

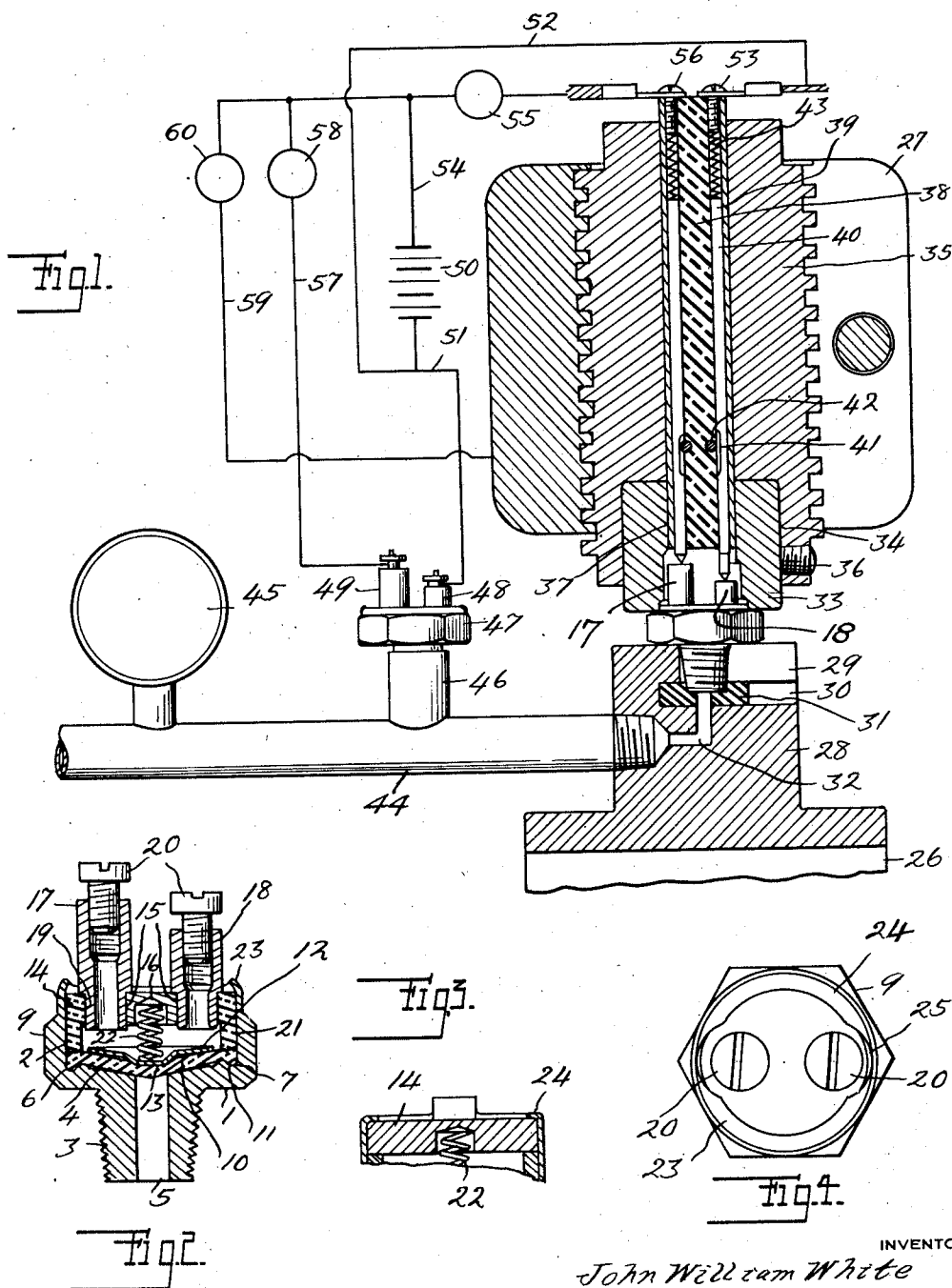
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J. W. WHITE

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METHOD OF AND APPARATUS FOR FORMING AND TESTING SWITCHES

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JOHN WILLIAM WHITE, OF DETROIT, MICHIGAN, ASSIGNOR TO KELSEY-HAYES WHEEL CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF NEW YORK

METHOD OF AND APPARATUS FOR FORMING AND TESTING SWITCHES

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The invention relates to the manufacture of switches and more particularly electric switches adapted to be operated by fluid pressure. The invention has for its primary object to provide an improved method of and apparatus for forming and testing switches. Another object is to provide in a machine for assembling the parts of a switch electrical connections whereby the operating pressure can be determined and any electrical defect in the switch detected.

Other objects will appear to one skilled in the art from an examination of the following description taken in connection with the drawing which forms a part thereof and in which

Figure 1 is a side elevation, partly in section, of an apparatus embodying my invention for forming and testing a switch;

Figure 2 is a sectional elevation of the switch;

Figure 3 is a similar view at right angles to Figure 2 of a portion of the switch;

Figure 4 is a plan view thereof.

As shown in the present instance, the invention is particularly applicable to the manufacture of stop light switches, each of which, as shown particularly in Figures 2, 3 and 4, comprises the cup-shaped casing 1 having the cup or pocket 2 therein and the externally threaded portion 3 extending axially from the base 4 of the cup and formed with the passage 5 opening into the cup. The inner face of the base 4 is preferably concaved slightly and provided at its outer perimeter with the annular groove 6 defined by the annular projection 7. The portion 8 of the casing 1 which forms the cup 2 is preferably hexagonal on its outer surface having the series of flat faces 9, which are adapted to provide a grip for a wrench. The externally threaded portion 3 of the casing provides for easily and quickly mounting the casing in an internally threaded sleeve, boss or the like, and may be threaded in by suitable means such as a wrench engaging the flat faces 9.

Within the cup 2 and in one position resting upon the base 4 thereof is the diaphragm 10 formed of suitable flexible material, such

as rubber, which is preferably premolded to provide on its under face the annular flange 11, which when the parts are assembled, as shown in Figure 2, enters the annular groove 6. Resting upon the diaphragm 10 is the metal plate 12 provided at its center with the depression 13. The plate is of thin metal and capable of bending under the application of pressure. The cover 14 of suitable dielectric material closes the mouth of the cup 2 and is provided with the pair of holes 15 extending transversely therethrough and the recess 16 formed centrally in the under face thereof between the holes.

Carried by the cover 14 are the pair of binding posts 17 and 18, the post 17 being longer than the post 18. Each post terminates in the projection 19 provided with longitudinally extended striations. The posts are mounted in the cover by inserting the projections 19 in the holes 15, the engagement of the striations with the walls of the holes fixing the posts in place.

The ends of the projections which project below the under face of the cover and which are preferably bent or peened over the edges of the holes to secure the posts in place constitute terminals. The binding posts 17 and 18 are internally threaded at their upper ends to receive screws 20 which may be of the usual type.

Integral with the cover 14 and projecting from the under face thereof at the periphery is the ring 21, which when the parts are assembled bears upon the outer periphery of the diaphragm 10 pressing it against the annular projection 7 and forcing the flange 11 into the groove 6. The lower edge of this ring is preferably, though not necessarily, rounded, as shown in Figure 2, so that it bears upon the diaphragm near its periphery and compresses it against the annular projection. The portion of the diaphragm at its periphery fills the groove 6 and the annular recess formed between the wall of the casing 1 and the lower edge of the ring. The diaphragm 6 at all times divides the cup 2 into two compartments and seals the compartment into which the passage 5 enters from that containing the ter-

minals of the binding posts 17 and 18 and the plate 12. The coil spring 22 seated at one end in the recess 16 and at the other end in the central depression 13 of the plate normally holds the plate against the diaphragm and places the diaphragm under compression and against the base 4 to close the passage 5.

When the casing 1 is formed the continuous annular flange 23 is provided at the mouth of the cup 2 and projecting above the cover 14 when the parts are assembled. It will be noted that in order to make the switch as compact as possible the binding posts 17 and 18 are quite near the outer edge of the cover, and since these posts are of metal and function as conductors of electricity, it is obviously necessary that there be no contact between the posts and the casing. Accordingly, as is clear from an examination of Figures 2 and 4, only the portions 24 of the flange 23 between the posts 16 and 17 are spun, crimped or peened over the top of the cover to secure it in position, the portions 25 of the flange adjacent the binding posts being left standing substantially upright.

When the stop light switch is in use, it is mounted upon some portion of a hydraulic brake system so that it is subjected to fluid pressure when the brakes are actuated in the well known manner. It will be understood that one post is connected to a battery or other suitable source of current, while the other post is connected to a lamp, which is to be controlled by the switch. Upon actuation of the brakes fluid is forced through the passage 5 and acts against the under face or bottom of the diaphragm flexing it to carry the plate 12 against the urge of the spring 22 into contact with the terminals of the binding posts 17 and 18, thus completing the electrical connection between the two posts. Upon releasing the brakes the parts of the switch assume their normal or idle positions, at which time the diaphragm 10 contacts with the base 4 of the cup and the plate 12 is held against the diaphragm by the spring 22.

The plate 12 does not contact with the ring 21 of the cover and is held at the center of the cup by means of the spring 22, which enters the central depression in the plate and also by reason of the fact that the plate soon becomes vulcanized to the diaphragm. Since the post 17 is longer than the post 18, the wires, not shown, which are fixed upon the posts by the screws 20, will be out of contact and thus the switch may be made smaller.

When the parts have been assembled with the annular flange 23 upstanding the switch is placed in a press, shown in Figure 1, comprising the movable ram 26 and the head 27. It is customary that the ram be

raised by any suitable means, as for example a toggle, thus carrying the switch into contact with the head. The ram includes the holder 28 provided with the slot 29 which receives the lower end, including the externally threaded portion 3 of the switch casing 1. Below the slot 29 is provided the pocket 30 in which is seated the rubber pad 31 on which the casing rests. Leading through the base of the holder 28 and the pad 31 is the conduit 32 which terminates at one end below the passage 5 of the switch. Mounted in the head 27 is the punch 33 carried in the recess 34 of the holder 35 and secured in position by any suitable means, such as the set screw 36. Through the punch 33 and the holder 35 extends the central passage 37, in which is inserted the plug 38 of rubber or other suitable dielectric material. Extending longitudinally through the plug are two holes 39 in which are seated the pins 40 provided with the notches 41 which receive set screws 42 to permit a certain amount of reciprocation of the pins 40 to prevent their involuntary removal from the holes 39. Springs 43 in the holes bear on the pins 40 and force them into the lowest position permitted by the set screws 42. It will be noted from an examination of Figure 1 that when the stop light switch is located in the die holder 28 and brought into contact with the punch 33 by raising the ram 26, the pins 40 will contact with the binding posts 17 and 18 of the switch, while the punch 33 will crimp the portions 24 of the projecting flange 23 down onto the cover 14, thus bringing the parts into their finally assembled position.

For the purpose of determining the range of pressure under which the switch will operate and of detecting any defect in the switch, the pipe 44 is connected to the outer end of the conduit 32. Pressure is set up in the pipe 44 by any suitable means and its amount is indicated by the reading of the gauge 45 mounted upon the pipe. Mounted upon the sleeve 46 projecting from the pipe 44 is the master switch 47, which is set to operate at the desired pressure. This master switch is of the same construction as the switch being formed and tested and has the binding posts 48 and 49 corresponding to the binding posts 18 and 17, respectively. One pole of the battery or other source of electrical current 50 is connected to the post 48 of the master switch by the lead 51 and to the post 18 of the switch in the press by the lead 52, the screw 53, the spring 43 and the pin 40. The other pole of the battery is connected to the post 17 of the switch in the press by the lead 54 through the bulb 55, the screw 56, the spring 43 and the pin 40 and to the post 49 of the master switch by the lead 57, which includes the bulb 58. The battery 50 is also connected to the head

27 of the press by the lead 59 joined to the lead 54 and including the bulb 60.

It will be noted from an examination of Figure 1 that one pole of the battery is connected to the corresponding posts 18 and 48 of the switch in the press and the master switch respectively, while the other pole is connected through the bulb 55 to the post 17 of the switch in the press, through the bulb 58 with the post 49 of the master switch and with the press itself through the bulb 60. Any desired amount of pressure may be introduced into the pipe 44, which pressure will be applied both to the master switch and the switch in the press and cause the plates in both switches to rise into contact with the terminals of the binding posts, thus completing the connection between the binding posts. By reason of the electrical arrangement previously described, the bulbs 55 and 58 thus will be lighted. As the operator crimps the flange 23 of the switch in the press he simultaneously admits pressure into the pipe 44. The master switch 47 will cause the bulb 58 to be lighted when the desired amount of pressure is applied. At the same time if the switch in the press is properly made the bulb 55 will be lighted. Thus the operator can simultaneously, while completing the switch, test its operation and make sure that it will respond to the desired pressure.

If the bulb 55 should light after the bulb 58, it is apparent that too much pressure is required to raise the plate 12 of the switch into contact with the terminals of the binding posts 17 and 18 or, in other words, that the distance between the plate in its idle position and the terminals is too great. The press will accordingly be adjusted to increase the amount of crimping, thus forcing the cover 14 into the cup 2 and the ring 21 against the diaphragm 10 until the bulb 55 lights simultaneously with the bulb 58. If the bulb 55 should light before the bulb 58 the crimping is too heavy and the switch is defective. In order to avoid such a condition, it is the practice to set the press at the point of minimum crimping and then increase the crimping, if necessary, in order to increase the responsiveness of the switch. The bulb 60, being connected to the head 27 of the press, will light, if the switch is in any way grounded, thus indicating a defect.

For the purpose of facilitating the checking up of the electrical circuits, it has been found desirable to make the bulbs 55, 58 and 60 of different colors. Preferably the bulb 55 is green, the bulb 58 is white, and the bulb 60 is red.

What I claim as my invention is:

1. In an apparatus for completing a switch having binding posts adapted to be connected electrically by an element of said switch under pressure, said apparatus com-

prising a bed in which said switch is placed and a movable die, connecting means carried by said die for contacting with said binding posts, a source of electrical energy and a bulb in circuit with said connecting means, a master switch, the binding posts of which are in circuit with a source of electrical energy and a bulb, means for operating and completing the switch in said bed, and means for supplying pressure simultaneously to both said master switch and the switch in said bed to cause the element in each switch to complete the circuits.

2. Those steps in the method of forming a switch which include, securing parts of the switch in assembled relation and testing the switch during the performance of the above step.

3. Those steps in the method of fashioning and testing pressure operated switches which include, finally securing the several parts of a switch in assembled relation and simultaneously determining the pressure at which the switch operates.

4. Those steps in the method of fashioning and testing pressure operated switches which include, securing several parts of the switch in assembled relation and simultaneously detecting any electrical defects therein.

5. Those steps in the method of fashioning and testing pressure operated switches which include, securing several parts of the switch in assembled relation and during the securing operation determining the pressure required to operate the switch as well as detecting any electrical defects therein.

6. Apparatus for fashioning and testing switches including, means for securing several parts of a switch in assembled relation, and means operable in dependence upon the means aforesaid for testing the switch.

7. Apparatus for fashioning and testing switches including, means for securing several parts of a switch in assembled relation, and means operable in dependence upon the means aforesaid for detecting any electrical defects in the switch.

8. Apparatus for testing pressure operated electric switches, comprising means for determining the pressure at which said switch operates in comparison with the pressure required to operate a master switch, and means for simultaneously detecting any electrical defect in said switch.

9. Apparatus for fashioning and testing pressure operated switches including, means for securing several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of the aforesaid means, and means for indicating the pressure required to operate said switch.

10. Apparatus for fashioning and testing pressure operated switches including, means

for securing several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the final operation of said first named means for actuating said switch, and means for indicating the operation of said switch and for also detecting any electrical defects in the switch.

11. Apparatus for fashioning and testing pressure operated switches including, means for securing the several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of the first named means, a pressure operated device also communicating with the fluid under pressure and fashioned to operate when a predetermined pressure has been reached, and means for determining the pressure at which the switch operates in comparison with the pressure at which said device operates.

12. Apparatus for fashioning and testing pressure operated switches including, means for securing several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of the above means to actuate the switch, a device responsive to the pressure conducted to the switch and operable when a predetermined pressure is reached, and means controlled by said first named means for indicating the time the switch operates in comparison with the time the device operates.

13. Apparatus for fashioning and testing pressure operated switches including, means for securing the several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of the first named means to actuate the switch, a device for indicating the pressure admitted to said switch, means operable in dependence upon the operation of the first named means for indicating the time the switch operates, and means for also detecting any electrical defect in said switch.

14. Apparatus for fashioning and testing pressure operated switches including, means for securing several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of the first named means to actuate the switch, means for indicating the pressure admitted to the switch, and means for indicating the time of operation of said switch.

15. Apparatus for fashioning and testing pressure operated switches including, means for securing several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of the first named means to actuate the switch, a master switch responsive to the pressure conducted to the switch aforesaid and operable when a predetermined

pressure is reached, and means for independently indicating the operation of both switches.

16. Apparatus for fashioning and testing pressure operated switches including, means for securing several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of the first named means to actuate the switch, a master switch responsive to the pressure conducted to the switch aforesaid and operable when a predetermined pressure is reached, means controlled by the first named means for independently indicating the operation of both switches, and means for determining the pressure at which the first named switch operates in comparison with the pressure at which the master switch operates.

17. Apparatus for fashioning and testing pressure operated switches including, means for securing several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of the first named means to actuate the switch, a pressure operated device responsive to the pressure conducted to the switch aforesaid and operable when a predetermined pressure is reached, and means for independently indicating the operation of both the device and switch.

18. Apparatus for fashioning and testing pressure operated switches including, means for clamping several parts of a switch in assembled relation, means for conducting fluid under pressure to the switch during the operation of said clamping means for actuating the switch, a pressure operated device responsive to the pressure conducted to said switch and operable when a predetermined pressure is reached, means for independently indicating the operation of the device and switch, and means for adjusting the clamping pressure exerted by said first named means to compensate for any variation in time between the operation of the device and the operation of said switch.

19. Apparatus for testing pressure operated electric switches comprising means for conducting fluid under pressure to the switch, a master switch responsive to the pressure conducted to the switch aforesaid and operable when a predetermined pressure is reached, means for independently indicating the operation of both switches, and means for simultaneously detecting any electrical defect in said first named switch.

In testimony whereof I affix my signature.

JOHN WILLIAM WHITE.