Feb. 14, 1933. W. R. WALKER 1,897,963

ELECTRIC SWITCH AND THE PRODUCTION THEREOF

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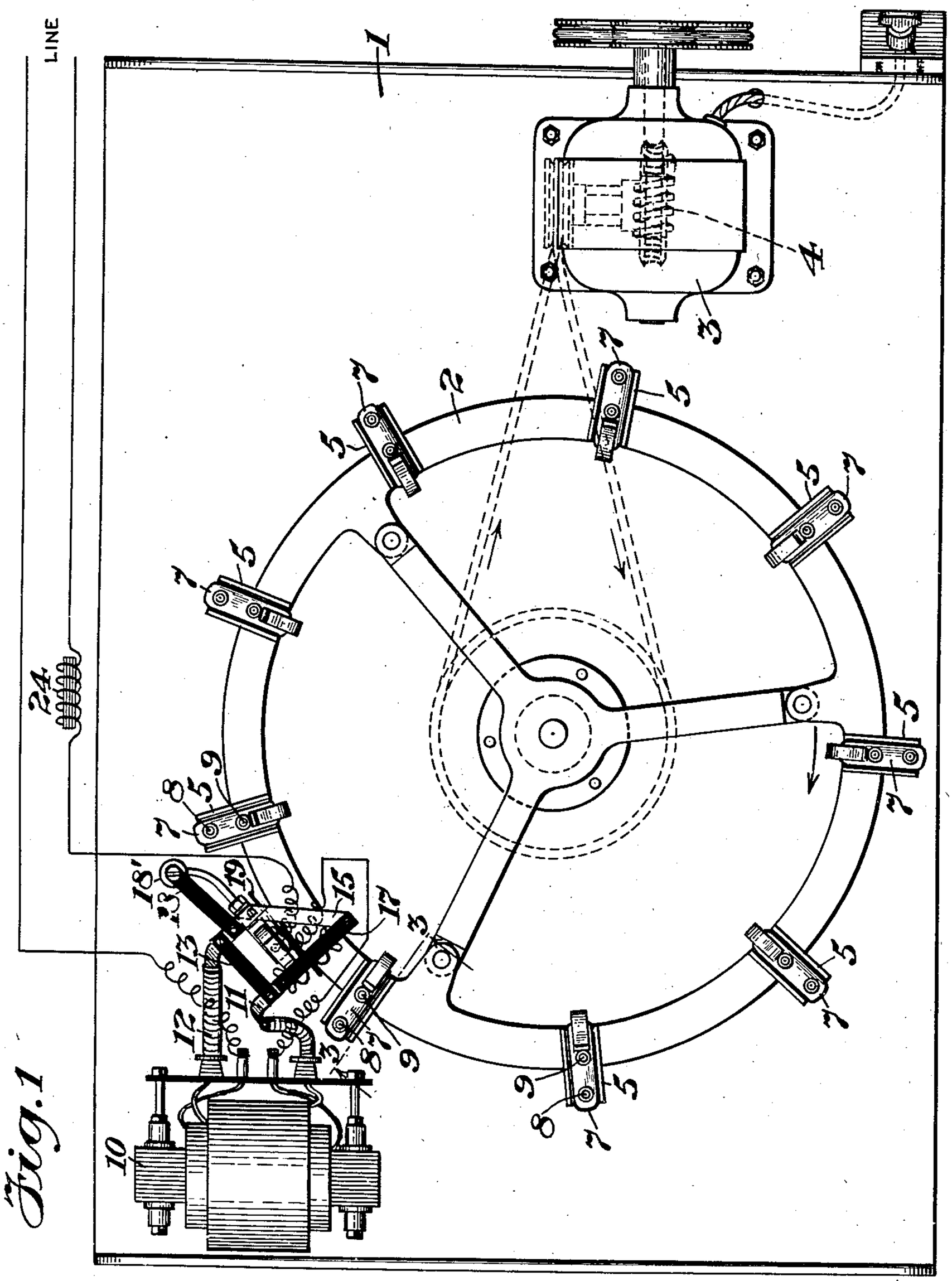

Fig. 1

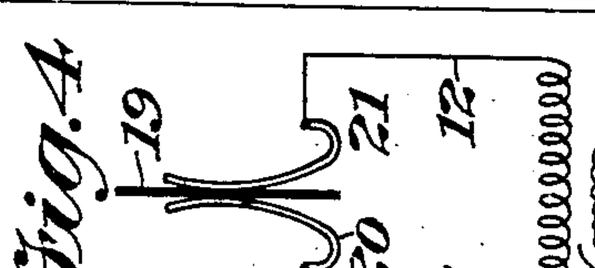

Fig. 4

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Fig. 3

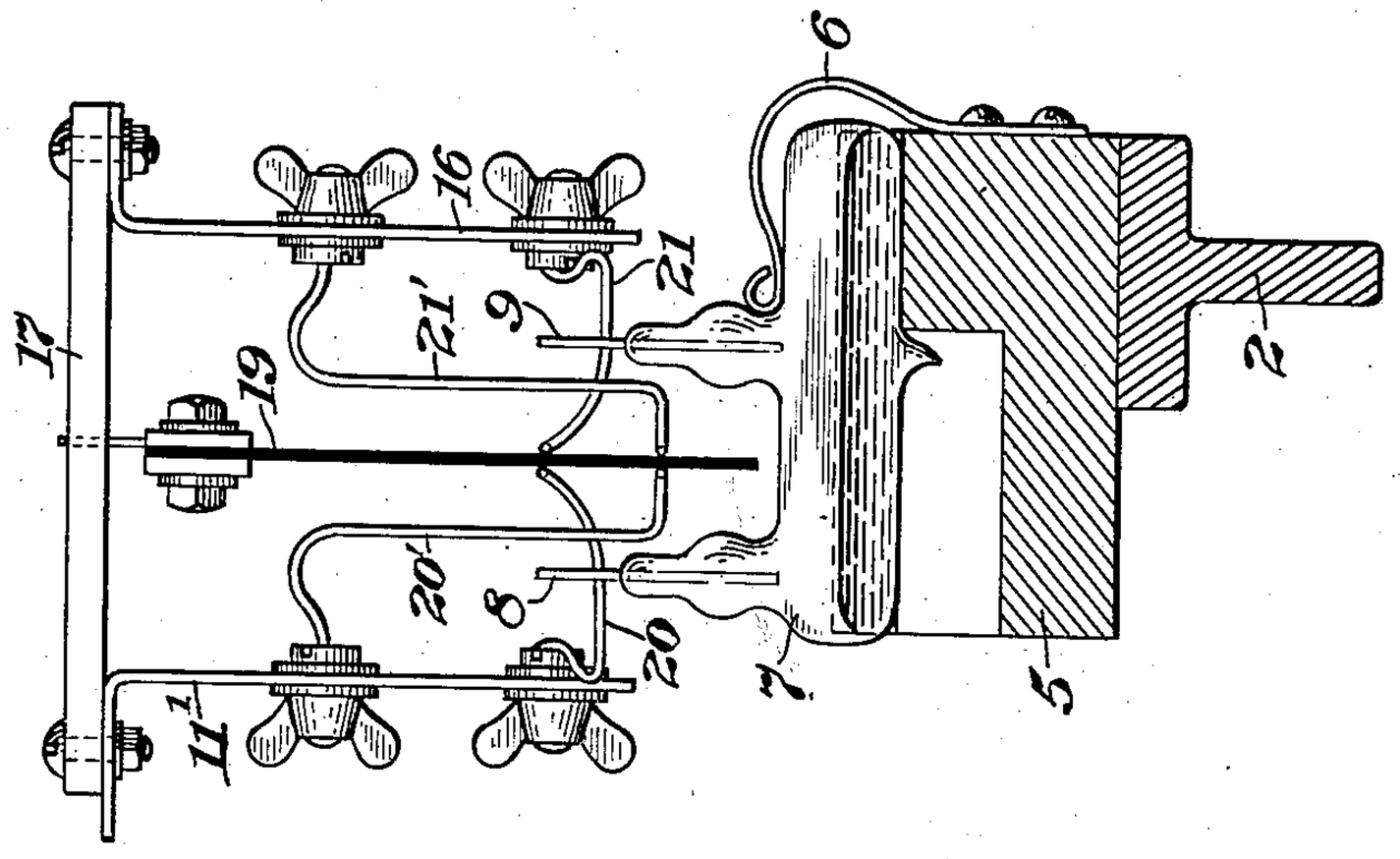
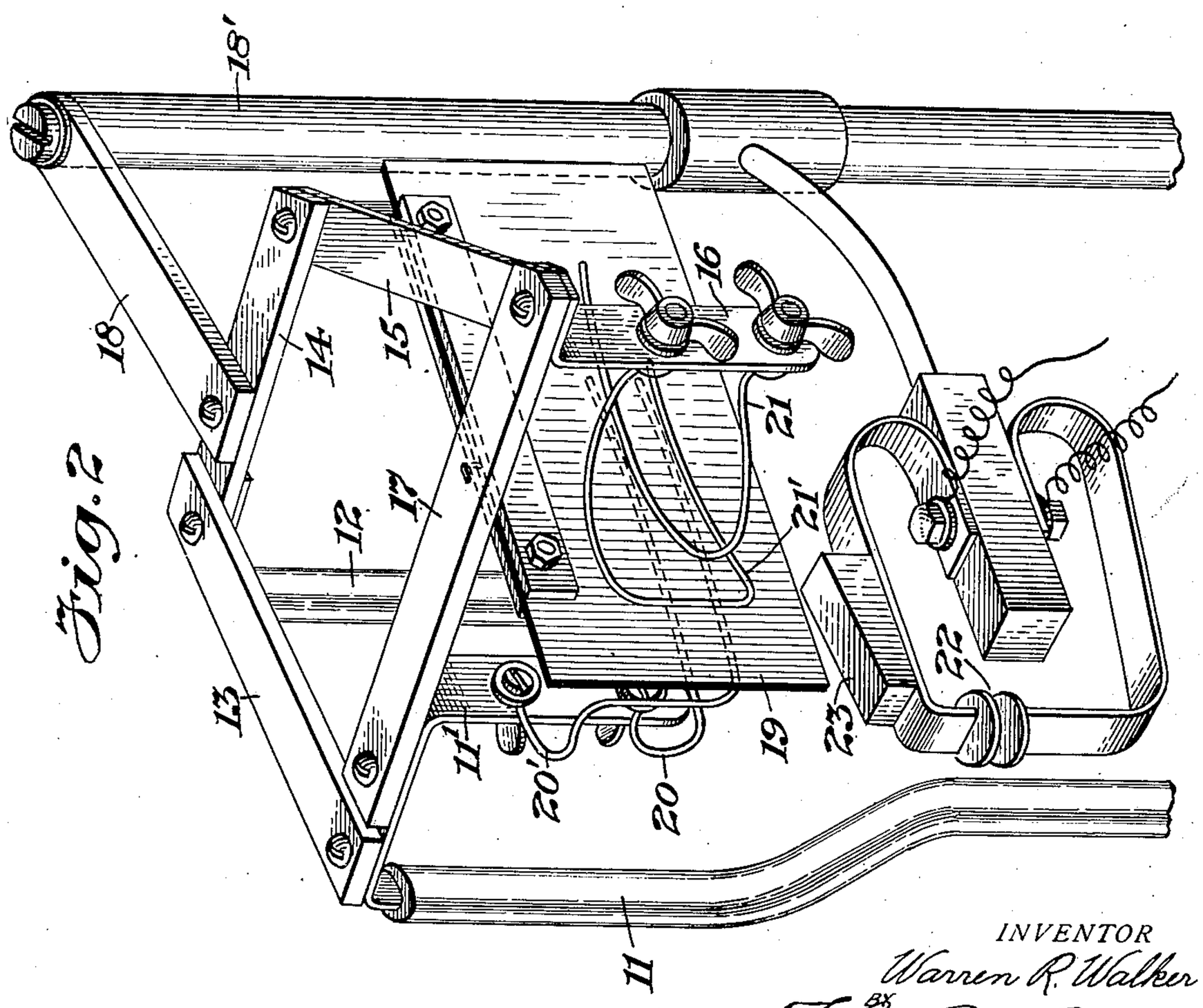


Fig. 2



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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH AND THE PRODUCTION THEREOF

Application filed July 27, 1929. Serial No. 381,663.

The present invention relates to electric switches of the fluid flow type, and particularly to the manufacture thereof.

The particular object of the invention is to provide a process and apparatus for treating the inleads of fluid flow switches to produce a clean metallic surface thereon. Other objects and advantages of the invention will appear from the following detailed specification, or from an inspection of the accompanying drawings.

The invention consists in a new and novel process, and in a new combination of apparatus for the performance thereof, as hereinafter set forth and claimed.

Fluid flow switches as ordinarily made consist of vitreous envelopes through which are sealed two or more inleads which project into the envelope, and between which the fluid makes a circuit. Metals such as nickel, tungsten, iron, or alloys thereof have been found to be desirable for these inleads, or for that portion of the inleads in contact with the fluid, especially when the fluid used is mercury, but in manufacturing such switches it is difficult to avoid the production of an oxide coating on the exposed portion of the inlead during the sealing-in process. This oxide coating increases the internal resistance of the switch and in addition causes wide variations in the resistance of different switches of the same construction. Since it is desirable that this internal resistance should be as low as possible, and that the resistance of each switch should be the same as that of every other switch of the same construction, this oxide coating has been a serious obstacle to the production of a good fluid flow switch of uniform quality. The removal of the oxide coating, however, has heretofore been so difficult, if not impossible, due to the construction of the switch envelope, that it has not been removed in commercial practice. By the present invention I have devised a new process, and apparatus for performing the same, whereby this oxide coating may be removed in a very simple manner. As a result switches of identical resistance characteristics may readily be produced in any quantity. According to this invention the electrodes are subjected to a high voltage discharge, the oxide being knocked off the electrodes by the resulting ionic bombardment thereof. A reducing atmosphere is also used in certain cases, but is not essential.

One form which the apparatus of my invention may take is shown for purposes of illustration in the accompanying drawings, in which

Fig. 1 is a plan view of a machine for treating the inleads of a mercury switch,

Fig. 2 is a detail view, in perspective, of the high voltage system,

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1, and

Fig. 4 is a schematic diagram of the electrical connections.

In the drawings a bed plate 1 supports a rotatable head 2, said head being slowly rotated in a clockwise direction by the motor 3, acting through a reduction gear 4. A series of channeled members 5 are mounted radially on the head 2 at spaced intervals, each channeled member 5 having a spring clip 6 attached to its inner end which positions and firmly holds a mercury switch 7 which is placed in the channel of the member 5 with the inleads 8 and 9 thereof extending vertically upward.

A transformer 10 having a secondary winding designed for a potential of say 15,000 volts is also mounted on the bed plate 1 adjacent to the rotatable head 2, the high tension secondary leads 11 and 12 thereof extending upwardly and toward said head 2, said leads being spaced apart near their ends by a fiber bar 13. The end 11′ of the lead 11 is turned downward at a point slightly outside of the path taken by the inleads 8 as the head 2 rotates. By means of extensions 14 and 15 the lead 12 is connected to a downwardly extending conductor 16 which is on the same radial line of the head 2 as the downturned end of the lead 11, and somewhat inside the path taken by the inleads 9 as the head 2 rotates. A fiber bar 17 spaces the lead 11 and conductor 16, as well as lending rigidity to the system of conductors, while a fiber bar 18 which is attached to

the conductor extension 14 and carried by the rod 8′ which is in turn fixed in the bed plate 1, gives further support to the structure. An insulating baffle 19 of mica or similar material is suspended from the conductor 14 and the fiber bar 17, said baffle being in a vertical plane which is perpendicular to the radial line on which are located the downturned end of lead 11 and conductor 16, and midway between said lead and said conductor. Attached to said conductor 16 and the downturned end of lead 11 are the resilient conductors 20 and 21 each of which extends in a wide sweep towards said baffle 19 so as to engage with the inleads 8 and 9, respectively, as the switch envelopes 7 are rotated therebetween, each of said conductors 20 and 21 extending for some distance in a clockwise direction so as to maintain contact with said leads for an appreciable interval, say a second. A second set of resilient conductors 20′ and 21′ are designed to make a similar contact with the leads of a similar mercury switch having smaller dimensions, as is readily apparent from the drawings, so that switches of either size may be readily treated by the apparatus. In order to avoid external arcing at the inleads 8 and 9 a circuit making device or switch 22 is included in the primary circuit of the transformer. Said switch 22 is supported by the rod 8′ in such a position that a cam 23 mounted on a resilient arm of the switch 22 is engaged by the channeled member 5 just after the inleads 8 and 9 of the switch 7 carried by said member 5 have engaged the conductors 20 and 21, the switch 22 being closed thereby. Said cam 23 extends some distance in a clockwise position and thus maintains the switch 22 closed until just before the inleads 8 and 9 reach the ends of the conductors 20 and 21, when the member 5 passes beyond said cam 23, allowing the switch 22 to open and thus breaking the primary circuit. In order to limit the current of the high voltage discharge to desired values, say of 10–20 milliamperes, an inductance 24 is also included in the primary circuit of the transformer 10.

In the use and operation of my apparatus to perform the process of my invention, the motor 3 being running, and the head 2 consequently slowly revolving, a switch 7 which is to be treated is inserted with the leads 8 and 9 extending upwardly in one of the channeled members 5 which is at the front of the machine, the clip 6 firmly holding said switch. As the head 2 rotates the inleads 8 and 9 are eventually brought into contact with the resilient conductors 20 and 21, respectively. Immediately thereafter the channeled member 5 engages the cam 23, depressing said cam and closing the circuit from the line through the primary of transformer 10 and inductance 24. The secondary of transformer 10 is thereby energized. The potential thus impressed upon the inleads 8 and 9 causes a high voltage discharge to take place therebetween within the envelope of the switch 7. This discharge may take place directly between the electrodes, or between each electrode and the mercury. In either case the ionic bombardment of the electrodes causes the knocking off of the oxide, leaving the electrodes with a clean metallic surface. In those cases where the switches contain a reducing atmosphere, such as hydrogen, the chemical reduction of the oxide thereby in the presence of the arc supplements the bombarding of the electrodes in the cleaning thereof. It has been found that a current of 10–20 milliamperes persisting for a period of a second or so is sufficient to clean the electrodes of the mercury switches of the type shown. The circuit through switch 22 is therefore maintained for this length of time, due to the shape of the cam 23, as the head 2 continues to rotate, the circuit therethrough being interrupted just before the inleads 8 and 9 break contact with the conductors 20 and 21. The head 2 then brings the channeled member 5 back to the front of the machine when the switch 7 is removed by the operator, and another switch 7 inserted to be treated in like manner. As each succeeding member 5 arrives in front of the operator it also has a switch inserted therein which passes in due course into contact with the high tension leads, as has been described, resulting in the cleaning of the electrodes thereof, so that the process is substantially continuous.

While I have described my process as being performed by machine, it is obvious that it can also be performed by hand. It is also to be understood that various changes in the process or in the apparatus within the scope of the appended claims may be made without departing from the spirit of my invention, and that the values given as to voltage, current and time are for purposes of illustration only. It is to be further understood that the process is not limited to fluid flow switches, but may be utilized in connection with any other devices in which analogous conditions exist.

I claim:

1. The method of treating the oxide coated inleads of a fluid flow switch which comprises applying a potential of the order of 15,000 volts between said inleads and permitting a current of 10–20 milliamperes to flow therebetween to cause an ionic bombardment of the oxide coating on said inleads to remove said coating.

2. The method of treating the oxide coated inleads of a fluid flow switch which comprises applying a potential of the order of 15,000 volts between said inleads and permitting a current of 10–20 milliamperes to

flow therebetween for approximately one second to cause an ionic bombardment of the oxide coating on said inleads to remove said coating.

Signed at Hoboken in the county of Hudson and State of New Jersey this 26th day of July A. D. 1929.

WARREN R. WALKER.