Dec. 1, 1936.

D. L. BAXTER

2,062,986

WIRE CONNECTING SLEEVE

Filed Oct. 21, 1935

FIG. 1

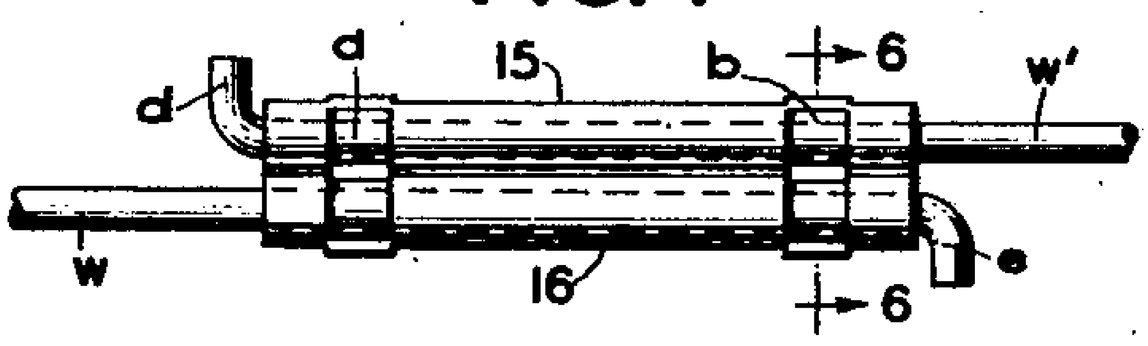


FIG. 2

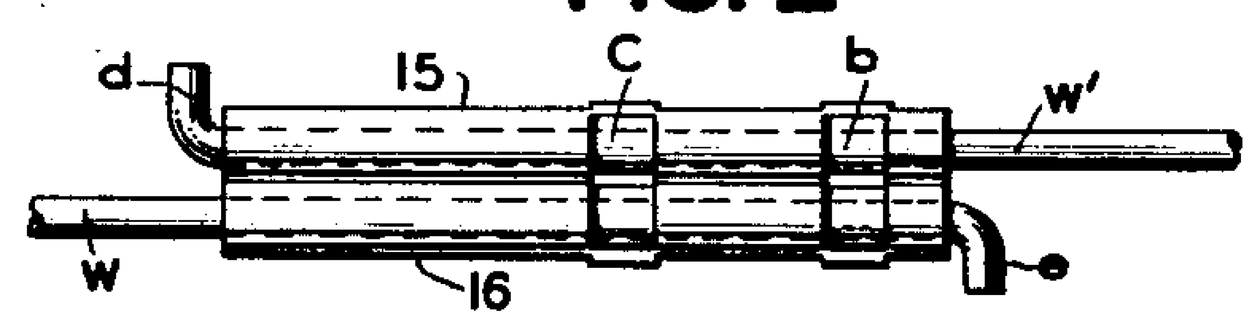


FIG. 3

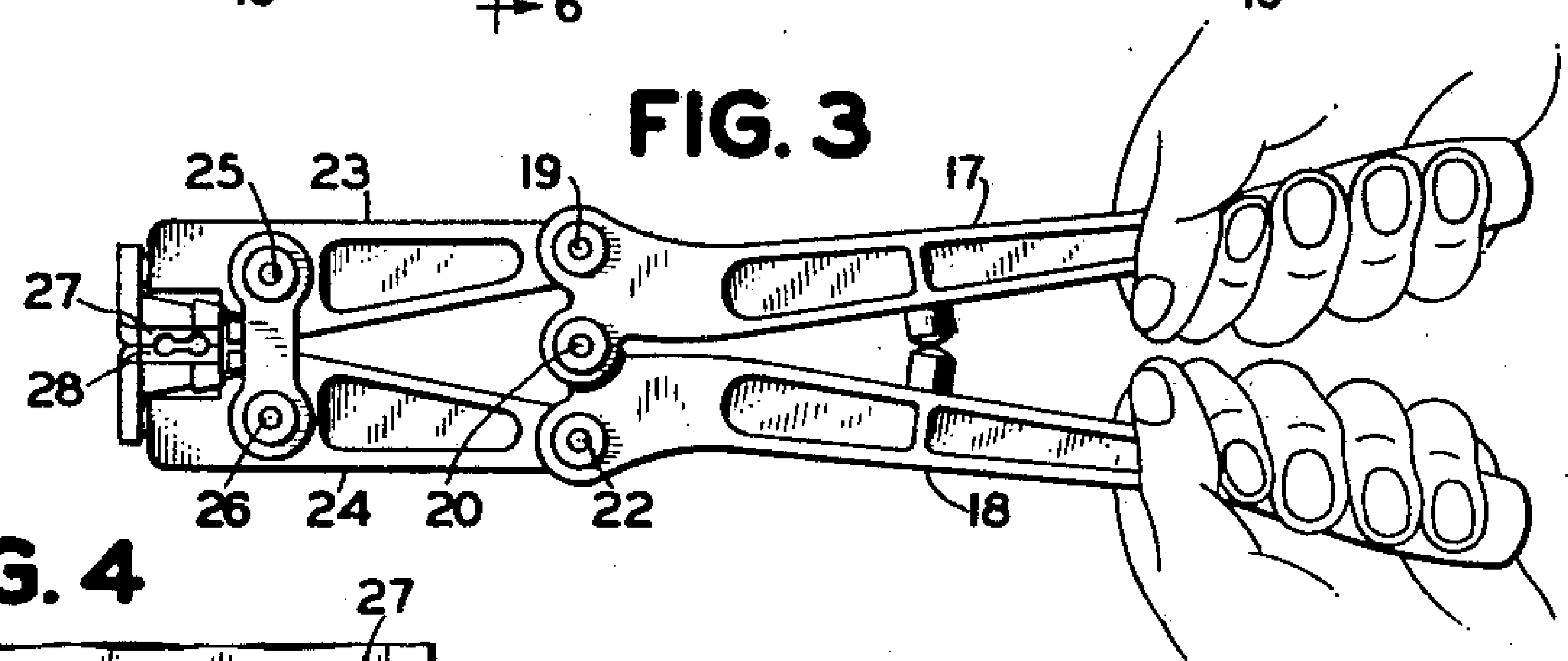


FIG. 4

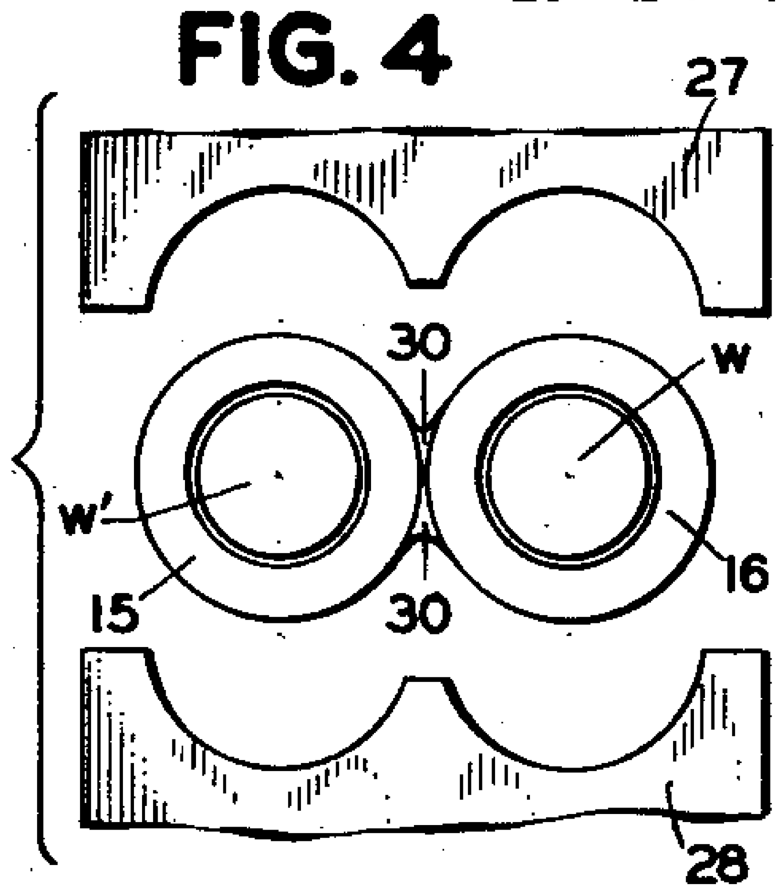


FIG. 6

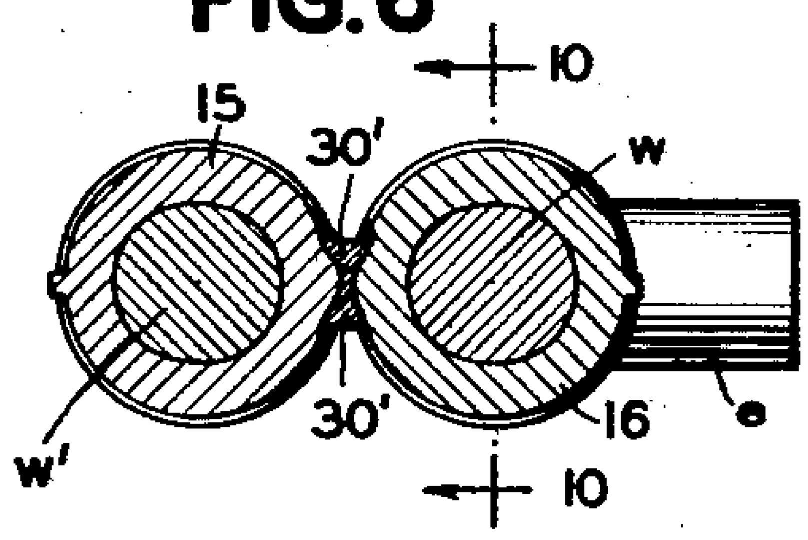


FIG. 7

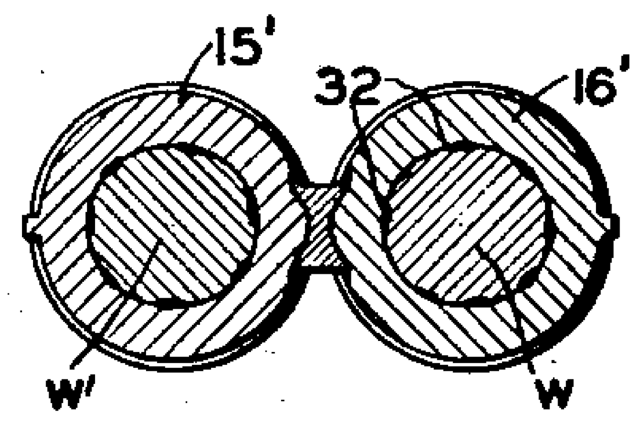


FIG. 5

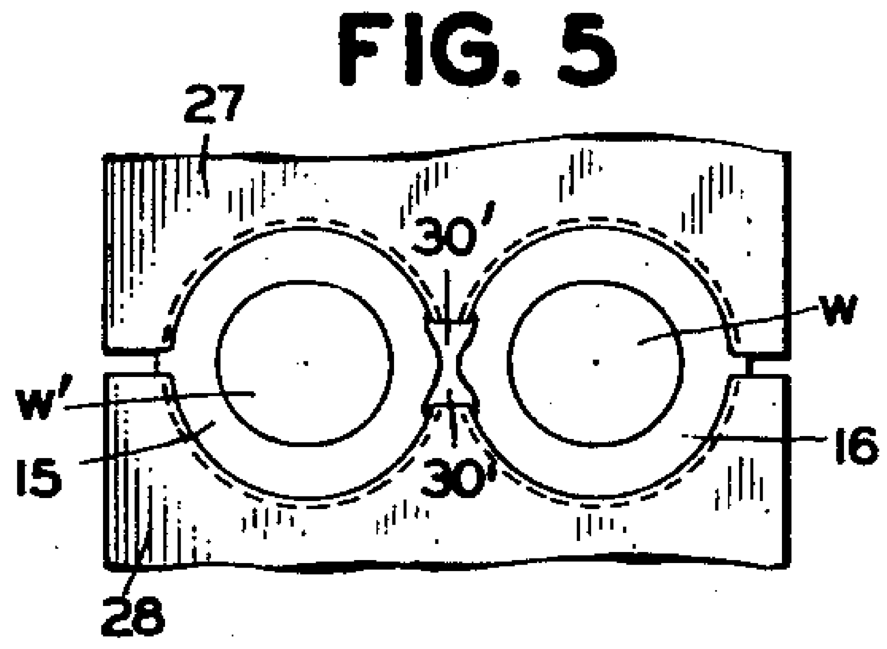


FIG. 8

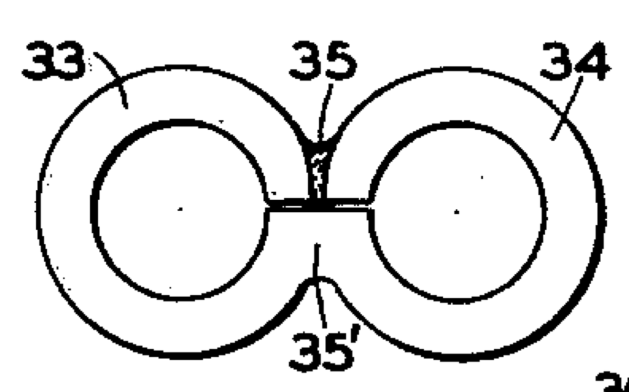


FIG. 11

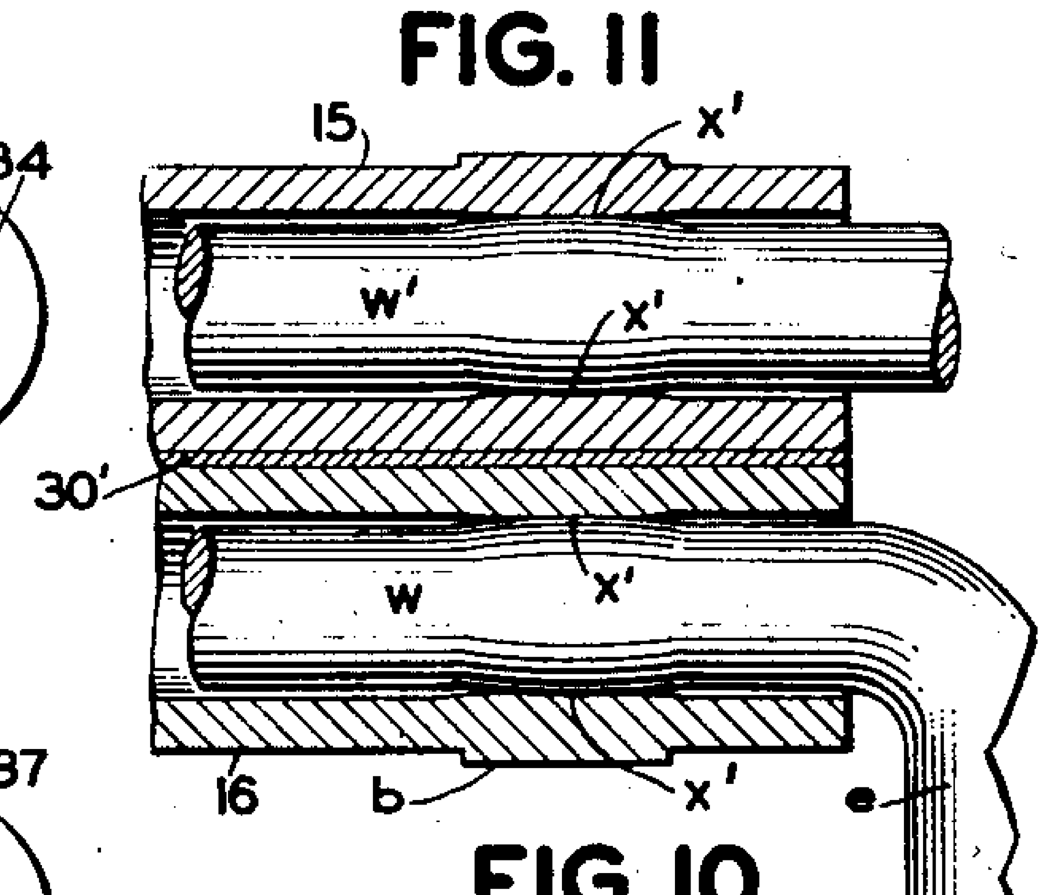


FIG. 9

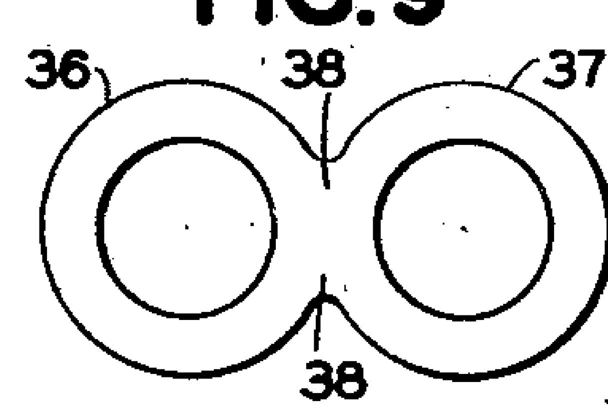


FIG. 10

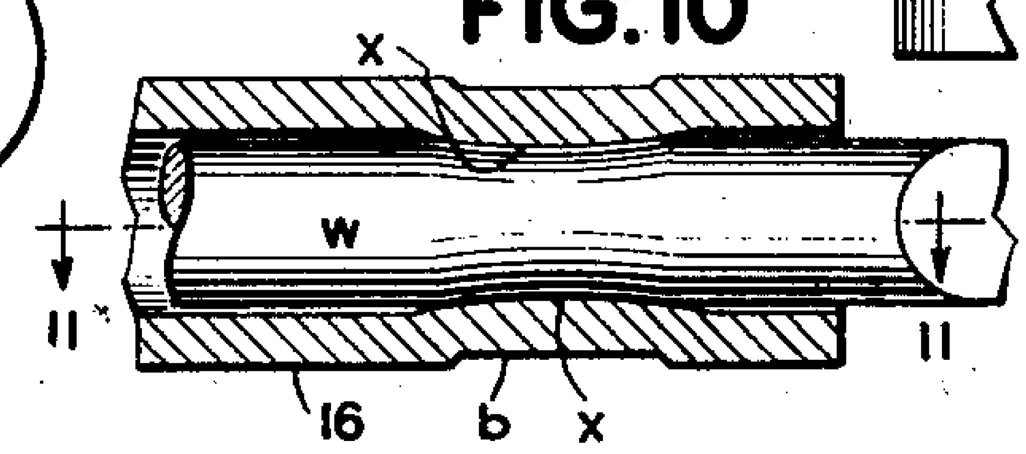
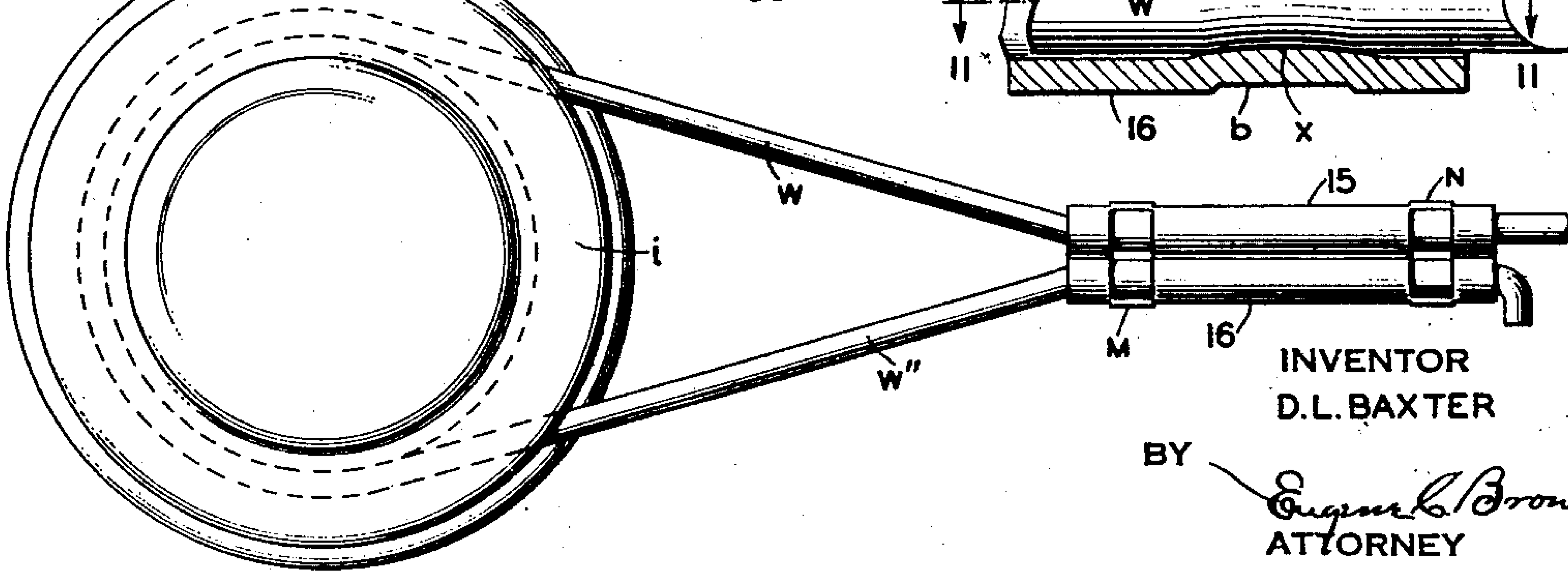


FIG. 12



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Patented Dec. 1, 1936 2,062,986

UNITED STATES PATENT OFFICE

2,062,986

WIRE CONNECTING SLEEVE

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Application October 21, 1935, Serial No. 46,019

7 Claims. (Cl. 173—263)

This invention relates to line wire connectors and more particularly to sleeve connectors for use with high frequency communication circuits.

For many years the splicing and dead-ending of copper line wires have been accomplished by means of thin-walled copper connectors, commonly called sleeves, into which the wires are inserted and the sleeves and wires are then given several complete twists by means of tools called "sleeve twisters". Such sleeves are reasonably satisfactory for dead-ending, although in various places where space is limited, it is difficult to twist the sleeves. For splicing, however, such sleeves have two serious weaknesses. In the first place, the sleeve twisters injure the wire at the point where they grip the sleeve and consequently the mechanical strength of the wire at the joint is appreciably less than that of the rest of the span. Secondly, these sleeves do not set so closely around the wires as to prevent corrosion of the wires and the inside of the sleeve, which corrosion in time causes a marked increase in the electrical resistance of the joint. For this reason these sleeves are not suitable for high frequency circuits which require low, constant resistance joints. If the resistance of a joint increases, this increases the attenuation of the circuit and also tends to unbalance the circuit.

In an effort to overcome the disadvantages of the twisted sleeve connectors, it has been proposed heretofore to employ connectors comprising a sleeve or tube into which the wires are pushed from the opposite ends of the sleeve until they meet within the sleeve, the tube then being rolled, pressed or squeezed until it is in intimate contact with the wire. In most cases joints made with such sleeves are sufficiently tight to prevent interior corrosion and the wire is injured less than is the case with twisted sleeves. Theoretically, such connectors should result in a perfect joint, and where made in the laboratory under favorable conditions and with adequate supervision, they have proved satisfactory. However, where such joints have been made in the field by linemen, often under difficult conditions and without close supervision, it has been found that the joints frequently are not mechanically dependable, and in some cases are electrically unsatisfactory. This has resulted from the fact that under such conditions the line wires may not have been fully inserted into the sleeve or they may have been prevented from being fully inserted by reason of some irregularity or obstruction in the sleeve, or because of a burr or bend in the wires themselves, or because in the making of the joint one or both wires have slipped partially out of the sleeve while the joint is being made. If the wires do not extend the proper distance into the sleeve, the strength of the joint becomes an entirely uncertain quantity. Thus, where the lineman is not extremely careful in making such a joint, the joint is always liable to fail in service.

Another disadvantage of the compression type of sleeve heretofore employed is that the joint will not support itself while being made up. Where such joints are made when the lineman is on the pole, it is necessary to hold the tension of the line wire and also to hold the ends of the wires together in proper position in the sleeve, by block and tackle secured to the wires, with clamps, or by means of other special devices for holding the ends of the wires together. When the joint is made on the ground, even these methods are not generally applicable, and it is usually necessary to employ an additional person to hold the ends of the wires in position while the lineman is applying the compression tool.

An additional disadvantage of this type of connector is that it cannot be used for dead-ending line wires and, consequently, twist type sleeves together with the necessary sleeve twisters must always be carried along for dead-ending at poles or other places where wires are terminated.

An object of the invention is to provide a novel and improved compression type multiple tube sleeve connector which obviates the foregoing disadvantages and which will in all cases be mechanically and electrically dependable, and which results in a joint that is gas tight and will not corrode, and which is substantially as strong as the line wire itself.

Another object is to provide a sleeve connector of the compression type which is practically foolproof, so that even though the joint is carelessly made by the lineman, it nevertheless will invariably result in a low, constant resistance connection.

Another object is the compression type sleeve connector which may be used for dead-ending as well as for straight splicing, to thereby obviate the necessity for the lineman to carry two kinds of connectors and two kinds of tools therefor.

The invention further resides in the novel construction, combination and arrangement of parts of the connecting device hereinafter described and specifically pointed out in the claims.

In the accompanying drawing:

Fig. 1 is a view showing a straight line wire joint, properly made, employing a compression sleeve in accordance with the invention;

Fig. 2 shows a carelessly made joint embodying the compression sleeve of the invention;

Fig. 3 illustrates one form of compression tool by means of which the lineman compresses the sleeve into engagement with the line wire;

Fig. 4 is a detail view of dies employed in the compression tool of Fig. 3;

Fig. 5 shows the action of the dies when compressing the sleeve;

Fig. 6 is an enlarged cross-sectional view of the line wire joint taken along the line 6—6 of Fig. 1, showing the deformation of the sleeve and conductors;

Fig. 7 is a cross-sectional view, similar to Fig. 6, of a joint utilizing keying particles between the connector and line wires;

Figs. 8 and 9 show modified forms of the connecting sleeve;

Fig. 10 is an enlarged fragmentary longitudinal sectional view of one end of the sleeve, taken along the line 10—10 of Fig. 6;

Fig. 11 is a longitudinal sectional view taken along line 11—11 of Fig. 10; and

Fig. 12 illustrates how the connector may be employed for dead-ending a line wire.

Referring now to Fig. 1 of the drawing, there is shown a straight line wire splice between two line wires w and w'. The sleeve connector comprises two integrally joined tubes 15 and 16 through which the line wires w' and w respectively have been passed. Preferably, the tubes 15 and 16 are composed of copper, and may be joined to each other by brazing or any other suitable method. After the line wires have been passed through their respective tubes, the extending ends d and e are bent over against the ends of the sleeve and, after the compression tool has been applied, the ends are cut off as shown in the figure.

Fig. 3 illustrates the manner in which the lineman applies the compression tool to make up the joint. The tool has handles 17 and 18 pivotally mounted at 19, 20 and 22 so as to enable leverage to be applied to the compression lever members 23 and 24. The latter members are pivotally mounted at 25 and 26 so that as the handles of the compression tool are brought together, the outer ends of the members 23 and 24 cause the dies 27 and 28 carried thereby to engage the sleeves 15 and 16 and compress them into intimate clamping contact with the line wires.

Fig. 4 is an enlarged detail view of the clamping dies, sleeve and line wires before the dies are compressed. Fig. 5 shows the position of the dies as they compress the sleeve and line wires. It will be noted from the latter figure that the wires w and w' and also the tubes 15 and 16 are compressed so as to have an oval configuration at the places where the tubes engage the line wires. This augments the strength of the joint because the oval sections of the wire resist being pulled through the adjoining round sections of the sleeve when strain is applied to the joint.

The dies 27 and 28 have a configuration such that they are adapted to engage and exert pressure over substantially the entire outer surface of the sleeve at the point of application thereto, the pressure exerted by the dies being sufficient to cause the metal of the tubes to flow into and completely fill the space between the tubes and the wires, and to cause the deformation of the wires and tubes as illustrated in Figs. 10 and 11. To facilitate this result, additional metal 30 may be provided between the tubes thus insuring the building up of effective pressures in the central area. There is thus provided a multiple tube sleeve connector in which each of the tubular bodies of the connector has inner wall portions for compression into intimate clamping contact with the line wire received therein, these inner wall portions including deformable metal adjoining and entirely surrounding the line wire for engaging and sealing the connection between the wire and connector around the entire circumference of each of the line wires received within the connector at each place where compression is applied to the connector, resulting in a gas tight joint of low, constant electrical resistance. In other words, in a joint made with this multiple tube connector the sealing action between the connector and line wires is one hundred percent because the deformable metal portions of the sleeve connector entirely surround each wire and engage and seal the entire circumference of each of the line wires at the place where compression is applied to the connector. These joints are gas tight at pressures as high as twenty pounds to the square inch, and cause so little injury to the wire that it will develop 98 to 99% of the strength of the wire elsewhere in the span.

Figs. 10 and 11 are enlarged detailed views showing the sealing action due to the fact that the metal of the tubes 15 and 16 is actually caused to flow inwardly at the areas x, x shown in Fig. 10, and the metal of the wires caused to flow outwardly at the areas x', x' shown in Fig. 11. In the connectors of the invention, the compression tool may be applied at only two places, preferably at the ends a and b, Fig. 1, and it is possible to make a joint suitable for certain purposes in which the compression tool is applied at only one place.

Since the ends of the line wires protrude from and are visible when the wires are in place in the sleeve, there can be no uncertainty as to their position either before or after the joint is compressed, and therefore even though the lineman is careless in not applying the compressing tool adjacent to the ends of the sleeve, as shown in Fig. 2, nevertheless a good joint is obtained. When the ends of the line wires are bent, the unfinished joint becomes self-supporting and consequently no device is necessary to hold the wires before or during compression, thus enabling the lineman to make up the joint without using special equipment to support the joint while on a pole, and without assistance when on the ground.

If desirable or necessary, and as indicated in Fig. 7, keying particles 32 composed of metal harder than that of the sleeve and line wires, may be employed to give the joint greater holding power. Preferably, although not necessarily, the keying particles 32 are applied to the sleeve in the manner disclosed and claimed in a copending application of Dipkie and Wheeler, Ser No. 49,814 filed November 14, 1935.

Fig. 8 shows a modified form of the sleeve connector in which the tubes 33 and 34 are pressed from sheet material to the form shown, the edges of the sheet being brazed or otherwise suitably joined. When the compression tool is applied, the metal of the tubes is caused to flow around the conductors to seal the joint in the manner hereinbefore described, which action may be facilitated by the addition of extra metal in sections 35, 35'.

Fig. 9 shows another form of the connector in which the sleeves 36 and 37 are extruded or drilled, the connector also having extra metal in the section 38 to facilitate obtaining a gas tight joint.

Fig. 12 illustrates how the connector of the invention may advantageously be employed for dead-ending, and in this respect the connector has the additional advantage in that it does not require any twisting and therefore can be made up where the clearance would otherwise be too small to permit operation of a sleeve twisting tool. After the line wire *w* has been passed through the tube 15 and around the dead-end support *i*, the end *w''* of the line wire is passed back through the other tube 16 and bent over against the end of the tube as shown in the figure. The tubes are then compressed at *m* and *n* into intimate clamping contact with the line wire and its end, and thus provide a dead-end joint of mechanical strength sufficient to permanently hold the strain on the line wire.

Various other modifications and forms will readily suggest themselves to those skilled in the art without the exercise of inventive skill, and I therefore do not wish to be restricted except as indicated by the scope of the appended claims.

The invention claimed is:

1. An electrical line wire compression type multiple tube sleeve connector comprising two integrally joined tubular bodies formed of malleable metal, each of said tubular bodies having a bore for receiving a line wire, each of said tubular bodies having inner wall portions for compression into intimate clamping contact with the line wire received therein, said inner wall portions of each of the tubular bodies including deformable metal for adjoining and entirely surrounding the received line wire to engage and seal the connection between each of the line wires and connector around the entire circumference of each line wire at each place where compression is applied to the connector, to provide a gas tight joint of low, constant electrical resistance and of mechanical strength sufficient to permanently hold the strain on the line wires.

2. An electrical line wire compression type multiple tube sleeve connector comprising two integrally joined tubular bodies formed of malleable metal, each of said tubular bodies having a bore therethrough for receiving a line wire in such manner that the ends of the respective line wires protrude from opposite ends of the sleeve when the wires are in place in the sleeve, each of said tubular bodies having inner wall portions for compression into intimate clamping contact with the line wire received therein, said inner wall portions of each of the tubular bodies including deformable metal for adjoining and entirely surrounding the received line wire to engage and seal the connection between each of the line wires and connector around the entire circumference of each line wire at each place where compression is applied to the connector, to provide a gas tight joint of low, constant electrical resistance and of mechanical strength sufficient to permanently hold the strain on the line wires.

3. An electrical line wire compression type multiple tube sleeve connector comprising two integrally joined tubular bodies formed of malleable metal, each of said tubular bodies having a bore for receiving a line wire in such manner that the ends of the respective line wires are visible when in place in the sleeve, each of said tubular bodies having inner wall portions adjacent to each end of the tubular body for compression into intimate clamping contact at a plurality of places with the line wire received therein, said inner wall portions of each of the tubular bodies including deformable metal for adjoining and entirely surrounding the received line wire to engage and seal the connection between each of the line wires and connector around the entire circumference of each line wire at each of the plurality of places where compression is applied to the connector, to provide a gas tight joint of low, constant electrical resistance and of mechanical strength sufficient to permanently hold the strain on the line wires.

4. An electrical line wire compression type multiple tube sleeve connector comprising two integrally joined tubular bodies formed of malleable metal, each of said tubular bodies having a bore for receiving a line wire in such manner that the ends of the respective line wires are visible when in place in the sleeve, each of said tubular bodies having inner wall portions at each end and intermediate the ends of the tubular body for compression into intimate clamping contact at a plurality of places with the line wire received therein, said inner wall portions of each of the tubular bodies including deformable metal for adjoining and entirely surrounding the received line wire to engage and seal the connection between each of the line wires and connector around the entire circumference of each line wire at each of the plurality of places where compression is applied to the connector, to provide a gas tight joint of low, constant electrical resistance and of mechanical strength sufficient to permanently hold the strain on the line wires.

5. An electrical line wire compression type multiple tube sleeve connector comprising two integrally joined tubes formed of malleable metal, each of said tubes having a bore for receiving a line wire in such manner that the ends of the respective line wires are visible when in place in the sleeve, each of said tubes having inner wall portions for compression into intimate clamping contact with the line wire received therein, the sleeve having a section of metal disposed so as to flow inwardly around the line wires when compression is applied to the sleeve, said inner wall portions and said section of metal being adapted to adjoin and entirely surround each of the received line wires for engaging and sealing the connection between the wires and connector around the entire circumference of each wire received within the sleeve at each place where compression is applied to the sleeve, thereby to provide a gas tight joint of low, constant electrical resistance and of mechanical strength sufficient to permanently hold the strain on the line wires.

6. An electrical line wire compression type multiple tube sleeve connector comprising two integrally joined tubes formed of malleable metal, each of said tubes having a bore for receiving a line wire in such manner that the ends of the respective line wires are visible when in place in the sleeve, each of said tubes having inner wall portions for compression into intimate clamping contact with the line wire received therein, and a section of metal disposed at the jointure of the tubes to flow in around the line wires when compression is applied to the sleeve, said inner wall portions and said section of metal being adapted to adjoin and entirely surround each of the received line wires for engaging and sealing the connection between the wires and connector around the entire circum-

ference of each wire received within the sleeve at each place where compression is applied to the sleeve, thereby to provide a gas tight joint of low, constant electrical resistance and of mechanical strength sufficient to permanently hold the strain on the line wires.

7. An electrical line wire compression type multiple tube sleeve connector comprising two malleable metal tubes brazed together, each of said tubes having a bore for receiving a line wire, each of said tubes having inner wall portions for compression into intimate clamping contact with the line wire received therein, and a section of metal including brazing metal disposed at the jointure of the tubes to flow inwardly around the line wires when compression is applied to the sleeve, said inner wall portions and said section of metal being adapted to adjoin and entirely surround each of the received line wires for engaging and sealing the connection between the wires and connector around the entire circumference of each wire received within the sleeve at each place where compression is applied to the sleeve, thereby to provide a gas tight joint of low, constant electrical resistance and of mechanical strength sufficient to permanently hold the strain on the line wires.

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