July 12, 1938. C. H. KOEHLER 2,123,631

ELECTRICAL CONNECTER

Filed July 8, 1935 3 Sheets-Sheet 1

Fig. 1.

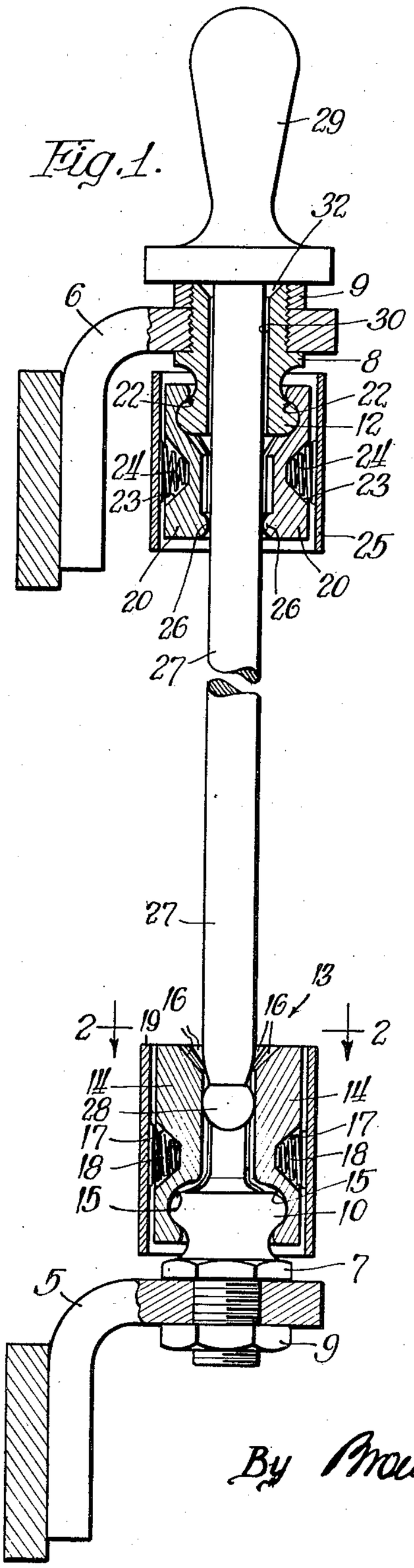
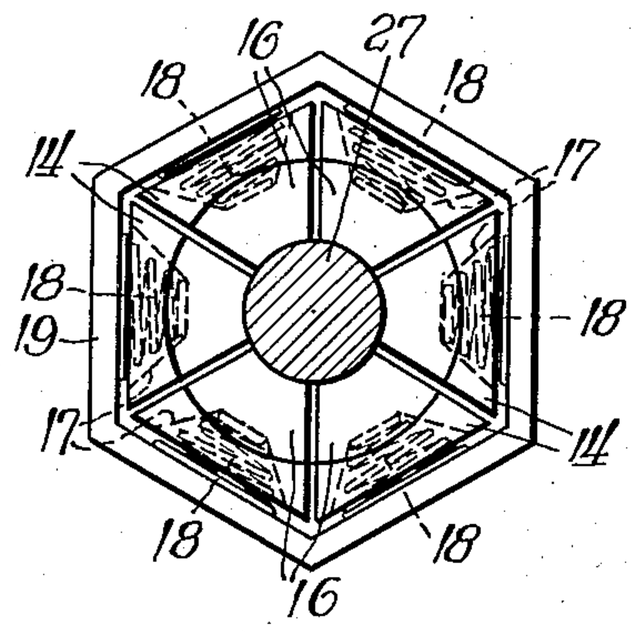


Fig. 2.



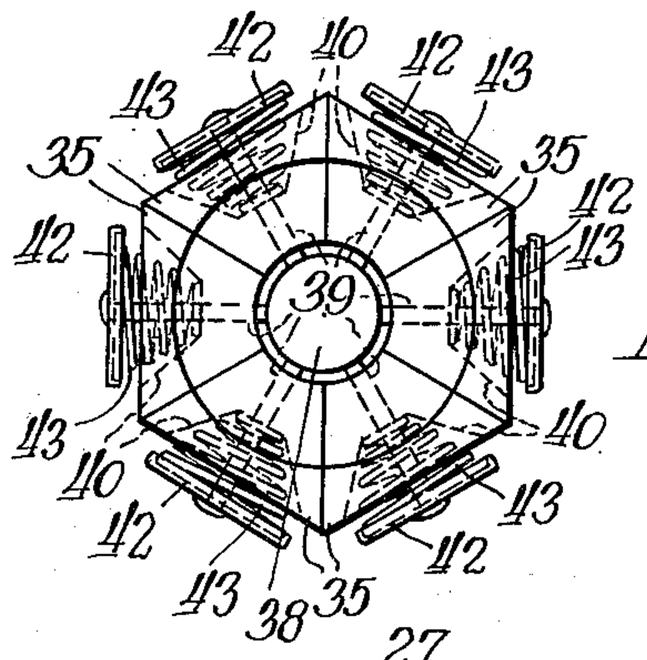


Fig. 3.

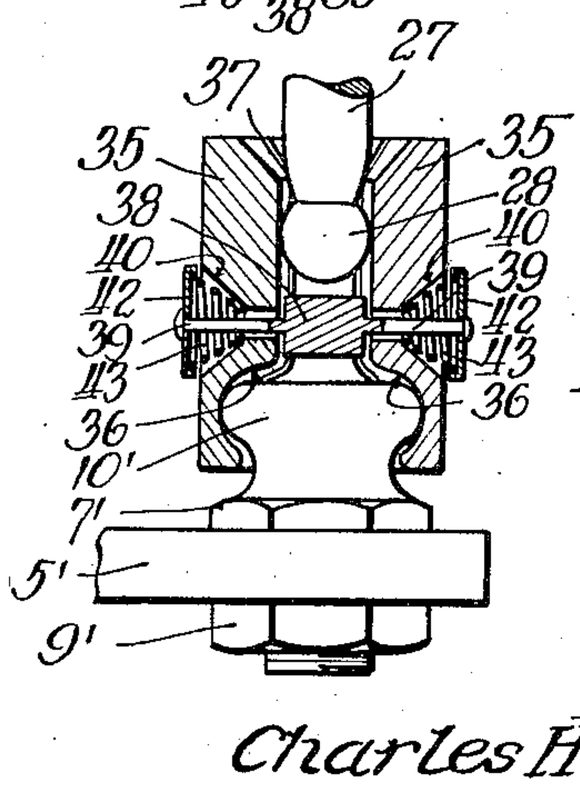


Fig. 4.

Inventor:
Charles H. Koehler.
By Macpherson Boutcher & Drewry
Attys.

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Fig. 5.

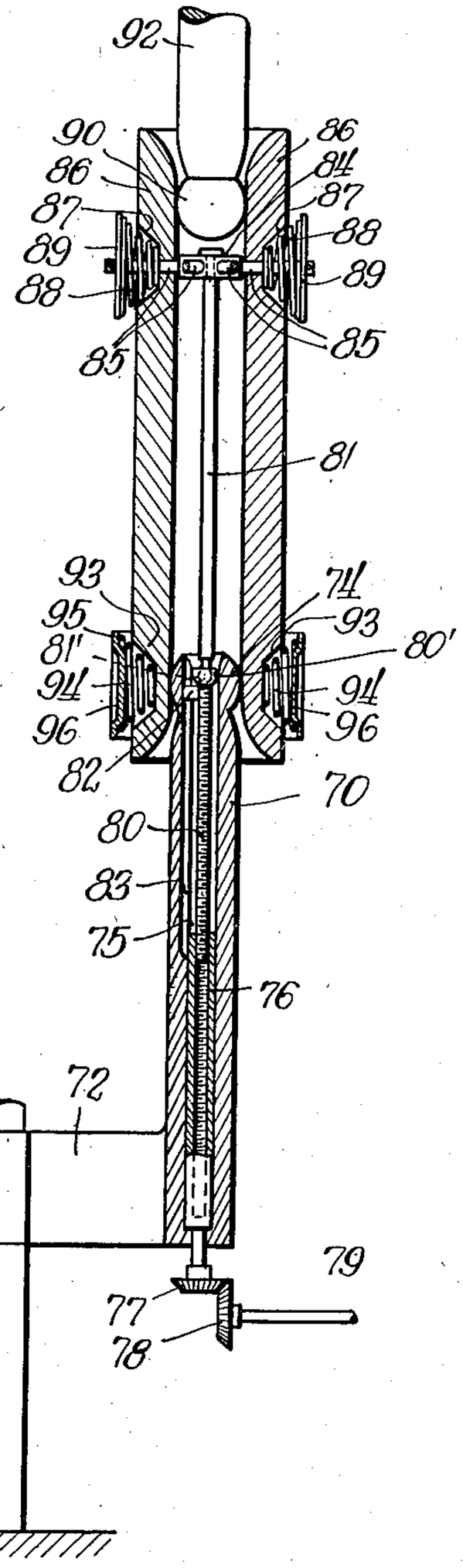


Fig. 6.

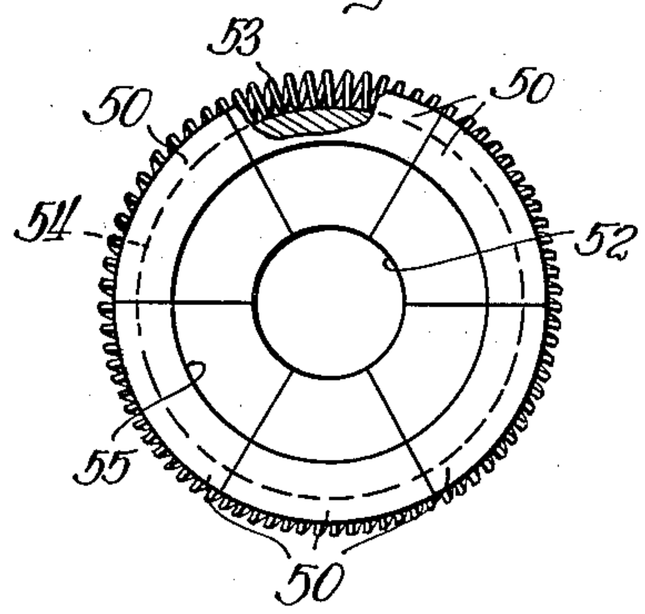
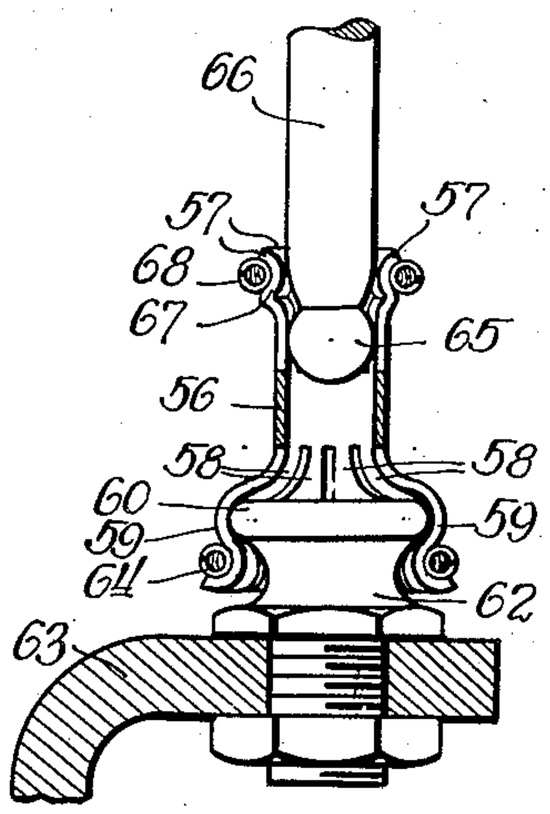


Fig. 7.



Inventor:
Charles H. Koehler
By Brown Jackson Boettcher - Dienner
Attys.

July 12, 1938. **C. H. KOEHLER** **2,123,631**

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Fig. 9.

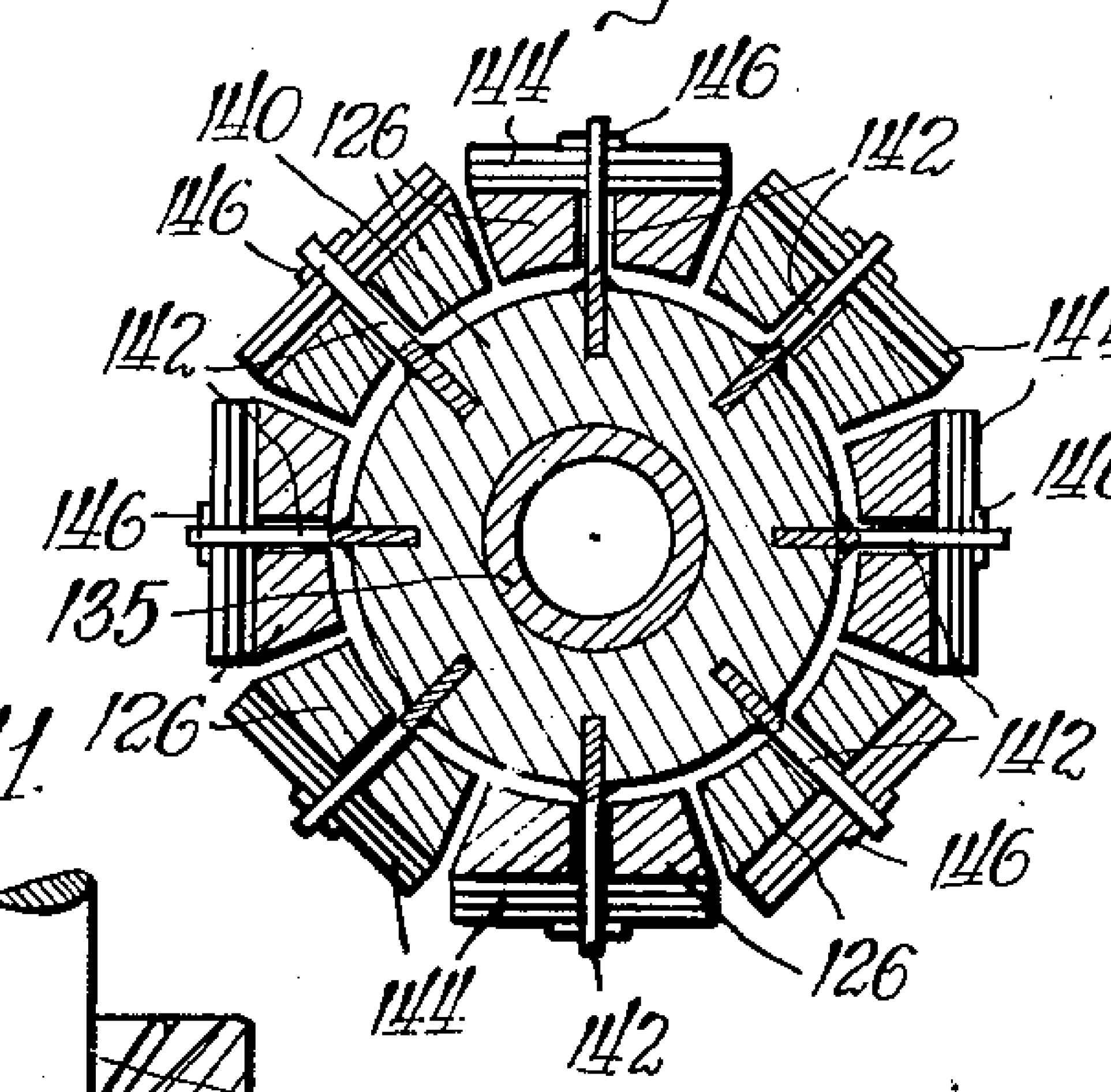


Fig. 8.

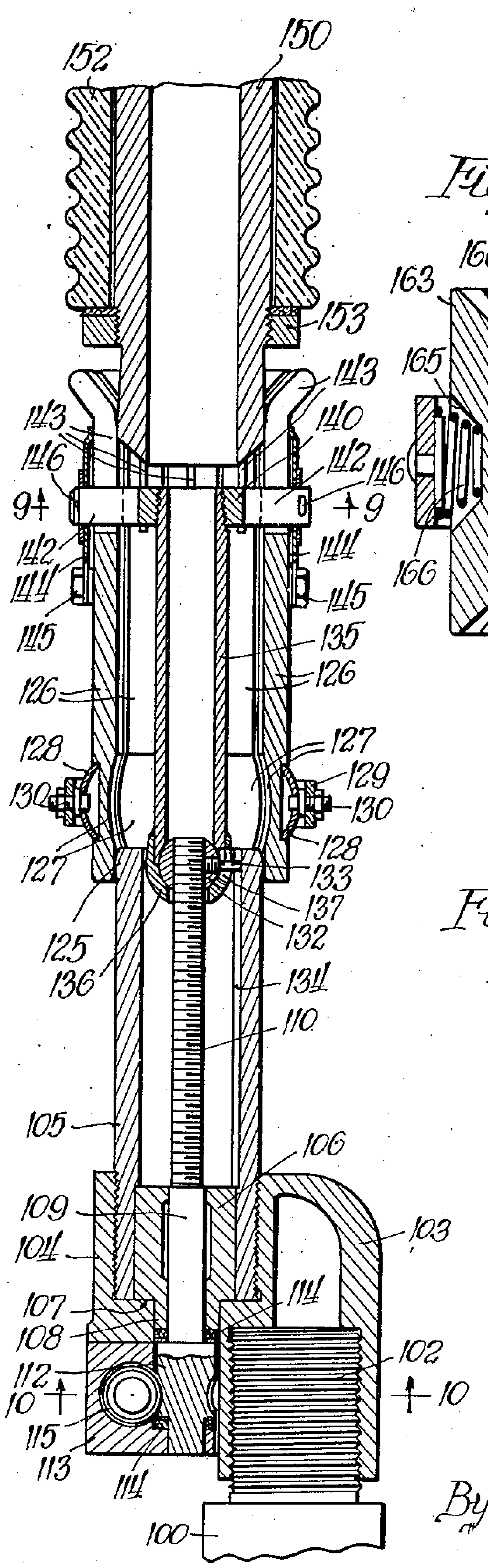


Fig. 11.

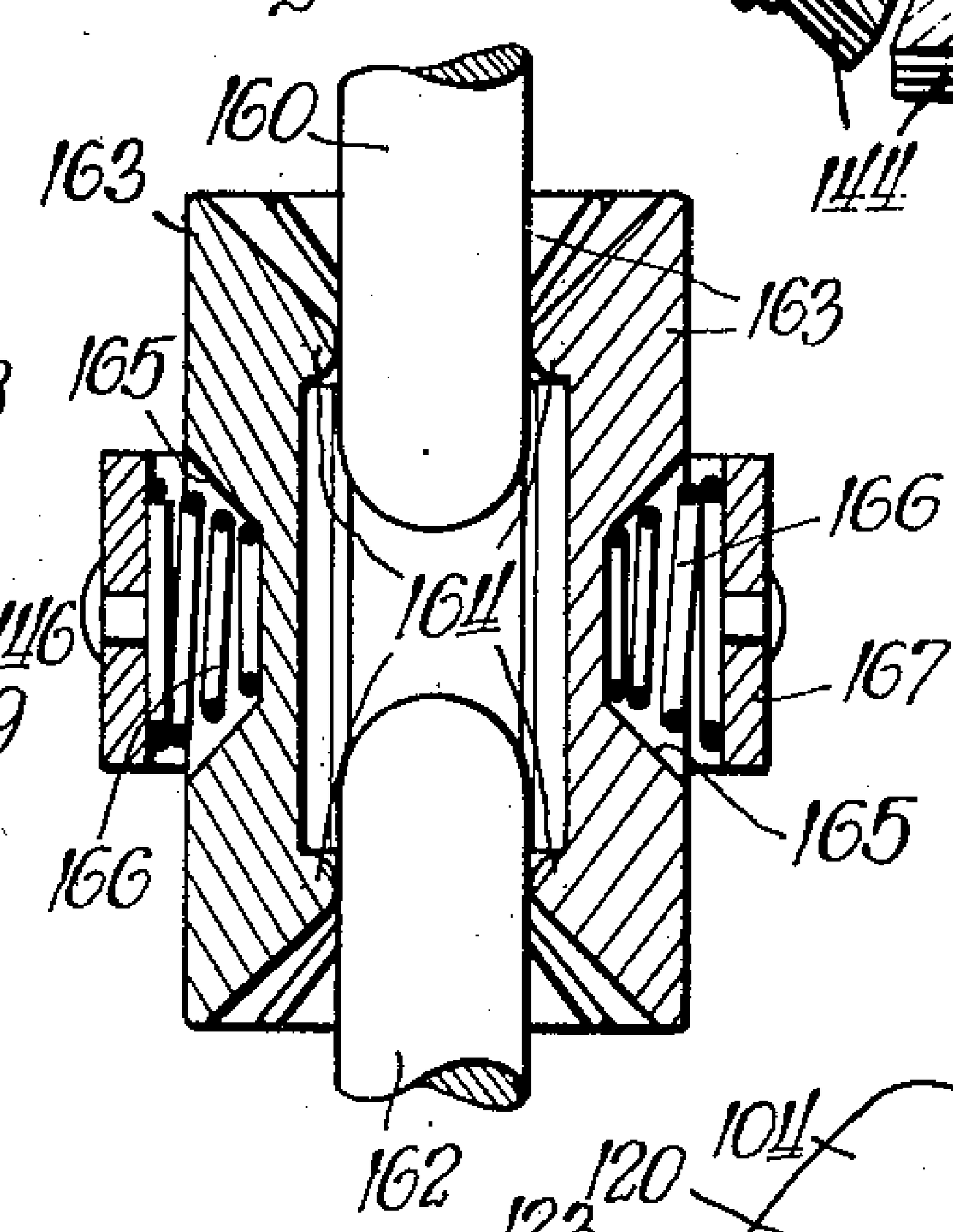


Fig. 12.

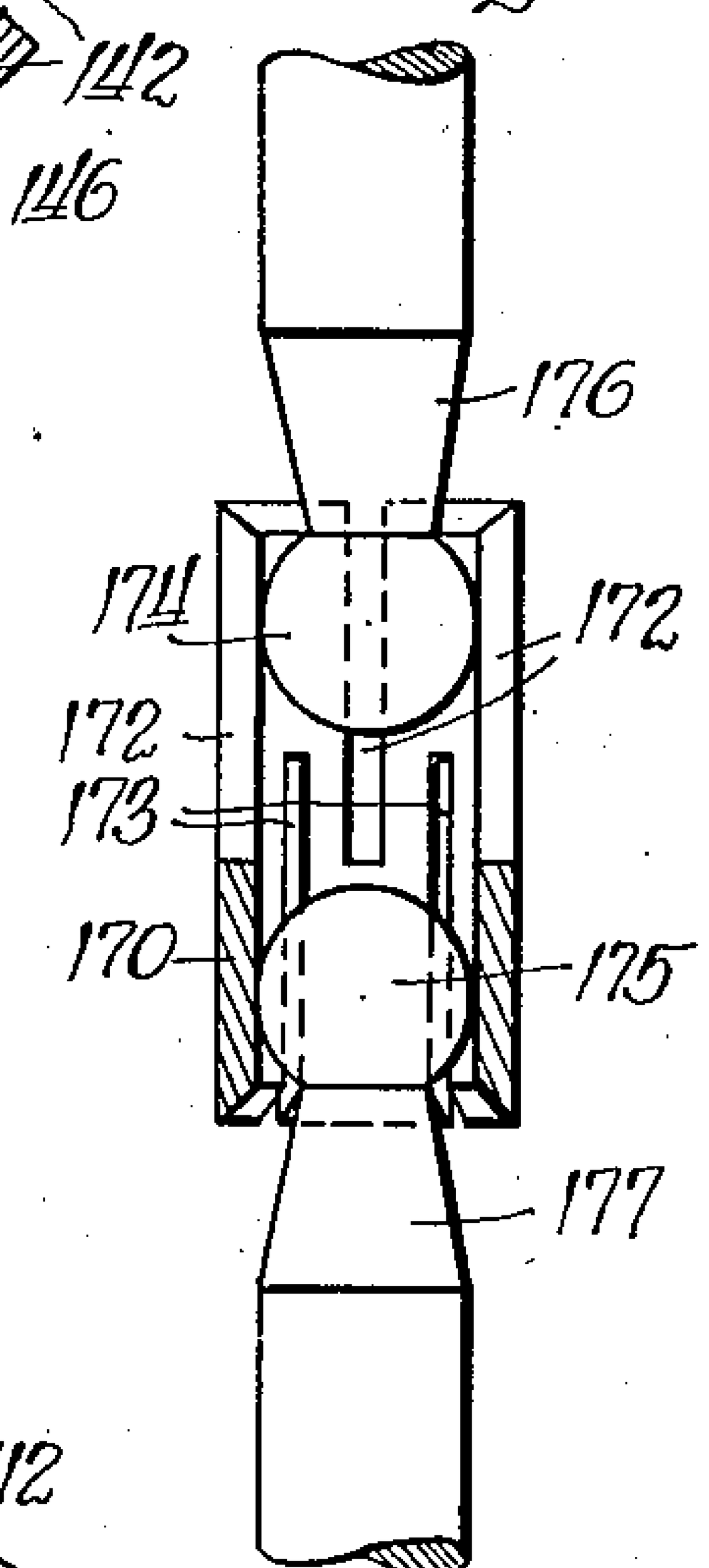
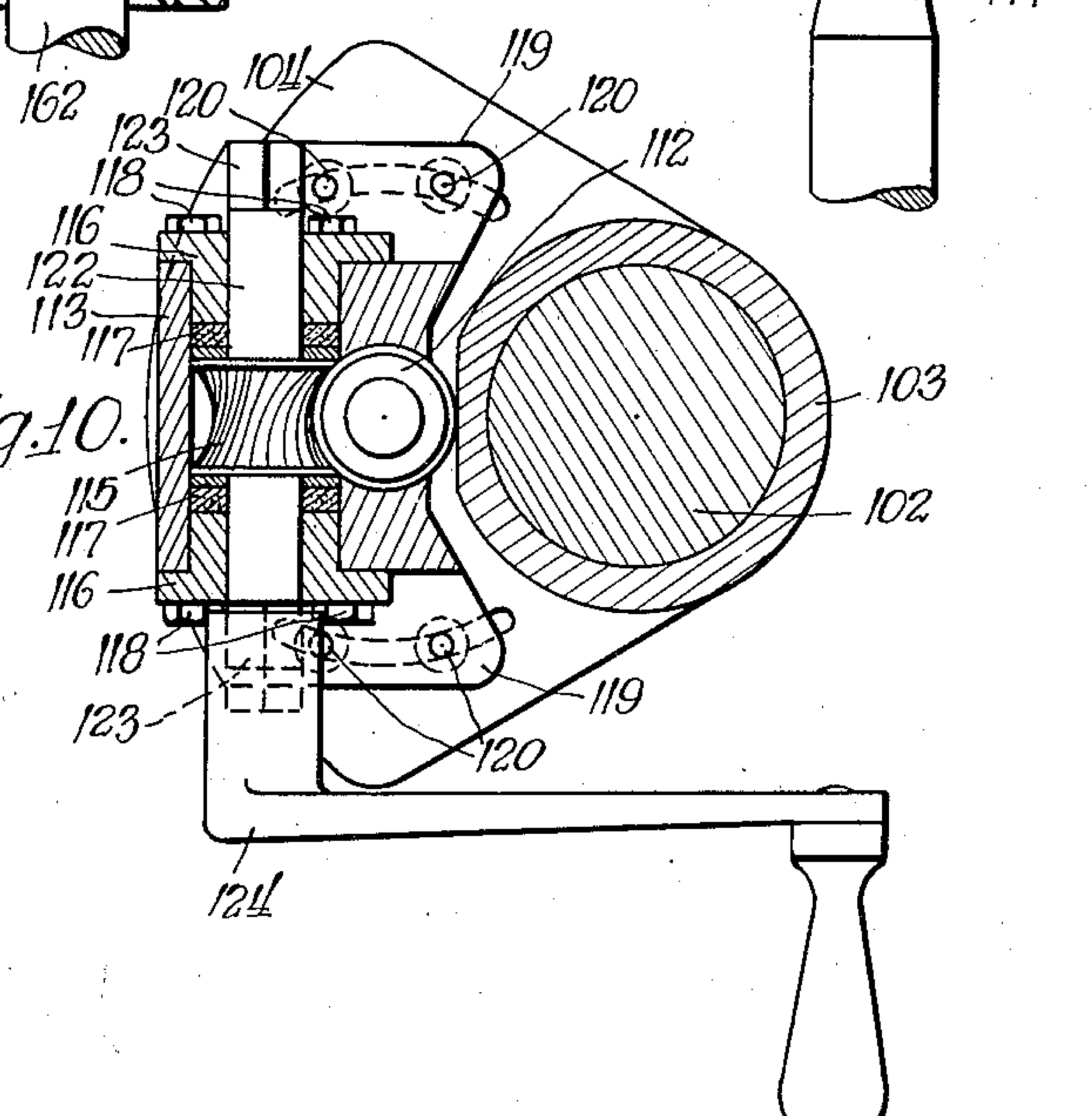


Fig. 10.



Inventor:
Charles H. Koehler.
By Brown Jackson Boettcher Dienner
Attys.

Patented July 12, 1938 2,123,631

UNITED STATES PATENT OFFICE

2,123,631

ELECTRICAL CONNECTER

Charles H. Koehler, Chicago, Ill.

Application July 8, 1935, Serial No. 30,283

14 Claims. (Cl. 173—328)

This invention relates to electrical connecters, and more particularly is directed to connecters providing a positive electrical connection between two spaced contact terminals, and capable of maintaining an equalized contacting pressure at both contact terminals regardless of slight misalignment of the terminals.

In my copending application, Serial No. 724,118, filed May 5, 1934, now Reissue Patent No. 20,608, dated December 28, 1937, I have disclosed a plug and receptacle connecter particularly adapted for connecting and disconnecting an electrical circuit, having a plurality of contact shoes mounted for universal movement about a terminal stud and adapted to engage about a contact stud carried by a movable closure member.

The present invention, in its preferred embodiment, is directed to a similar connecter mounted on a fixed terminal stud which is connected to a second spaced contact terminal by means of an extending connecter having substantially floating engagement therebetween. This accommodates any slight misalignment between the terminals. Engaging each of the terminals is a plurality of contact shoes having substantially universal movement about the terminals and normally urged under spring pressure against the terminals and also against the connecter.

An object of the present invention is to provide a connecter for electrically connecting two spaced contact terminals, which connecter has relative floating engagement between the terminals to accommodate slight misalignment therebetween.

Another object of the present invention is to maintain equal contact pressure between the terminals and the contact shoes, and between the shoes and the connecter. This equalization of pressure is obtained by the provision of a full-floating housing enclosing the shoes and biasing the outer ends of the springs associated with each of the shoes, or by the provision of an intermediate spider member having arms upon which the shoes are mounted for substantially universal spring-controlled movement.

Another object of the present invention is the elimination of spring means from any part of the electrical circuit through the contact terminals, whereby the life of the springs is materially increased.

In the provision of a disconnecting device or connecter for connecting and disconnecting two spaced terminals, spacial requirements usually demand a compact but sturdy construction. The present invention finds particular application for such use and produces a high-grade efficient contact device. Also, because of its self-aligning characteristics, the present invention is capable of being employed in connection with the terminals of circuit breakers, if desired, since the sockets or terminals of such breakers must be self-adjusting and capable of maintaining equalized contact pressure upon the male contact plugs with which the breaker terminals are engaged when the breaker is connected in switch-closed position. It is to be understood, however, that the invention is not to be limited to these specific uses, since the broad features thereof are applicable in various other fields.

Other objects and advantages of the present invention will appear more fully from the following detailed description which, taken in conjunction with the accompanying drawings, will disclose to those skilled in the art the particular construction and operation of a preferred form of the present invention.

In the drawings:

Figure 1 is an elevational view, partly in section, of an electrical connecter embodying the present invention;

Figure 2 is an enlarged plan view of one of the terminal contact devices, taken substantially on line 2—2 of Figure 1;

Figure 3 is a plan view of a modified form of contact structure;

Figure 4 is a view, on a smaller scale, taken through the structure shown in Figure 3, with the connecter inserted;

Figure 5 is a vertical sectional view through a modified form of connecter;

Figure 6 is a plan view of a modified assembly of contact shoes;

Figure 7 is a sectional view through a still further modified type of connecter;

Figure 8 is a vertical sectional view through a telescoping type of connecter embodying the principles of the present invention;

Figure 9 is a sectional view taken on line 9—9 of Figure 8;

Figure 10 is a sectional view taken substantially on line 10—10 of Figure 8; and

Figures 11 and 12 are sectional views of modified types of contacts.

Considering now Figure 1 in detail, I have provided a pair of spaced terminal supporting members 5 and 6, which members are in the form of brackets having normally extending portions adapted to be disposed in substantial vertical alignment. The brackets 5 and 6 may be connected through any suitable connecting

means to a source of current supply. Each of the brackets 5 and 6 has extending therethrough a contact terminal, indicated respectively at 7 and 8. The contact terminals are held in fixed position by means of flanged collar portions engaging one surface of the bracket arms 5 and 6 and having threaded nut members, such as the hexagonal nut members 9, threaded over the extending portions of the studs 7 and 8.

Each of the studs 7 and 8 is provided with an enlarged rounded head portion 10 and 12, respectively, which head portions are joined to the flange portion of the stud by means of a reduced neck portion.

The stud 7 is provided with a contacting structure indicated generally at 13, comprising a plurality of contact shoes 14, preferably six in number in the illustrated embodiment of the invention, although it is to be understood that any desired number of contact shoes may be provided. These shoes are internally recessed at one end, as shown at 15, to engage about the head portion of the stud 7, whereby substantially ball and socket engagement of the shoe members 14 about the head portion 10 of the stud 7 is provided.

At their opposite ends, the shoes 14 are provided with inwardly extending tapered surfaces 16, defining an inwardly tapering circular opening for receiving a connecting member. The external lateral surfaces of the shoe members are provided with recesses 17 as shown in Figure 1, which recesses are tapered to receive the small ends of helically coiled spring members 18, which spring members, at their inner ends, bear against the shoe members 14 to urge the same into equalized contact pressure about the head portion 10 of the stud 7, and at their outer ends are biased against the defining walls of an enclosing housing member 19 which is preferably polygonal in shape, having as many sides as there are shoe members in the present embodiment of the invention, being in the form of an hexagonal tube extending axially of the stud member 7. This member 19 may be formed of insulating material if desired.

Thus a full-floating self-aligning contact receiving structure 13 is provided about the head portion 10 of the stud, which has substantial universal movement about the stud 7. By reason of the springs 18, each of the shoe members has substantially uniform contacting pressure with the stud whereby equalized contact pressure of the structure 13 with the lateral surface of the stud 7 is provided.

The head portion 12 of the stud member 8 has engaged therewith a plurality of contact shoes 20, which shoes have recessed portions at one end thereof, as shown at 22, adapted to have bearing engagement about the rounded stud 12, whereby the shoes are supported for substantially universal conjoint movement about the stud head 12.

The shoes 20, in their outer surfaces, are recessed as shown at 23 to provide suitable seating portions for helically coiled springs 24, which springs, at their outer ends, are biased against an enclosing tubular polygonally shaped member 25 corresponding to the member 19 of Figure 2. The shoes are thus resiliently maintained in pressure contact about the head portion 12 of the stud 8, and are supported for floating movement thereabout due to the fact that the sleeve member 25 does not extend up to the flange of the stud and therefore floats about the head 12 with the shoe members. Each of the shoes 20 is also provided with an inwardly extending contacting portion 26, which contacting portion is adapted to have equalized pressure contact upon the lateral surface of a connecting rod 27, which rod is formed of a suitable metal member having a relatively high degree of conductivity, such as copper or the like, the rod 27 being of sufficient length to have its head portion thereof, indicated at 28, comprising a substantially spherically formed head portion guided by the inclined surfaces 16 of the shoes 14 into the substantially cylindrical opening defined within the inner surfaces of the shoe members 14 to provide for contact between the shoes 20 and the shoes 14.

The connecting member or rod 27, at its upper end, is mounted within a suitable insulating handle member 29, or may be carried by any other suitable operating mechanism for projecting it through the stud 8, which stud is provided with a cylindrical axially extending opening 30 adapted to receive the rod 27, and through the cylindrical opening formed in the contact shoes 20 downwardly into engagement within the opening formed by the shoes 14. It will be noted that the rod 27 has relative telescoping engagement with respect to the stud member 8, and the contact between the stud member 8 and the rod 27 is provided by the engagement of the inwardly extending portions 26 of the contact shoes 20 with the lateral surface of the rod. This provides a wiping contact of these portions of the shoe members along the surface of the rod, whereby clean and positive pressure contact of the shoe members with the rod is provided.

Since the shoe members 20, at their opposite ends, have pressure contacting engagement with the head end 12 of the stud, which is connected to the contact supporting bracket 6, it is apparent that the rod 27 is in proper equalized pressure contact with the bracket 6 so that current may be transmitted from the bracket 6 through the rod 27 with a minimum of resistance.

It will be noted that the upper end of the stud 8 is provided with an outwardly flaring opening 32 so that the head end 28 of the rod 27 may be readily guided into the interior of the stud member 8 for telescoping movement therethrough when it is desired to connect the contact brackets 5 and 6.

Normally, when the rod has not been connected in position, the springs 18 bearing against the tubular sleeve member 19 will urge the upper ends of the shoe members 14 inwardly, and when the head end 28 of the rod is guided into the open end of these shoe members along the tapered surfaces 16, the shoe members are spread outwardly against the pressure of the springs 18 whereby an equalized pressure contact of each of the shoes upon the head end 28 of the rod is provided.

It is thus apparent that I have provided an electrical connecter whereby the connecting rod 27 may be telescoped with respect to one contact stud and guided into electrical contact engagement with a second spaced contact stud, the two contact studs having contact devices whereby the rod is supported substantially for floating movement between the two contacts, thus accommodating for any misalignment between the contacts and providing an equalized contact pressure about each of the contacts and about the surface of the rod at each of the contacts regardless of variations in the alignment between these contacts. The opening 30 in the stud 8 accommodates slight cocking of the rod 27 there-

in when the studs 7 and 8 are not in exact alignment.

In the embodiment of the invention shown in Figures 3 and 4, the contact bracket 5' has a contact stud 7' mounted thereon by means of the nut 9' threaded over the extending portion of the stud, the head portion 10' of the stud being adapted to receive a plurality of contact shoes 35 having recessed portions 36 at their lower ends adapted to engage about the head portion 10' of the contact stud 7' whereby substantially universal movement of the shoes with respect to the stud is provided.

The shoes 35, at their upper ends, are provided with outwardly flaring tapered surfaces 37 for guiding the end 28 of a contact rod or connecting rod 27 into engagement within the circular opening formed by the respective surfaces of the shoes. Intermediate the head portion 10' of the stud and the position which the head portion 28 of the rod 27 assumes with respect to the shoes 35, there is provided a spider member 38 having a plurality of radially extending arms 39. The arms are adapted to extend through enlarged openings formed in the shoes 35, and project outwardly of the external periphery of the shoe members to the tapered openings 40 formed in the shoe members. At their outer ends, the arms 39 are adapted to carry suitable cap members 42, which cap members provide for biasing the outer ends of the helically coiled spring members 43 against displacement outwardly of the ends of the arms 39, while the springs 43 are biased at their inner ends against the base of the tapered openings 40. The shoes are thus mounted for universal movement about the stud member 7', and are held in their respective cooperating positions by means of the spring members 43 mounted about the arms 39 of the spider 38.

In this manner the shoes may move outwardly to accommodate the admission of the head end 28 of the connecting rod 27, and an equalized pressure of each of the shoe members against the surface of the rod and against the surface of the head portion 10' of the stud is provided.

It is obvious that the maintenance of equalized pressure and the provision of a positive, high grade, efficient contact structure is provided with either the construction shown in Figures 1 and 2, where an enclosing polygonally shaped housing is provided, or by the provision of a spider such as shown in Figures 3 and 4.

In Figure 6 I have shown a further modified form of contact assembly, in which a plurality of contact shoes 50 form a circular opening 52 into which a contact connecting member is adapted to extend, and are held in position by means of a coiled garter spring 53 engaged in a suitable groove 54 formed in the outer lateral periphery of the shoes 50. The shoes are provided, at one end, with the inclined tapered surface 55 for guiding a connecting rod into the socket defined by the shoes. The garter spring 53 is adapted to constantly urge the shoes toward each other, and radially inwardly toward the contact member, whereby equalized pressure of each of the shoes against the contact member is provided.

The structure shown in Figure 7 comprises a resilient metal socket member 56, which is provided at its opposite ends with slotted portions providing a plurality of spring fingers 57 and 58, respectively. The spring fingers 58 are provided with an enlarged arcuately curved portion indicated at 59, adapted to engage the head end 60 of a terminal stud member 62 secured in any suitable manner to a supporting bracket 63. A suitable garter spring 64 engages the free ends of the spring fingers 58 for urging them into tight uniform pressure contact with the head end 60 of the terminal 62. The opposite end of the contact socket member 56 is adapted to receive the ball tip end 65 of a connecter rod 66 corresponding to the connecter rod 27 of Figure 1, and the spring fingers are inwardly rounded, as at 67, to receive a circularly coiled garter spring 68 for urging the fingers radially inwardly to provide a uniform pressure contact of each of the spring fingers 57 about the lateral surface of the ball tip 65. In this manner a self-aligning contact assembly is provided in which uniform contacting pressure is produced between each of the contact fingers and the contact terminal and contact rod.

In Figure 5 I have disclosed a modified form of connection, in which only two points of contact are required to effect electrical connection between a pair of spaced contacts.

Referring in detail to the structure shown in Figure 5, I provide a fixed contact member 70, having a normally extending arm 72 supported upon a suitable supporting bracket 73. The contact member 70 is provided with a ball tip end 74, and is also provided with a longitudinally extending central passageway 75 receiving the internally threaded sleeve 76 which is mounted therein and which has an extending end portion projecting below the contact 70 and having a bevel gear member 77 keyed thereto. The gear 77 is driven by a second gear member 78 supported on a driving shaft 79.

The threaded shaft 76 is adapted to receive an externally threaded shaft 80 which is reciprocated within the passageway 75 by rotation of the shaft 76, the shaft 80 having a suitable stop member 82 for limiting its downward movement within the passageway 75. The stop 82 slides in a suitable keyway 83 formed in the passageway 75 to prevent rotation of the shaft 80 and to provide for only longitudinal movement thereof. The upper end of shaft 80 has a socket 80' receiving the ball end 81' of a pin 81 mounted for universal movement about the upper end of shaft 80.

At its upper end, the pin 81 is provided with a spider member 84 having radially extending arms 85 passing through suitable openings formed in a plurality of contact shoe members or bars 86, the outer lateral surface of the contact bars 86 being provided with tapered recesses 87 receiving the helically coiled spring members 88 carried by the arms 85 and biased at their outer ends against a stop plate 89 secured to the outer ends of the arms. This provides for resilient movement of the contact bars 86 inwardly and outwardly with respect to the spider 84, and also provides for resilient and uniform contact pressure of the bars against the ball tip end 90 of a contact member 92 fixed at a predetermined distance from the contact 70.

The lower ends of the contact bars 86 are also provided with tapered recesses 93 formed in the outer lateral surface thereof, which recesses are adapted to receive helically coiled springs 94 normally biasing the lower ends of the contact bars into contact engagement with the ball tip 74 of the contact 70. The springs are maintained in proper biasing position by an enclosing housing member 95 having suitably inset portions 96

forming spring seats for the springs 94. In this manner the lower ends of the contact bars 86 are biased inwardly into uniform contact engagement with the lateral surface of the ball tip 74. Preferably, the inner contacting surfaces of the contact bars 86 and the ball tips 74 and 90 of the contacts 70 and 92 are silverplated in order to reduce the resistance to passage of current therethrough.

In the operation of the structure shown in Figure 5, in the position shown in this figure the contact bars 86 have been moved upwardly to provide for contacting engagement between the contacts 70 and 92. When it is desired to disconnect the electrical connection between these contacts, the shaft 79 is rotated by any suitable driving means to effect corresponding rotation of the sleeve 76. This results in threading of the externally threaded shaft 80 downwardly within the passageway 75, and results in corresponding movement of the contact bars 86 due to their engagement by the arms 85 of the spider 84 secured on the sleeve member, away from the ball tip 90, disconnecting the contact 70 therefrom. At the same time, the lower ends of the contact bars are moved downwardly past the ball tip 74 of the contact 70 until the contact bars 86 assume a position with the spider 84 disposed immediately above the ball contact tip 74 of the contact 70, with the lower ends of the contact bars 86 being disposed about the lower cylindrical portion of the contact 70.

This provides a suitable clearance between the contacts 92 and 70, and at the same time produces wiping engagement of the inner surfaces of the contact bars 86 across the ball contact tip 74, and also across the ball contact tip 90 when the bars are moved upwardly into contact engaging position. This is extremely advantageous in providing a clean and positive contact between the ball contact tips and the contact bars, thus reducing the resistance through the connection. At the same time, the spring mounting of the contact bars 86 at their upper and lower ends assures that uniform contact pressure of each of the bars upon the lateral surface of the ball contact tips 74 and 90 will be secured.

Obviously, the reciprocatory movement of the contact bars 86 might be secured by other means than the externally threaded shaft fitting into the threaded sleeve 76, and I do not intend to limit my invention to this specific form of actuating mechanism, since a suitable plunger member might be employed for producing the same mode of operation. Further, even if a slight misalignment of the contacts 92 and 70 is present, the resilient mounting of the contact bars 86 upon the sleeve 80 insures that such misalignment will be accommodated, and that no uneven contact pressure will be produced thereby.

Considering now, in detail, the embodiment of the invention shown in Figures 8, 9 and 10, a contact stud 100 is provided with an extending threaded portion 102 receiving a support member 103 threaded thereover and having a laterally extending portion 104 which receives a hollow metallic tube 105 threaded into a recess formed in the portion 104 of the member 103.

Within the lower end of the tube 105 there is provided a bushing 106 which has an annular shoulder 107 seating on the bottom of the recess into which the tube 105 extends. The bushing 106 also has an extending cylindrical portion 108 which extends into a suitable recess formed in the member 104, the bushing serving as a guide for the lower end 109 of a threaded shaft 110, which shaft at its lower end is provided with a helical gear 112 having bearing within a suitable supporting bracket member 113. Suitable thrust washers 114 are provided at opposite ends of the gear 112, and the gear is adapted to be rotated by a second helical gear 115 carried within suitable bushings 116 extending into opposite ends of a cylindrical recess formed in the member 113. Suitable graphite or other bearing members 117 are interposed between the ends of the gear 115 and the bushings 116, the bushings 116 being bolted into position by means of the stud bolts 118 threading into the lateral walls of the bracket 113.

The bracket 113 is also provided with oppositely extending flanged shoulders 119, which shoulders are adapted to receive suitable stud members 120 securing the bracket 113 to the portion 104 of the member 103. It will be noted that the bracket 113 may be rotated through a limited arc with respect to the member 104 in order to accommodate any slight misalignment between the member 104 and the shaft 122 which carries the gear 115.

The shaft 122 extends outwardly of the bushings 116 and is provided with squared end portions 123, one of the end portions 123 receiving a crank member 124 whereby the shaft 122 may be rotated in opposite directions to produce corresponding rotation of the threaded shaft 110.

The upper end of the tubular member 105 is provided with a rounded external bead 125, which bead is adapted to form a suitable contact surface engaged by a plurality of contact shoes 126 having arcuate inner surfaces engaging about the bead 125 at the lower end thereof. The contact shoes 126 are also provided with concave recesses 127 for clearing the bead 125 when the shoes are lowered. A plurality of spring members of arcuate cross-section, indicated at 128, are adapted to engage in suitably notched portions of the external surface of the members 126, being held in position by means of a polygonal band 129 surrounding the shoes and connected with the springs 128 by means of the adjustable threaded pin members 130 which have suitable seating engagement in the arched portions of the spring 128. This serves to urge the shoes 126 resiliently into engagement with the upper end of the tubular member 105 and to maintain equalized pressure between the shoes and the contact surface of the member 105.

The threaded shaft 110 is provided with a spherical traveling nut 132 adapted to move upwardly and downwardly on the shaft 110 by reason of the pin 133 guided in the keyway 134 formed in the internal surface of the member 105, whereby the nut 132 is prevented from rotation and threads upwardly and downwardly upon the shaft 110 as the shaft is rotated.

A suitable supporting sleeve 135 is provided at its lower end with a ball socket portion 136 welded or otherwise suitably secured thereto which engages about the spherical surface of the traveling nut 132 to provide for substantially universal movement of the sleeve 135 about the member 132. The socket portion 136 of the member 135 is suitably milled out as shown at 137 about the pin 133 to provide for this universal movement of the sleeve 135 about the traveling nut.

The upper end of the sleeve 135 is provided with an annular disc-like member or spider 140 having a plurality of radially extending slots milled into the outer surface thereof, which slots

are adapted to receive radially extending blade or cam members 142, the members 142 extending radially outwardly of the spider 140 and being suitably welded or otherwise secured in the milled out slots formed in the outer surface of the disc 140. The upper ends of the shoe members 126 are slotted, as indicated at 143, from the end longitudinally to a point below the extending arms 142 of the spider 140. Suitable leaf spring members 144 are mounted in vertically extending position on the external surface of the shoes 126 by means of bolts 145 threading into the shoes 126.

Retaining means 146 are carried by each of the arms 142 at the ends thereof, whereby the shoes 126 are supported upon the arms 142 by means of the bearing of the spring members on the upper edges of the arms 142. This provides for resilient mounting of the shoe members upon the spider 140, whereby the shoe members may move radially inwardly and outwardly under the pressure of springs 144 to be expanded or contracted, as desired.

A hollow contact sleeve 150, or any other desired type of contact, is mounted in fixed position above the tube 105, and has an externally enclosing insulating member 152 carried thereabout and maintained in predetermined position with respect to the contact sleeve 150 by means of the lock nut 153 bearing against the lower end of the insulator 152 and threaded onto the contact sleeve.

In the operation of the construction shown in Figures 8, 9 and 10, rotation of the crank 124 serves to rotate the shaft 110, causing the nut 132 to travel longitudinally of this shaft. This results in downward movement of the member 135 from the position shown in Figure 8, which results in drawing of the upper ends 143 of the shoes 126 downwardly out of engagement with the contact end of the sleeve 150, thereby breaking contact between the contact 150 and the contact 100. This downward movement is accommodated by means of the recessed portions 127 of the shoes 126 which fit around the beaded portion 125 of the tubular member 105. The traveling nut 132 can move downwardly upon the shaft 110 until the spider 140 rests upon the upper surface of the tubular member 105. Inasmuch as the normal external diameter of the tubular member 105 is substantially less than the beaded portion 125 thereof, or the external diameter of the contact sleeve 150, the shoes will be expanded against the pressure of springs 128 and 143 when in the position shown in Figure 8. Consequently, upon downward movement, the shoes will contract, but cannot contract inwardly beyond the external diameter of the member 140 or the external diameter of the member 105. When the shoes have reached their lowermost position, the upper ends 143 thereof are contracted to a slight extent by reason of the pressure of springs 144, so that upon upward movement into switch closing position, the shoes will be spread radially as they come into engagement with the contact sleeve 150 due to the upwardly and outwardly flaring end portions 143 thereof, so that any slight misalignment of the contact 150 and the tubular member 105 will be accommodated by the swinging movement of the sleeve 135 about the traveling nut 132, the sleeve having substantially universal movement about this nut so that as the contact shoes are guided into engagement, the sleeve may rotate about the nut in any desired manner to accommodate any misalignment which may be present. This swings the shoes in unison therewith. Also, by reason of the particular spring mounting disclosed, equalized contact pressure of each of the shoes against the stationary contact is provided, and the wiping action of the shoes across the contact surfaces serves to maintain these surfaces clean and bright.

In Figure 11, I have shown a modified type of contact structure in which two round ended cylindrical contact members, 160 and 162, are adapted to receive therebetween a suitable contact sleeve formed of a plurality of contact shoes 163. Each of the contact shoes is provided at opposite ends with inwardly beaded portions 164 having substantially line contact engagement about the external surface of the members 160 and 162, whereby circular line contact of the shoes 163 with the external cylindrical surfaces of the members 160 and 162 is provided. Suitable tapered recesses 165 are formed in the external surfaces of each of the shoe members, and receive helically coiled springs 166 seating thereagainst and biased into position by means of a polygonal shaped sleeve member 167 maintaining the shoes in pressure engagement with the contacts 160 and 162. This provides for equalized contact pressure of the beaded portions 164 of each of the shoes against the contact surfaces.

In Figure 12, I have disclosed a second type of contact sleeve comprising a cylindrical member slotted longitudinally from the opposite ends inwardly past the central portion thereof, the member 170 having slots 172 extending from one end thereof which are alternately spaced with respect to slots 173 extending from the opposite end thereof, the inner ends of the adjacent slots overlapping, as shown. The sleeve is adapted to fit over the rounded tips 174 and 175 of a pair of contact studs 176 and 177, respectively. Due to the slotting of the sleeve 170, the fingers formed by the slots 172 and 173 are resiliently maintained in pressure engagement with the surface of the ball contact tips 174 and 175, thereby maintaining a substantially equalized contact pressure about each of these contact tips. The sleeve 170 or the contact assembly comprising the shoes 163 of Figure 11 may be reciprocated with respect to the contacts in any desired manner to provide for closing and opening of the circuit therebetween.

It is therefore believed apparent that I have provided an electrical connecter adapted for use in situations in which contacts may be slightly misaligned, and which provides for the maintenance of equalized contact pressures and for the floating support of the contact member between the spaced contacts.

Having described my invention in accordance with the patent statutes, what I claim as new and desire to secure by Letters Patent is:

1. In an electrical connecter, a pair of spaced contact studs, a full-floating contact structure mounted for universal movement about each of said studs, one of said contact structures being adapted to receive a connecting member endwise therethrough, and a connecting member movable endwise through said one contact structure into the other of said contact structures and having floating engagement between said contact structures.

2. In an electrical connecter, a pair of spaced contact studs, each of said studs having a spring controlled contact structure mounted for uni-

versal movement thereon, one of said contact studs being adapted to receive a contact member endwise therethrough, and a contact member movable endwise through said one contact stud and into engagement between said contact structures to effect electrical contact between said studs through said structures.

3. In an electrical connecter, a pair of spaced contact studs, a plurality of contact shoes for each of said studs, means for maintaining the shoes for each of said studs in equalized pressure contact with said respective studs, one of said studs being adapted to receive a connecting member endwise therethrough, and a connecting member movable endwise through said one stud into engagement between the respective shoes of each of said studs for effecting contact therebetween.

4. In an electrical connecter, a pair of spaced contact studs, one of said studs being adapted to receive a connecting member endwise therethrough, a plurality of contact shoes for each of said studs, means for maintaining the shoes for each of said studs in equalized pressure contact with said respective studs, said means comprising an enclosing housing for said shoes having spring means biased between the interior of said housing and each of said shoes, and a connecting member movable endwise through one of said studs into engagement between the respective shoes of each of said studs for effecting contact therebetween.

5. In an electrical connecter, a pair of spaced contact studs, one of said studs being adapted to receive a connecting member endwise therethrough, a plurality of contact shoes for each of said studs, means for maintaining the shoes for each of such studs in equalized pressure contact with said respective studs, said means for one of said studs comprising a spider member having radial arms receiving said shoes and spring means urging said shoes centrally toward said spider member, and a connecting member movable endwise through the other of said studs into engagement between the respective shoes of each of said studs for effecting contact therebetween.

6. An electrical connecter comprising a first terminal stud having a rounded head portion and adapted to receive a contact member endwise therethrough, a plurality of contact shoes mounted for conjoint universal movement about said head portion and defining a contact-receiving opening, a second terminal stud spaced from said first stud and having contact shoes mounted for conjoint universal movement thereabout, and a contact member movable endwise and axially of said first terminal stud into engagement in said opening and with said contact shoes of said other stud.

7. An electrical connecter comprising a pair of spaced terminal studs having rounded head portions, a plurality of contact shoes mounted for universal movement about each of said head portions, one of said studs having an axial opening therethrough, and means movable through said opening and into engagement between the respective contact shoes of each stud for effecting electrical connection between said studs.

8. In combination, a pair of spaced contact studs, supporting brackets for each of said studs, said contact studs being adapted to receive a contact member endwise therethrough, a plurality of contact shoes having substantially universal movement about each of said studs and extending outwardly of said studs, the shoes for one of said studs defining an outwardly flaring cylindrical opening, the shoes for the other stud having inwardly extending contacting portions at their free ends, and a contact member movable endwise through said one contact stud into said opening and within said contacting portions for floating support between said studs.

9. In combination, a pair of spaced contact studs having rounded head portions, one of said studs being adapted to receive a rod-like member endwise therethrough, a plurality of contact shoes for said one of said studs having ball and socket engagement at one end about the head portion of said stud and having inwardly extending contacting portions at the opposite end, spring means intermediate the ends of said shoes urging said shoes together, a plurality of corresponding contact shoes mounted at one end about the head portion of the other stud and having outwardly flaring surfaces at their opposite ends, corresponding spring means for said second plurality of shoes, and a rod-like member movable endwise through said one stud and the contacting portions of said first plurality of shoes and guided at its opposite end by said flaring surfaces into contact within said second plurality of shoes.

10. In combination, a first terminal stud adapted to receive a connecting member endwise therethrough, contact shoes mounted for universal movement thereabout and extending outwardly of said stud, a second terminal stud, contact shoes mounted for universal movement about said second stud and extending outwardly toward said first stud, a connecting member movable endwise through said first stud and between said contact shoes carried thereby into engagement within the contact shoes carried by said second stud, and means for equalizing the contact pressure between each of said shoes and the corresponding studs and between said shoes and said connecting member.

11. In combination, a pair of spaced contact studs, contact shoe structures mounted for universal movement about each of said studs and extending toward each other, one of said studs having an axial passageway therethrough, and a contact rod movable through said passageway and having a ball tip portion engageable in the contact shoe structure of said other stud, the contact shoe structure of said first stud engaging about the lateral surface of said rod as it is moved into engagement with the contact shoe structure of said other stud.

12. An electrical connecter comprising, in combination, a pair of spaced apart contact members having convex spherical contact portions, a polygonally shaped support member disposed substantially coaxially with said contact members, a contact shoe individual to each inner side of said polygonal support member and arranged and adapted to interconnect said contact members by contact engagement with said convex spherical contact portions thereof, and resilient means acting between said support member and said contact shoes for biasing them inwardly into contact engagement with said convex spherical contact portions of said contact members.

13. An electrical connecter comprising, in combination, a pair of spaced apart contact members having convex spherical contact portions, a polygonally shaped support member disposed substantially coaxially with said contact members, a contact shoe individual to each in-

ner side of said polygonal support member and arranged and adapted to interconnect said contact members by contact engagement with said convex spherical contact portions thereof, means preventing detachment of said contact shoes from one of said contact members, said contact shoes being readily detachable from the other of said contact members, and resilient means individual to each of said contact shoes and acting between the same and the side of said polygonal support member individual thereto for biasing said contact shoes inwardly into contact engagement with said convex spherical contact portions of said contact members.

14. In an electrical connecter, a pair of spaced contact members, one of said contact members being adapted to receive a connecting member endwise therethrough, an assembly of contact fingers for each contact member, a connecting member movable endwise through said one contact member into engagement with the respective assemblies of contact fingers for effecting contact therebetween, and resilient means for maintaining equalized contact pressure between said assemblies of contact fingers, spaced contact members and connecting member for predetermined positions of misalignment of said spaced contact members.

CHARLES H. KOEHLER.