C. H. POSTEL.

SPARK PLUG ASSEMBLING MACHINE.

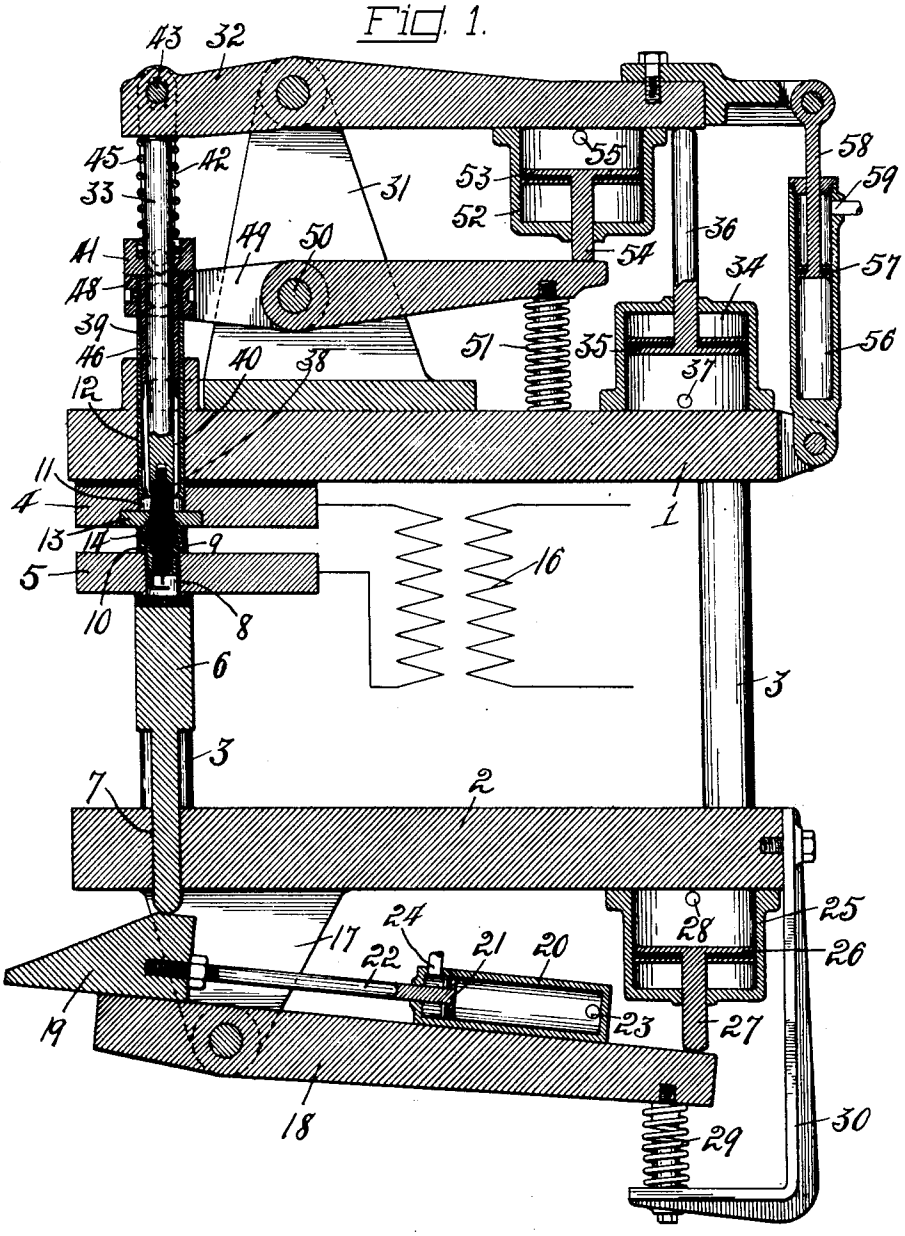
APPLICATION FILED APR. 29, 1915.

1,173,214.

Patented Feb. 29, 1916.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

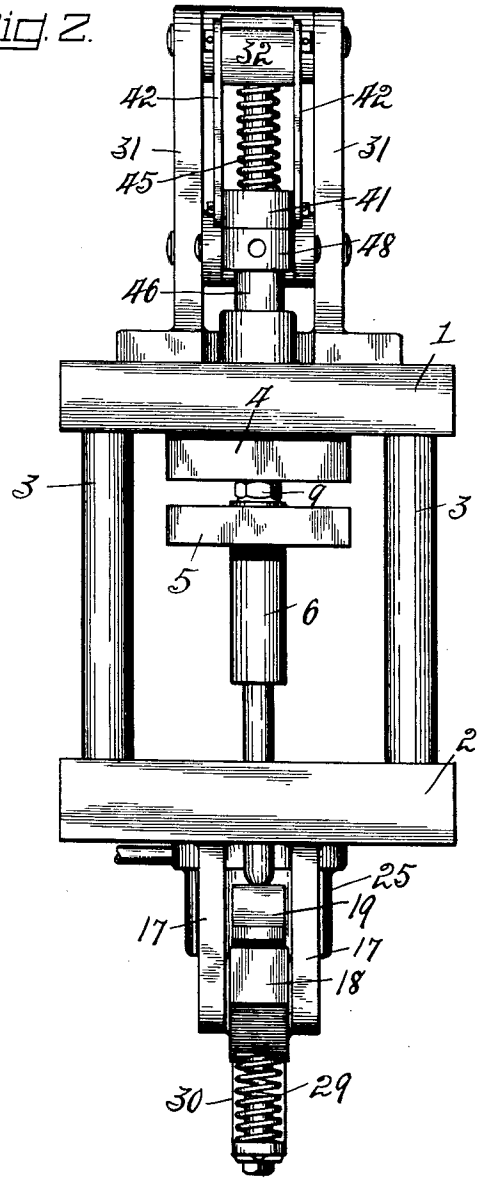
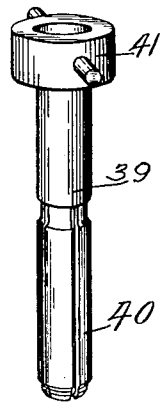


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 3.

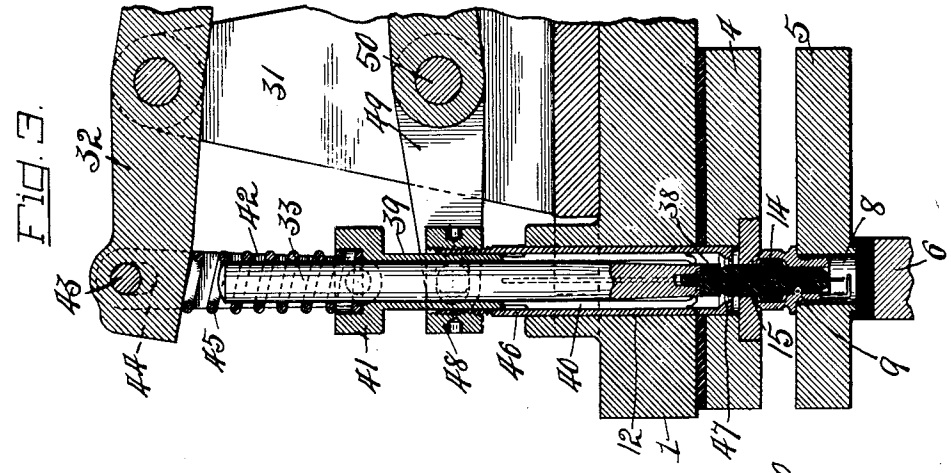
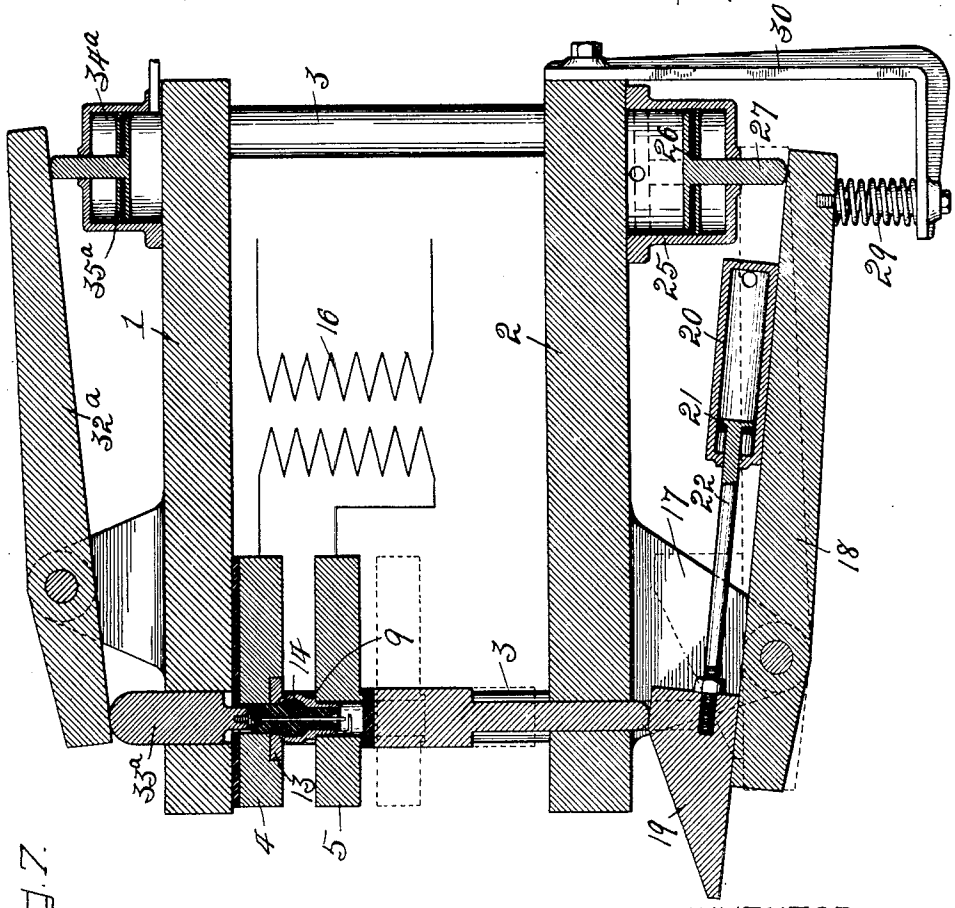


Fig. 7.



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4 SHEETS—SHEET 4.

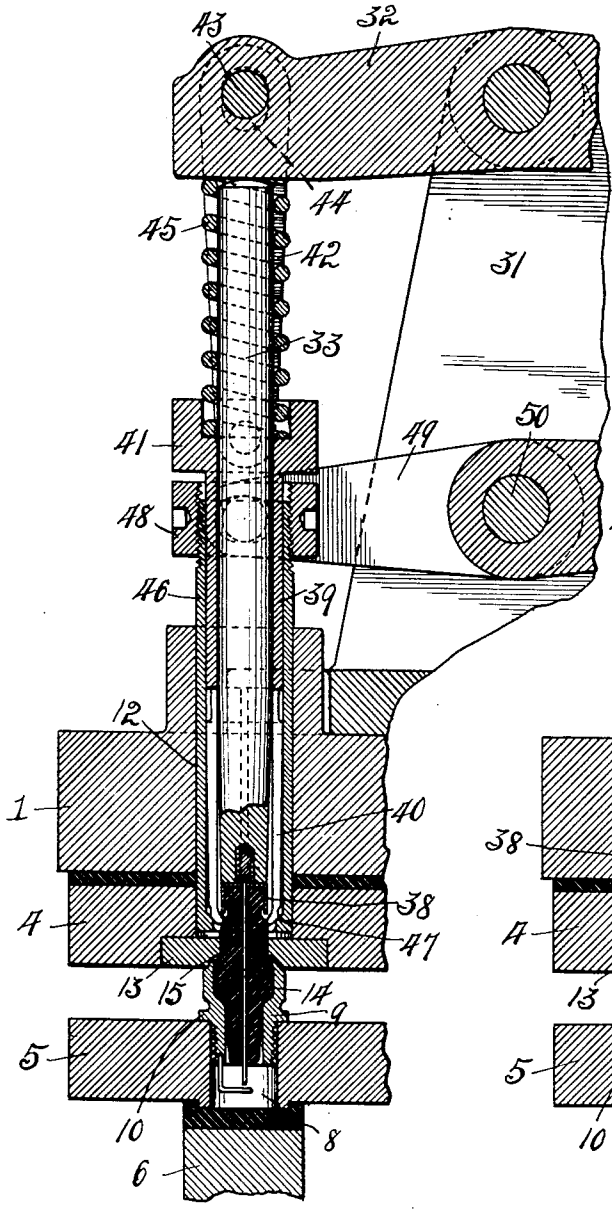


Fig. 5.

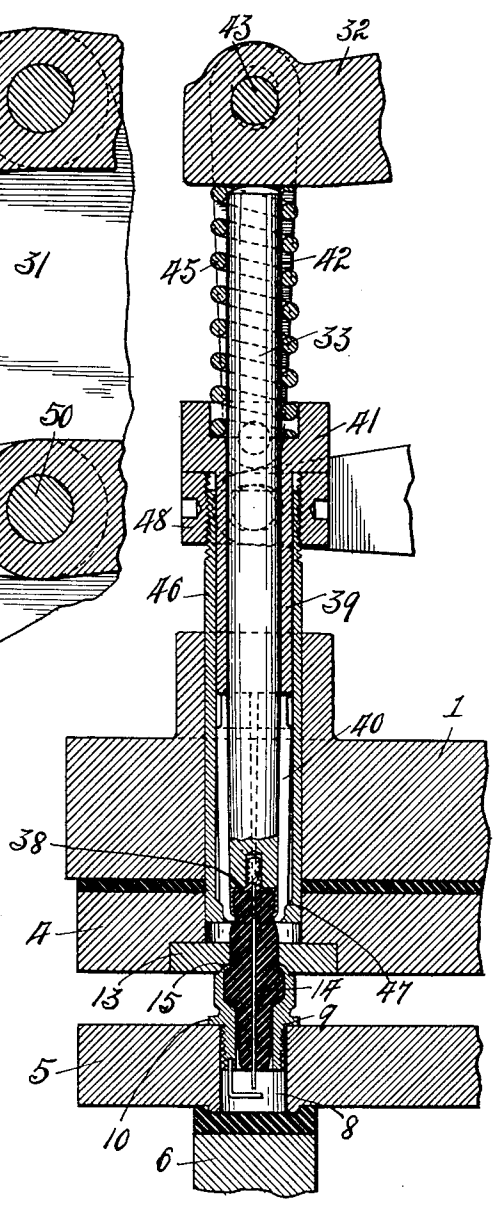


Fig. 6.

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UNITED STATES PATENT OFFICE.

CARL H. POSTEL, OF TOLEDO, OHIO, ASSIGNOR TO CHAMPION SPARK PLUG COMPANY, OF TOLEDO, OHIO, A CORPORATION OF MASSACHUSETTS.

SPARK-PLUG-ASSEMBLING MACHINE.

1,173,214. Specification of Letters Patent. Patented Feb. 29, 1916.

Application filed April 29, 1915. Serial No. 24,793.

To all whom it may concern:

Be it known that I, CARL H. POSTEL, a citizen of Germany, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Spark-Plug-Assembling Machine; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates particularly to the manufacture of spark plugs of the type commonly used in internal combustion engines.

The object of my invention is the provision of an improved machine for securing the shell and porcelain of a spark plug in assembled relation by turning an edge flange of the shell over a shoulder on the porcelain.

A further object of the invention is the provision of simple and efficient means for securing a cap to the terminal attaching end of the porcelain.

Further objects and advantages of the invention will be apparent from the following detailed description thereof.

While the invention in its broader aspect is capable of embodiment in numerous forms, two embodiments only thereof are illustrated in the accompanying drawings, in which,—

Figure 1 is a sectional view of a machine embodying both the shell and porcelain assembling features and the cap securing feature, and showing the relative position of the parts when the respective assembling operations have been completed and the spark plug is still engaged by the coacting mechanisms. Fig. 2 is a front elevation of the portion of the machine shown in Fig. 1. Fig. 3 is an enlarged partial section similar to Fig. 1 showing the relative positions of the cap crimping mechanism parts when in normal at rest position. Fig. 4 is a perspective view of the cap crimping member of said mechanism. Figs. 5 and 6 are enlarged sectional view of portions of the machine illustrating different positions of the cap crimping mechanism, and Fig. 7 is a sectional view of a portion of a machine embodying the invention and having the cap securing means eliminated therefrom.

Referring to the drawings, 1 and 2 designate upper and lower stationary frame beams or parts which, in the present instance, are rigidly spaced apart by a set of standards 3. 4 and 5 designate two plates disposed one above the other and forming electrodes, the former being insulatingly secured in a rigid manner to the frame part 1 near the forward end thereof and the latter being insulatingly carried for vertical movements toward and from the electrode 4 by a standard 6, the lower end of which projects through an opening 7 in the frame part 2.

The lower electrode 5, which may also be termed a work supporting table, is provided therein with a vertical opening or socket 8 of suitable size to freely receive the threaded plug portion of a spark-plug shell 9, the flange or shoulder 10 of which is intended to seat on the marginal edge of the socket wall, as shown. The upper electrode plate 4 is provided with an opening 11 in vertical register with the opening 8 in the lower electrode plate and also in communication at its upper end with a vertically registering opening 12 through the beam or frame part 1. A shell-edge crimping die 13 is mounted in the outer or lower end of the opening 11 and has an opening therethrough in communication with the opening 11 and in axial registry with the opening 8 in the lower electrode to permit the upper end of a spark plug porcelain or insulating member 14 to be projected therethrough. The die opening is of suitable size to permit the porcelain to have a loose sliding fit therein, and the lower edge of its wall is recessed in a manner to receive the thinned inner edge 15 of the shell 9 and effect an inward crimping of such edge over a registering shoulder of the porcelain, as best shown in Fig. 3, when the shell is forced upward against said die.

The electrode plates 4 and 5 are disposed in a common electric circuit having a transformer 16 therein, and when the circuit is open and a shell 9 has been raised by the lower electrode 5 into contact with the die 13 an electric heating current will flow between the two electrodes through the shell and crimping die, thereby causing a heating and consequent softening of the thinned edge of the shell to facilitate an inward crimping or turning of such edge over the respective porcelain shoulder.

Mounted below the frame part 2 in spaced bearing arms 17 depending therefrom is a power lever 18, the short arm of which is disposed below the standard 6. A wedge or cam block 19 is slidingly mounted on the lever 18 between the short arm thereof and the lower end of the standard 6, which end projects below the frame part 2 and rests upon the inclined surface of the block. A cylinder 20 is mounted on the top of the long arm portion of the lever 18 and contains a plunger 21, which is connected by a rod 22 to the large end, in the present instance, of the slide block 19 so that movements of the block are controlled by movements of the plunger 21 within the cylinder 20. The cylinder 20 has the opposite ends thereof in valve controlled communication through passages 23 and 24 with a source of fluid pressure supply whereby fluid under pressure may be admitted to the cylinder at either side of the plunger to effect movements of the same in one direction or the other.

A vertically disposed cylinder 25 is secured to the frame part 2 above the outer end of the long arm portion of the lever 18 and contains a plunger 26 the stem or rod 27 of which projects down through the lower end of the cylinder 25 and in contact with the respective end of the lever 18. The upper end of the cylinder 25 has valve controlled communication through a passage 28 with a source of fluid pressure supply whereby pressure may be admitted to the cylinder above the plunger to impart a downward movement to the plunger and a consequent upward power movement to the short arm of the lever 18, which movement is communicated to the standard 6 and movable electrode 5 through the slide-block 19. When the plunger 26 has been relieved of pressure on the upper side thereof a coiled compression spring 29, which is interposed between a bracket arm 30 and the lever 18 in opposition to the plunger stem 27 effects a retraction or upward movement of the rear end of the lever 18 and the plunger 26. The bracket arm 30 depends, in the present instance, from the rear end of the frame part 2.

When the slide-block 19 is in its retracted position and the lever 18 is in its normal position, as shown by dotted lines in Fig. 7, the work carrying electrode plate 5 is at the limit of its lowering movement in suitable spaced relation to the stationary electrode 4 to permit the placing of a spark plug in proper position thereon or its removal therefrom. When a shell 9 with a porcelain 14 freely supported therein has been placed in proper position on the electrode 5 the operator admits air to the cylinder 20 through the passage 23, thereby forcing the slide-block 19 forward and effecting a raising of the electrode 5 into position for the edge of the shell to substantially have contact with the registering surface of the crimping die 13. Pressure is now admitted to the cylinder 25 to impart a power movement to the lever 18, and at approximately the same time the heating circuit is closed to effect a softening of the shell edge 15 and thereby facilitate a crimping in of such edge over the respective porcelain shoulder as the shell is forced upward against the crimping surface of the die 13. In practice an upward pressure of approximately 6000 pounds is applied to the electrode 5 by the lever 18.

Mounted over the frame part 1 in bearing arms 31 rising therefrom is a lever 32 the short arm of which is disposed over the opening 12 in the frame part 1 and is adapted during a portion of its downward movement to communicate a downward pressure on the porcelain 14 through the medium of a plunger 33 which extends down through the frame opening 12 and bears against the upper end of the porcelain 14 when in assembling position within the machine, as shown in the drawings. Power is applied to the under side of the long arm of the lever 32 from a cylinder 34 that is mounted, in the present instance, on the frame part 1 and has its plunger 35 provided with a stem 36 that projects from the cylinder through the upper end thereof and bears inward against said lever. The lower end of the cylinder 34 is in suitable valve controlled communication with a source of fluid pressure supply through a passage 37 therein. The pressure applied to the upper end of the lever 32 and plunger 33 in practice is approximately 2000 pounds. It is found that 2000 pounds is about the maximum pressure that porcelain will stand without breaking or crumbling. The purpose of this pressure is to force the porcelain into the shell to effect the compression of a gasket between the inner shoulders of the porcelain and shell and to form a gas tight joint therebetween. It is apparent that inasmuch as the porcelain 14 has a downward pressure of approximately 2000 pounds against the shell 9 the resultant pressure of

the shell against the crimping die 13 will be only approximately 4000 pounds instead of 6000.

In order to secure a metallic cap 38 to the outer end of the porcelain 14 by crimping the edge of the cap within a registering recess formed in the porcelain, I provide a simple and efficient mechanism which will now be described.

Mounted for sliding movements on the plunger 33 is a sleeve 39, the lower end of which is longitudinally slotted to form a plurality of crimping fingers 40. The free ends of the fingers 40 are turned slightly inward to adapt them when forced inward in register with the edge of the cap 38 to effect an inward forcing or crimping of the cap edge into the registering recess of the porcelain, as indicated in Fig. 1. The sleeve 39 is provided at its upper end with a head 41, which is connected by a pair of links 42 to the free short arm of the lever 32 so that the movements of the sleeve 39 may be controlled by movements of said lever. A pin 43 connects the lever to the links 42, and it is preferable to provide a limited play between such connection as indicated at 44 by dotted lines in Fig. 3. A coiled compression spring 45 is interposed between the lever 32 and sleeve head 41 and serves to normally maintain a maximum spacing of said parts.

A wedge sleeve 46 telescopes over the sleeve 39 below the head thereof and fits into the opening 12 of the frame part 1 for free reciprocatory movements therein. The lower end of the wedge sleeve 46 extends below the lower end of the crimping fingers 40 and is provided within an internal wedge or cam surface 47, which, when the wedge sleeve is raised relative to the sleeve 39, coacts with correspondingly shaped portions at the ends of the fingers 40 and causes an inward forcing of such fingers into a registering groove or recess in the porcelain 14 and below the lower edge of the cap 38, as best shown in Figs. 5 and 6. When the wedge sleeve 46 has had a predetermined upward movement relative to the sleeve 39 the wedge portion of the former will have moved into locking contact with the finger ends so that a continued upward movement of the wedge sleeve will communicate a corresponding upward movement to the sleeve 39, as hereinafter more fully described. During this unitary upward movement of the sleeves 39 and 46 the crimping ends of the fingers 40 will be forced upward in contact with the lower edge of the cap 38 and effect an inward rolling of the cap edge into the porcelain recess provided therefor, thereby serving to lock the cap securely on the porcelain, as indicated in Fig. 6.

A cylinder 52 is carried, in the present instance, by the lever 32 at the under side of its long arm and contains a plunger 53 the stem 54 of which projects down through the lower end of the cylinder and bears against the long arm of the lever 49 at the upper side thereof, or in opposition to the spring 51. The upper end of the cylinder 52 has communication through a valve controlled passage 55 with a source of fluid pressure supply, and when pressure is admitted to the cylinder through said passage the plunger is forced downward and moves the lever 49 to cause an upward drawing of the wedge sleeve 46 into wedge coaction with the ends of the crimping fingers 40 to impart cap crimping movements thereto.

A cylinder 56 pivotally rises from the rear end portion of the frame part 1 and has its plunger 57 connected by a rod 58 to the rear end of the power lever 32. The upper end of the cylinder 56 has communication through a valve controlled passage 59 with a source of fluid pressure supply, so that when pressure is admitted to the upper end of the cylinder the plunger 57 is forced downward and causes a raising of the forward end of the lever 32 and attached sleeve 39 to coöperative position. Such raising can only take place however when the plungers 35 and 53 are free to move inward in the respective cylinders 34 and 52 as is apparent.

In the operation of the machine supposing the parts to be in operative position with the slide block 19 retracted the power lever 18 in normal spring held position and the levers 32 and 49 and associated parts in substantially the inoperative position shown in Fig. 3, the operator places a spark plug shell in the opening 8 of the movable electrode plate 5 with the flange 10 of the shell seating on the marginal edge of the opening wall. When the shell is placed on the electrode plate 5 it loosely contains a porcelain 14 with a gasket between the inner shoulders of the porcelain and shell and also with a gasket over the outer shoulder of the porcelain in position to be compressed by the edge 15 of the shell when crimped thereover, as hereinafter described. The porcelain also has a cap 38 mounted loosely on its outer end, which cap is connected to the electrode carried by the porcelain and is provided at its outer end with a stem to which a terminal binding nut may be threaded. The work parts having been placed in position the operator admits fluid pressure to the cylinder 20 through the passage 23 therein, thus forcing the plunger 21 outward and causing the block 19 to slide under the standard 6 and effect a raising of the electrode plate 5. The raising of the plate 5 in this manner moves the spark plug upward to project the capped end of the porcelain through the die 13 and to bring the edge 15

of the shell into inward contact with the crimping surface of the die 13. The operator may then at the same time, or substantially the same time, admit operating fluid to the cylinders 25 and 34 to move the plunger 26 of the former to act through the lever 18 to apply an upward crimping force to the electrode plate 5 and to move the plunger 35 to act through the lever 32 to apply a downward pressure through the plunger 33 on the capped end of the porcelain and also to move the sleeve 39 to place the crimping ends of its fingers 40 in crimping register with the edge of the porcelain cap, as shown by the position of the parts in Fig. 1. It is therefore evident that the slide block 9 does not act to apply power or pressure to the electrode plate 5 but merely as a quick raising or positioning means therefor, and that the lever 18 serves as the power or pressure member, a slide movement of the short arm of such lever being sufficient to impart the crimping movement to the shell 9. At approximately the time of applying the crimping pressure to the work carrying plate 5 the heating circuit is closed, thereby causing a heating current of electricity to flow from one electrode plate 4, 5 to the other and effect a softening of the thin edge 15 of the shell. This permits a more efficient crimping or turning in of the shell edge over the respective shoulder of the porcelain and the interposed gasket by the die 13, as the shell edge is forced therein, than would otherwise be the case. After power has been applied to the lever 32 to force the plunger 33 into contact with the porcelain end, and the sleeve 39 to its lowered position, fluid pressure is admitted to the cylinder 52 to cause an outward forcing of the plunger 53 and a consequent upward power movement to the short arm of said lever. This movement of the lever 49 causes an upward drawing of the wedge sleeve 46 for a limited distance relative to the sleeve 39 and causes an inward forcing of the ends of the crimping fingers 40. When the crimping fingers 40 have been thus forced inward a predetermined extent the adjustable head 48 of the sleeve 46 will have moved into upward forcing contact with the head 41 of the sleeve 39 so that upward movement will be communicated to the sleeve 39 with the sleeve 46 during the continued upward movement of the latter. This upward movement of the sleeve 39 is against the tension of the spring 45 and is permitted by reason of the pin and slot connection between the lever 32 and the links 42, which connect said lever with the sleeve 39. As the two sleeves move upward together the crimping ends of the fingers 40 move upward into contact with the adjacent edge of the porcelain cap 38 and cause an inward pulling of such edge into the registering groove in the porcelain. Upon a release of the fluid pressure within the cylinders 25, 34 and 52 and the admission of fluid pressure to the cylinder 56 and to the cylinder 20 through the passage 24 thereof the parts are returned to their normal positions. The heating circuit is also opened when the shell crimping operation has been completed.

It is evident that a considerable pressure, for instance, 2000 lbs. is applied to the upper end of the porcelain in opposition to the upward pressure of, say 6000 lbs., applied to the shell 9 so that the resultant crimping pressure which the shell edge exerts against the die 13 will be approximately 4000 lbs., while the pressure exerted on the porcelain to force it to a close gasket seat in the shell is approximately 2000 lbs., which in practice is found to be about the maximum pressure the porcelain will stand.

I am aware that it is old to apply pressure to a spark plug shell to force its edge into a crimping die to effect an inward crimping of such edge over a porcelain shoulder and to subject the shell edge to a heating current of electricity to soften the same, whereby to facilitate the crimping operation. It is new, however, so far as I am aware, to provide a positioning means between the work carrying member and power member, and also to apply a counteracting force to the porcelain to effect a close seating of its inner shoulder against an inner gasket faced seat within the shell at the same time the crimping pressure is applied to the shell, whereby the shell is caused to have a close gas tight seat against both shoulders of the porcelain. It is also new so far as I am aware to provide a porcelain cap crimping mechanism in a machine of the character described, which mechanism may operate either in conjunction with the feature of applying pressure to the spark plug parts or separately therefrom as desired. It is preferable, however, to have the different mechanisms operate substantially in unison, as hereinbefore described.

In Fig. 7 a form of machine having the cap crimping mechanism eliminated therefrom is illustrated. In this form the parts are the same in their operation and arrangement as described in connection with the other figures of the drawing with the exception that a short plunger 33ª is substituted for the long plunger 33, the power lever, which is designated 32ª, is brought closer to the frame part 1 than is shown by the position of the lever 32, and all of the other parts between the frame part 1 and the power 32 are eliminated with the exception of a cylinder 34ª and plunger 35ª, which perform the same functions as the cylinder 34 and plunger 35 in the first construction. The operation of this form of invention will be readily understood from the foregoing description.

I wish it understood that my invention is not limited to any specific construction, arrangement or form of the parts or to any particular combination of elements, as it is capable of numerous modifications without departing from the spirit of the claims.

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

1. In a machine of the class described, the combination with means for applying a crimping pressure to a spark plug shell, of means for applying a simultaneous opposing pressure on the insulating member of the plug to force it to a close seat in the shell.

2. In a machine of the class described, the combination with means for applying a crimping pressure to a spark plug shell, of fluid pressure operated means for simultaneously applying a counteracting pressure to the insulating member of a spark plug to force it to a close seat in the shell.

3. In a machine of the class described, means for applying an edge crimping pressure to the shell of a spark plug, of a plunger disposed to act against the outer end of a porcelain seated in the shell, and means operable to apply a predetermined pressure to said plunger to partially counteract the shell pressure.

4. In a machine of the class described, means for applying a crimping pressure in one direction to a spark plug shell, a plunger disposed to act against the outer end of a porcelain seated in the shell, and fluid pressure operated means for applying a predetermined pressure through said plunger to the porcelain to partially counteract the opposing pressure applied to the shell.

5. In a machine of the class described, means for applying a crimping pressure in one direction to a spark plug shell, a plunger disposed to act against the outer end of a porcelain seated in said shell, a lever, and means for actuating said lever to apply a predetermined pressure through said plunger to the porcelain to partially counteract the opposing pressure on the shell.

6. In a machine of the class described, in combination, two relatively movable parts, means operable to move one of said parts into operative relation to the other part, and means acting through a part of said first means to force one of said movable parts toward its companion.

7. In a machine of the class described, in combination, a die member, a work carrying part movable toward and from said die member, a power member, means interposed between said power member and part for communicating movements from one to the other and operable relative to said power member to impart predetermined movements to said part, and means for moving said power member to apply further movement to the work carrying part toward said die member.

8. In a machine of the class described, a die member, a work carrying part movable toward and from said die member, a power member, means carried by said power member to impart movements therefrom to said work carrying part and operable relative to said power member to quickly move said part into or out of operative relation to said die member.

9. In a machine of the class described, a die member, a work carrying part movable toward and away from said member, a movable power member for operating said part, a wedge member slidingly interposed between said power member and part and operable to quickly move the work carrying part into or out of operative relation to said die member.

10. In a machine of the class described, two relatively movable parts, a power member operable to forcefully move one of said parts toward the other, a wedge block carried by said power member and operable to quickly move one of said parts into or out of operative relation to the other part, and means for controlling the movement of said wedge block.

11. In a machine of the class described, a pair of relatively movable work coacting parts, a power lever operable to impart movements to one of said parts relative to the other, a wedge block carried by said lever in contact with the part which is movable by the lever, said block being movable relative to the lever to impart predetermined movements to the movable part when the lever is at rest, and means operable to control the movements of said block.

12. In a machine of the class described, a pair of relatively movable work coacting parts, a power lever, fluid pressure means for controlling the power movements of said lever, a member slidingly carried by the lever and having an inclined surface in contact with the part which is movable by the lever, and fluid pressure means operable to move said member relative to the lever to effect a placing of the movable part into operative relation to its companion.

13. In a machine of the class described, work holding means having upper and lower work clamping members, a pair of telescoped members mounted for relative longitudinal sliding movements, the inner member having a set of work crimping fingers and the outer member having a part which is movable into coaction with said fingers to impart work crimping movements thereto, and means operable to control the relative movements of said member.

14. In a machine of the class described, a work holding plunger, work crimping means having parts movable with and rela-

tive to said plunger, and operable upon predetermined relative movements of said parts to crimp a work piece, means operable to control the movements of said plunger and one of said parts, and means operable to control the movements of the other of said parts.

15. In a machine of the class described, a work holding plunger, a work crimping member slidingly mounted on said plunger, means operable to control the movements of said plunger and member, and means operable to act on said member to impart work crimping movements thereto.

16. In a machine of the class described, a plunger, a pair of sleeves encircling said plunger and one telescoping within the other, the inner sleeve having work crimping fingers and the outer sleeve having a part for coacting with said fingers to impart crimping movements thereto when the sleeves have predetermined relative movements, means operable to control the movements of said plunger and one of said sleeves, and means operable to control the movements of the other of said sleeves.

17. In a machine of the class described, a work coacting plunger, a pair of telescoped sleeves slidingly carried by said plunger, the inner of said sleeves having crimping fingers and the outer sleeve having wedge parts for coacting with said crimping fingers upon predetermined relative movements of the sleeves to impart crimping movements to the fingers, a lever operable to control the movements of said plunger and the inner sleeve, a second lever operable to control the movements of said outer sleeve, separate fluid controlled means for imparting predetermined movements to said levers, and separate means for imparting different predetermined movements to said levers.

18. In a machine of the class described, a reciprocally movable work holding plunger, a sleeve fitting around said plunger and having work crimping fingers extended below the plunger, an operating lever, a coiled compression spring disposed between the outer end of said sleeve and lever, link connection between said sleeve and lever adapted to permit limited movements of said sleeve and lever toward and away from each other, a second sleeve inclosing the crimping finger portion of said first sleeve and operable to impart crimping movements to said fingers, and means for moving said second sleeve relative to said first sleeve.

19. In a machine of the class described, a pair of oppositely movable members for holding and acting on a shell like part, means for applying predetermined pressure through one of said members in one direction on said part, and means for applying a different predetermined pressure in opposition to said first pressure on a work part for seating it within the shell part.

In testimony whereof, I have hereunto signed my name to this specification.

CARL H. POSTEL.