No. 671,883. Patented Apr. 9, 1901.

F. HEAD.

ELECTRIC SWITCH.

(Application filed Jan. 28, 1901.)

(No Model.)

Fig. 3.

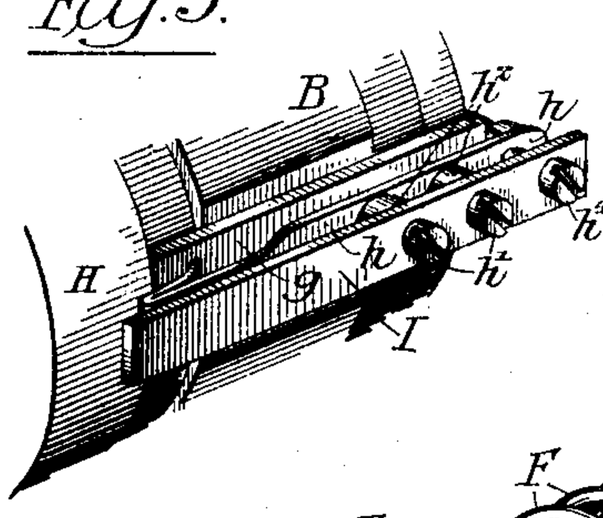
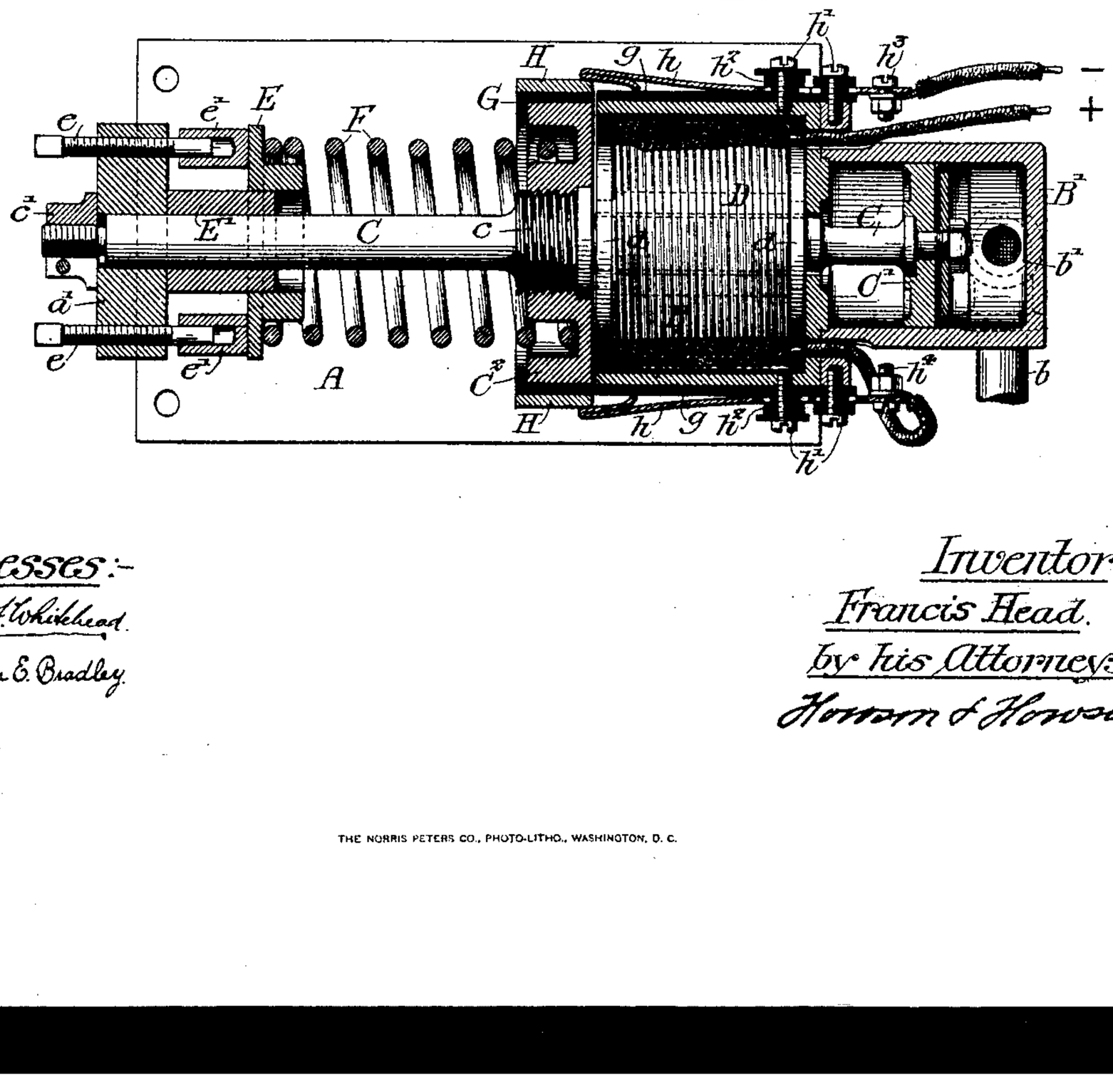


Fig. 1.

Fig. 2.



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UNITED STATES PATENT OFFICE.

FRANCIS HEAD, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 671,883, dated April 9, 1901.

Application filed January 28, 1901. Serial No. 45,155. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS HEAD, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Electric Switches, of which the following is a specification.

My invention relates to certain improvements in electric switches, and more particularly to improvements in that class of switches whose operation is dependent upon and governed by the pressure of a fluid.

The object of my invention is to provide a switch which shall be simple in construction and inexpensive to manufacture, further objects being to so make the switch that it is certain in action and has no parts which materially deteriorate by long-continued use. These objects I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of my improved switch. Fig. 2 is a horizontal sectional view through the axis of the piston-rod, and Fig. 3 is a view of a detail of construction which has been omitted from the other figures for the sake of clearness.

In the drawings and in the following description my invention is shown as employed to open and close the circuit of the pump-motor of the air-brake system on an electric car, although it will be understood that I may, if desired, use it to make and break an electric circuit for any purpose, and it may be operated by any suitable fluid.

A is the supporting base or frame of the switch mechanism proper, having near one end two standards *a a*, which support a magnet-casing B, and at the other end a standard *a'* for the support of one end of a piston-rod C, with tension-adjusting mechanism to be hereinafter described. The said casing is preferably made of iron and acts as the pole-pieces of the magnet. It will be understood that this cylindrical casing may be dispensed with, if desired, and plain pole-pieces used for the magnet without departing from my invention.

To the rear face of the casing B is attached a cylinder B', bored to receive a piston C', having an opening at one end and connected to a suitable source of fluid-supply by a pipe *b*.

The piston-rod C is attached to the piston-rod C' in any suitable manner, the said rod passing through the hollow interior of the spool on which the magnet D is wound, and preferably having an enlarged section *c*, which is threaded to receive an armature C^2 for the said magnet. The outer end of the rod C passes through a bearing in the standard *a'* and is threaded to receive a cap *c'*, the said cap being slit longitudinally and having a clamping-screw for retaining it in any given position on the end of the rod. A bushing E' is loosely fitted to the piston-rod just inside of the standard *a'*, and a second bushing E, having a flange, is made to slide on the first bushing, although it will be understood that, if desired, the bushing E' may be made to slide directly on the piston-rod, thus doing away with the bushing E'. Bolts *e e* pass through the standard *a'*, as shown, and engage pieces *e' e'*, which bear against the bushing E. A spring F extends between this bushing E and the armature C^2 of the magnet, there being a suitable recess in this latter for retaining the same in an operative position.

Firmly fitted to the armature C^2 is an insulating-ring G, on the outside surface of which is driven or otherwise tightly fastened a ring H, preferably of copper, this latter, it will be noted, being thus electrically insulated from the rest of the mechanism.

Spring-contact pieces *h h* are supported on the sides of the magnet-casing B, there being plates of insulating material placed between them and the said casing. Screws *h' h'* hold the contact-pieces in position, being insulated therefrom by insulating-bushings h^2 h^2.

In order to strongly concentrate the lines of force from the magnet D at points in the vicinity of the end of the contact-pieces, plates of iron I may be placed over the said contact-pieces, as shown in Fig. 3, they being magnetically connected to the magnet-casing B by the iron or steel screws *h' h'*, while being insulated from the contact-pieces *h h*.

Terminals h^3 h^4 are provided on the contact-pieces *h h*, one of the wires from an external source of current being attached to the terminal h^3 and one end of the magnet-wire being connected to the terminal h^4, while the other end of the magnet is connected to the second wire of the external circuit. It will

be understood that the above magnet is not necessarily connected in series with the external circuit, as it may in some cases be connected as a shunt to said circuit.

The operation of my device is as follows, it being assumed that the pipe *b* is connected to an air-pump operated by an electric motor, the current to which is made to pass through the switch, there being also an air-reservoir connected to said pipe. It will be further assumed that the apparatus has been designed to operate when the air-pressure in the reservoir has fallen to forty pounds to the square inch and to cease operation when it has risen to sixty pounds to the square inch. The various parts being in the position shown in the figures, when current from a suitable source of electricity is turned on it will flow in at the terminal marked +, through the coil D into one of the contact-pieces *h* at the terminal h^4, then, passing from this to the ring H, it reaches the second contact-piece *h*, and will finally flow out at the terminal h^3 to the pump-motor. This will be started in the usual manner and will operate the air-pump, thereby compressing air in the reservoir. The pipe *b* being in communication with this, the air will exert pressure on the piston C′, tending to move it in the cylinder B′, this movement being opposed partly by the spring F and partly by the action of the magnet D on the armature C^2. As the pressure continues to rise, under ordinary circumstances the spring would be compressed and the piston begin to move in the cylinder; but the magnet in the present instance still continues to prevent this movement until the pressure has risen to the predetermined point at which the switch was designed to open—in the present case sixty pounds to the square inch. When this point has been reached, the magnet suddenly releases the armature and the spring is compressed, the said armature, with its ring H, being quickly moved and held away from the magnet, thereby breaking the electric circuit and stopping the motor. Any flash occurring between the contact-pieces *h h* and the ring H when the circuit opens is instantly blown out by the magnetic effect of the coil D, this being concentrated by the side pieces I. As the compressed air in the reservoir is used for any purpose the pressure back of the piston B′ falls and the spring F forces it forward, the ring H also approaching the magnet-casing. By the time the pressure has fallen to the predetermined point, depending upon the strength of the spring F, the piston C′ has reached the end of its stroke and the ring H has formed contact between the pieces *h h*, thus again starting the compressor.

In practice the pressure at which the magnet releases the armature can be varied within a limited range by varying the distance between the edge of the casing B and the armature C^2, this being accomplished by adjusting the position of the cap *c*′ on the piston-rod when the switch is in the closed position. The pressure at which the switch closes can similarly be varied by changing the compression of the spring F, using for this purpose the bolts *e e* to alter the position of the flanged bushing E.

It will be noted that I have utilized the holding-magnet of the apparatus to blow out the arc formed when the circuit is broken between the ring and the contact-pieces, by this means making the use of a second magnet unnecessary. As a slight burning of the ring will unavoidably occur through continued use, it, with the attached parts, may from time to time be turned, so as to expose fresh surfaces to the contact-pieces.

If desired, I may send the current through the magnet in such a direction as to have the arc blown inwardly when the switch is opened, thus causing the slight burring or burning to take place on the inside edge of the ring H and not injuring the contact-surfaces.

I claim as my invention—

1. An electric switch operated by fluid under pressure, said switch having a magnet to govern the pressure at which it opens and having a spring operative upon the movable member of the switch which determines the pressure at which it closes, substantially as described.

2. In an electric switch, the combination of a rod, means for moving said rod, operated by variations of fluid under pressure, contact-points, means carried by the rod for completing an electric circuit between said points, means for exerting a force opposing movement of the rod by the fluid and a device for holding the rod stationary until the pressure thereupon has increased to a point beyond that at which said pressure would otherwise have overcome the said opposing force and have moved the rod, substantially as described.

3. The combination in an electric switch, of a cylinder connected to a source of fluid-supply, a piston therein, a piston-rod connected to said piston, contact-points, means connected to said piston-rod for completing an electric circuit between said contact-points, means acting against fluid-pressure in the cylinder exerting a force tending to prevent motion of the piston and of its attached rod, and a device for keeping the circuit closed between the contact-points and consequently holding the said piston-rod stationary until the pressure on the piston has increased to a point beyond that necessary for moving the piston against the force tending to prevent its motion, substantially as described.

4. In an electric switch, a frame, a cylinder supported thereby, a piston in the cylinder, a piston-rod attached thereto, a spring acting upon said rod, a magnet constructed to influence the motion of said rod, the said spring being operative upon the rod at all positions thereof, contact-pieces supported by the frame, and a piece of metal connected to the piston-rod constructed to form electrical con-

nection between said contact-pieces when the pressure in the cylinder is below a certain predetermined point, substantially as described.

5. In an electric switch, the combination of a frame, a cylinder and a magnet supported thereon, a piston in the cylinder, a piston-rod attached thereto and passing through the magnet, an armature and a metallic contact-piece on the said rod, other contact-pieces supported by the frame, constructed to be electrically connected by the contact-piece supported on the piston-rod when the armature thereon is in the nearest position to the magnet, and a mechanical device continually acting on said armature whereby it is forced toward the magnet against pressure in the cylinder, substantially as described.

6. The combination in an electric switch, of a frame, a magnet and a cylinder supported thereon, a piston in the cylinder, a piston-rod connected to the same, an armature on said rod, a spring acting to move said armature toward the magnet, a contact-piece supported on said armature, other contact-pieces supported by the frame, and so placed that the contact-piece on the armature will form electrical contact between them at a certain definite position of the piston-rod, the said magnet being energized only when the piston-rod is in said position, substantially as described.

7. In an electric switch, the combination of a magnet, a cylinder and a frame supporting the same, a piston in the cylinder, a piston-rod attached thereto, an armature on said rod and a spring acting against the said armature and a projection on the frame, a metallic ring supported by the armature but insulated therefrom, contact-pieces supported on the pole-pieces of the magnet, and insulation between said contacts and their support, substantially as described.

8. In an electric switch operated by fluid under pressure, the combination of a magnet, a cylinder, a piston therein, a spring, a piston-rod connected to said piston and having its movement governed by said spring at all points of the stroke of the piston, said rod also having on it an armature, with electric terminals and means for closing an electric circuit when the piston is forced toward one end of the cylinder against fluid-pressure, substantially as described.

9. The combination in an electric switch, of a frame, a cylindrical magnet-casing and a cylinder supported thereby, a piston in the cylinder, a piston-rod attached thereto and extending through the magnet-casing, a magnet in the casing wound concentric with the rod, a projection on the piston-rod forming an armature for the magnet, a spring acting thereon, contact-pieces, and means carried by the armature for forming electrical connection between said pieces, substantially as described.

10. An electric switch having a supporting-frame, a cylinder and a piston therein, a piston-rod attached thereto, a magnet for holding the piston from being moved by fluid under pressure in the cylinder, electrical contacts constructed to be made and broken by motion of the piston-rod, said contacts being within range of said magnet, whereby an arc formed will be blown out, substantially as described.

11. In an electric switch, the combination of a frame, a cylinder, a piston in the cylinder, a rod attached to the piston and passing through a bearing supported by the frame, an armature for the magnet supported by the rod, means for exerting pressure on the rod against pressure on the piston, and means on the said rod for adjusting the distance between the magnet and the armature, substantially as described.

12. In an electric switch, the combination of a frame, a magnet, a rod, and means for moving said rod operated by fluid under pressure, an armature for the magnet attached to the rod, a contact-piece attached to the rod but insulated therefrom, stationary contact-pieces supported by the frame and so placed that the contact-piece on the piston-rod will form electrical connection between them when the armature is in its nearest position to the magnet, means for exerting pressure on the rod against pressure on the piston and a device for varying at will the pressure exerted on the rod by said means, substantially as described.

13. In an electric switch, the combination of a rod, means operated by variations of fluid-pressure for moving the same, a magnet constructed to act upon said rod, electrical contacts constructed to be made and broken by motion of the rod, said contacts being within range of the effect of said magnet, and auxiliary pole-pieces in the vicinity of the magnet for concentrating the magnetic effect thereof in the space immediately surrounding said contacts, whereby an arc formed will be blown out, substantially as described.

14. In an electric switch of the character described, the combination of a magnet having pole-pieces, an armature carrying a contact-piece, other contact-pieces carried by the pole-pieces of the magnet, and auxiliary pole-pieces extending beyond the said contacts on the magnet and magnetically connected to the pole-pieces of the magnet, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANCIS HEAD.

Witnesses:
WILLIAM E. BRADLEY,
JOS. H. KLEIN.