Sept. 15, 1931. H. RABEZZANA 1,823,430

AUTOMATIC CONTROL ATTACHMENT

Filed March 15, 1930

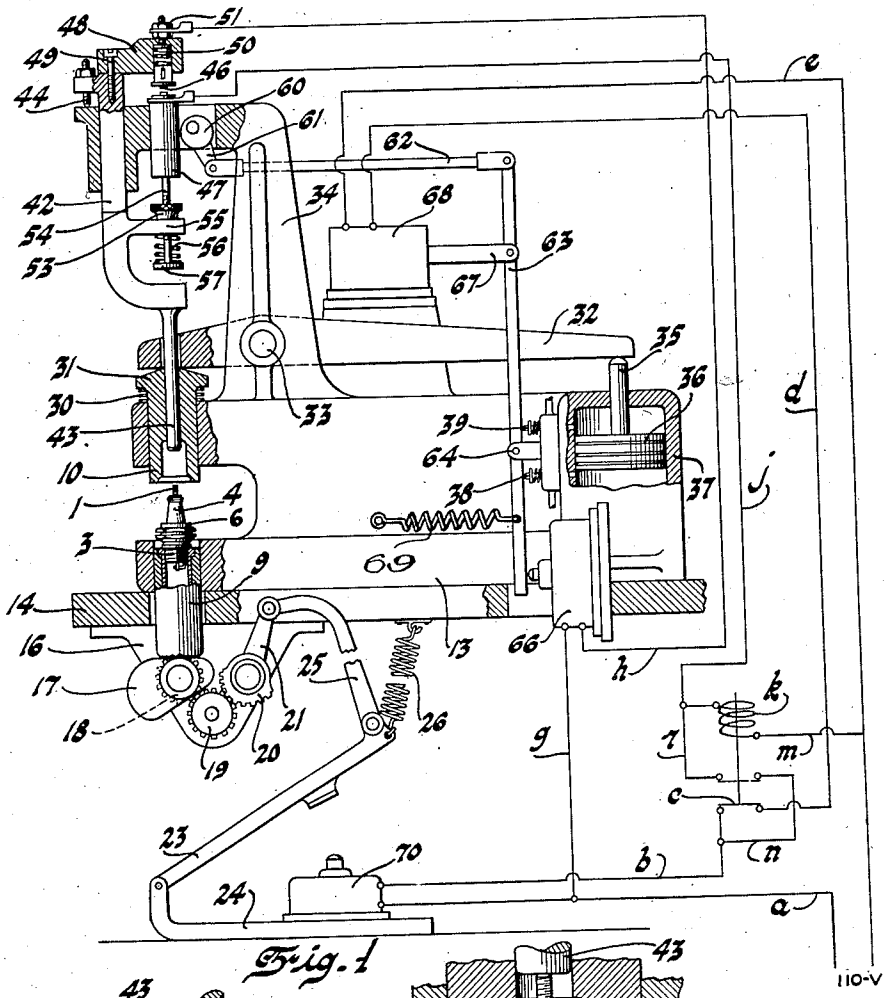


Fig. 1

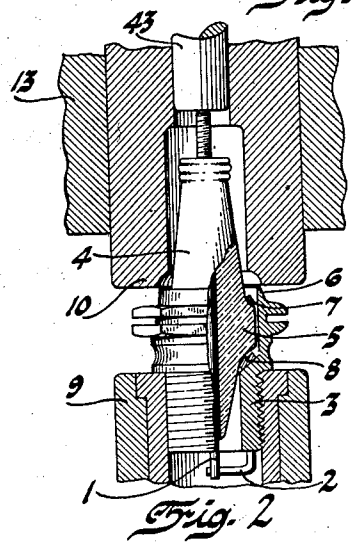


Fig. 2

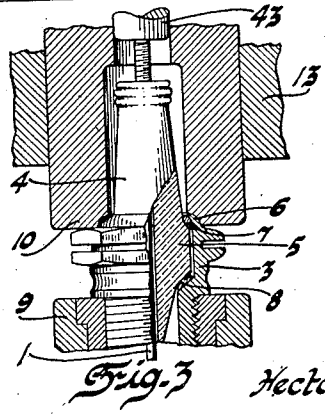


Fig. 3

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UNITED STATES PATENT OFFICE

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AUTOMATIC CONTROL ATTACHMENT

Application filed March 15, 1930. Serial No. 436,245.

This invention relates to the manufacture of spark plugs, and has for its particular object the provision of an improved machine for assembling spark plugs of the type disclosed in my issued Patent No. 1,609,735.

These so-called one-piece plugs have their parts permanently assembled; the assembled unit consisting of an insulator core for the central electrode secured and held in the shell by an inturned flange with suitable sealing gaskets between the core and shell.

Heretofore the assembly operation involved merely the application of pressure to bend the shell flange over the core to lock the core in the shell and at the same time compress the gaskets to make the joint leak proof, the extent of pressure application being gauged entirely by the operator. Thus proper assembly of the plug was dependent somewhat upon skill of the workman and obviously the product was not uniform as variations resulted according to the extent of pressure application. If too little pressure was applied there would be insufficient compression of the gaskets while if pressure application exceeded the proper amount, the gaskets were squashed and damaged and very often the insulator core was cracked.

To eliminate the human element and the exercise of skill on the part of the workman so that lower priced labor may be used and to automatically compensate for slight irregularities and variations of different plug parts as are bound to occur, so that spark plugs may be assembled at a rapid rate with unvarying uniformity and without needless scrap, are among the purposes for which the machine forming the present subject matter has been designed. To this end there is contemplated the provision of mechanism that will automatically adjust itself according to the character of each set of parts to be acted upon and assembled into a complete unit to terminate the action of pressure after a core has been sunk a predetermined distance in its shell, whereby the gaskets in every plug assembled are compressed to the same degree.

The invention will be better understood upon reference to the accompanying drawings wherein Figure 1 is a side elevation of the machine with parts broken away and shown in section together with a diagrammatic illustration of an electric wiring system. Figures 2 and 3 are detail sectional views of the die members in different stages of relative movement.

Referring first to the structure of the spark plug, the spark gap is shown in the drawings as being provided by spaced electrodes 1 and 2, the electrode 2 being secured to the outer metallic shell 3 that is to be threaded in an opening leading to the engine combustion chamber, and the electrode 1 being surrounded by a core 4 of insulating material such as porcelain or the like, that has a medial enlargement 5 adapted to be secured in the shell upon the crimping or deformation of a preformed upwardly extending flange 6. This flange 6 is crimped or bent in upon the drawing together of a pair of die sections which sinks the core in the shell and thereby compresses the sealing gaskets 7 and 8 interposed between the core and shell and formed preferably of ductile metal, copper being an example.

The die sections 9 and 10 are slidable respectively in the main frame 13 of the machine which is mounted on a bed or work table 14. Figure 1 illustrates the relative position of the several parts of the machine with the die sections separated to permit insertion and removal of the spark plug parts. Beneath the table 14 is a dependent bracket 16 on which is mounted a rotary cam or eccentric 17 for engagement with the bottom of the die member 9. The cam is provided with a gear element 18 meshing with a gear 19 which in turn is engaged by a gear sector 20 having operating arm 21. A foot lever 23 is pivoted to a floor plate 24 and connected by a link 25 with the operating arm 21 of the gear train. A spring 26 may be provided to normally hold the foot lever in retracted position. Depression of the foot lever actuates the cam through the gear train to swing it in a clockwise direction and thereby lift the die 9 to bring the spark plug flange 6 in

close proximity to the crimping die 10, the contour of the cam being such that at the upper limit of movement it locks the die in raised position. An expansion spring 30 bears against the underside of the head 31 of the crimping die 10 to normally hold the die in retracted position, while one end of a rock lever 32 pivoted at 33 to the standard 34 of the frame bears against the top of the head 31; the other end of the rock lever being engaged by the stem 35 of a piston 36 slidable in the power cylinder 37. A valve 38 controls communication from a suitable source of air pressure to the underside of the piston while a valve 39 controls communication to the upperside of the piston.

Slidable in a lateral arm of the upright 34 is a carrier element or follower 42 having a dependent pin 43 projecting through the rock lever 32 and crimping die 10 for engagement with the core unit or upper end of the central electrode 1 of the spark plug. Descent of the carrier or follower 42 is limited by the set screw 44. Carried by the follower are a pair of contacts 46 and 47 respectively. The contact member 46 is slidable in an opening of the block 48 secured by the screw 49 and forming a part of the carrier 42, against the tension of a spring 50 and has an extension or stem which carries adjustment nuts 51 thereon beyond the head 48. The contact member 47 is slidable in an aperture of the upright 34 and has an adjustable stop or nut 53 threaded on its stem 54 and engageable with a lateral projection 55 of the carrier 42, a coil spring 56 being provided between the underside of the projection 55 and terminal head 57 of the stem 54 to yieldingly maintain the stop 53 on its seat. The spacing between the contacts 46 and 47 is dependent upon the desired sinking of the core and it may be varied by the adjustment of the nuts 51 and 53 to suit different conditions of use. A cam or eccentric 60 pivoted in the upright 34 is engageable with the slider contact 47 to lock it fixed relative to the frame upon proper manipulation, and has an operating arm 61 connected by the link 62 with a lever 63 that is pivoted at 64 to the main frame 13. This lever 63 engages on opposite sides of its pivot point 64 with the stems or operating members controlling the valves 38 and 39 to alternately open and close the same and the lower end of the lever engages with the operating member of a switch 66. A link 67 forming a part of the solenoid 68 is connected with the lever 63 for controlling the swinging movement thereof against the tension of a spring 69.

This solenoid forms a part of a main electrical circuit leading from a source of electrical energy indicated by the figures 110 V. The main circuit includes a line or conduit a connected through a switch 70 with a line b in turn connected through the relay switch c with the line d leading to the solenoid and the return line e leading from the solenoid. Tapped in on the line a is a line g connected through the switch 66 with the line h leading to the contact element 46, which together with the wire j leading from the contact 47 through the coil k controlling the switch core and line m leading to the return line e, forms another circuit.

To effect assembly of a plug by the operation of the machine, the operator inserts a spark shell with the core in place in the die 9 and then depresses the foot pedal 23 to raise the die and plug parts. In this step the upper end of the central electrode engages with the carrier pin 43 and lifts the carrier bodily upwardly together with the spaced contact members 46 and 47. In its final movement lever 23 engages with the switch 70 to close the main circuit whereupon current flows through the lines a and b, switch c, line d, and through the coil of the solenoid and return line e, thus causing the link 67 to be sucked into the solenoid swinging the lever 63 to simultaneously rotate the cam 60 and wedge the slider 47 to the frame, actuate the valves 38 and 39, and close the switch 66 between the current conducting lines g and h. Thereupon the pressure device rocks the lever 32 to depress the crimping die which deforms the upwardly extending flange 6 compressing the gaskets 7 and 8 causing the core 4 to sink in the shell. As the core sinks the carrier 42 follows its movement closing the space between the contacts and bringing the contact 46 into engagement with the slider contact 47, now wedged and held stationary with the frame by the cam 60. The engagement of the contacts 46 and 47 connects the lines h and j and allows current flow, since switch 66 is closed, through to the coil k, line m and return line e. Energization of the coil k retracts the switch c breaking the main circuit and closing the lines n and r connected respectively to the line b and coil k. As soon as the main circuit is broken the action of the solenoid 68 ceases and the parts controlled thereby are restored to original position under influence of the spring 69. So long as the foot pedal is held depressed and the switch 70 closed, current will flow through the lines a, b, n, r, k, m and e, and further operation of the machine cannot occur until manual pressure on the foot pedal is relieved when the spring 26 will return the die 9 to its lowered position and open the switch 70 completely cutting off current flow to allow the switch c to resume original position. The assembled plug can then be removed and the cycle of operations repeated.

It will be apparent that with t! machine as above described a uniform product will

result and compression of the gaskets and sinking of the core will be the same for each set of parts acted on. Slight differences in dimensions and size of parts as is bound to happen from time to time in mass production are compensated for by the fact that the contact parts are set after the carrier is engaged with a given core to be sunk in the shell, so that the extent of its follow up movement is limited by the predetermined spacing of the two contact members. As before pointed out the proper spacing of the contact members may be varied by the adjustment of the nuts 51 and 53 according to conditions of use.

While the parts have been described more or less specifically it will be understood that various changes may be readily made. For example, instead of electrically controlled timing devices there may be substituted pneumatic pressure devices with suitable pressure conducting lines and valve mechanisms. It is intended to cover the invention in all of its forms as set forth in the appended claims.

I claim:

1. A machine for assembling spark plugs of the type wherein a gasket is interposed in compression between the core and shell, including a pressure applying member engageable with a part of the shell to crimp the same over a portion of the core and sink the core in the shell to thereby compress the gasket, means to actuate said member, a follower engageable with the core and movable to follow the sinking thereof, and cooperative control elements for said actuating means at least one of which is movable with the follower in its movement so as to vary the relation of the elements and thereby terminate the action of the actuating means after a predetermined sinking of the core.

2. A machine for assembling spark plugs of the type wherein a gasket is interposed between the core and shell and compressed upon the application of pressure on the shell to deform a part thereof for holding the parts assembled, including a pressure applying member engageable with the shell control mechanism therefor, and means engageable with the core to follow the sinking thereof in the shell and operatively associated with the control mechanism for rendering the pressure applying member ineffective after the core has been sunk a predetermined distance.

3. A machine for assembling spark plugs of the type wherein a gasket is interposed between the core and shell and compressed upon the application of pressure on the shell to deform a part thereof for holding the parts assembled, including a pressure applying member engageable with the shell to deform the same and thereby sink the core, means to actuate said member, and mechanism to cut off said means, including a follower engageable with the core and movable to follow the sinking thereof, and a pair of elements which normally have a spaced apart relation corresponding to the predetermined proper degree of sinking of the core, and one of which is movable with the follower to take up said space and thereby terminate the action of said actuating means.

4. A machine for assembling spark plugs or the like, including a pair of relatively movable members, one engageable with a part of the spark plug shell and the other engageable with a part of the spark plug core, means to actuate the shell engaging member to move said shell part to assembled position, and thereby sink the core, and control means associated with the core engaging member to automatically render inoperative the first mentioned means after a predetermined sinking of the core.

5. A machine for assemblying spark plugs or the like, including a movable member engageable with a part of the spark plug shell, means to actuate said member to bring said shell part into assembled position and sink the spark plug core in the shell, means to follow up the sinking of the core, and a control device operative automatically at a predetermined stage in the movement of said follow-up means for restoring the actuating means to original position.

6. A machine for bending a portion of a spark plug shell over a shoulder of an insulator core to sink and hold the core on a sealing gasket and in assembled position, including a main frame, a pair of movable die members carried by the frame, one of which is to receive the shell with the core in place, means to lift and lock the last mentioned die, a power device for depressing the other die, an element slidable in the frame and adapted for engagement with the core to lift therewith upon the manipulation of said means and to follow the sinking thereof, a pair of contacts normally spaced apart a distance corresponding to the desired degree of sinking of the core, one of which is carried by said slidable element in its movement in both directions and the other of which is carried by the element in one direction, means to lock the last mentioned contact fixed with the frame when the element reaches its uppermost limit in the operation of the machine, a main circuit adapted to be closed when the lower die is lifted, a device in said circuit energized by current flow to render effective both said lock means and power device, and a second circuit of which said contacts form a part and having therein a device for breaking the first mentioned circuit when the second circuit is closed by the engagement of said contacts as said slidable element follows up the sinking of the core.

7. A machine for bending a portion of a

spark plug shell over a shoulder of an insulator core to sink and hold the core on a sealing gasket and in assembled position, including a main frame, a pair of movable die members carried by the frame, one of which is to receive the shell with the core in place, means to lift and lock the last mentioned die, a power device for depressing the other die, an element slidable in the frame and adapted for engagement with the core to lift therewith upon the manipulation of said means and to follow the sinking thereof, a pair of contacts normally spaced apart a distance corresponding to the desired degree of sinking of the core, one of which is carried by said slidable element in its movement in both directions and the other which is carried by the element in its upward movement, means to fix the last mentioned contact relative to the frame at the uppermost position of the element, an electrically actuated device for rendering the power device effective, a current conducting circuit therefor, a second circuit controlled by said contacts, and electrically controlled means in the second circuit to open the first circuit when the contacts are closed upon movement of the element in following core sinking.

8. The structure of claim 7 together with adjustable means to vary the normal spacing of the contacts.

9. A machine for bending a portion of a spark plug shell over a part of an insulator core to sink the core on a sealing gasket in the shell and hold the parts assembled, including a main frame, a pair of movable die members carried by the frame, one of which is to receive the shell with the core in place, means to move the shell receiving die toward the other die, a power device for moving said other die into engagement with the shell portion to be bent, a power transmission conduit leading to said device, an element movable with the core, a valve device controlled by said element, means to set the valve parts for predetermined action after the shell receiving die has reached its limit of movement toward the other die, a power transmission conduit controlled by said valve, and a device associated with said last mentioned conduit for cutting off the transmission of power thru the first mentioned conduit by the action of said valve after a predetermined sinking of the core.

10. A machine for bending a portion of a spark plug shell over a part of an insulator core to sink the core on a sealing gasket in the shell and hold the parts assembled, including a main frame, a pair of movable die members carried by the frame, one of which is to receive the shell with the core in place, means to move the shell receiving die toward the other die, a power device for moving said other die into engagement with the shell portion to be bent, an element slidable in the frame and engageable with the core for movement therewith, a device operatively associated with said element for rendering the power device ineffective after a predetermined sinking of the core, and means to automatically set the device for operation thru said element in each operating cycle of the machine in accordance with the plug parts to be assembled.

11. A machine for bending a portion of a spark plug shell over a part of an insulator core to sink the core on a sealing gasket in the shell and hold the parts assembled, including a main frame, a pair of movable die members carried by the frame, one of which is to receive the shell with the core in place, means to move the shell receiving die toward the other die, a power device for moving said other die into engagement with the shell portion to be bent, means for rendering the power device ineffective, a carrier for said means engageable with the core to follow the sinking of the core, and a device for setting said means so that it operates thru the carrier after a predetermined sinking of the core.

12. A machine for bending a portion of a spark plug shell over a part of an insulator core to sink the core on a sealing gasket in the shell and hold the parts assembled, including a main frame, a pair of movable die members carried by the frame, one of which is to receive the shell with the core in place, means to move the shell receiving die toward the other die, a power device for moving said other die into engagement with the shell portion to be bent, an electric circuit adapted when closed to render the power device ineffective; a pair of contacts in said circuit normally spaced apart a predetermined distance in accordance with the desired sinking of the core, a carrier for said contacts engageable and movable with the core, and means to automatically fix one of the contacts when the power device is made effective for engagement with the other contact movable with the carrier as it follows up the sinking of the core.

13. A machine for bending a portion of a spark plug shell over a part of an insulator core to sink the core on a sealing gasket in the shell and hold the parts assembled, including a main frame, a movable die member engageable with the shell portion to bend the same, a power device for moving said die member, and means controlled by the sinking of the core to render the power device ineffective after a predetermined degree of sinking.

14. A machine for bending a portion of a spark plug shell over a part of an insulator core to sink the core on a sealing gasket in the shell and hold the parts assembled, including a main frame, a movable die mem-

ber engageable with the shell portion to bend the same, a power device for moving said die member, and means to render the power device ineffective, including a pair of contact elements having an initial spacing corresponding to the desired degree of sinking, and a slider device engageable with the core to follow the sinking thereof, and adapted by its movement to close the space between the contacts.

15. A machine for bending a portion of a spark plug shell over a part of an insulator core to sink the core on a sealing gasket in the shell and hold the parts assembled, including a main frame, a movable die member engageable with the shell portion to bend the same, a power device for moving said die member, and means to render the power device ineffective, including a pair of contact elements having an initial spacing corresponding to the desired degree of sinking, a follower for the core carrying one contact for movement therewith in both directions and the other contact for movement in one direction, and means to lock the last mentioned contact at one limit of follower movement, whereby the other contact is moved into engagement therewith as the follower moves with core sinking.

In testimony whereof I affix my signature.

HECTOR RABEZZANA.