

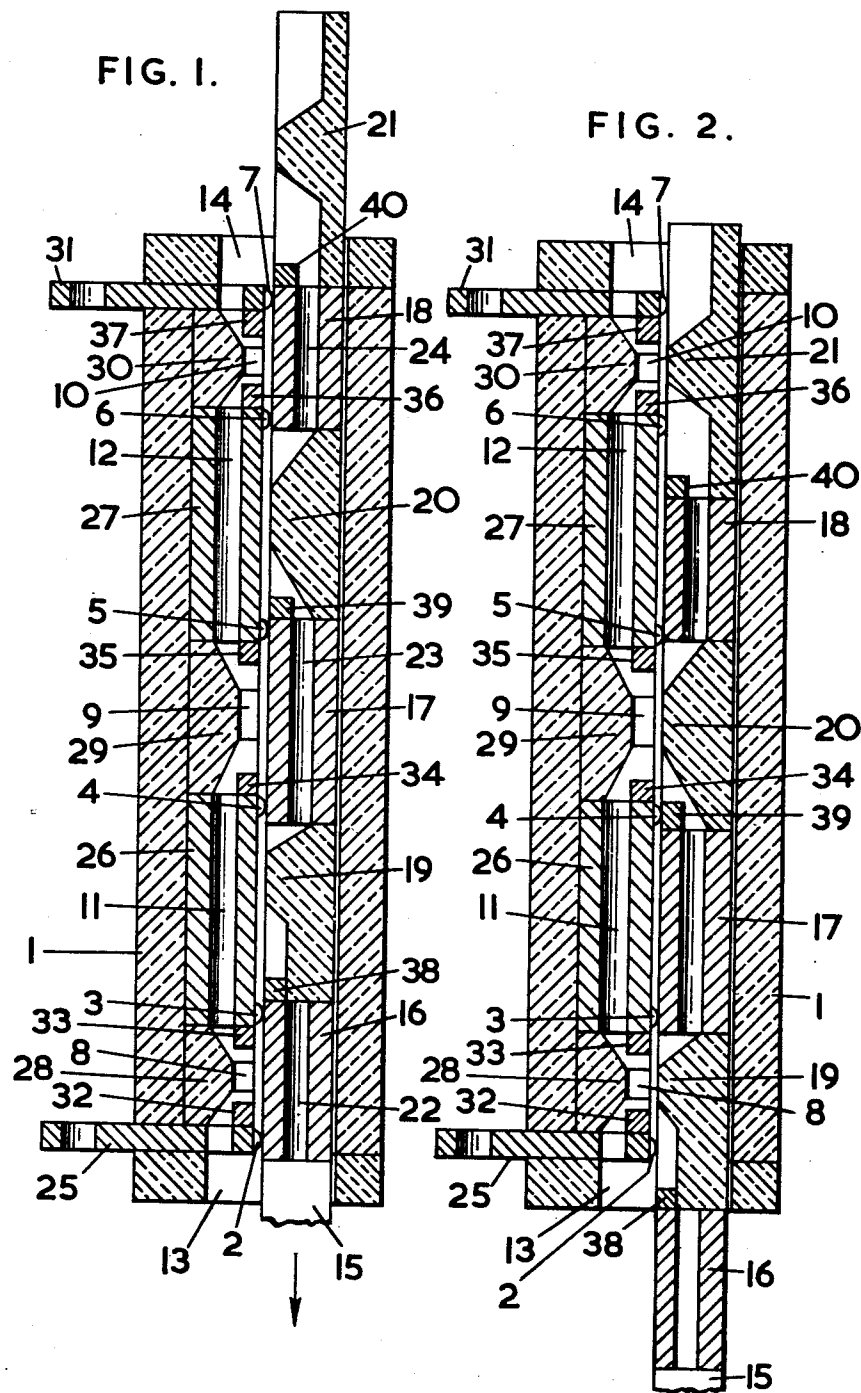
July 24, 1962

B. INGVALDSEN
ELECTRICAL SWITCH

3,046,376

Filed Aug. 31, 1960

2 Sheets-Sheet 1



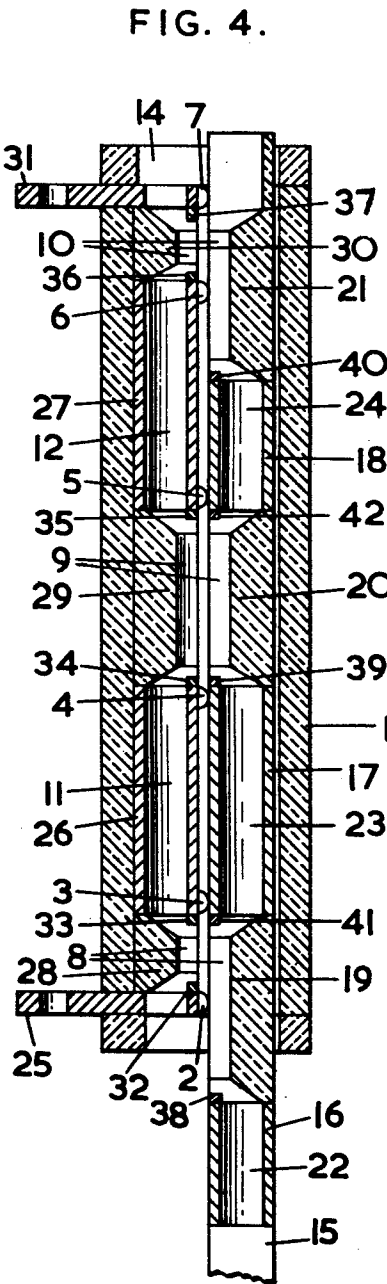
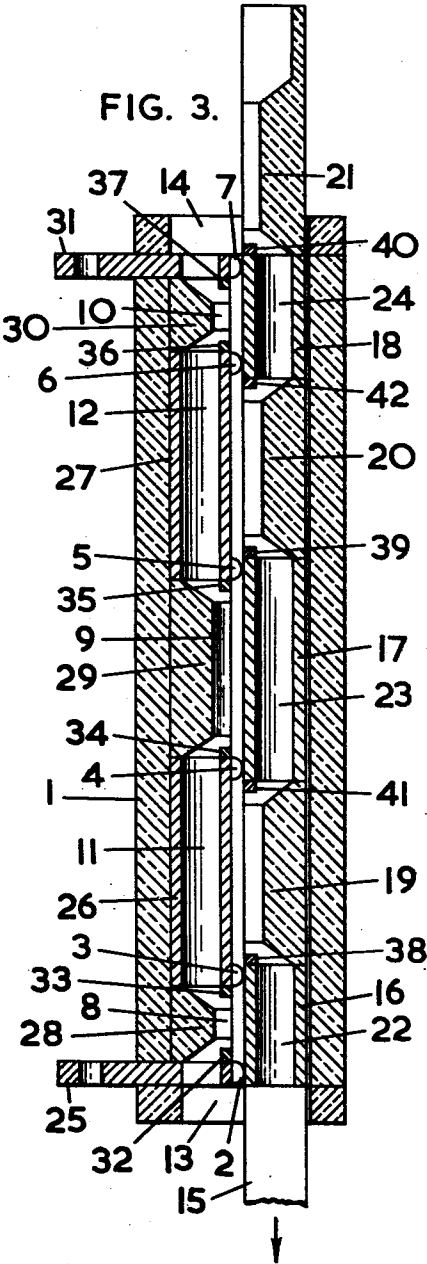
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ELECTRICAL SWITCH

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1 Claim. (Cl. 200-148)

This invention relates to electrical switches of the kind comprising a quenching chamber containing quenching medium and provided with fixed contacts and an axially-movable switch pin formed of electrically insulating and conducting parts, the arrangement being such that during opening of the switch, the conducting parts of the switch pin draw from some of the fixed contacts arcs which are in series with each other and produce pressure in the quenching medium so that the latter flows through and past the arcs for quenching the arcs.

As the quenching operation is effected in a very short space of time it is necessary to obtain correct timing of the formation and guidance of the arcs and the flow of the quenching medium in relation to the movement of the switch pin.

In known switches the correct timing is not always obtained, and the present invention is therefore intended to provide an improved switch of the kind referred to.

According to the invention there is provided a switch of the kind referred to wherein the switch pin comprises insulating parts which in the open position of the switch partly define passages in which the arcs are exposed to the action of the flowing quenching medium.

The said passages may be of substantially circular cross-section where the arcs are exposed to the action of the flowing quenching medium. Preferably there is a channel open through the quenching chamber in all positions of the switch pin. In a preferred construction open-ended tubular conductors are arranged in the quenching chamber, the internal spaces of these tubular conductors forming portions of the said channel open through the quenching chamber. Advantageously the fixed contacts are electrically connected to fixed terminals arranged so that the arcs travel from the contacts and the switch pin to burn in gaps between the fixed terminals and are there exposed to the action of the flowing quenching medium.

In the accompanying drawings two switches according to the invention are illustrated by way of example in sectional elevation,

FIGS. 1 and 2 showing one switch in its closed and open positions respectively, and

FIGS. 3 and 4 showing a modified switch in its closed and open positions respectively.

The switch illustrated in FIGS. 1 and 2 comprises a quenching chamber 1 of electrically-insulating material in which are secured apertured connectors 25 and 31, open-ended tubular conductors 26 and 27, and fixed insulating parts 28, 29 and 30 which may be integral with the quenching chamber 1.

The quenching chamber 1 contains quenching medium and has outlets 13 and 14, which may be provided in known manner with valves (not shown) which allow quenching medium to flow out only when the pressure in the quenching chamber exceeds a predetermined value.

The quenching medium may be in the form of gas or liquid, alone or mixed with powder, and the powder and/or insulating parts of the switch may be of known kinds which under the action of the arcs release gases which assist in the quenching of the arcs.

The connectors 25 and 31 have outlet apertures, and the insulating parts 28, 29 and 30 are shaped to partly define passages 8, 9 and 10 which widen towards their ends and communicate with the internal spaces 11 and 12

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of the tubular conductors 26 and 27 so that there is a channel open through the quenching chamber between the outlets 13 and 14. When there are no valves and the quenching medium is air this open channel permits a circulation of air to cool the switch and remove heat due to the passage of current whilst the switch is in the closed position, and it also assists cooling of the switch after the latter has been opened.

On the connector 25, conductors 26 and 27, and connector 31, are fixed contacts 2, 3, 4, 5, 6 and 7 and fixed terminals 32, 33, 34, 35, 36 and 37.

A switch pin is axially movable in the quenching chamber 1 and is formed of electrically insulating parts 15, 19, 20 and 21 and open-ended tubular conducting parts 16, 17 and 18, the parts 16, 17 and 18 being provided with terminals 38, 39 and 40 respectively and having internal spaces 22, 23 and 24 respectively.

In the closed position of the switch as shown in FIG. 1 the path of the current is through connector 25, contact 2, conducting part 16, contact 3, conductor 26, contact 4, conducting part 17, contact 5, conductor 27, contact 6, conducting part 18, contact 7, and connector 31.

In the open position of the switch as shown in FIG. 2 the insulating parts 19, 20 and 21 of the switch pin partly define the passages 8, 9 and 10 in which the arcs are exposed to the action of the flowing quenching medium.

During opening of the switch the switch pin is moved axially downwards from the position shown in FIG. 1 to the position shown in FIG. 2. As the terminals 38, 39 and 40 move down past the contacts 3, 5 and 7 three arcs in series with one another are struck and burn at first one between the terminal 38 and the contact 3, one between the terminal 39 and the contact 5, and one between the terminal 40 and the contact 7. The upper ends of three arcs quickly jump on to the terminals 33, 35 and 37 and further movement of the switch pin draws out the three arcs which are now burning in the passages 8, 9 and 10 between the terminals 38 and 33, between the terminals 39 and 35, and between the terminals 40 and 37, causing an increase in pressure in the quenching medium which is caused to flow towards the outlets 13 and 14. As the terminals 38, 39 and 40 pass the terminals 32, 34 and 36 the lower ends of the three arcs jump on to the terminals 32, 34, and 36, and the three arcs now burn in the passages 8, 9 and 10 in gaps one between the fixed terminals 32 and 33, one between the fixed terminals 34 and 35, and one between the fixed terminals 36 and 37 continuing to generate pressure in the quenching medium. When the switch pin reaches the end position shown in FIG. 2 the passages 8, 9 and 10 are partly defined by the insulating parts 19, 20 and 21 of the switch pin; quenching medium is expelled from both ends of the passage 9, passing downwards through the hollow conductors 26 and 17 and through the passage 8 and outlet 13, and upwards through the hollow conductors 27 and 18 and passage 10 and outlet 14, and thus the three arcs are all exposed effectively to the action of the flowing quenching medium and are quickly quenched.

The modified switch shown in FIGS. 3 and 4 is similar in many respects to that shown in FIGS. 1 and 2, like reference numerals indicating like parts. In the switch shown in FIGS. 3 and 4, however, the conducting parts 17 and 18 of the switch pin are provided at their lower ends with terminals 41 and 42 respectively and the insulating parts 19, 20 and 21 of the switch pin are shaped so that when the switch is in the open position shown in FIG. 4 the passages 8, 9 and 10 are of substantially circular cross-section where the arcs burn in gaps between the fixed terminals and are exposed to the action of the flowing quenching medium; just prior to being quenched the lower arc burns with its lower end on the terminal 32 and its upper end on the terminals 33 and/or 41, the middle arc

burns with its lower end on the terminal 34 and/or 39 and its upper end on the terminal 35 and/or 42, and the upper arc burns with its lower end on the terminal 30 and its upper end on the terminal 37, and it will be seen that all these terminals lie near to the common longitudinal central axis of the passages 8, 9 and 10 so that the arcs are all exposed effectively to the action of the flowing quenching medium.

From the above description it will be seen that the invention provides improved switches of the kind referred to in which quenching medium is stored in spaces in the moving and stationary parts of the switch and is caused to flow through passages each defined partly by a moving part and partly by a stationary part of the switch.

I claim:

An electrical switch of the kind in which during opening of said switch arcs in series with each other are quenched by quenching medium flowing under pressure produced by the arcs themselves, comprising a quenching chamber containing quenching medium and having two oppositely-disposed outlets, two connectors attached to said quenching chamber one at each of said outlets, a fixed arc terminal on each of said connectors, a plurality of fixed insulating parts in said quenching chamber, a plurality of fixed conductors in said quenching chamber between said fixed insulating parts, a fixed arc terminal on each end of each of said fixed conductors, and an axially-movable switch pin extending through said quenching chamber and passing through said outlets, said switch pin comprising a plurality of insulating pin parts and a plurality of conducting pin parts and an arc-drawing terminal on each of said conducting pin parts, said conducting pin parts being rigidly secured to and between said insulating pin parts, the arrangement being such that in

the closed condition of said switch there is one of said insulating pin parts adjacent to each of said fixed conductors and said fixed conductors and said conducting pin parts complete a current path between said connectors, during opening of said switch each of said arc-drawing terminals draws out an arc so that there are formed a plurality of arcs which are in series with each other and generate pressure in said quenching medium and each of which extends between one of said arc-drawing terminals and one of said fixed arc terminals, and upon said switch reaching its open condition there is one of said conducting pin parts adjacent to each of said fixed conductors and one of said insulating pin parts opposite each of said fixed insulating parts, and said insulating pin parts and said fixed insulating parts are mutually complementary in defining the perimeters of a plurality of passages in each of which one of said arcs burns and is exposed to the action of said quenching medium until quenched by said medium flowing under said pressure, said insulating pin parts and said fixed insulating parts being so shaped and disposed that each of said passages widens towards its ends and said passages have a common longitudinal central axis, and said fixed arc terminals all lie near to said common longitudinal central axis.

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