

Sept. 18, 1934.

W. T. GRAY

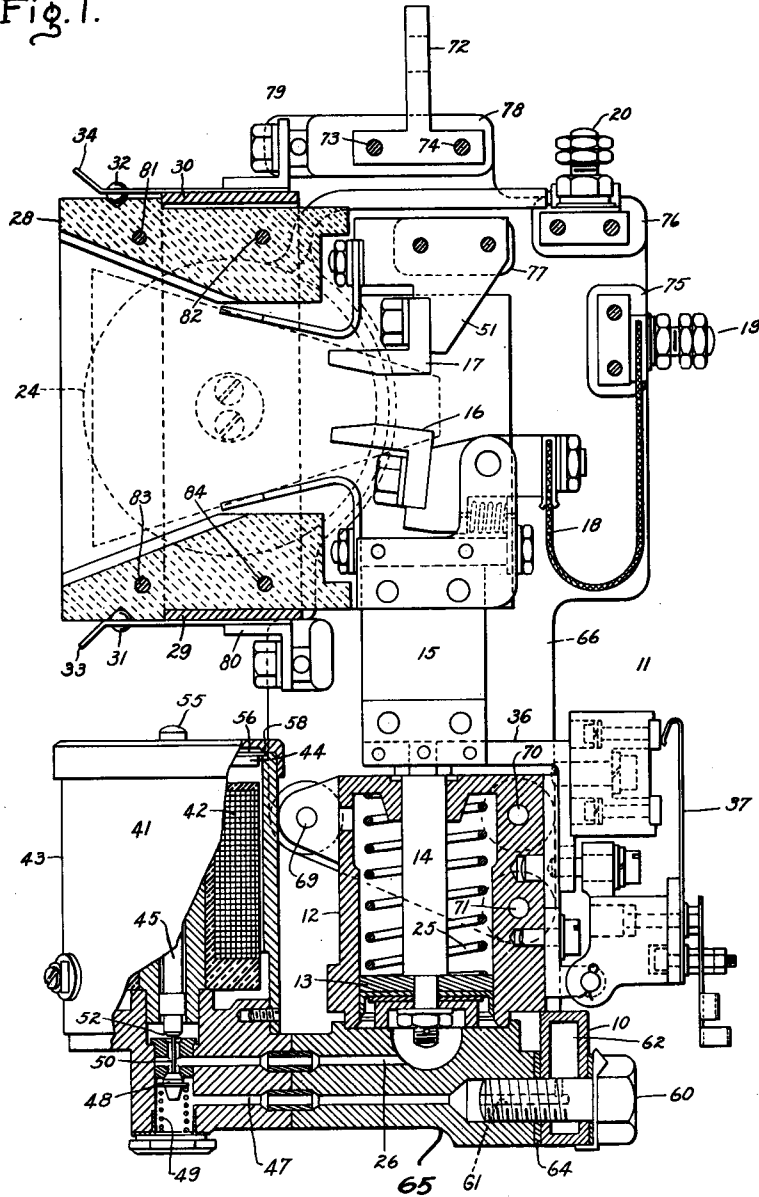
1,974,306

ELECTROMAGNETICALLY CONTROLLED CIRCUIT CONTROLLER

Filed March 16, 1933

2 Sheets-Sheet 1

Fig. 1.



Inventor:
William T. Gray,
by *Charles T. Allen*
His Attorney.

Sept. 18, 1934.

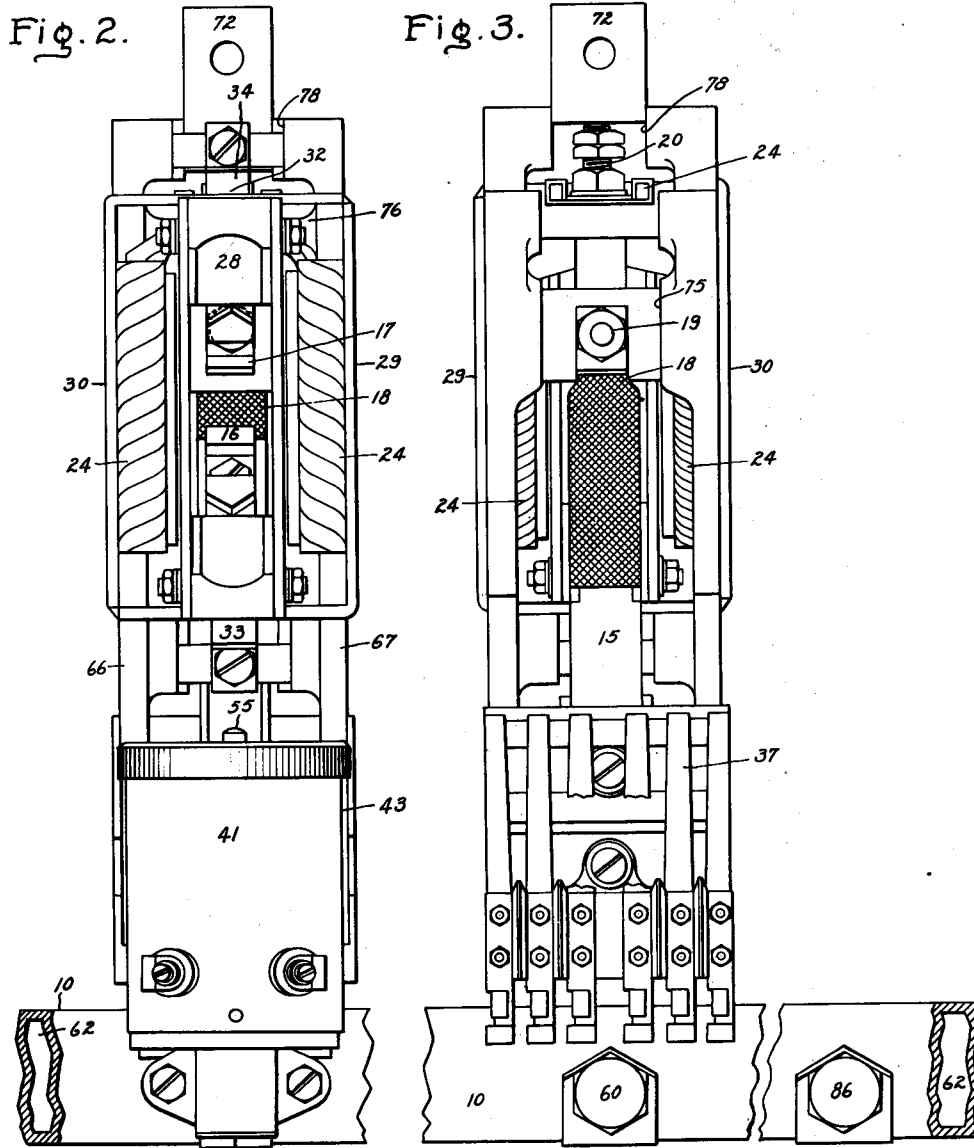
W. T. GRAY

1,974,306

ELECTROMAGNETICALLY CONTROLLED CIRCUIT CONTROLLER

Filed March 16, 1933

2 Sheets-Sheet 2



Inventor:
William T. Gray.
by *Charles T. Allen*
His Attorney.

UNITED STATES PATENT OFFICE

1,974,306

ELECTROMAGNETICALLY-CONTROLLED CIRCUIT CONTROLLER

William Train Gray, Altrincham, England, as-
signor to General Electric Company, a corpora-
tion of New York

Application March 16, 1933, Serial No. 661,141
In Great Britain March 17, 1932

6 Claims. (Cl. 200—81)

My invention relates to electromagnetically-
controlled circuit controllers commonly called
unit switches or unit contactors of the kind
adapted to be opened or closed by means of com-
pressed air or other operating fluid, and has for
an object the provision of simple, inexpensive,
and reliable unit switches, which can be readily
assembled together in groups.

The compressed air or operating fluid which is
supplied to the pneumatically operated cylinders
of the respective unit switches is controlled by
electromagnetically-operated valves energized
from a suitable circuit under the control of a
master controller. These switches are common-
ly arranged in groups, each switch or contactor
being clamped to a metal support, as a steel bar
for example. The air valve is biased to a closed
position by means of a spring and is opened
against this bias by the armature of a solenoid.
This armature also controls the operation of the
exhaust valve for the cylinder and is arranged
so that when the solenoid is energized a cylinder
is opened to the compressed air supply and when
the solenoid is deenergized the cylinder is opened
to exhaust. Compressed air is supplied at a suf-
ficient pressure to insure that the main contacts
are closed with considerable effort.

In accordance with the present invention, the
conduit for supplying the compressed air or other
operating fluid to the switch is provided in the
metal supporting member on which each unit
switch is mounted, thereby eliminating the use
of a separate mounting bar. The switch units are
secured to the metal supporting member by
means of bolts passed therethrough, which bolts
are drilled to allow the passage of the operating
fluid from the conduit to the operating cylinder
of the switch units. Furthermore, the armature
of the electromagnetic valve controlling the flow
of compressed air to the cylinder is attached to
the center of a thin diaphragm which is slightly
larger in diameter than the armature. By
mounting the armature in this fashion, it is lo-
cated centrally in the valve body and serves to
insure a uniform air gap between its periphery
and the valve body, whereby the friction which
is developed by armatures of the sliding type is
avoided.

For a more complete understanding of my in-
vention, reference should now be had to the
drawings, Fig. 1 of which shows in sectional ele-
vation a unit switch of the electromagnetical-
ly-controlled, pneumatically-operated type con-
structed in accordance with the present inven-
tion; Fig. 2 is a front elevation of the switch
shown in Fig. 1 and Fig. 3 is a rear elevation of
the switch shown in Fig. 1.

Referring to the drawings, I have shown my
invention in one form as applied to one switch
of a group of switches which can be readily as-

sembled together on a metal supporting mem-
ber 10. In Fig. 1 it will be observed that the
switch 11 includes a cast iron cylinder 12 in which
there is arranged a single-acting, pneumatically-
operated piston 13. The piston is secured at the
lower end of a piston rod 14, the upper end of
which is connected by an insulating member 15
to the movable contact 16 of the switch. This
movable contact 16 is associated with a fixed
contact 17 and is connected by a flexible lead 18
to a terminal 19. The fixed contact 17 is con-
nected to the terminal 20 by means of blow-out
coils 24. The piston 13 is biased by means of a
spring 25 towards the open position of the con-
tactor and is moved to close the contactor by
compressed air admitted to the cylinder 12
through a conduit 26. The compressed air is sup-
plied at sufficient pressure to insure that the
main contacts 16 and 17 are closed with a con-
siderable pressure. The contacts 16 and 17 are
located in an arc chute 28 of fireproof material.
The blow-out coils 24 on each side of the chute
are connected between the upper terminal 20
and the fixed contact 17. The arc chute 28 is
located between two horizontal guides 29 and 30
and is secured in position by balls 31 and 32 car-
ried on spring arms 33 and 34, respectively, which
balls are arranged to be spring biased in notches
in the lower and upper sides, respectively, of
the chute. The movable member 36 of the inter-
lock contacts 37 is attached to the piston 14.

The supply of compressed air to the cylinder
12 is controlled by an electromagnetically-oper-
ated valve 41. The valve includes an operating
coil 42 disposed within a cylindrical casing 43,
which coil can be energized to move an armature
44. The armature rests on the upper end of a
spindle 45 which extends through the center of
the coil 42 to control the operation of a com-
pressed-air admission valve and also an exhaust
valve for the cylinder 12. It will be observed that
compressed air is supplied to the valve 21 through
a conduit 47 and that the valve 48 is disposed at
the end of this conduit. The valve 48 is biased to
the closed position by a spring 49 in addition to
the biasing force normally exerted by the com-
pressed air. The valve 48 is connected by a thin
spindle 50 to the spindle 45. The lower end of
the spindle 45 carries an exhaust valve 52 which
is arranged to close the conduit 26 when the
valve 48 opens this conduit to the compressed
air and to open the conduit 26 to exhaust when
the valve 48 is closed. The armature 44 is
connected by means of a rivet 55 to the center
of a thin phosphor bronze diaphragm 56 which
is slightly larger in diameter than the armature
44. The thin phosphor bronze diaphragm is lo-
cated in a recess 58 provided in the upper end
of the casing 43. By means of this construction,
the armature 44 is provided with a

uniform air gap between its periphery and the operating coil and the friction which is obtained with armatures of the sliding type is avoided. Consequently, a greater voltage operating range
5 is obtained and the construction of the valve is thereby rendered less expensive.

The supporting bar 10 on which the unit switches are mounted is hollow in construction and serves as a conduit for supplying the compressed air,
10 thus obviating the use of a separate air conduit. The switch units are each tightly secured to the bar by means of a bolt 60 passing through the bar and into screw-threaded engagement with the switch frame 65 as shown in Fig. 1. It will
15 be understood that each bolt is drilled to provide a connecting passageway from the air supply channel 62 to the conduits of each switch. Thus, for example, the bolt 60 is drilled to provide a pas-
20 sageway 61 extending from the air supply conduit or channel 62 to the conduit 47 leading to the switch operating cylinder. A gasket 64 is interposed between the supporting member 10 and the switch to prevent the escape of air.

The fixed contact 17, the terminal therefor and
25 the terminal 19 for the movable contact, the blow-out coils 4, the chute 28 and the guides 29 and 30 therefor are all secured to and supported by a pair of side plates 66 and 67 of molded insulation material. These sideplates are attached to the
30 cast iron cylinder 12 by means of the bolts 69, 70 and 71. This construction permits of considerable reduction in the width of each switch. The cost of the switch may also be reduced by the employment of extruded sections for certain parts.
35 For example, the upper securing element 72 is of extruded section and is secured to the upper ends of the molded plates 66 and 67 by the bolts 73 and 74. The terminals 19 and 20, the bracket 51 for the fixed contact 17, and the member 72 are res-
40 spectively mounted between bosses, 75, 76, 77, and 78, respectively, provided on the inner side of the plate 66 and a corresponding set of bosses on the inner side of the plate 67. This arrangement permits adequate creepage distances to be ob-
45 tained between points of different potential. The blow-out coils 24 and the brackets 79 and 80 for the guides 29 and 30 are also secured by bolts 81 and 84, inclusive, between bosses on the inner sides of the plates 66 and 67.

If at any time one of the unit switches should
50 become defective, it is only necessary to unscrew the connecting bolt, as for example the bolt 60, to remove the defective switch. In case a second switch is not immediately available, the remain-
55 der of the switches in the group can be operated by inserting a bolt in the place of the one removed, which bolt is not provided with a pas-
60 sageway. Thus, for example, I have shown in Fig. 3 the bolt 60 serving to hold the switch 11 to the supporting member 10, while a bolt 86 is ar-
65 ranged to seal the opening in the bar 10 provided for a second unit switch.

While I have shown a particular embodiment of
65 my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit
70 and scope of my invention.

What I claim as new and desire to secure by
Letters Patent of the United States, is:

1. Means for mounting unit switches of the
75 electromagnetically - controlled, pneumatically-
operated type comprising a switch-supporting
member provided with a conduit for supplying

compressed air to the switch, and a connecting
bolt for bolting each switch to said member, said
bolt being provided with a passageway for con-
ducting the compressed air from said conduit to
said switch.

2. The combination of an electromagnetically-
controlled, pneumatically - operated electric
switch, of mounting means for said switch com-
prising a hollow supporting bar, a bolt for con-
necting said switch to said bar, said bolt being
drilled to allow the passage of an operating fluid
from said bar to said switch.

3. A switch comprising a fixed contact and a
movable contact, a cylinder, a piston movable
within said cylinder and connected to said mov-
able contact for operating said movable contact
from one position to another, switch supporting
means provided with a passageway for supplying
compressed air to said cylinder, a bolt for se-
curing said switch to said supporting means, said
bolt being drilled to provide a passageway for
the flow of compressed air from said supporting
means to said cylinder.

4. An electromagnetically - controlled, pneu-
matically-operated electric switch including a
cylinder, a switch-operating piston arranged
within said cylinder, a hollow switch-supporting
bar, a bolt for securing said switch to said bar,
said bolt being provided with a passageway ex-
tending from the portion of the bolt intermediate
the sides of said bar to the inner end of the bolt,
and a conduit extending from the inner end of
said bolt to said cylinder for conducting the
supply of compressed air from said supporting
bar to said cylinder.

5. An electromagnetically - controlled, pneu-
matically-operated electric switch including a
frame for the switch, a movable contact, a piston
arranged to move within a cylinder for operating
said movable contact, said frame being provided
with a conduit, a valve interposed in said conduit
for controlling the supply of compressed air to
said piston, and means for supplying compressed
air to said valve comprising a hollow switch-
supporting bar, a bolt extending through said
bar and having a passageway formed therein to
provide for the flow of compressed air from said
bar to said valve, and means for controlling the
energization of said valve for admitting com-
pressed air to said cylinder.

6. The combination of a pneumatically-
operated electric switch having a switch-operat-
ing piston arranged for movement in a cylin-
der, a frame for supporting said cylinder, a nor-
mally closed valve for controlling the supply of
compressed air to said cylinder, means for elec-
trically operating said valve comprising a magnet
winding, a diaphragm, a member of magnetic
material secured to said diaphragm in coopera-
tive relation with said winding, an operating
member extending from the mid-portion of said
diaphragm to said valve so that the energization
of said coil attracts said magnetizable member
to open said valve, said frame being provided
with conduits one of which leads from one side
of said valve to said cylinder and the other of
which leads from the other side of said valve,
means for supplying compressed air to said other
conduit comprising a switch-supporting member
having a compressed air passageway formed
therein, and a bolt for securing said member to
said frame, said bolt being drilled to complete a
passageway for the flow of compressed air from
said member to said other conduit.

WILLIAM TRAIN GRAY. 150