W. S. THOMAS.

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APPLICATION FILED FEB. 10, 1920.

1,383,675.

Patented July 5, 1921.

3 SHEETS—SHEET 1.

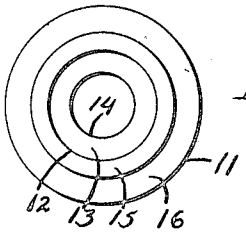


Fig. 1

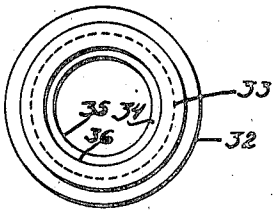


Fig. 3

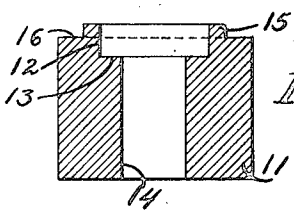


Fig. 2

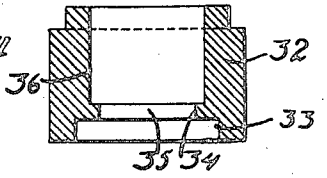


Fig. 4

Fig. 5

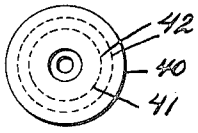


Fig. 9

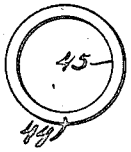


Fig. 7

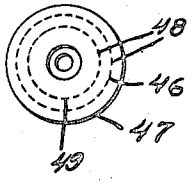


Fig. 6

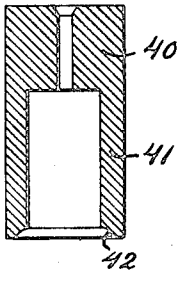


Fig. 10

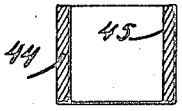
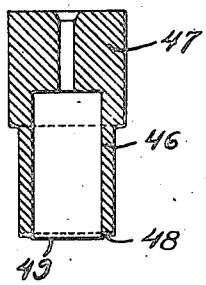


Fig. 8



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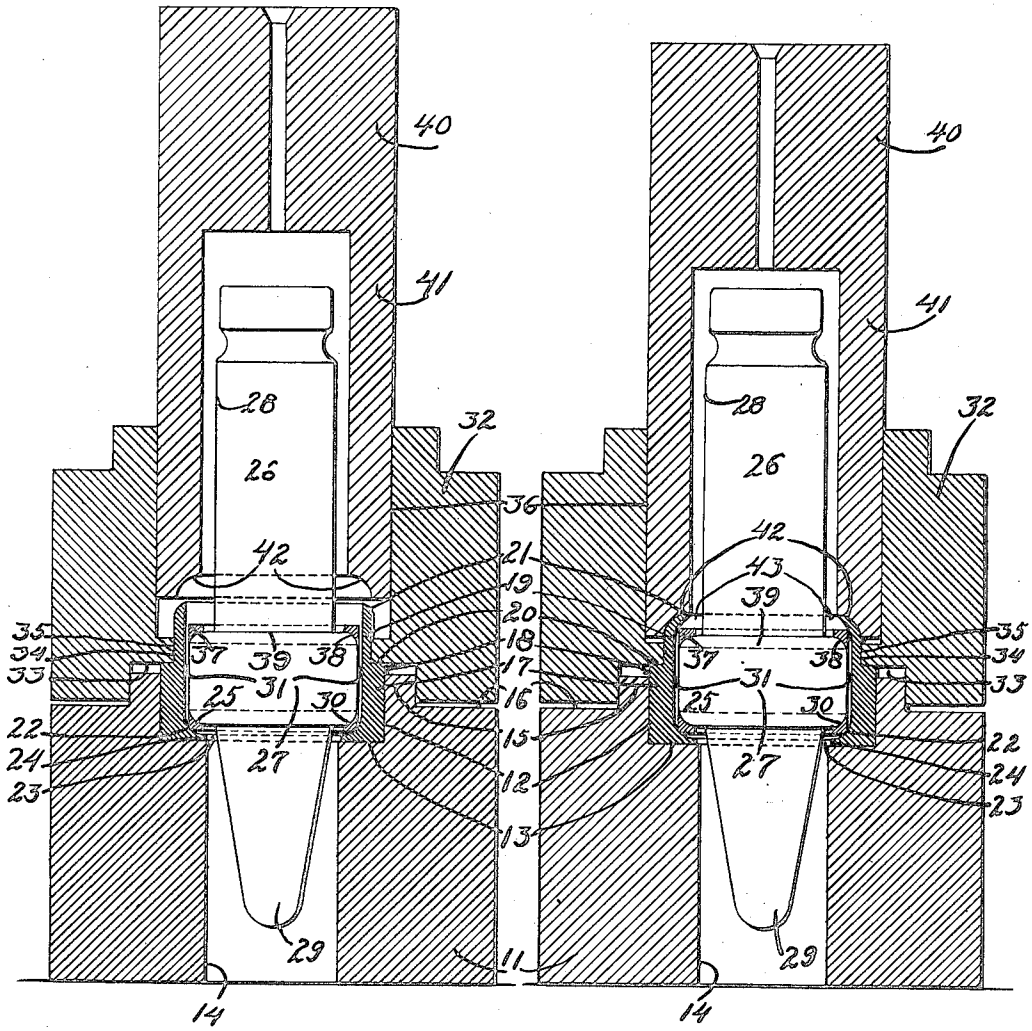
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3 SHEETS—SHEET 2.

Fig. 11

Fig. 12



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3 SHEETS—SHEET 3.

Fig. 13

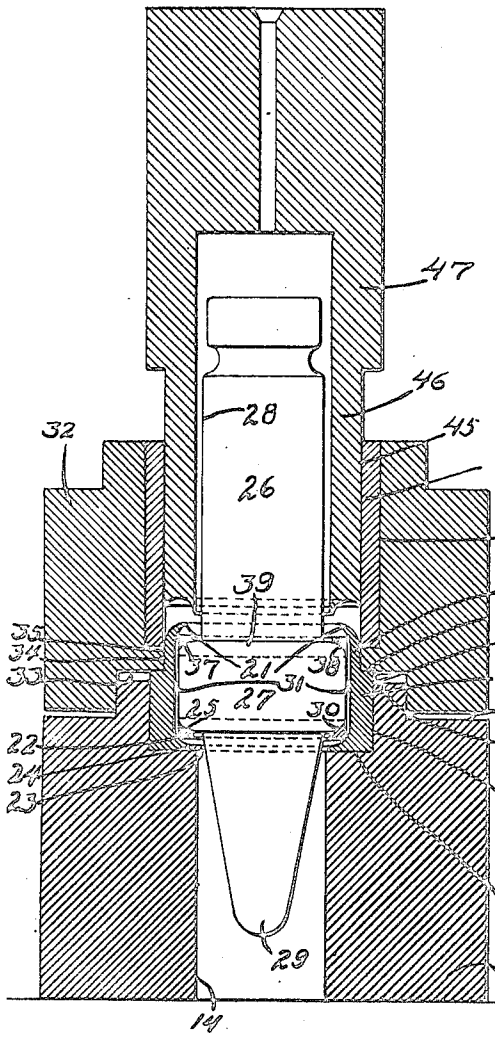
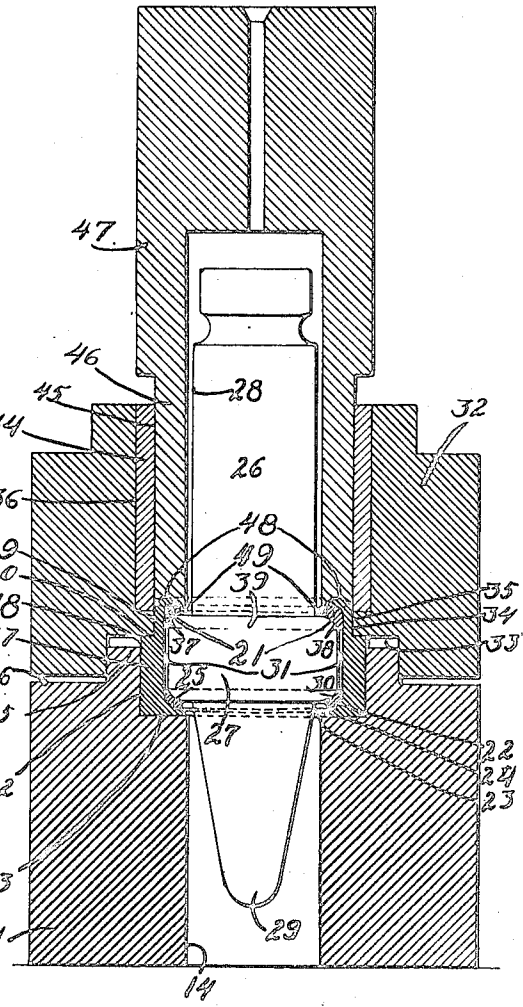


Fig. 14



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UNITED STATES PATENT OFFICE.

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1,383,675. Specification of Letters Patent. Patented July 5, 1921.

Application filed February 10, 1920. Serial No. 357,722.

To all whom it may concern:

Be it known that I, WILLIAM S. THOMAS, a citizen of the United States, residing at Lock Haven, in the county of Clinton and State of Pennsylvania, have invented certain new and useful Improvements in Dies, of which the following is a specification.

Readily removable electrode insulators for spark plugs, such for example as used in internal combustion engines, are usually provided with metallic jackets for the purpose of taking the thrust of the clamping gland nut when the latter is used to secure the electrode insulator to the body portion of the spark plug. It is quite obvious that the above mentioned metallic jackets are necessary for the purpose specified for the reason that insulators are usually made of porcelain or other non-metallic material which is easily cracked and that it would not be practical to directly jam nuts or other binding portions directly against the porcelain insulator. However, it has long been a source of trouble and a difficult problem to apply the metallic jackets to the porcelain insulators for the reason that if the jacket is clamped with sufficient pressure against the porcelain insulator so as to prevent leakage of the products of combustion and also transverse current leakage there is a possibility that in securing the jacket to the porcelain insulator the insulator will be cracked and thereby destroy the value of the insulator and render it either totally inoperative or cause the same to permit current leakage through the cracked portion of the insulator. Another of the past difficulties in jacketing porcelain insulators made prior to my invention is that unless there is a possible chance for expansion of the insulator which necessarily occurs due to the extremely high temperature to which the insulator is subjected, the insulator is liable to crack for the reason that it will jam against portions of the jacket which are unyieldable.

One object of my invention is to provide an improved set or series of dies whereby jackets of the above type can be placed upon porcelain or other insulators in such manner that they will not cause the cracking of the insulator either during the application of the jacket to the insulator or during the use of the insulator as a part of a spark plug.

Another object is to so construct and arrange my improved dies that when a jacket is applied by the use of said dies, an efficient seal will be provided between the insulator and the jacket to prevent passage of oils or products of combustion therebetween and at the same time the insulator will be free to expand and contract within the jacket without causing cracking of the insulator or any detrimental effect to the insulator.

Insulators of the above type usually have an enlarged portion between their ends; said enlarged portion being in the form of an annulary extending flange.

Another object of my invention is to produce dies which can be operated in such manner as to place a jacket upon an insulator of the above type so that the jacket will be confined entirely to said flange and so that no portion of the jacket will engage the insulator above or below said flange. Thus an insulator having a jacket placed thereon by the use of my improved dies will have said jacket secured to its strongest portion and not in contact with the portions of less diameter.

These objects, and other advantageous ends which will be described hereinafter, I attain in the following manner, reference being had to the accompanying drawings in which—

Figure 1 is a top plan view of a base or primary die constructed in accordance with my invention,

Fig. 2 is a central sectional elevation of the die shown in Fig. 1,

Fig. 3 is a plan view of a top die constructed in accordance with my invention.

Fig. 4 is a central sectional elevation of the die shown in Fig. 3,

Fig. 5 is a top plan view of a primary plunger die forming a part of my invention,

Fig. 6 is a central sectional elevation of the die shown in Fig. 5,

Fig. 7 is a top plan view of a secondary plunger die which forms a part of my invention,

Fig. 8 is a central sectional elevation of the die shown in Fig. 7,

Fig. 9 is a top plan view of a collar die which I preferably use,

Fig. 10 is a central sectional elevation of the collar die shown in Fig. 9, and

Figs. 11 to 14 inclusive are enlarged sectional views illustrating the application of my improved set or series of dies in various positions which they occupy in securing a jacket to an electrode insulator such for ex-

ample as described in my co-pending application for process patent, Serial No. 357,723.

In the following description I will describe the dies and their action as they operate to place a jacket upon an insulator of the above described type in accordance with the description of the process, such for example as carried out in my above mentioned application for patent.

Referring to the drawings, 11 represents a central sectional elevation of a base or primary die which at its top has a recess 12; the bottom of the recess forming a shoulder 13. A hole 14 extends through the body of the die 11 from the recess downwardly and a flange 15 surrounds the recess. The top 16 below the flange 15 forms a ledge for a purpose hereinafter described. A metallic jacket 17 has a cylindrical portion 18 of the same diameter as that of the recess 12 and is adapted to fit within the recess and rest upon the shoulder 13 as clearly shown in Fig. 11. The jacket 17 is hollow in the form of a collar and the flange 19 projects upwardly from the portion 18; said flange having its inner surface of the same diameter as the upper part of the inner surface of the cylindrical portion 18. However, the flange 19 is of less external diameter than the internal diameter of the cylindrical portion 18 so that a ledge 20 is provided. The extreme top portion of the flange 19 is beveled or chamfered inwardly as shown at 21. The lower part of the inner surface of the cylindrical portion 18 is curved inwardly to a smaller diameter as shown at 22 and a hole 23 extends through the cylindrical portion 18; said hole being of less diameter than the internal diameters of the cylindrical portion 18 and flange 19. Thus an inwardly projecting annular flange 24 is provided.

After placing the jacket 17 within the recess 12 as above described a ring washer 25 is inserted within the jacket. This ring washer is of less external diameter than the internal diameters of the flange 19 and upper part of the cylindrical portion 18 but is of greater external diameter than the diameter of the hole 23. Thus the ring washer rests upon the curved surface 22 of the inwardly projecting annular flange 24.

An electrode insulator 26, which may be made of porcelain, has an enlarged annular flange 27 between its ends 28 and 29. After the ring washer 25 has been inserted within the jacket, the insulator is placed within the jacket so that the lower surface of the flange 27 rests on the upwardly curved surface 30 of the ring washer 25 and the lower end 29 of the insulator extends through the ring washer 25, hole 23 of the jacket 17 and into the hole 14 of the base die 11. The flange 27 of the insulator is of less external diameter than the internal diameters of the upper part of the cylindrical portion 18 and flange 19 of the jacket 17. Thus there is a space 31 provided between the flange 27 and the jacket 17. After the insulator has thus been inserted, a top die 32 is placed upon the base die 11; said top die having a cavity 33 into which the flange 15 of the base die 11 fits. An inwardly extending flange 34 of the top die 32 above the cavity 33 snugly fits around the flange 19 of the jacket 17 below its top and rests upon the ledge 20 of the jacket 17. Thus a hole 35 is produced by the flange 34 through which the flange 19 of the jacket 17 projects, and a recess 36 extends upwardly from the flange 34 to the upper surface of the top die 32. With this construction it will be noted that the portion of the flange 19 of the jacket 17 above the flange 34 of the top die 32 extends into the recess 36 of the top die. Before the top die has thus been placed, a second ring washer 37 is dropped over the end 28 of the insulator 26 and this washer 37 has a downwardly curved surface 38 which fits against the top rounded edge 39 of the flange 27 of the insulator 26. The ring washer 37 is of less external diameter than the internal diameter of the flange 19 of the jacket 17 and the flange 27 of the insulator 26 is of such height or width that when thus positioned the ring washer 37 will be at a level below the top of the flange 19. The ring washers 25 and 37 are preferably made of a softer metal than that from which the jacket 17 is made, for example the jacket 17 may be made of steel and the ring washers 25 and 37 may be made of copper.

After the ring washer 37 has thus been placed, a primary plunger die 40 which has a sleeve portion 41 for encircling the upper end of the electrode insulator 26 is inserted within the recess 36. This plunger die 40 has an inwardly curved surface 42 which is of such diameter and curvature that when moved downwardly upon the chamfered upper edge 21 of the flange 19 as shown in Fig. 12, the upper edge portion of the flange 19 will be turned over the top of the ring washer 37. However it is important here to note that the extreme edge portion 21 is not bent inwardly a sufficient distance to touch the insulator 26. In other words, as clearly shown in Fig. 12, a space 43 exists between the edge 21 and the insulator 26.

After the upper edge portion of the jacket flange 17 has thus been turned, the primary plunger die 40 is removed from the recess 36 and a collar 44 is inserted within the recess 36 as clearly shown in Fig. 13. This collar is of an internal diameter equal to the external diameter of the jacket flange 19 which has not been turned inwardly and the lower end of the collar 44 rests on the top of the flange 34. This collar 44 provides another recess 45 into which the lower sleeve end 46 of a secondary plunger die 47 is in-

serted. The lower end 48 of the secondary plunger die 47 is curved from a diameter less than the diameter of the hole formed by the turned-in edge 21 to a diameter greater than that of the hole formed by the turned-in edge 21 so that when the die 47 moves inwardly the inner part 49 of the die will pass within the hole formed by said turned-in edge 21 of the jacket flange 19 and the remaining part of the curved surface 48 will bend the edge portion 21 of the jacket downwardly to provide a hooked flange and at the same time will compress the ring washers 25 and 37 against the top and bottom rounded edges of the insulator flange 27 and the inner surface of the jacket. It will be noted however that the part 49 of the secondary plunger die 47 will prevent any portion of the jacket flange 19 from engaging the insulator as is clearly shown in Fig. 14. It will be further noted that by thus making a hooked flange at the top, the upper ring washer will be confined within the rounded edge 39. This latter action of the secondary plunger die 47 will also crush the lower ring washer 25 against the curved surface 22 of the collar and will be firmly lodged between said surface 22 and the lower rounded edge of the insulator flange 27. Thus the space 31 above described will be preserved between the ring washers 25 and 37 and the adjacent surfaces of the flange 27 and jacket 17. This space will permit expansion and also serve as an insulating space and by an inspection of Fig. 14 it will be noted that any strain which is placed upon the insulator will occur directly against the enlarged and strong flange 27. Furthermore by the use of my above mentioned set or series of dies the pressure exerted by the ring washers upon the insulator will be diagonally across the flange 27 and in this manner the weaker portions of the insulator will be free of any strains due to the pressure exerted between the jacket, the ring washers and the insulator.

While I have described my invention as taking a particular form, it will be understood that the various parts of my invention may be changed without departing from the spirit thereof, and hence I do not limit myself to the precise construction set forth, but consider that I am at liberty to make such changes and alterations as fairly come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A set of dies, for securing a jacket to an insulator which has an enlarged flange between its ends, including a base die having a recess into which the jacket can be seated; a top die fitting said base die and including a hole for embracing said jacket below the upper edge thereof, said top die including a recess above said flange; and a plunger die movable downwardly within said recess and having a portion adapted to engage and turn inwardly said upper edge of the jacket whereby when said flange of the insulator is placed within said jacket, the edge of said jacket can be turned over the flange of the insulator; substantially as described.

2. A set of dies, for securing a jacket to an insulator which has an enlarged flange between its ends, including a base die having a recess into which the jacket can be seated; a top die fitting said base die and including a hole for embracing said jacket below the upper edge thereof, said top die including a recess above said flange; a plunger die movable downwardly within said recess and having a portion adapted to engage and turn inwardly said upper edge of the jacket whereby when said flange of the insulator is placed within said jacket, the edge of said jacket can be turned over the flange of the insulator; and a second plunger die movable into said recess of the top die and having a portion movable into engagement with said turned edge of the jacket for bending the same within the jacket to produce an inturned hooked flange; substantially as described.

3. A set of dies, for securing a jacket to an insulator which has an enlarged flange between its ends, including a base die having a recess into which the jacket can be seated; a top die fitting said base die and including a hole for embracing said jacket below the upper edge thereof, said top die including a recess above said flange; a plunger die movable downwardly within said recess and having a portion adapted to engage and turn inwardly said upper edge of the jacket whereby when said flange of the insulator is placed within said jacket, the edge of said jacket can be turned over the flange of the insulator; and a second plunger die movable into said recess of the top die and having a portion movable into engagement with said turned edge of the jacket for bending the same within the jacket to produce an inturned hooked flange, said second plunger die having a portion adapted to position itself between said inturned edge of the jacket and the insulator at the portion at one side of its flange whereby said hooked flange is prevented from contacting with said latter portion of the insulator; substantially as described.

4. A set of dies, for securing a jacket to an insulator which has an enlarged flange between its ends, including a base die having a recess into which the jacket can be seated; a top die fitting said base die and including a hole for embracing said jacket below the upper edge thereof, said top die including a recess above said flange; a plunger die movable downwardly within said re-

cess and having a portion adapted to engage and turn inwardly said upper edge of the jacket whereby when said flange of the insulator is placed within said jacket, the edge of said jacket can be turned over the flange of the insulator; a second plunger die movable into said recess of the top die and having a portion movable into engagement with said turned edge of the jacket for bending the same within the jacket to produce an inturned hooked flange, said second plunger die having a portion adapted to position itself between said inturned edge of the jacket and the insulator at the portion at one side of its flange whereby said hooked flange is prevented from contacting with said latter portion of the insulator; and a collar die interposed between said second plunger and the top die, said collar forming a guideway for said second plunger and also serving to prevent outer spreading of the jacket during the action of said second plunger; substantially as described.

5. A set of dies for securing a jacket to an insulator which has an enlarged flange, including a die having a hole providing an inner surface for engagement with the outer surface of said jacket whereby the jacket is held against spreading; and a plunger die having a portion adapted to engage and turn inwardly an edge of said jacket whereby when said flange of the insulator is placed within said jacket, said edge of the jacket can be turned over the flange of the insulator; substantially as described.

6. A set of dies for securing a jacket to an insulator which has an enlarged flange, including a die having a hole providing an inner surface for engagement with the outer surface of said jacket whereby the jacket is held against spreading; and a plunger die having a portion adapted to engage and turn inwardly an edge of said jacket whereby when said flange of the insulator is placed within said jacket, said edge of the jacket can be turned over the flange of the insulator, said plunger die having a portion adapted to keep between said edge of the jacket and the insulator during the turning action to prevent said edge from engaging the material of the insulator; substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM S. THOMAS.

Witnesses:
ANNA RENTON.
CHAS. E. POTTS.