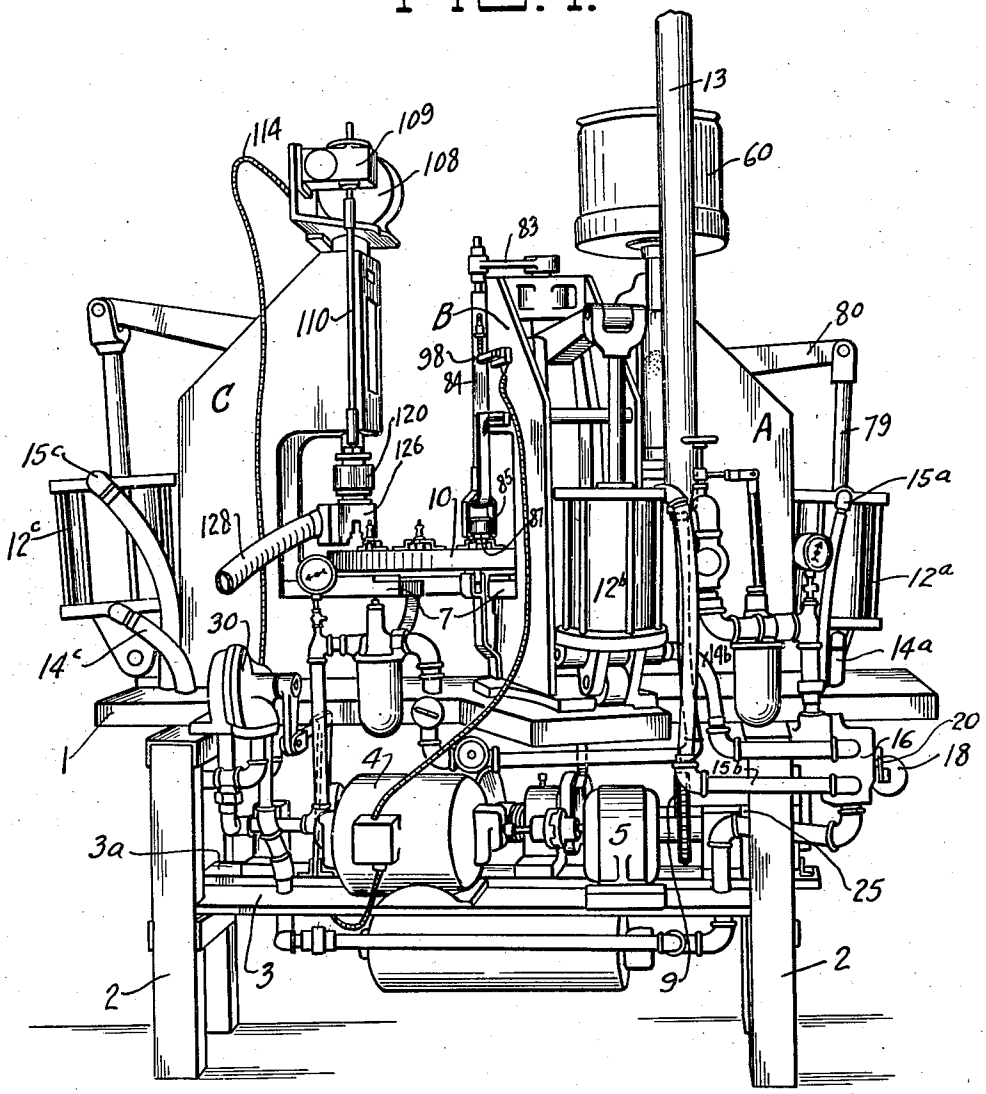
March 2, 1937. C. E. DEWAR 2,072,087

SPARK PLUG ASSEMBLING MACHINE

Filed Aug. 6, 1936 5 Sheets-Sheet 1

FIG. 1.



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SPARK PLUG ASSEMBLING MACHINE

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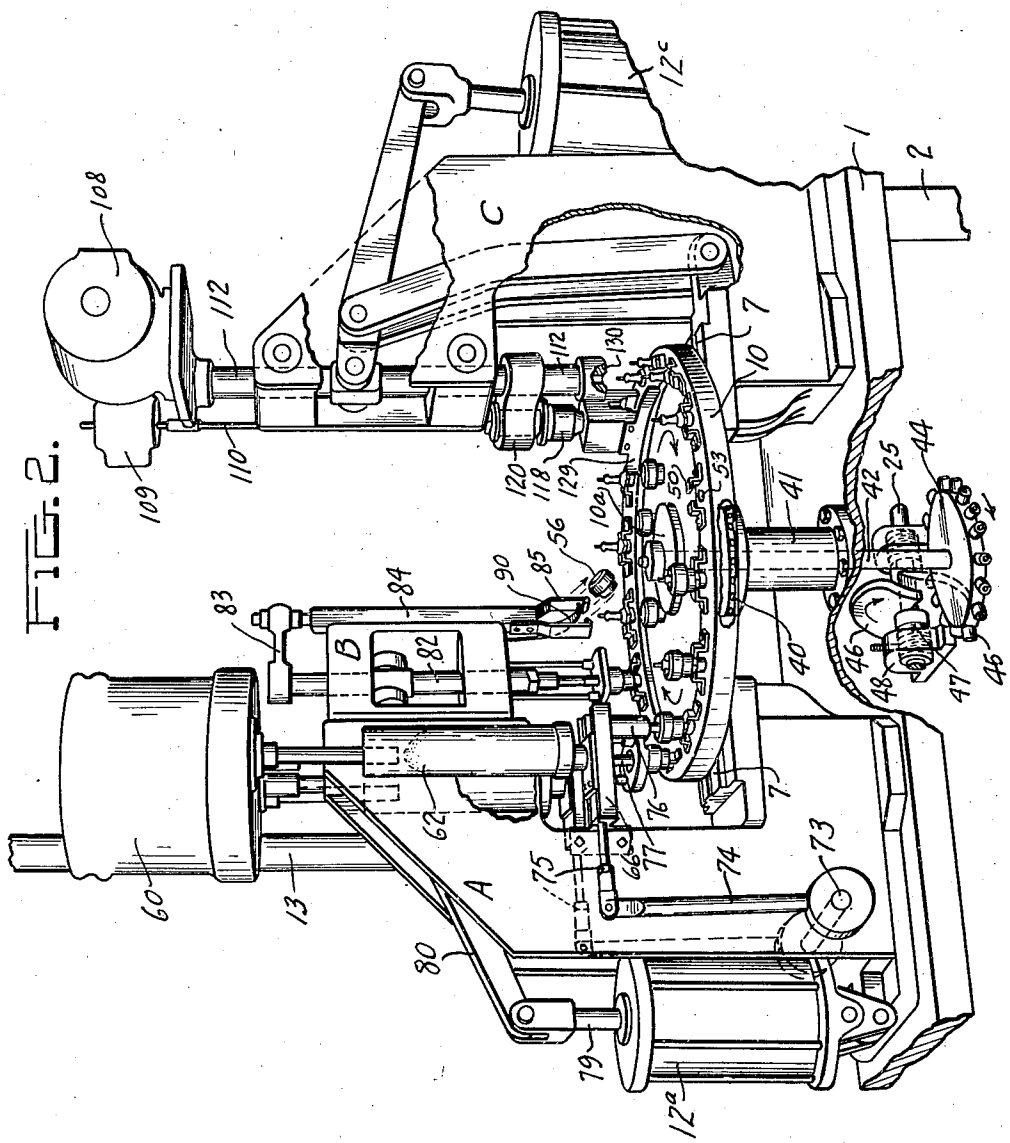
FIG. 2.



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SPARK PLUG ASSEMBLING MACHINE

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FIG. 3.

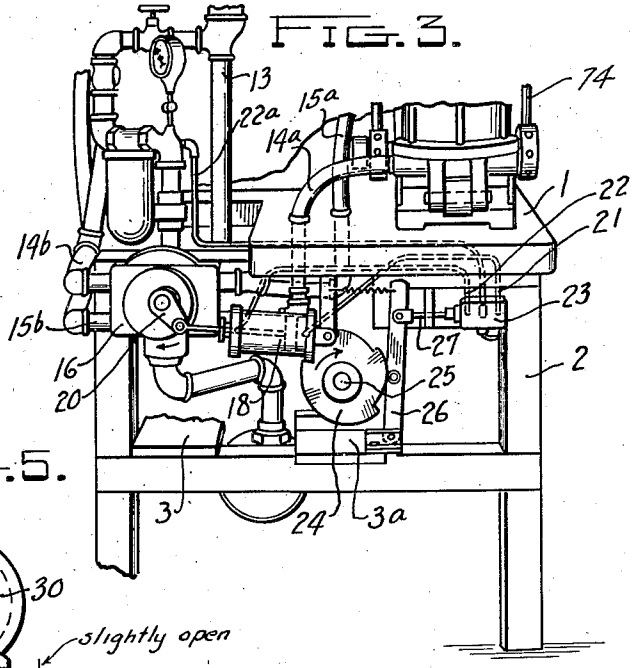


FIG. 5.

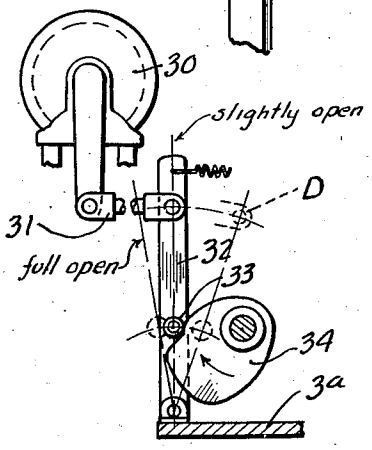
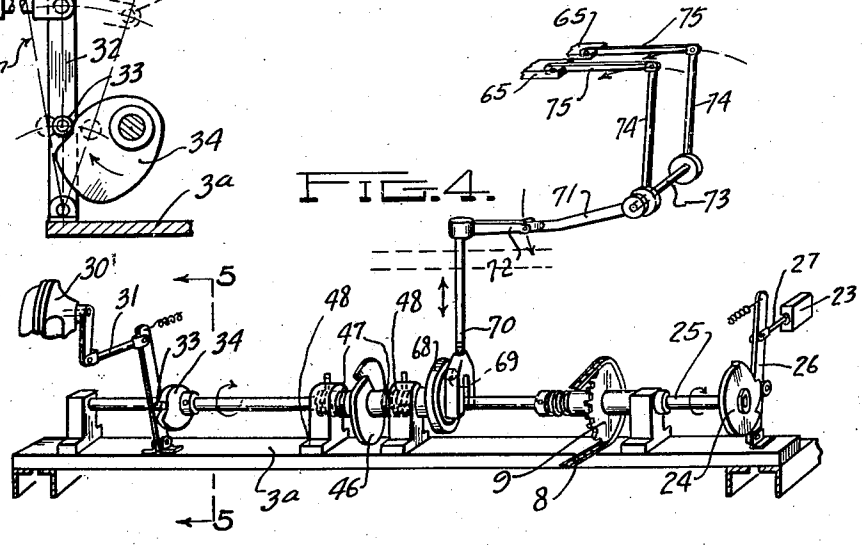


FIG. 4.



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SPARK PLUG ASSEMBLING MACHINE

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FIG. 6.

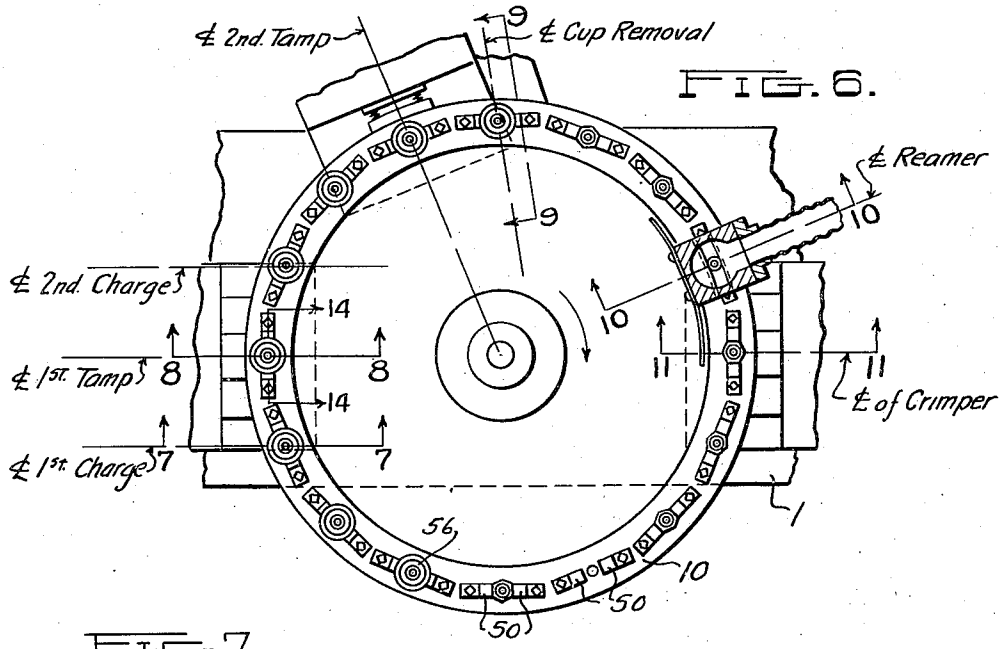


FIG. 7.

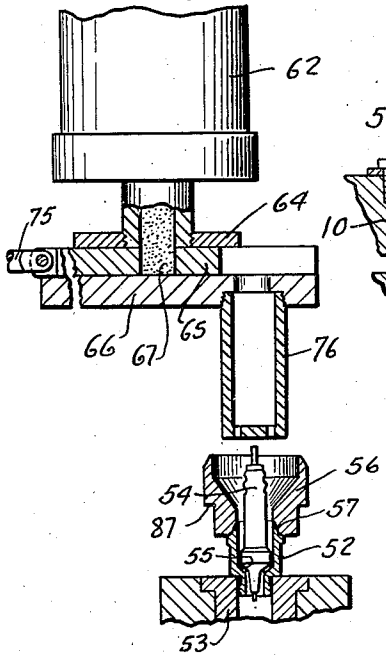


FIG. 14.

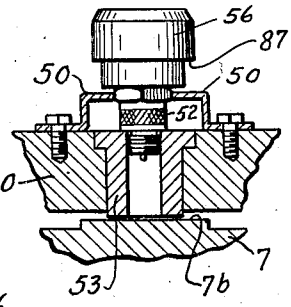
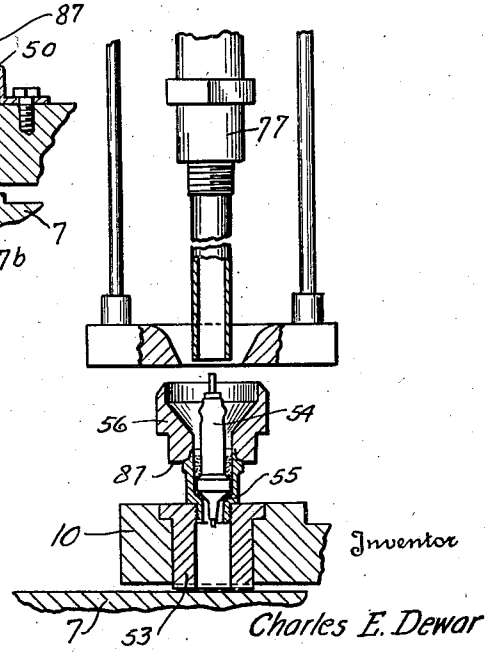


FIG. 8.



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SPARK PLUG ASSEMBLING MACHINE

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FIG. 9.

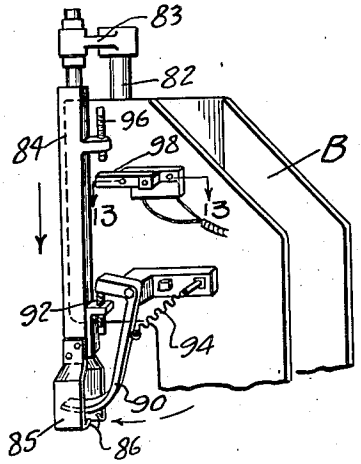


FIG. 10.

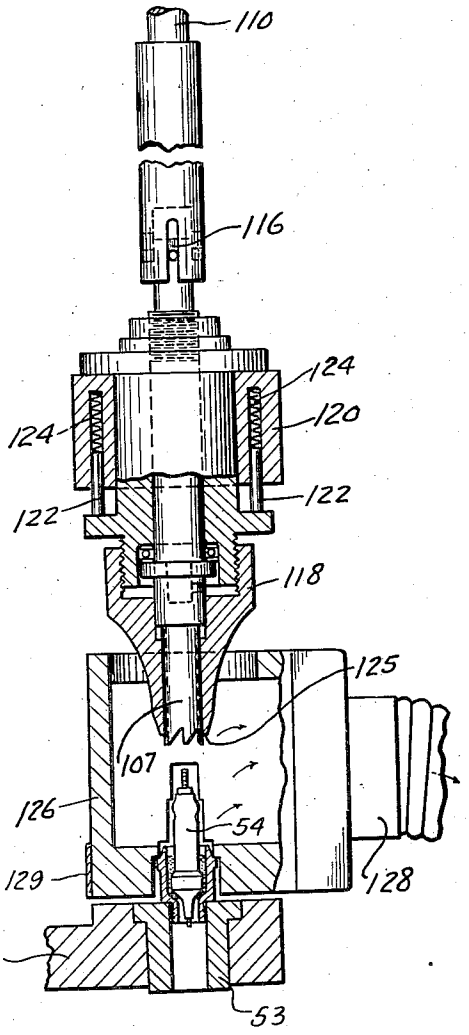


FIG. 11.

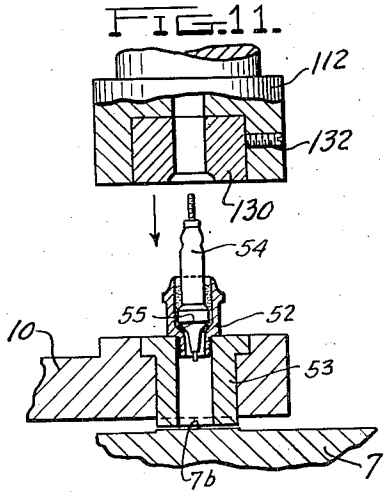


FIG. 12.

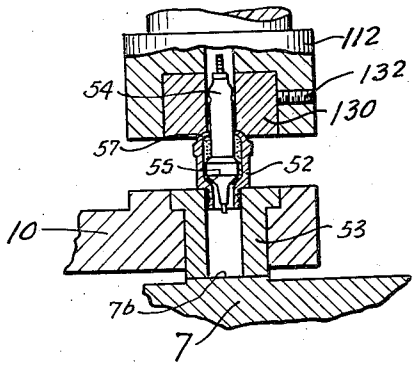
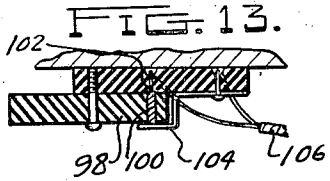


FIG. 13.



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Patented Mar. 2, 1937

2,072,087

UNITED STATES PATENT OFFICE

2,072,087

SPARK PLUG ASSEMBLING MACHINE

Charles E. Dewar, Toledo, Ohio, assignor to Champion Spark Plug Company, Toledo, Ohio, a corporation of Delaware

Application August 6, 1936, Serial No. 94,650

16 Claims. (Cl. 29—84)

This invention relates to spark plug assembling machines and is more particularly directed to a machine to affix a core and center electrode assembly in a shell.

In the patent to Otto C. Rohde No. 2,020,967, issued November 12, 1935, there is disclosed and claimed the method of securing a rigid spark plug core in a metallic shell, which consists in placing the core concentrically in the shell with a space between the concentric surfaces, pouring a powder into this space and packing the powder to form a gas-tight holding means between the core and shell. The present invention comprises a novel apparatus to carry out this method.

In the accompanying drawings, Fig. 1 is an assembly elevational view of a machine constructed in accordance with the present invention; Fig. 2 is a fragmentary perspective view, with parts broken away, of the operating table and its actuating mechanism with relation to certain of the forming parts of the machine; Fig. 3 is a fragmentary end elevation showing the valve arrangement for certain of the pneumatic presses used; Fig. 4 is a somewhat diagrammatic view of the drive shaft of the machine together with certain driven parts; Fig. 5 is a section on line 5—5 of Fig. 4; Fig. 6 is a plan view of the operating table showing the relative position at which the various operations take place; Figs. 7, 8, 9, 10 and 11 are fragmentary sectional views taken on lines 7—7, 8—8, 9—9, 10—10 and 11—11, respectively, in Fig. 6; Fig. 12 is a view similar to Fig. 11, but showing the parts in another position and showing a vertical cross-section of a plug in completed form; Fig. 13 is a diagrammatic detail view of a safety switch used to prevent completion of an imperfectly formed plug, being a section on line 13—13 of Fig. 9, and Fig. 14 is a section on line 14—14 of Fig. 6.

Referring to the drawings, the frame of the machine includes a press carrying table 1 mounted on legs 2 and intermediate cross members 3 and 3a carried horizontally between the top and bottom of the legs. The cross member 3 carries a driving motor 4 and reduction gear 5, while the cross member 3a carries a cam shaft (25) and its associated mechanism, as will be more particularly hereinafter described.

A plurality of pneumatic presses, designated by A, B and C, are mounted on the table 1 and arranged on the periphery of a circle. Each press has a bed plate or anvil 7 extending toward the center of the circle. An operating table 10 is mounted to turn within the circle of presses over the bed plates or anvils 7. Each of the presses generally represents a "station" at which a certain part of the operation of finishing the plugs is performed. Each press is of a standard type having double acting pneumatic cylinders 12a, 12b, 12c, in each of which a piston is reciprocated by air pressure supplied from a common supply pipe 13 through air conduits 14a, 14b and 14c and 15a, 15b and 15c to points above and below the piston which operates within the cylinder. Inasmuch as the presses operate and are constructed in a conventional manner, a detailed description thereof is deemed unnecessary.

Presses A and B are controlled by a single valve 16 of a conventional type interposed between a connection to the supply pipe 13 and the conduits 14a, 14b, 15a and 15b, so that the presses operate together. The actuation of valve 16 is accomplished by a small cylinder and piston assembly 18, the piston being directly connected to a valve actuating lever 20 of the valve 16, as shown in Fig. 3. Air is supplied to the cylinder of the assembly 18 by supply lines 21 and 22 entering at each end of the cylinder, so that the piston therein may be moved in either direction depending on which line carries air pressure temporarily. The air pressure to lines 21 and 22 is derived from a branch 22a from supply pipe 13 and are controlled in turn by a small slide valve 23 mounted on the frame of the machine. A cam 24 carried by shaft 25 actuates an arm 26 pivoted on the machine member 3a and connected adjacent its outer end to the slide valve 23 by a push rod 27. Thus, as cam 24 turns, a follower carried by arm 26 moves the arm and push rod 27 so that the slide valve 23 causes air to be admitted to the cylinder and piston assembly 18, which in turn moves the valve 16 to admit air to the press cylinders 12a and 12b. A return of the slide valve to its initial position causes air to be admitted to the opposite ends of the press cylinders, so that each piston is returned to the lower end of its stroke. The shaft 25 is driven from the motor 4 through the reduction gear 5 and a chain 8 meshing with a sprocket 9 fixed on the shaft 25.

The pneumatic press C is operated by a separate valve 30 that is carried on the frame of the machine and actuated by a link 31 which is directly connected to its actuating arm and to a spring biased arm 32 pivoted to the cross member 3a, as shown in Fig. 4. The arm 32 carries a cam follower 33 which cooperates with a cam 34 on the cam shaft 25 and is thus periodically moved to actuate the valve 30 and admit air to the cylinder of press C, above and below the piston therein, to move the press parts to active or inactive

positions for the performance of their respective functions, as hereinafter described.

It will be appreciated that the piping arrangements, valves and press parts are conventional and in themselves form no part of the present invention, but merely serve to bring about the necessary plug finishing movements in properly timed sequence and relationship.

The operating table 10 is preferably supported on an annular series of anti-friction members 40 resting in the top of a pedestal extension 41 carried by the frame table 1. A centrally disposed vertical shaft 42 is journaled in the pedestal and drives the table 10 through a hub 10a on the latter. At its lower end the shaft 42 is keyed or otherwise fixed to a drive plate 44, having an annular series of cam engaging lugs 45 extending radially therefrom. A cam 46 carried by the drive shaft 25 engages the cam lugs and is formed to impart a measured progressive movement to the table equal to the distance between centers of adjacent lugs on each revolution of the drive shaft 25. It will be seen that the configuration of the cam is such that the movement imparted to the table 10 is intermittent, so that the table is caused to periodically progress and to dwell in each attained position a predetermined period of time.

The cam 46 is carried on the shaft 25 between spaced bearings 47 which are adjustable in their axial position on the shaft 25 by reason of threaded engagement with stationary journal housings 48 carried by the member 3a. By adjusting the axial position of the bearings 47 on the shaft 25, the angular dwelling position of the operating table 10 may be adjusted to bring the parts accurately in centered relation with the various operating elements hereinafter described.

The operating table 10 is provided with an annular series of jigs 50 equally spaced and corresponding in number to the cam lugs 45. Each jig is made up of a pair of opposed jaw plates bent to lie parallel with, but vertically offset from, the rim surface of the table 10. The jaw plates of each jig are spaced to correspond closely with the dimensions of the hex portion of a previously formed spark plug shell part 52, so that the shell may be received between the jaws and supported thereby against turning movements as well as any lateral or tipping movements. To further prevent a tipping of the shell part, hollowed hardened inserts 53 are positioned in the rim of the table 10 and are adapted to receive the threaded lower end of the spark plug shell 52, as shown for example in Fig. 7.

A previously formed core and center electrode assembly 54 and a gasket 55 are manually loosely assembled by an operator and placed within the shell 52, as shown in Fig. 7. A funnel member 56 is disposed over the shell and has its lower surface countersunk to engage a corresponding tapered extension 57 of the shell 52. It will be seen that in this manner the funnel 56 forms a temporary tight joint with the shell but is free to be moved vertically therefrom at a later stage in the operation of the machine.

After the operator has loaded the machine by assembling the shell, core and cups, and placed them between the jaws of the jigs 50, a movement of the operating table 10 in a clockwise direction in Fig. 2 brings the parts beneath the operating station generally located by the pneumatic press A. At this station a charge of non-metallic mineral packing powder commercially known as "Sillment" is introduced into the cup 56. The powder is such that when it is compacted by pressure it will form a gas tight seal between the core 54 and the shell 52. Obviously, any other powder which will perform the desired holding and sealing function between the parts may be used with the machine.

The volume of powder in its uncompacted, loose state is so great in comparison to its compacted volume that it is desirable to introduce the powder in a plurality of charges with a tamping step between successive charges. The charging mechanisms in the present instance are largely duplicates and are carried on opposite sides of the press A. Both are driven together from the same power source and both are supplied with powder from a primary container 60.

In each instance the powder is transferred from the primary container 60 into a transparent secondary container 62 having its lower end threaded into a plate 64. A slide 65 (Fig. 7) reciprocates between the plate 64 and the upper surface of a grooved plate 66 carried by the press A and is provided with a hole 67 of a predetermined size which is adapted to register with the discharge port of the secondary container 62, so that the hole 67 is completely filled with powder from the container 62 when brought into registry with the discharge spout of the container.

A sliding movement is imparted to each valve 65 by a mechanism best shown in Fig. 4, which includes a cam 68 carried by the cam shaft 25. A cam follower 69 is carried by a forked rod 70 straddling the shaft 25, so that the rod 70 is vertically reciprocated by the cam 68. The vertical reciprocation of the rod 70 causes a measured rotation of an arm 71 which is pivotally connected to the top of the rod 70 by a link 72. The arm 71 is fixed to the end of a shaft 73 journaled in the side frames of the pneumatic press A. As above noted, two charges of powder are placed in each funnel 56 so that duplicate charging valves 65 are used and are each driven from the shaft 73 through the medium of an arm 74 fixed to the shaft and pivotally connected to the stem 75 of the respective slide valves. Thus, as the shaft 73 is rotated by movement of the cam 68 the arms 74 are moved to cause simultaneous reciprocation of both slide valves. In one position the valves 65 register with the discharge ports of their respective secondary containers 62 and receive a charge of powder therefrom. In another position the valves register with the upper opening of spouts 76 and dump the powder through the spout into funnels 56 as a first and second charge.

After receiving the first charge of powder from the first spout 76, the funnel 56 and associated spark plug parts are advanced to come directly beneath the plunger 77 of the pneumatic press A. The advancing operation is accomplished by the next measured progression of the table 10. The powder is tamped by the plunger 77 of the press A, the plunger being moved by the actuation of a piston in the cylinder 12a, the piston rod 79 being connected to the plunger by lever 80 having a floating fulcrum similar to that of press C shown in Fig. 2. The plunger 77 is hollow at its lower end (Fig. 8) to surround the core assembly 54 and is of a diameter which accurately fits the annular intervening space between the core and shell parts into which the charge of powder is tamped. It will be seen from the configuration of the cam 24 that for each revolution of the shaft 25, three strokes of the press are made since the cam is provided with three lobes. Thus, the

powder is progressively packed in relatively small quantities so as to effectively prevent "bridging" of the powder between the core and shell.

Directly beneath the path of the plunger 77 the anvil 7 of the press is provided with a slightly raised surface 7b (Fig. 14) which serves as a supporting medium for the hardened table insert 53 during the tamping operation. In this way the force of the tamping operation is transmitted to the anvil of the press, and the strain ordinarily resulting from this operation has no tendency to tip the table 10 from a horizontal plane.

After this tamping operation is completed, the second charge of powder is introduced into the funnel 56 by the mechanism previously described, the second slide valve 65 receiving its motion from the opposite end of the shaft 73. As above noted, the valves move in synchronism so that each dumps a charge at the same time into different funnels.

The second charge of powder is tamped into place by the second pneumatic press B, the plunger of which is reciprocated by the piston in the usual manner. As heretofore described, the press B is operated in synchronism with and by the same mechanism as the press A, so that the time and extent of the tamping operations are the same as those previously performed. The plunger 82 of the press B is extended above the frame of the press and is connected by means of a bracket 83 (Figs. 2 and 9) to a slide 84 carried at one side of the frame of the press. At its lower end the slide 84 carries a pair of opposed resilient jaws 85 which are provided with inturned and upturned fingers 86. As shown in Fig. 1, the jaws 85 are adapted to slide down so that the fingers 86 engage under a shoulder 87 formed on the side of the funnel 56. Upon the next vertical movement of the slide 84, the funnel will be carried up with the slide and removed from its position over the shell 52. As shown in Fig. 9, a vertical movement of the slide 84 imparts a forward rotary movement to an ejector lever 90 carried by the side frame of the press B. The lower arm of the lever 90 is curved so that in its forward position its end extends between the jaws 85 and ejects a funnel member carried by the jaws out onto the surface of the table 10, as diagrammatically illustrated in Fig. 2. The lever 90 is actuated by a pin 92 carried by an extension of the slide 84 and capable of vertical adjustment to determine the extent of movement of the lever. A spring 94 is provided to return the lever 90 to its rearward position on the down stroke of the press, so that the jaws 85 may engage a cup and lift it in position to be ejected by the lever.

A safety feature is provided in connection with the slide 84, which prevents completion of an improperly formed plug. For this purpose a pin 96 is carried by a side extension of the slide 84, so as to be reciprocated therewith and is vertically adjustable. A pivoted knife type switch block 98 is carried by the press frame and disposed in the path of the pin 96. As shown in Fig. 13, the switch block 98 has a metallic insert 100 at its inner end which is adapted to complete a circuit through spaced contacts 102 and 104. The contact 104 is preferably a resilient metallic member fixed to an insulating block so that it exerts a slight pressure on the block 98 when the latter is in circuit closing position. A conduit 106 is provided in the driving motor circuit, so that if the circuit is broken between the contacts 102 and 104, no current will flow to the driving motor and the entire machine will stop. If the plug parts are properly filled with powder, the extent of downward movement of the plunger 82 of the press B during the tamping operation will be such that the pin 96 will not come in contact with the switch block 98, but will stop just short of this member. If, for any reason, the charge of powder between the plug parts has been insufficient, the plunger 82 will descend to an abnormal extent and the pin 96 will strike against the block 98 and turn it out of its normal position, so that the metallic insert 100 will be removed from between the contacts 102 and 104. The block is prevented from returning to its previous circuit closing position by reason of the resilient nature of the contact 104 since the latter will move into the path of the block if it should tend to return to circuit closing position. When the circuit is broken, it is necessary for the operator to remove the plug that has caused the trouble and to manually return the switch block 98 and its metallic insert 100 to circuit closing position before operation can be resumed.

After the second tamping operation (that at press B) is completed, the upper surface of the tamped powder is made to stand at a predetermined height within the shell by a reaming tool 107 shown in Fig. 10. The reaming tool is driven by an electric motor 108 through a gearing connection 109 and shaft 110. The motor and its attendant drive mechanism are mounted on a platform carried by the plunger 112 of the pneumatic press C. Current is supplied to the motor in any suitable manner by means of a flexible conduit 114. The shaft 110 has a pin and slot connection 116 with the reamer 107, which permits the transmission of rotary motion while allowing for a certain amount of reciprocation between the spindle of the reaming tool and its shaft. The reaming tool is carried by a housing 118 and is mounted for rotation therein. The housing 118 is carried by a bracket 120, being held against rotary movements with respect thereto by means of spaced pins 122. These pins are backed by springs 124 to exert a predetermined downward pressure on the housing 118 to urge it out of the bracket 120. It will be seen that as the bracket 120 moves down with the plunger 112 of the press C, the reaming tool 107 will come in contact with the packed powder between the core and shell parts of the plug and will operate to remove a portion of the powder. The reaming tool 107 is kept from exerting the full force of the press C on the powder by reason of its resilient connection with the bracket 120. Thus, the bracket 120 is free to move downwardly with relation to the housing 118 of the reaming tool even though the latter has reached the lower end of its inward stroke. The inward stroke of the reaming tool is limited by a shoulder 125 of the spindle housing 118 since the shoulder will come in contact with the upper end of the spark plug shell. The depth of the reaming cut is determined by the setting of the reaming tool with relation to this shoulder.

The plug parts, during the reaming operation, are enclosed in a chamber 126 to which is connected a vacuum conduit 128, so that the powder, as it is reamed away from the packed body, is carried out of the chamber 126 and deposited in a suitable collector bag (not shown).

A guard plate 129 is carried on the inner part of the housing forming the chamber 126, so as to protect completed plugs from damage by reason of being struck by the cups 56 as they are ejected from between the jaws 85.

After the powder has been reamed to stand at a definite height in the shell, the plug is moved to the finishing position beneath the plunger 112 of the press C. A die 130 is carried by the plunger 112, being removably held therein by a set screw 132. The die is of a configuration such that it will accurately press the upstanding tapered portion 57 of the plug inward over the tamped body of powder. This holds the powder against exposure to moisture, and since the inturned portion of the shell fits very closely around the core, effectually prevents erosion of the tamped mass of powder by any external agency.

The pressing operation is controlled by the cam and valve mechanism shown in Fig. 5. It will be seen from the configuration of the cam 34 that the valve 30 is moved to the slightly opened position shown in full lines in Fig. 5, the closed position of the valve being designated in dotted lines at D. This "cracks" the valve 30 and permits air to be admitted to the cylinder of the press C so that the plunger descends with very little pressure behind it until the cam 34 has reached the point shown in full lines. Further rotation of the cam 34 causes a sudden opening movement of valve 30 since a very steeply rising portion of the cam next engages the follower 33. This causes a sudden high pressure to be exerted on the piston of the press C, so that the last pressing action of the plunger 112 is very rapid and exerts a tremendous force on the tapered upper part of the shell to roll it into its final position. It will be appreciated that if the packed powder is to be protected against erosion in any other manner than by rolling part of the shell over it, the pressing step may be omitted. When the plunger 112 is raised from the plug, the table 10 is moved to present the completed plug to the operator to be removed from the machine.

A brief summary of the operation of the machine is as follows:

The operator manually assembles the core and shell parts of the plug, places a cup 56 around them and inserts the loosely assembled parts in one of the jigs 50. A progressive movement of the machine then brings the parts in position to receive the first charge of powder from the spout 76. The next movement of the machine brings the charged parts in position for a tamping of the first charge of powder, which is done by the pneumatic press A. A second charge of powder is then placed in the funnel 56 after the parts have moved away from press A and the charge is in turn tamped by press B after a suitable movement of the machine. The funnel member 56 is then removed by the jaws 85 and ejected out onto the surface of the table by the lever 90. The plug is next presented to the reaming tool 107 and the level of the powder reduced to a predetermined point, any powder that is removed being sucked away through the vacuum conduit 128. After the reaming operation, the parts are moved to the final operating position where the upper tapered end 57 of the core is rolled over the packed powder by the press C. The plug is then presented to the operator complete and ready to be removed from the machine.

While the invention has been described in connection with a particular apparatus, it should be expressly understood that numerous changes may be made in the form and disposition of the parts without departing from the invention as defined in the appended claims.

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

1. In a machine of the class described, means to releasably support a loosely assembled spark plug shell and core with an annular space therebetween, means to introduce a charge of packing material into said space, means to tamp said charge of material, means to introduce a second charge of material into said space, and means to tamp said second charge to form a gas-tight seal between said core and shell.

2. In a machine of the class described, means to support a loosely assembled spark plug shell and core with an annular space therebetween, means to introduce a charge of packing powder into said space, means to tamp said powder, means to introduce a second charge of powder into said space, means to tamp said second charge to form a gas-tight seal between said core and shell, and means to form an end of the shell to protect the compacted powder against erosion.

3. In a machine of the class described, means to support a loosely assembled spark plug shell and core with an annular space therebetween, means to introduce a charge of packing powder into said space, means to compact said powder to form a gas-tight seal between said core and shell, and means to remove a portion of the compacted powder so that the remaining mass assumes a predetermined height.

4. In a machine of the class described, means to releasably support a loosely assembled spark plug shell and core with an annular space therebetween, a funnel member removably seated on said shell part and having a throat opening into said space, means to introduce a packing powder into said funnel member, means to compact said powder into said annular space to form a gas-tight seal between said core and shell, and means to remove said funnel member from said shell.

5. In a machine of the class described, means to releasably support a loosely assembled spark plug shell and core with an annular space therebetween, a funnel member removably seated on said shell part and having a throat opening into said space, means to introduce a charge of packing powder into said funnel member, means to tamp said charge of powder into said annular space, means to introduce a second charge of powder into said funnel member, and means to tamp said second charge of powder to form a gas-tight holding means between said core and shell.

6. In a machine of the class described, means to releasably support a loosely assembled spark plug shell and core with an annular space therebetween, a funnel member removably seated on said shell part and having a throat opening into said space, means to introduce a charge of packing powder into said funnel member, means to tamp said charge of powder into said annular space, means to introduce a second charge of powder into said funnel member, means to tamp said second charge of powder to form a gas-tight holding means between said core and shell, and means including resilient fingers to remove said funnel member from said shell.

7. In a machine of the class described, means to releasably support a loosely assembled spark plug shell and core with an annular space therebetween, a funnel member removably seated on said shell part and having a throat opening into said space, means to introduce a charge of packing powder into said funnel member, means to tamp said charge of powder into said annular space, means to introduce a second charge of

powder into said funnel member, means to tamp said second charge of powder to form a gas-tight holding means between said core and shell, means to remove said funnel member from said shell, and means to eject a funnel member from said removing means.

8. In a machine of the class described, means to support a loosely assembled spark plug shell and core with an annular space therebetween and with a shoulder of the core resting on a shoulder of the shell, means to introduce a charge of packing powder into said annular space above said shoulders, means to compact said powder to form a gas-tight seal between said core and shell, and means to remove a portion of the compacted powder so that the remaining mass assumes a predetermined height.

9. In a machine of the class described, means to support a loosely assembled spark plug shell and core with a shoulder of the core resting on a shoulder of the shell and with an annular space between the core and shell above said shoulders, means to introduce a charge of packing powder into said space, and pneumatically driven means to compact said powder and form a gas-tight seal between said core and shell.

10. In a machine of the class described, means to support a loosely assembled spark plug shell and core with a shoulder of the core resting on a shoulder of the shell and with an annular space between said core and shell, means to introduce a charge of packing powder into said space, means to impart successive tamping forces to said charge of powder, means to introduce a second charge of powder into said space, and means to impart successive tamping forces to said second charge of powder.

11. In a machine of the class described, means to support a loosely assembled spark plug shell and core with a shoulder of the core resting on a shoulder of the shell with an annular space between said core and shell, means to introduce a charge of packing powder into said space, pneumatically driven means to impart successive tamping forces to said charge of powder, means to introduce a second charge of powder into said space, and other pneumatically driven means to impart successive tamping forces to said second charge of powder.

12. In a machine of the class described, a frame, an operating table carried by said frame, means to impart intermittent, progressive, rotary movements to said operating table, jigs carried by said table to receive a loosely assembled spark plug shell and core with a shoulder of the core resting on a shoulder of the shell and with an annular space between said core and shell, means carried above said operating table to discharge a predetermined quantity of powder into the annular space between said core and shell, and a pneumatic press carried by said frame to compact said charge of powder.

13. In a machine of the class described, a frame, a circular operating table carried by said frame, jigs carried by said table and adapted to receive a loosely assembled spark plug shell and core with an annular space therebetween, a pneumatic press carried by said frame and having its plunger disposed above the periphery of said table, means carried by said frame to discharge a predetermined quantity of powder into the annular space between said core and shell, means to impart intermittent, progressive, rotary movements to said operating table to bring said core and shell with said charge of powder into position below the plunger of said pneumatic press, and means to impart successive tamping strokes to said press whereby the mass of powder is compacted between said core and shell to form a gas-tight seal.

14. In a machine of the class described, a frame, a circular operating table carried by said frame, jigs carried by said table and adapted to receive a loosely assembled spark plug shell and core with an annular space therebetween, pressing means carried by said frame and having its plunger disposed above the periphery of said table, means carried by said frame to discharge a predetermined quantity of packing powder into the annular space between said core and shell, means to impart intermittent, progressive, rotary movements to said operating table to bring said core and shell with said charge of powder into position below the plunger of said press, means to adjust the angular attained position of said rotary movement, and means to cause said press to operate whereby the mass of powder is compacted between said core and shell to form a gas-tight seal.

15. In a machine of the class described, a frame, a circular operating table carried by said frame, jigs carried by said table and adapted to receive a loosely assembled spark plug shell and core with a shoulder of the core resting on a shoulder of the shell and with an annular space between said core and shell, means carried above said operating table to discharge a predetermined quantity of powder into the annular space between said core and shell, a press carried by said frame adapted to compact said charge of powder, means carried by said frame to remove a predetermined quantity of said compacted charge so that the remaining mass stands at a predetermined height in said annular space, and means to impart intermittent, progressive, rotary movements to said operating table to present said core and shell to each of said means in succession.

16. In a machine of the class described, a frame, a circular operating table carried by said frame, jigs carried by said operating table having opposed jaw parts adapted to receive a loosely assembled spark plug shell and core with a shoulder of the core resting on a shoulder of the shell and with an annular space therebetween, a funnel member loosely mounted on said shell having a throat communicating with the annular space between said core and shell, means carried by said frame to discharge a predetermined quantity of packing powder into said cup, a press carried by said frame to tamp said powder into said annular space between the core and shell, means to discharge a second predetermined quantity of powder into said funnel member, a second press adapted to compact said second charge of powder, means to remove said funnel member from its position over the shell, means to impart intermittent, progressive, rotary movements to said table whereby said core and shell are presented in turn to each of said above means, and means to impart successive tamping forces to each of said presses.

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