Jan. 3, 1961 D. D. HUYETT 2,966,820

PLUG SLITTING AND WIRE INSERTION APPARATUS

Original Filed May 3, 1954 3 Sheets-Sheet 1

FIG. 1.

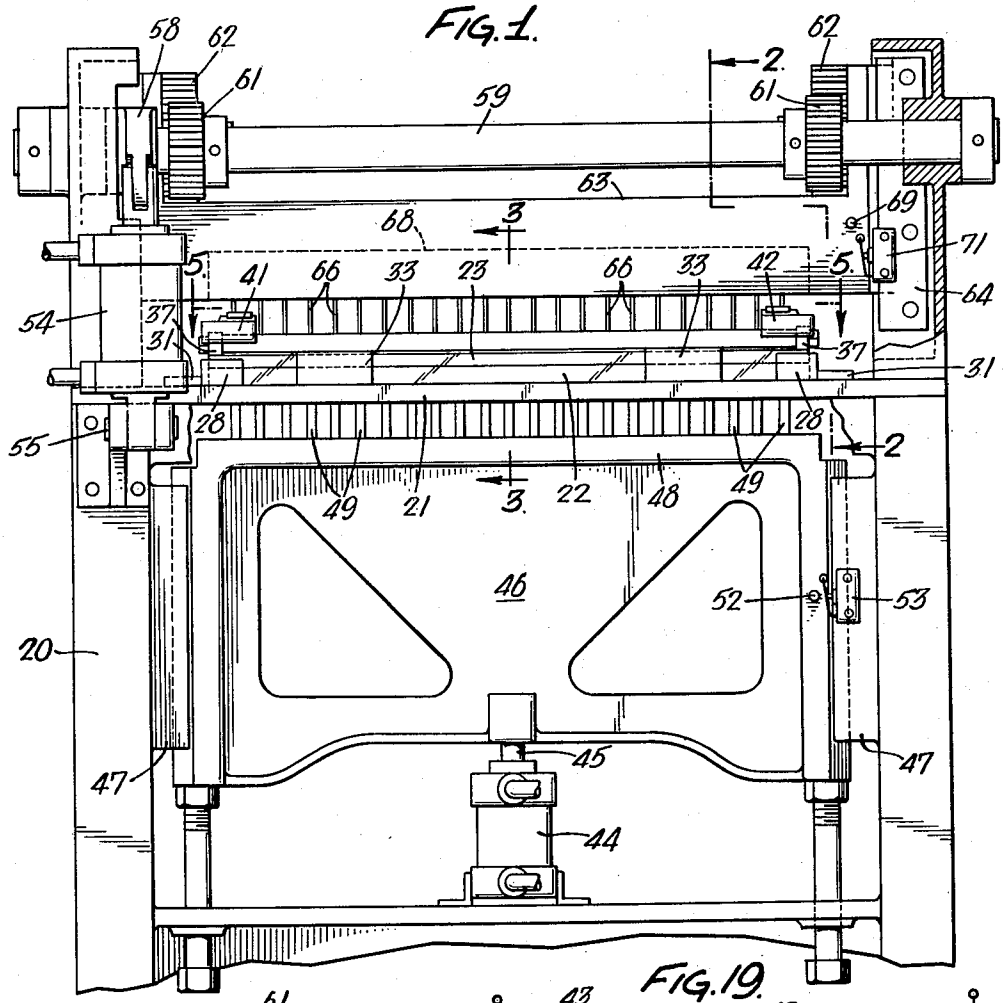


FIG. 19.

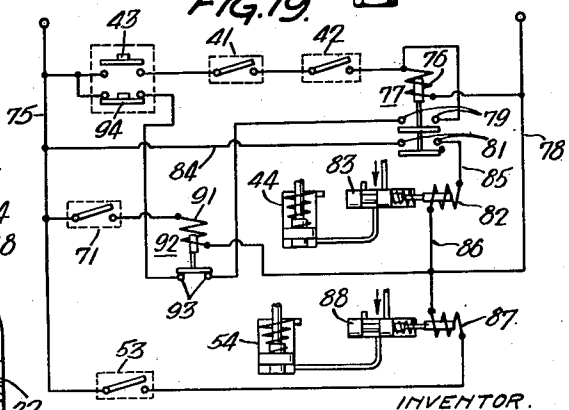
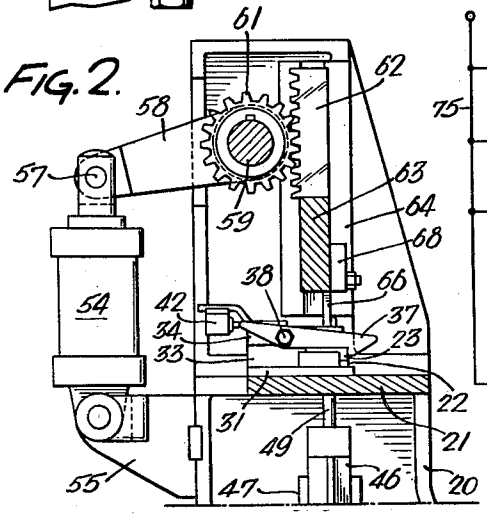


FIG. 2.



INVENTOR.
Daniel D. Huyett
BY Howson & Howson
ATTORNEYS

Jan. 3, 1961 D. D. HUYETT 2,966,820

PLUG SLITTING AND WIRE INSERTION APPARATUS

Original Filed May 3, 1954 3 Sheets-Sheet 2

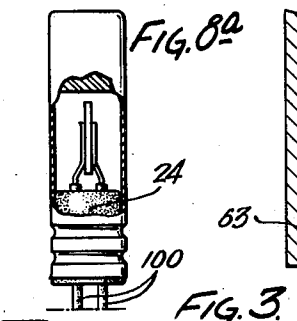


FIG. 8a

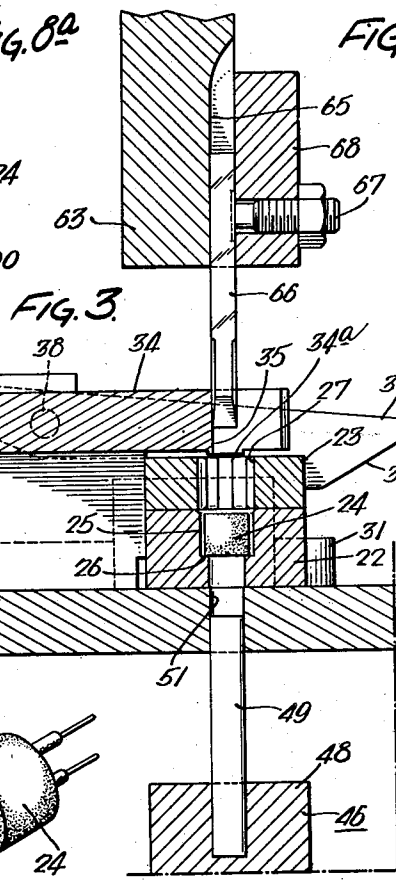


FIG. 3

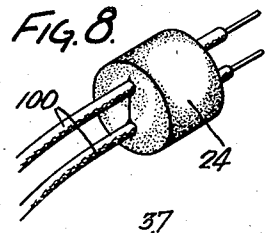


FIG. 8

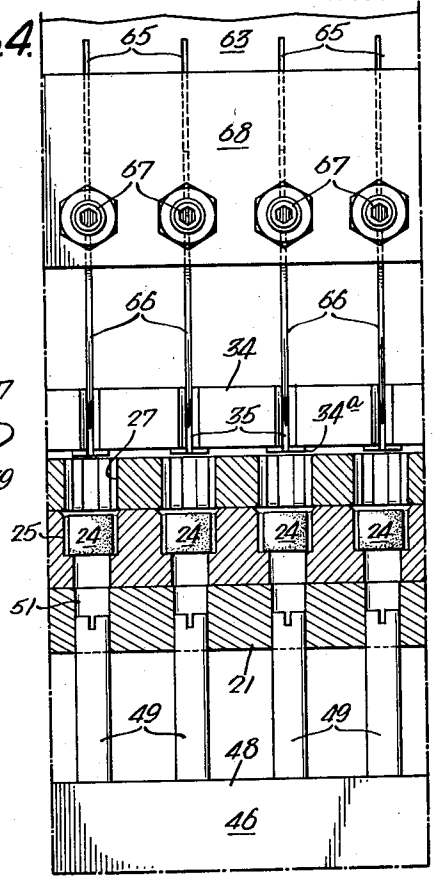


FIG. 4

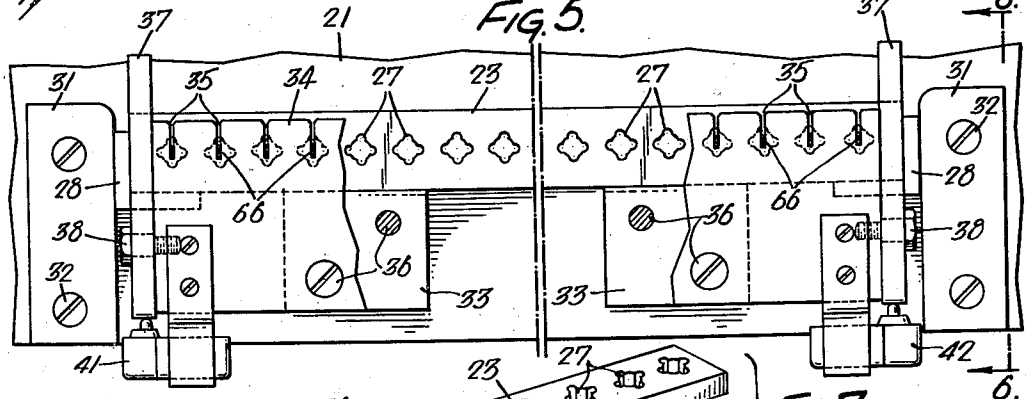


FIG. 5

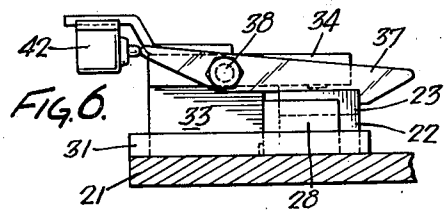


FIG. 6

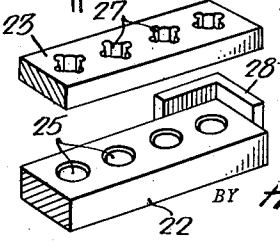


FIG. 7

INVENTOR.
Daniel D. Huyett
BY Howson & Howson
ATTORNEY

Jan. 3, 1961 D. D. HUYETT 2,966,820

PLUG SLITTING AND WIRE INSERTION APPARATUS

Original Filed May 3, 1954 3 Sheets-Sheet 3

FIG. 9.

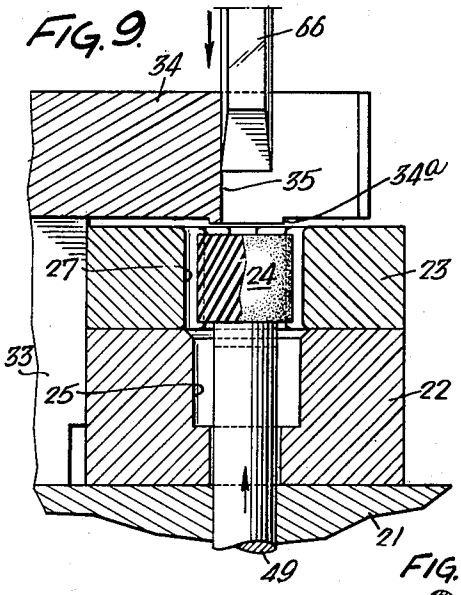


FIG. 10.

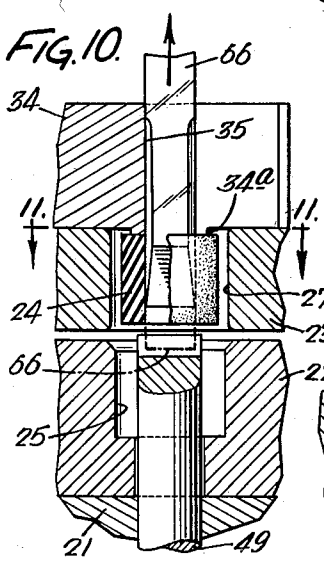


FIG. 11.

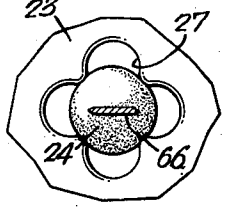


FIG. 12.

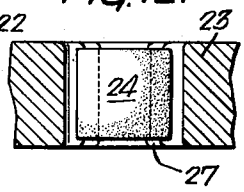


FIG. 19a



FIG. 13.

FIG. 16.

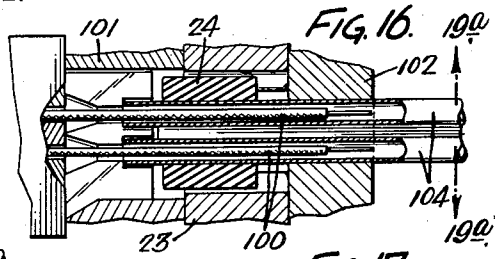


FIG. 17.

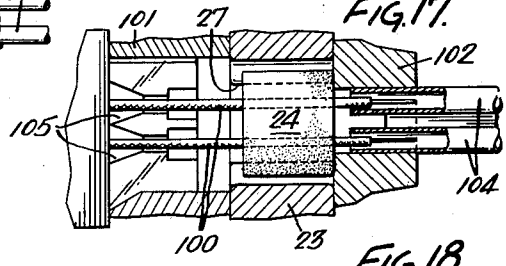


FIG. 14.

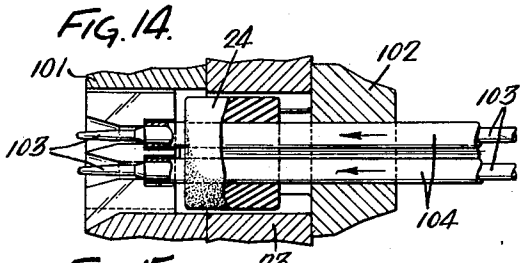


FIG. 18.

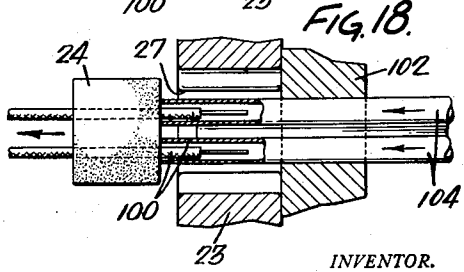
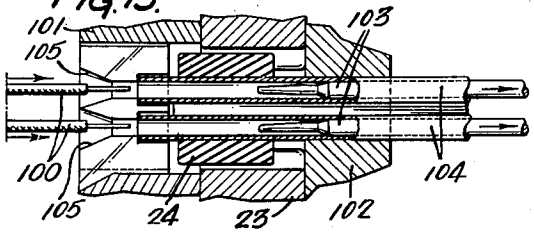


FIG. 15.



INVENTOR.

Daniel D. Huyett

BY Howson & Howson

ATTORNEYS

United States Patent Office 2,966,820 Patented Jan. 3, 1961

2,966,820

PLUG SLITTING AND WIRE INSERTION APPARATUS

Daniel D. Huyett, Wilmington, Del., assignor to Atlas Powder Company, Wilmington, Del., a corporation of Delaware

Original application May 3, 1954, Ser. No. 427,064, now Patent No. 2,797,473, dated July 2, 1957. Divided and this application Mar. 19, 1957, Ser. No. 647,084

8 Claims. (Cl. 83—146)

The present invention relates to new and useful improvements in wire insertion apparatus and more particularly to new and useful improvements in apparatus for providing a longitudinal slit in each of a plurality of rubber plugs or the like and subsequently inserting a corresponding plurality of pairs of wires into the slit plugs. This is a division of my copending application for Plug Slitting and Wire Insertion Apparatus and Method, filed May 3, 1954, and assigned Serial No. 427,064 issued as Patent No. 2,797,473 on July 2, 1957.

The present invention is particularly adapted to the manufacture of electric blasting initiators wherein a plurality of pairs of wires are inserted into a like number of resilient rubber plugs or the like, for example, preformed plug closures which, in turn, are inserted into loaded detonator shells as shown and described in my United States Patent No. 2,773,409, issued December 11, 1956. Prior to the present invention and as disclosed in my U.S. Patent No. 2,657,454, the customary procedure followed in the insertion of pairs of wires into plugs was to position a plurality of solid plugs formed of a resilient material, such as rubber, into a plug holder and then cause pairs of spaced, axial-aligned perforating points or needles to pierce the plugs in advance of a complementary pair of sleeve-like elements or tubes moving with said needles and carried thereby, the needles functioning to form pilot openings in the plugs for reception of the tubes. The needles are then withdrawn leaving the tubes through the plugs for reception of a pair of wires. The tubes are then withdrawn leaving the plugs in firm gripping enclosure of the wires.

This prior method possesses one principal disadvantage in that the solid plug material between the pair of needles forces the points of the needles outwardly causing them to diverge away from each other so that the needles rub against the inner surface of the tubes with resulting excessive wear of the parts. Spreading of the needles also causes the tubes to spread outwardly resulting in wear on the exterior of the tube ends causing them to become sharp, deformed, and split or broken so that they cut the plug material. In addition, the spreading of the needles causes the needle points to bear hard on the tapered or funneled inlets to the plug holding jaws causing them to become worn and expose the tube ends so that the latter constitute obstructions to proper insertion of the wires into the tubes.

With the foregoing in mind, the principal object of the present invention is to provide novel apparatus for simultaneously slitting a plurality of resilient plugs prior to insertion of a corresponding plurality of pairs of wires through the plugs.

Another object of the present invention is to provide novel apparatus of the stated character which greatly improve upon prior wire insertion practice and prevent excessive wear on the wire insertion apparatus.

A further object of the present invention is to provide novel apparatus for forming a longitudinal slit in a rubber plug and then inserting a pair of needles through the slit in the plug followed by a pair of tubes preparatory to positioning a pair of wires in the rubber plugs.

A further object of the present invention is to provide novel apparatus which combine the plug slitting operation with the transfer of the plugs from a first holder to a second holder.

A still further object of the present invention is to provide novel apparatus having the features and characteristics set forth which is of relatively simplified construction and entirely efficient and effective in operation and use.

These and other objects of the present invention and the various features and details of the operation and construction thereof are hereinafter more fully set forth and described with reference to the accompanying drawings, in which:

Fig. 1 is a rear elevational view of a slitting machine made in accordance with the present invention for slitting a plurality of preformed resilient plugs simultaneously;

Fig. 2 is a fragmentary transverse sectional view taken on line 2—2 of Fig. 1, illustrating the mechanism for actuating the plug slitters;

Fig. 3 is an enlarged fragmentary transverse sectional view taken on line 3—3 of Fig. 1, illustrating the plug transfer and slitting mechanism;

Fig. 4 is a front elevational view partially in section of mechanism illustrated in Fig. 3;

Fig. 5 is a sectional plan view taken on line 5—5, Fig. 1 illustrating the means for positioning the plugs and plug holders in the slitting machine;

Fig. 6 is a transverse sectional view taken on line 6—6, Fig. 5 illustrating the latch means for maintaining the plug holders in the slitting machine;

Fig. 7 is a perspective view of one end of the first plug holder and second or clover-leaf plug holder which are inserted into the slitting machine;

Fig. 8 is a perspective view of a preformed plug closure having a pair of wires inserted therethrough according to the process of the present invention;

Fig. 8*a* is a side elevational view partially in section of an electric blasting cap incorporating the preformed plug closure assembly shown in Fig. 8.

Fig. 9 is an enlarged fragmentary sectional view illustrating the position of the plugs and various other operating parts of the present invention immediately prior to the slitting operation;

Fig. 10 is a fragmentary sectional view similar to Fig. 9 at the end of the slitting operation;

Fig. 11 is a sectional plan view taken on line 11—11, Fig. 10 illustrating the position of a plug in a plug holder with the slitting blade extending therethrough;

Fig. 12 is a fragmentary sectional view of the clover-leaf plug holder with a plug positioned therein;

Figs. 13 to 18, inclusive, are enlarged fragmentary sectional views illustrating the successive steps in the insertion of the wires through the slit plugs of the present invention;

Fig. 19 is a schematic wiring diagram illustrating the control mechanism for the slitting machine of the present invention; and

Fig. 19*a* is a sectional view taken on line 19—19, Fig. 16.

Referring now to the drawings and particularly Fig. 1 thereof, one form of slitting machine made in accordance with the present invention comprises generally a frame 20 and a flat horizontal work table 21 projecting outwardly at opposite sides of the frame. The table 21 supports a plug receiving and holding device comprising a pair of plug holders 22 and 23 which are placed upon

table 21 and are positioned and removably retained thereon in proper position relative to the operating mechanism of the slitting machine. Resilient plugs 24 formed of rubber or like material, are transferred from the first holder 22 to the second holder 23 and are slit during operation of the slitting machine.

The two plug holders 22 and 23 which constitute the plug receiving and holding device, are illustrated in Figs. 3 and 7 of the drawings. The plug holder 22 has a plurality of openings 25 extending therethrough which are adapted to receive the resilient plugs 24. Each opening 25 is provided with a shoulder 26 to provide a plug receiving portion of greater length and greater effective diameter than the plug so that the plug may be readily inserted into the openings of the holder 22. The plug holder 23 has a plurality of clover-leaf shaped openings 27 extending therethrough corresponding to the number of openings 25 in the holder 22. The clover-leaf openings 27 are of an effective diameter slightly less than the diameter of the resilient plugs 24 so that the plugs 24 must be forced into the openings 27 and after the plugs are in the openings 27 they are prevented from moving relative to the openings by the frictional engagement of the plugs with the circumferentially-spaced, inwardly and axially extending portions of the wall defining each clover-leaf opening 27. Where, in the present specification and in the subjoined claims, reference is made to "effective diameter," this phrase is used to define the actual or true diameter of an opening of cylindrical transverse cross-section, such as, for example, the opening 25 in plug holder 22. When this phrase is used in connection with a non-cylindrical opening such, for example, as when defining the clover-leaf opening 27 in plug holder 23 (see Fig. 11), it refers to the transverse distance between the inner ends of the circumferentially-spaced, inwardly and axially extending wall portions between the axially-extending grooves defining the clover-leaf openings 27, which wall portions, in the case of the clover-leaf opening 27, comprise diametrically opposed pairs of such wall portions, between the inner ends of which a plug will be frictionally gripped and retained within the clover-leaf opening when a plug is forced therein. Guide blocks 28, 28 are fixedly secured to the opposite rearward corners of the plug holder 22 and extend upwardly therefrom adjacent the front and side surfaces of the plug holder 22, for example, as illustrated in Fig. 7. These guide members 28, 28 engage the corners of the plug holder 23 and properly position the plug holder 23 relative to the plug holder 22 with the openings 27 and 25, respectively, in axial alignment with one another.

After the holders 22 and 23 are placed together with a plurality of resilient plugs 24 in the openings 25 of the holder 22, the two holders are inserted into the slitting machine on top of the table 21 in the relation shown in Fig. 3. With reference to Fig. 5, positioning blocks 31, 31 are bolted to opposite ends of the table 21, for example, as indicated at 32, and engage the outer side edges of the guide blocks 28, 28 secured to the lower plug holder 22 to position the plug holders 22 and 23 in proper position longitudinally of the table. In addition, a second pair of positioning blocks 33, 33 are also bolted to the table 21 and engage the rear surfaces of plug holders 22 and 23 to position the plug holders transversely of the table 21. A stripper plate 34 having a plurality of slots 35 therein is secured to the upper surfaces of the positioning blocks 33, 33 for example by means of bolts as indicated at 36, and extends forwardly from the positioning blocks 33, 33 to overlie the upper surface of the upper plug holder 23 with the slots 35 in alignment with the plug holder openings 27. By this construction when the two plug holders 22 and 23 are placed on the table 21 of the slitting machine in engagement with the pairs of positioning blocks 31 and 33 the plug holders 22 and 23 will be in the proper position relative to the slitting machine.

In accordance with the present invention means are provided to secure the plug holders 22 and 23 in position on the slitting machine and prevent operation of the slitting machine when the plug holders are not properly positioned therein. To this end, a pair of latches 37, 37 are pivotally mounted adjacent opposite sides of the stripper plate 34, for example, as indicated at 38, 38 and extend forwardly beyond the forward surface of the stripper plate, as shown in Figs. 3 and 6. During insertion of the plug holders 22 and 23 into the slitting machine the rear edge of the upper plug holder 23 engages cam surfaces 39, 39 on the forward ends of the latches 37, 37 and pivots the latches upwardly about their pivot points. When the plug holders 22 and 23 reach their rearward limit position in the slitting machine against the positioning blocks 33, 33 the latches 37, 37 engage the forward surface of the upper plug holder 23 and maintain the two plug holders 22 and 23 in position against the blocks 33, 33. When the latches 37, 37 are in this position in engagement with the forward surface of the upper plug holder 23, the rear ends of the latches engage and close a pair of series connected control switches 41 and 42 which are also in series with a start switch 43.

When the start switch 43 and switches 41 and 42 are closed, the machine is placed in operation. The plugs 24 are first transferred from the openings 25 in the plug holder 22 to the openings 27 in the plug holder 23 where they are slit longitudinally. More particularly, upon actuation of the start switch 43 when the two control switches 41 and 42 are closed, hydraulic fluid, such as air under pressure, is admitted to the lower end of a hydraulic cylinder 44. With reference to Fig. 1, the cylinder 44 is secured to the frame 20 of the machine and has the upper end of its piston rod 45 connected to a cross head 46. The cross head 46 is mounted in slides 47, 47 secured to the frame 20 and may be moved between upper and lower limit positions by means of the hydraulic cylinder 44. When hydraulic fluid under pressure is admitted to the bottom end of the cylinder 44 the cross head 46 is moved to its upper limit position and conversely, when the hydraulic pressure is released from the lower end of the cylinder 44, the cross head 46 is moved to its lower limit position.

Extending transversely of the cross head 46 at the upper end thereof is a plunger support 48 which carries a plurality of slotted plungers 49, for example, as illustrated in Figs. 3 and 4 corresponding to the number of openings in the plug holders 22 and 23. In the lower limit position of the cross head 46 the upper ends of the plungers 49 are positioned interiorly of openings 51, in table 21, and the openings 51, in turn, register with the openings 25 in the lower plug holder 22. During movement of the cross head 46 to its upper limit position the plungers 49 are moved upwardly into engagement with the bottoms of the plugs 24 in the lower plug holder 22 and force the plugs 24 upwardly into the openings 27 of the upper plug holder 23, for example, as illustrated in Fig. 9 of the drawings. As previously described the openings 27 of the upper plug holder 23 are of clover-leaf shape, as shown in Fig. 11, and since the effective diameter of each of said openings is less than the diameter of a plug forced therein, the walls defining said clover-leaf openings will frictionally engage the side walls of the plugs 24 to prevent relative movement of the plugs 24 with respect to the plug holder 23.

When the cross head 46 reaches its upper limit position, a switch actuating member 52 carried by one side of the cross head, as illustrated in Fig. 1, engages and closes a switch 53 secured to the slide 47. This, in turn, causes hydraulic fluid under pressure to be admitted to a hydraulic cylinder 54 which has its lower end pivotally secured to a bracket 55 extending outwardly from the

rear of the frame 20, as illustrated in Fig. 2. The forward end of the piston rod 56 of the hydraulic cylinder 54 is pivotally secured, as illustrated at 57, to one end of a rocker arm 58. The opposite end of the rocker arm 58 is fixedly secured to a shaft 59 extending transversely of the slitting machine so that when hydraulic fluid under pressure is admitted to the hydraulic cylinder 54, the shaft 59 is caused to rotate in the clockwise direction relative to Fig. 2, and when the hydraulic pressure is released the shaft 59 is caused to rotate in the counterclockwise direction. A pair of pinions 61, 61 are secured to the shaft 59 in engagement with racks 62, 62. The racks 62, 62, in turn, are carried by a cross head 63 extending transversely of cutter means such as the slitting machine and slidably mounted in slides 64, 64 secured to the frame 20 for vertical movement between upper and lower limit positions.

With reference to Figs. 3 and 4, a plurality of slots 65 are provided in the front face of cross head 63 and are adapted to receive a corresponding plurality of knives 66. Each knife 66 is secured in a slot 65 by means of an adjustable locking bolt 67 passing through a guard member 68 secured to the front surface of the cross head and by loosening the adjusting bolts 67, the knives 66 may be adjusted vertically relative to the cross head 63. In the upper limit position of the cross head 63 the lower ends of the knives 66 terminate in the slots 35 of the stripper plate 34 and are coaxial with the opening 27 in the upper plug holder 23. During the admission of hydraulic fluid to the hydraulic cylinder 54 the shaft 59 is caused to rotate in the clockwise direction relative to Fig. 2 and the knives 66 are actuated downwardly into engagement with the plugs 24 secured in the openings 27 of the upper plug holder 23. The end portions of the knives 66 are passed completely through the plugs 24 to a position within the slots in the upper ends of the slotted plungers 49, for example, as illustrated in Fig. 10 of the drawings thereby providing a transverse slit longitudinally through the plugs 24. It is to be noted particularly that the width of the transverse slit formed by the knives 66 is substantially less than the diameter of the plug 24 so that the opposite edges of the slit at no point extend to the circumference of the plug and the slit is entirely surrounded throughout its length by the resilient material of the plug.

When the cross head 63 reaches its lower limit position a switch actuating member 69 secured to the rear surface of the cross head 63 engages and closes a switch 71 which releases the hydraulic pressure from the lower end of the hydraulic cylinder 44 causing the piston of the hydraulic cylinder 44 to be moved to its lower limit position thereby lowering the cross head 46 and moving the plungers 49 to their lower limit position. As the cross head 46 is lowered, the switch actuating member 52 carried by the cross head 46 is disengaged from the switch 53 thereby opening the switch 53 and permitting the hydraulic fluid to be exhausted from the lower end of the hydraulic cylinder 54. This permits the piston of the hydraulic cylinder 54 to be moved to its lower limit position thereby rotating the shaft 59 in the clockwise direction and elevating the knives.

During initial upward movement of the knives 66 they carry with them the plugs 24 thereon and the holder 23. This upward travel of the plugs 24 and holder 23 at the start of the upward movement of the knives 66 continues for a very short distance only until the top surface of the holder 23 engages the underface of the stripper plate 34 as shown in Fig. 10 of the drawings. In this position of the holder 23 the projections 34*a* on the underside of the stripper plate 34 are received within the openings 27 of the holder 23 and are engaged by the top surface of the plugs 24 as shown. Thus, as upward movement of the knives 66 continues the knives are withdrawn from the plugs and the latter are retained by the projections 34*a* in a position centrally in the holder openings 27 with clearance both above and below the plugs as illustrated in Fig. 12 of the drawings.

This completes one cycle of operation of the slitting machine of the present invention and the latches 37, 37 may then be disengaged from the forward surface of the upper plug holder 23 permitting the plug holders 22 and 23 to be removed from the slitting machine. The machine is now ready to receive a second set of plug holders and repeat the above-mentioned slitting operation.

Fig. 19 is a schematic diagram illustrating the electrical and pneumatic controls for the slitting machine of the present invention. The relative position of the switches and cylinders is the position these switches and cylinders assume at the end of one complete cycle of operation of the slitting machine prior to the positioning of a pair of plug holders on the slitting machine table.

As a pair of plug holders is inserted into the slitting machine the switches 41 and 42 are closed and upon closing the start switch 43 a circuit is completed through the switches 41, 42 and 43 from a lead line 75 at one side of the line to the coil 76 of a relay 77 and then through a lead 78 to the other side of the line. This energizes the coil 76 and actuates the relay 77 to its upper limit position thereby completing a circuit through a first pair of contacts 79 and a second pair of contacts 81. Upon completion of a circuit through the second pair of contacts 81, the coil 82 of a solenoid valve is energized and the valve 83 is moved to the right from the position shown thereby permitting hydraulic fluid under pressure to be admitted to the lower end of the hydraulic cylinder 44. The circuit for the coil 82 is from the lead 75 at one side of the line through the lead line 84, the contacts 81, lead line 85 to the coil 82 and then through lead line 86 to the lead line 78 at the other side of the line.

When the piston of the hydraulic cylinder 44 reaches its upper limit position the switch 53 is closed thereby completing a circuit to the coil 87 of a solenoid valve 88 which in turn moves the solenoid valve to the right from the position shown permitting hydraulic fluid under pressure to be admitted to the lower end of the hydraulic cylinder 54. This causes the piston of the cylinder 54 to be moved to its upper limit position thereby forcing the knives downwardly. When the cross head 63 carrying the knives reaches its lower limit position the switch 71 is closed thereby energizing a coil 91 of a relay 92 actuating the relay 92 upwardly to open the circuit through a pair of contacts 93. The contacts 93 are in series with the first pair of contacts 79 of the relay 77 and the holding circuit for the relay coil 76 passes through the contacts 79 and 93. When this holding circuit is broken by energizing the relay 92 the relay coil 76 is deenergized thereby permitting the relay 77 to be moved downwardly breaking the circuit through the contacts 81 for the solenoid valve 83. The solenoid valve 83 is then returned to its off position permitting air to be exhausted from the lower end of the hydraulic cylinder 44 and the hydraulic cylinder 44 moves to its lower limit position. During movement of the hydraulic cylinder 44 to its lower limit position the switch 53 is opened, as previously described, which de-energizes the coil 87 of the solenoid valve 88 causing the solenoid valve 88 to move to its original position thereby permitting hydraulic fluid to be exhausted from the lower end of the hydraulic cylinder 54.

This permits the cutter means such as knives 66 to be retracted thereby completing one cycle of operation of the slitting machine. If it is desired to stop operation of the slitting machine at any time during its cycle of operation a stop switch 94 which is in series with the above-mentioned pairs of contacts 79 and 93 is opened causing the coil 76 of the cylinder 77 to be de-energized as previously described, thereby stopping operation of the slitting machine.

An important feature of the present invention is the

insertion of a plurality of pairs of wires **100** into a corresponding plurality of resilient plugs to form a finished article, for example, as illustrated in Fig. 8, consisting of a plug having a pair of wires inserted therethrough. As described previously, the plugs **24** are first transferred to a clover-leaf plug holder **23** and maintained in the desired position in the clover-leaf plug holder by frictional engagement between the walls of the openings **27** in the plug holder and the outer surfaces of the plug. After the plugs **24** are transferred to the plug holders **23**, the plugs are slit longitudinally, for example, by means of the knives as shown in Fig. 10. After the plugs are slit by the knives the plug holder **23** is positioned intermediate a pair of guides **101** and **102** with the slit in each plug extending in a predetermined position. A plurality of pairs of needles **103, 103** are mounted adjacent one side of the plug holder **23** for relative movement between forward and rearward limit positions and in the forward limit position thereof the needles are adapted to be projected through the slits in the plugs carried by the plug holder. It is to be noted with reference to the drawings that instead of the sharp pointed needles heretofore employed, the needles **103** of the present invention are provided with rounded or blunt ends in order to eliminate piercing or cutting of the plug material as the needles pass through the slit in the plug.

In addition, a pair of tubes **104, 104** is positioned coaxially with each pair of needles **103, 103** for relative longitudinal movement between forward and rearward limit positions. In order to retain the pairs of tubes **104, 104** in truly parallel relation as they pass through the slit in the plug, the tubes of each pair preferably are secured in fixed relation to each other by means of an intermediate connecting web **104***a* arranged as shown in Fig. 19*a* of the drawings and extending substantially the full length of the otherwise free or unsupported end portions of the tubes. The pair of wires **100, 100** is positioned at the opposite side of the plug holder from the needles and tubes in axial alignment with the needles and tubes and guide means **105** is provided to direct the wires **100** toward the plugs **24**. A pair of needles, a pair of tubes and a pair of wires are provided for each plug carried by the plug holder **23**.

With reference to Figs. 13 to 18, inclusive, of the drawings, there is illustrated the various steps in the wire insertion method of the present invention. The needles and tubes **103** and **104**, respectively, are in the position illustrated in Fig. 13 at the start of the insertion operation. In order to insert a pair of wires through a plug **24** the needles **103** are first forced toward their forward limit position wherein the points of the needles pass through the slit opening in the plug **24**. After the needles **103, 103** have pierced the plug **24** the tubes **104, 104** are projected to their forward limit position and are forced through the slit in the plug **24**. The needles are then withdrawn, for example, as shown in Fig. 15 of the drawings, and a pair of wires **100, 100** is inserted through the guide means **105** into the tubes **104, 104**. This position is illustrated in Fig. 15 of the drawings. Upon further retraction of the needles and further insertion of the wires, the wires pass entirely through the plug, for example, as illustrated in Fig. 16 of the drawings, and the tubes **104, 104** are retracted from the slit opening in the plug. The needle insertion apparatus is now in the position illustrated in Fig. 17 of the drawings wherein the pair of wires is securely gripped by the plug, while the plug is still in the plug holder **23**. The needles remain in the retracted position while the tubes **104, 104** are again forced toward their forward limit positions engaging the forward surface of the plug and forcing the plug out of the plug holder **23**. This completes the slitting and insertion operation of the present invention and the plug holder **23** may be returned to the slitting machine to receive a subsequent supply of plugs to be slit.

From the foregoing it is apparent that the present invention provides new and useful improvements in apparatus for providing a longitudinal slit in each of a plurality of plugs and inserting a corresponding plurality of pairs of wires into the slit plugs which greatly improves upon prior wire insertion practice and prevents excessive wear on the wire insertion apparatus. In addition, it is apparent that the present invention provides novel slitting apparatus for slitting a plurality of plugs simultaneously to prepare the plugs for further wire insertion operations.

While particular embodiments of the present invention have been illustrated and described herein, it is not intended to limit the invention to such a disclosure and changes and modifications may be incorporated and embodied therein within the scope of the following claims.

I claim:

1. In a machine for slitting plugs, a work table having an opening extending therethrough; a plug receiving and holding device adapted to be removably positioned on said work table above the opening therethrough and comprising a first holder having at least one opening of a greater effective diameter than a plug to readily receive a plug therein; and a second holder having at least one opening therein of an effective diameter slightly less than the diameter of a plug forced into said opening to frictionally retain said plug therein, said second holder being superimposed upon said first holder; guide means effective on said first and second holders to maintain the openings therein in axial alignment when said second holder is superimposed upon said first holder; positioning means on said work table effective on the plug receiving and holding device to maintain said opening in said work table in axial alignment with the axially aligned openings of said plug receiving and holding device; plunger means beneath said work table and operable to extend through the aligned opening in said work table and said first holder to transfer a plug from the opening in said first holder into the opening in said second holder and to support said plug within the opening in said second holder; cutter means operable to engage and pass through the plug in the second holder when said plug is frictionally retained in the opening in said second holder and is supported by said plunger, to thus provide in the plug a slit extending longitudinally through the plug; and means to retract the plunger and cutter means from engagement with the plug and out of the opening in the first and second holders, respectively, after the cutter means has passed through said plug to form the slit therein.

2. In a machine for slitting plugs as defined in claim 9, including stripper means to retain the plug within the opening in the second holder during retraction of the cutter means from engagement with the plug.

3. In a machine for slitting plugs, a first holder having openings to receive a plurality of plugs, a second holder having openings positioned in registry with the openings in said first holder and constructed to receive and retain the plugs therein, means including a plurality of plungers operable to engage and transfer plugs from the openings in the first holder into the openings of said second holder, actuating means for said plungers operable to advance the same in unison and transfer the plugs, a plurality of knives mounted at the opposite side of said plugs from said plungers operable to engage and pass through the plugs in the second holder while said plungers are in engagement with said plugs thereby providing in each plug a transverse slit extending longitudinally through the plug, actuating means for said knives operable in timed relation to the plunger-actuating means to advance said knives in unison entirely through the plugs, control means operable in the advanced position of the knives to cause the plunger-actuating means to retract the plungers from the first holders, and control means operable in the retracted position of the plungers to cause the knife-actuating means to retract the knives.

4. In a machine for slitting plugs, a first holder having openings to receive a plurality of plugs, a second holder

having openings positioned in registry with the openings in said first holder and constructed to receive and retain the plugs therein, means including a plurality of plungers operable to engage and transfer plugs from the openings in the first holder into the openings of said second holder, actuating means for said plungers operable to advance the same in unison and transfer the plugs, a plurality of knives mounted at the opposite side of said plugs from said plungers operable to engage and pass through the plugs in the second holder thereby providing in each plug a transverse slit extending longitudinally through the plug, actuating means for said knives operable in timed relation to the plunger-actuating means to advance said knives in unison entirely through the plugs, control means operable in the advanced position of the knives to cause the plunger-actuating means to retract the plungers from the first holders, control means operable in the retracted position of the plungers to cause the knife-actuating means to retract the knives, and stripper means to retain the plugs in the second holder upon retraction of said knives.

5. In a machine for slitting plugs, a first holder having openings to receive a plurality of plugs, a second holder having openings positioned in registry with the openings in said first holder and constructed to receive and retain the plugs therein, latch means operable in the latched position thereof to secure said first and second holders in predetermined relation to each other and the machine, means including a plurality of plungers operable to engage and transfer plugs from the openings in the first holder into the openings of said second holder, actuating means for said plungers operable to advance the same in unison and transfer the plugs, a plurality of knives mounted at the opposite side of said plugs from said plungers operable to engage and pass through the plugs in the second holder thereby providing in each plug a transverse slit extending longitudinally through the plug, actuating means for said knives operable in timed relation to the plunger-actuating means to advance said knives in unison entirely through the plugs, and control means operable in the latched position only of said latching means to effect operation of said actuating means for the plungers and knives.

6. In a machine for slitting plugs, a first holder having openings to receive a plurality of plugs, a second holder having openings positioned in registry with the openings in said first holder and constructed to receive and retain the plugs therein, latch means operable in the latched position thereof to secure said first and second holders in predetermined relation to each other and the machine, means including a plurality of plungers operable to engage and transfer plugs from the openings in the first holder into the openings of said second holder, actuating means for said plungers operable to advance the same in unison and transfer the plugs, a plurality of knives mounted at the opposite side of said plugs from said plungers operable to engage and pass through the plugs in the second holder thereby providing in each plug a transverse slit extending longitudinally through the plug, actuating means for said knives operable in timed relation to the plunger-actuating means to advance said knives in unison entirely through the plugs, control means operable in the advanced position of the knives to cause the plunger-actuating means to retract the plungers from the first holders, control means operable in the retracted position of the plungers to cause the knife-actuating means to retract the knives, stripper means to retain the plugs in the second holder upon retraction of said knives, and control means operable in the latched position only of said latching means to effect operation of said actuating means for the plungers and knives.

7. In a machine for slitting plugs, a holder having openings to receive a plurality of plugs, said openings having radially spaced inwardly directed wall portions extending longitudinally thereof operable to engage the plugs at predetermined portions of their periphery and permitting lateral expansion of the plugs at the unengaged portions thereof, means including a plurality of plungers operable to engage the plugs in the holder, actuating means for said plungers operable to advance the same in unison into engagement with the plugs, a plurality of knives mounted at the opposite side of said plugs from said plungers operable to engage and pass through the plugs in the holder thereby providing in each plug a transverse slit extending longitudinally through the plug, actuating means for said knives operable in timed relation to the plunger-actuating means to advance said knives in unison entirely through the plugs, control means operable in the advanced position of the knives to cause the plunger-actuating means to retract the plungers from engagement with the plugs, and control means operable in the retracted position of the plungers to cause the knife-actuating means to retract the knives.

8. In a machine for slitting plugs, a holder having openings to receive a plurality of plugs, latch means operable in the latched position thereof to secure said holder in predetermined relation to the machine, means including a plurality of plungers operable to engage the plugs in the holder, actuating means for said plungers operable to advance the same in unison into engagement with the plugs, a plurality of knives operable to engage and pass through the plugs in the holder thereby providing in each plug a transverse slit extending longitudinally through the plug, actuating means for said knives operable in timed relation to the plunger-actuating means to advance said knives in unison entirely through the plugs, control means operable in the advanced position of the knives to cause the plunger-actuating means to retract the plungers from engagement with the plugs, control means operable in the retracted position of the plungers to cause the knife-actuating means to retract the knives, stripper means to retain the plugs in the holder upon retraction of said knives, and control means operable in the latched position only of said latching means to effect operation of said actuating means for the plungers and knives.

References Cited in the file of this patent

UNITED STATES PATENTS

1,916,495	Wilcox	Mar. 1, 1927
2,713,713	Tubbs	July 26, 1955

UNITED STATES PATENT OFFICE

CERTIFICATION OF CORRECTION

Patent No. 2,966,820 January 3, 1961

Daniel D. Huyett

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, line 48, for the claim reference numeral "9" read -- 1 --.

Signed and sealed this 30th day of May 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents