gear secured to the end thereof adjacent the transverse pin, a pair of gears rotatably mounted on the transverse pin and engaging the gears on

the drive shaft and the second shaft when the transverse pin is rotated to move the second sleeve toward the elongated sleeve, and socket connecting means on the free end of the second shaft.

5. In an angularly adjustable power transmitting mechanism, a pair of sleeves each having axially extending ears at one end thereof, a transverse pin pivotally connecting the ears of one of said sleeves to the ears of the other of said sleeves, each of said sleeves having a shaft rotatably mounted therein, each of said shafts having a gear fixed thereon at the end thereof adjacent said pin, two idler gears rotatably mounted on said pin and drivingly engaged with each of said gears on the shafts, and means to move one of the shafts endwise whereby to disengage the gear thereon from said idler gears, said means comprising a retracting sleeve mounted at the end of one of said shaft carrying sleeves opposite the ears thereon, a collar rotatably but non-slidably mounted on the shaft which is carried by said sleeve, said collar being secured to said retracting sleeve whereby to move the shaft endwise upon movement of the retracting sleeve, and means connecting the retracting sleeve to the shaft carrying sleeve operable to secure the retracting sleeve against endwise movement.

6. A socket wrench comprising a pair of sleeves each having axially extending ears at one end thereof, a transverse pin pivotally connecting the ears of one sleeve to the ears of the other sleeve, a drive shaft rotatably mounted in one of the sleeves, said shaft being mounted for limited endwise movement in the sleeve, a stub shaft rotatably but non-slidably mounted in the other sleeve, said drive shaft and said stub shaft each having a bevel

gear secured to the end thereof adjacent the transverse pin, a pair of bevelled idler gears rotatably mounted on the transverse pin and engaging the gears on the drive shaft and stub shaft, means on the free end of the drive shaft to connect a driving member thereto, socket connecting means on the free end of the stub shaft, a retracting sleeve mounted at the free end of the drive shaft carrying sleeve, a collar rotatably but non-slidably mounted on the drive shaft, said collar being secured to said retracting sleeve and constituting means to move the drive shaft and the bevel gear thereon away from the idler gears upon endwise movement of the retracting sleeve, a slot in the retracting sleeve, said slot having a laterally extending portion and having a longitudinal portion extending from said lateral portion toward the end of the drive shaft carrying the bevel gear, and a pin in the shaft carrying sleeve extending outwardly through the slot.

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