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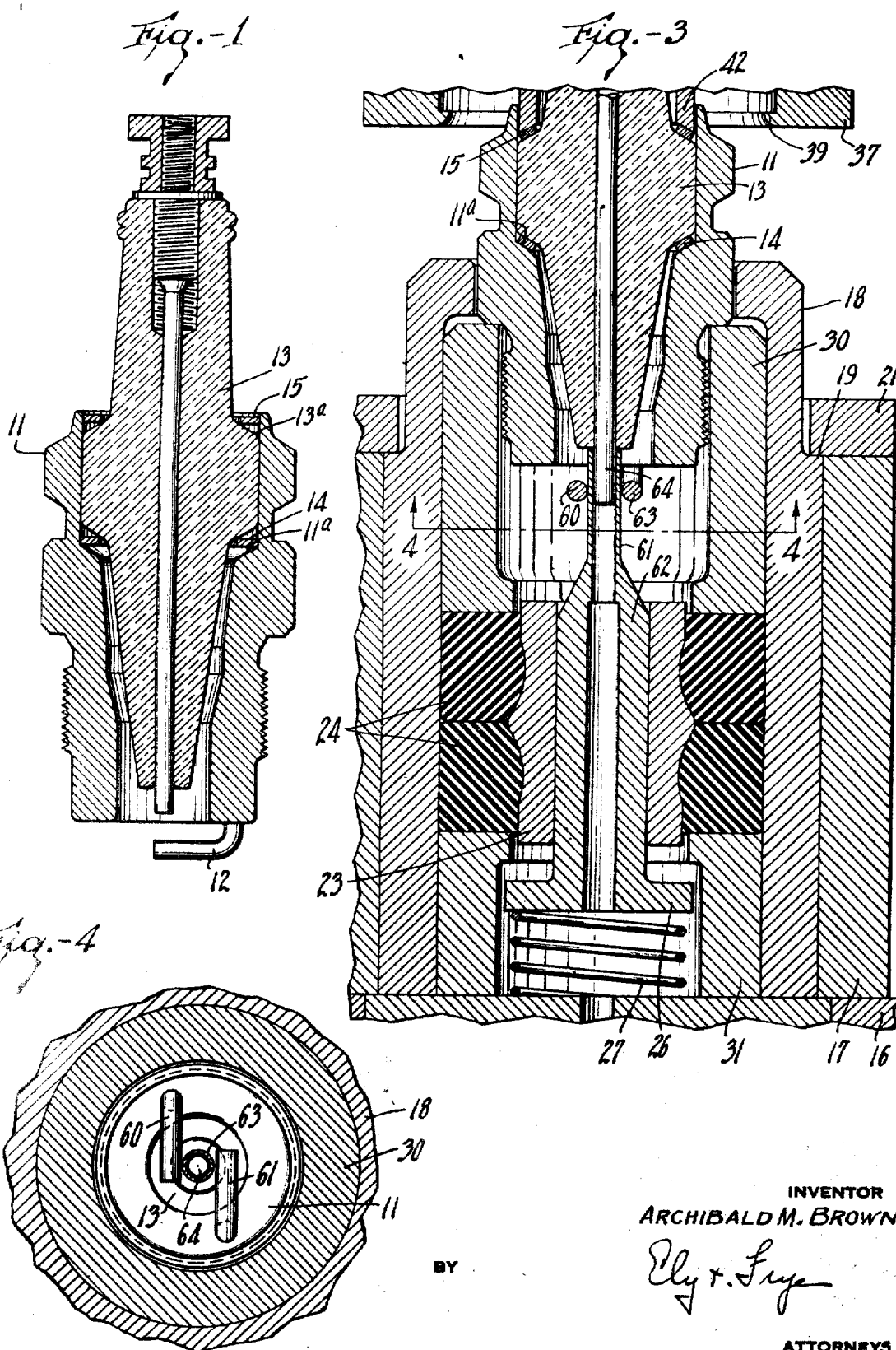
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2,272,882

APPARATUS FOR ASSEMBLING SPARK PLUGS

Filed July 16, 1938

2 Sheets-Sheet 1



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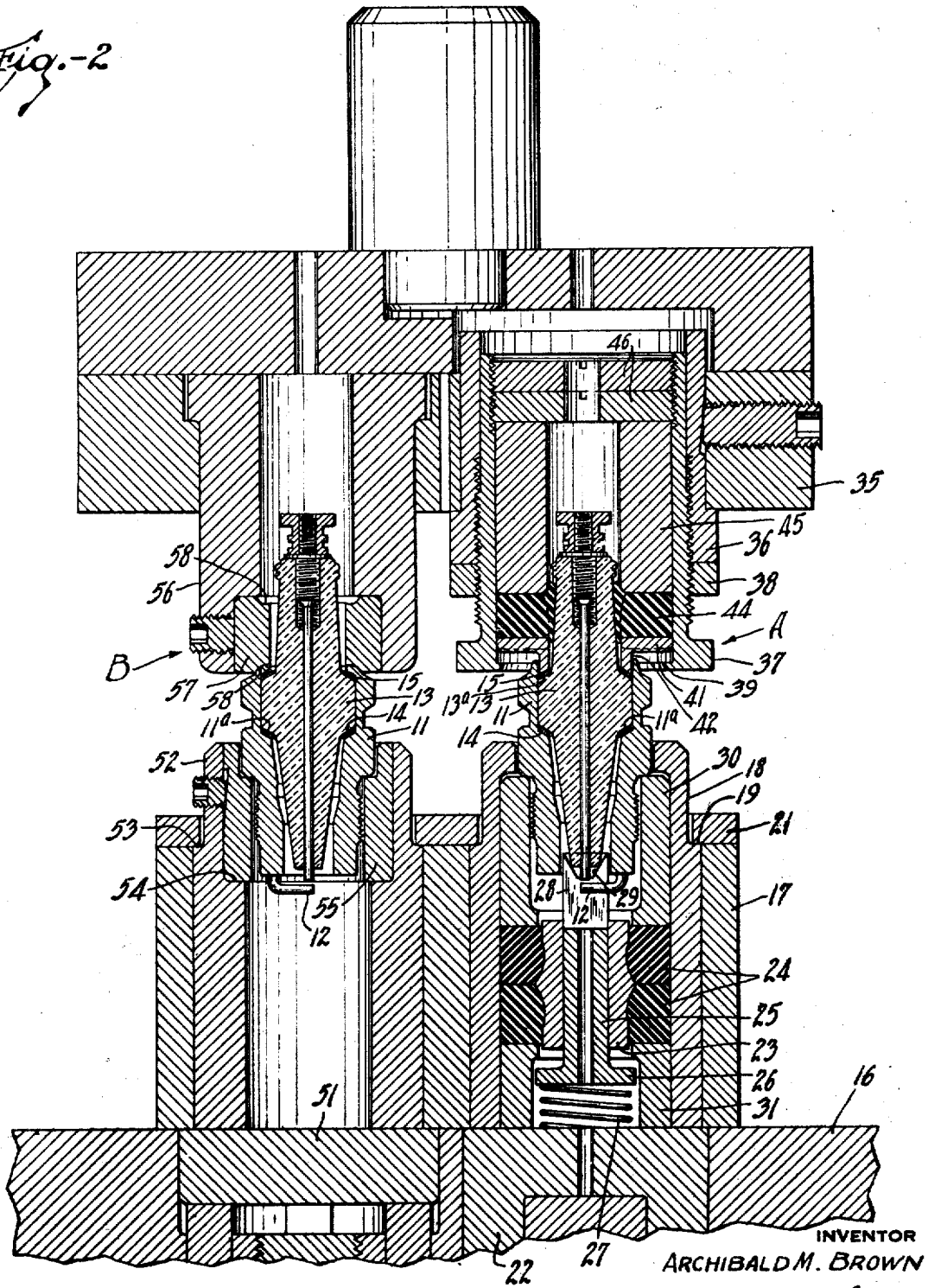
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Fig.-2



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APPARATUS FOR ASSEMBLING SPARK
PLUGS

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6 Claims. (Cl. 29—84)

This invention relates to apparatus for assembling spark plugs, and more especially it relates to improved mechanism for assembling the porcelains and metal washers in metal spark plug shells of the crimped type.

The present invention is an improvement upon the spark plug assembling apparatus shown and described in my previous Patent No. 2,106,451 issued January 25, 1938. While the apparatus disclosed in that patent functions satisfactorily and assembles spark plugs in a manner superior to that of other apparatus, it still occasionally breaks the porcelains in such operations. This breakage usually is due to variations in the shape of porcelains with the previous type of apparatus being adapted to handle most but not all of such eccentric, or untrue porcelains.

The general object of this invention is to overcome the foregoing disadvantage of known types of apparatus for assembling spark plugs and to provide apparatus for assembling and centering porcelains in spark plugs without breakage of the porcelains even though such porcelains be of untrue shape.

The foregoing and other objects are achieved by providing a resilient centering guide for the lower portion of the porcelain while also using a resilient centering member for the upper portion of the porcelain. Thus the centering members can adjust themselves to compensate for slight deviations in the shape of the porcelain from the true shape.

In the accompanying drawings;

Figure 1 is a vertical section of a spark plug prior to being acted upon by the apparatus of the invention;

Figure 2 is a vertical section of apparatus embodying the invention;

Figure 3 is a vertical section through a second form of apparatus embodying the invention; and

Figure 4 is a transverse section taken on line 4—4 of Figure 3.

Referring to the drawings, Figure 1 shows a spark plug of the crimp type in its initially assembled condition. This spark plug comprises a metal shell 11, having an electrode 12 extending from the bottom thereof and an annular shoulder 11a in the bore thereof, in which is received a porcelain 13 having an annular flange 13a adapted to mate with the shoulder 11a intermediate its ends. A deformable gasket 14 that is carried by shoulder 11a of the metal shell 11 supports porcelain 13 thereon while a second deformable gasket 15 is carried by the upper surface of the flange 13a. This spark plug is per-

manently assembled by two steps, the first of which comprises simultaneously telescoping the porcelain 13 down into its seat in the metal shell 11 and deforming the gaskets 14 and 15, and, secondly the upper edge of the metal shell 11 is crimped around and down upon the gasket 15 and the porcelain 13 to hold them in place. In Figure 2 the apparatus for performing the first of these actions is indicated generally by A while the apparatus for performing the second of these steps is indicated by B.

The apparatus A includes a die shoe 16 which carries a die holder 17 on its upper surface. The die holder receives a die positioning sleeve 18 therein, which sleeve is of reduced diameter adjacent its upper end to form a shoulder 19 thereon. The die positioning sleeve 18 is held in place by an apertured face plate 21 which engages with the shoulder 19 and is supported by a resiliently supported pressure block 22. A centering sleeve guide 23 is received in the die positioning sleeve 18 and is secured therein by two resilient bushings 24, which are made of any suitable material such as rubber, the bushings 24 being carried by the guide 23 and slidably received in the die positioning sleeve. Figure 2 shows that the ends of the centering sleeve guide 23 protrude a slight distance from the bushings 24. A centering sleeve 25 is slidably received in the bore of the centering sleeve guide 23 and it extends from both ends thereof. A head 26 is formed on the lower portion of the centering sleeve 25 while a light spring 27 is placed between the head 26 and the pressure block 22 to urge the centering sleeve upward to engage with the porcelain 13. The upper portion of the centering sleeve comprises bifurcated arms 28 which have a downwardly extending, frusto-conical recess 29 formed in their ends, which recess is provided to receive and center the lower end of the porcelain 13. A tubular centering die 30, which is adapted to engage with a shoulder on the metal shell 11, is slidably received in the die positioning sleeve 18 and is supported by the bushings 24. The upper end of the die positioning sleeve 18 is constructed to limit the position that the shell 11 assumes on the die 30. A tubular support 31 is received in the die positioning sleeve between the lower portion of the rubber bushings 24 and the pressure block 22 to transmit force applied to the rubber bushings by the die 30 to the pressure block.

Figure 2 shows that the cone shaped recess 29 of the centering sleeve 25 engages with the lower end of a porcelain in the metal shell sup-

ported on the die 38 and that the electrode 12 on the metal shell is received in the opening between the arms 28. The ends of the centering sleeve guide 23 are loosely received in the ends of the die 38 and support 31 to retain it in approximately the center of the apparatus and to permit the centering guide to align itself with the porcelain, prior to telescoping the porcelain into the shell.

To telescope the porcelain into its seat in the metal shell and deform the gaskets 14, means such as those disclosed in my previously identified patent may be used. These means include a punch holder 35 to which is imparted determinate vertically reciprocating movement by any suitable means (not shown). A bushing 36 having threads cut in the lower portion of its bore is secured in the punch holder 35 by a set screw. This bushing receives and engages with a punch positioning sleeve 37 that is locked in its given position by a lock nut 38. The punch positioning sleeve 37 has a small radially inwardly extending flange 39 formed on its lower end and this confines a centering punch 41 therein which has an annular flange 42 extending downwardly therefrom and outlining a central aperture therein. The flange 42 is adapted to be placed around the porcelain 13 and engage with the gasket 15 to press it against the shoulder 13a when the punch holder is moved into the position shown in Figure 2. An annular ring 44, which normally is made from rubber, is placed above the center punch 41 to engage the upper portion of a porcelain while it is being telescoped into its seat in the metal shell. The ring 44, is backed by a tubular spacer 45 which abuts against nuts 46 that are secured to the punch holder 45. Figure 2 shows the apparatus when some pressure is being applied to the assembled spark plug whereby the ring 44 is deformed, as shown, and the centering punch 41 is raised up from its seat on the flange 39 on the punch holder.

It will be observed that the rubber bushings 24 which mount the centering sleeve guide 23 and thereby the centering sleeve 25 in the die positioning sleeve 18 can be compressed to permit slight lateral movement of the lower end of the porcelain 13 as it is being telescoped into the metal shell. Thus if the porcelain is of slightly irregular shape the bushings 24 permit the centering sleeve 25 to take and retain a slightly eccentric position relative to the metal shell. Such slight eccentricity does not impair the functioning of the assembled spark plug and prevents breakage of the porcelains while assembling the spark plug. This feature of the apparatus differs it appreciably from the rigid lower centering device employed in previous types of centering apparatus. The conical recess 29, being appreciably larger than the lower end of the porcelain 13 does not restrain the porcelain's initial tendency to oscillate as the porcelain is telescoped into position. In all events, the centering sleeve tends to center the porcelain in the shell and maintain it there even though not fixedly holding it in such position.

In the apparatus indicated at B, a pressure support 51 carries a tubular member 52 that has a reduced diameter upper end forming a shoulder 53. The member 52 is retained in position by the shoulder 53 engaging with the face plate 21. A shoulder 54 is formed in the bore of the member 52 and it supports a tubular seat 55 that is received in the member 52. The seat 55 is adapt-

ed to receive a spark plug therein and mount it for the operation of crimping the spark plug shell into its final position.

To crimp the metal shell 11, the punch holder 35 carries a punch 56 which has a punch filler 57 secured in its lower end. The punch filler 57 has annular grooves 58 formed in the ends thereof adjacent its bore which grooves are designed to crimp the upper edge of the metal shell 11 down upon the gasket 15 to retain the spark plug in the position given it by the apparatus A.

Figure 3 shows apparatus constructed in accordance with the invention for centering spark plugs carrying two electrodes 60 and 61 on the metal shell. This embodiment of the invention is identical with that shown in A of Figure 2 except that the centering sleeve 62 has a small, tubular upper portion 63 in place of the bifurcated arms 28. The end of the portion 63 is beveled inwardly and receives the lower end of the center electrode 64 of the porcelain to be centered to maintain it in the center of the metal shell in a manner similar to that of the apparatus shown in Figure 2.

Figure 4 indicates that a small clearance remains between the portion 63 of the centering sleeve 62 and the electrodes on the spark plug whereby slight movement of the porcelain may occur in telescoping it into the metal shell and whereby the porcelain may assume a slightly eccentric position in the metal shell.

In accordance with the patent statutes, I have illustrated and described the structure and mode of operation of a complete embodiment of the invention. However, it will be understood that various modifications can be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. Apparatus for assembling spark plugs including a metal shell and a porcelain received in the shell, said apparatus comprising a relatively stationary positioning sleeve, a centering sleeve guide received in said positioning sleeve, a rubber bushing carried by said centering sleeve guide and being snugly received in the bore of said positioning sleeve, said centering sleeve guide protruding slightly from said rubber bushing, a tubular centering die for a tubular metal shell slidably received in said positioning sleeve and being supported by said rubber bushing, supporting means engaging with the lower portion of said rubber bushing, means for forcing a porcelain into telescoped relation with a metal shell on said tubular die, a centering sleeve slidably received in said centering sleeve guide and extending from the ends thereof, and means engaging with the lower end of said centering sleeve to urge it upwardly, the upper end of said centering sleeve being bifurcated and having a downwardly extending conical recess of appreciable size formed therein which is adapted to engage with and center the lower end of the porcelain in the metal shell on said die, said centering sleeve being resiliently positioned for limited lateral movement by said centering sleeve guide and said rubber bushing, whereby the porcelain may move laterally slightly when being telescoped into the metal shell without being broken and still be substantially centered in the shell.

2. Apparatus for assembling spark plugs including a metal shell and a porcelain received in the shell, said apparatus comprising a positioning sleeve, a centering sleeve guide received in said positioning sleeve, a rubber bushing car-

ried by said centering sleeve guide and being snugly received in the bore of said positioning sleeve, said centering sleeve guide protruding slightly from said rubber bushing, a tubular centering die slidably received in said positioning sleeve and being supported by said rubber bushing, supporting means engaging with the lower portion of said rubber bushing, means for forcing a porcelain into telescoped relation with a metal shell on said tubular die, and a centering sleeve slidably received in said centering sleeve guide, the upper end of said centering sleeve having a downwardly extending conical recess formed therein which is adapted to engage with and center the lower end of the porcelain in the metal shell on said die, said centering sleeve being resiliently positioned for limited lateral movement by said centering sleeve guide and said rubber bushing whereby the porcelain may move laterally slightly when being telescoped into the metal shell without being broken.

3. Apparatus for assembling spark plugs including a metal shell and a porcelain received in the shell, said apparatus comprising a positioning sleeve, a centering sleeve guide received in said positioning sleeve, a rubber bushing carried by said centering sleeve guide and being snugly received in the bore of said positioning sleeve, a centering die slidably received in said positioning sleeve and being supported by said rubber bushing, means for forcing a porcelain into telescoped relation with a metal shell on said die, a centering sleeve slidably received in said centering sleeve guide, and means engaging with the lower end of said centering sleeve to urge it upwardly, the upper end of said centering sleeve being bifurcated and having a downwardly extending conical recess formed therein which is adapted to engage with and center the lower end of the porcelain in the metal shell on said tubular support, said centering sleeve being resiliently positioned for limited lateral movement by said centering sleeve guide and said rubber bushing.

4. Apparatus for assembling spark plugs including a metal shell and a porcelain received in the shell, said apparatus comprising a positioning sleeve, a centering sleeve guide received in

said positioning sleeve, a rubber bushing carried by said centering sleeve guide and being snugly received in the bore of said positioning sleeve, a centering die slidably received in said positioning sleeve and being supported by said rubber bushing, means for forcing a porcelain into telescoped relation with a metal shell on said die, and a centering sleeve slidably received in said centering sleeve guide, the upper end of said centering sleeve extending upwardly from said centering sleeve guide and being adapted to engage with and center the lower end of the porcelain in the metal shell on said tubular support, but to enable limited off-center positioning of untrue porcelains due to the resiliency of said rubber bushing.

5. In apparatus for assembling spark plugs, a positioning sleeve, supporting means received in said positioning sleeve for supporting a spark plug shell adapted to receive a porcelain therein, centering means of appreciably smaller outside diameter than the inside diameter of said positioning sleeve received therein and adapted to engage with and center a porcelain carried by a spark plug shell on said supporting means, means resiliently supporting said centering means for vertical movements, and resilient means interposed between said centering means and said positioning sleeve to center, normally, said centering means in said positioning sleeve but permit limited lateral movement of said centering means.

6. In apparatus for assembling spark plugs, supporting means for a tubular spark plug shell, centering means for engaging the lower end of a porcelain carried by a supported shell to center it therein, means for resiliently supporting said centering means for vertical movement, a rubber sleeve positioned around said centering means, and confining means for said rubber sleeve for positioning same and limiting the movement thereof, said rubber sleeve mounting said centering means for limited lateral movement but normally maintaining same in a given centering position, said supporting means being supported by said rubber sleeve to mount same resiliently.

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