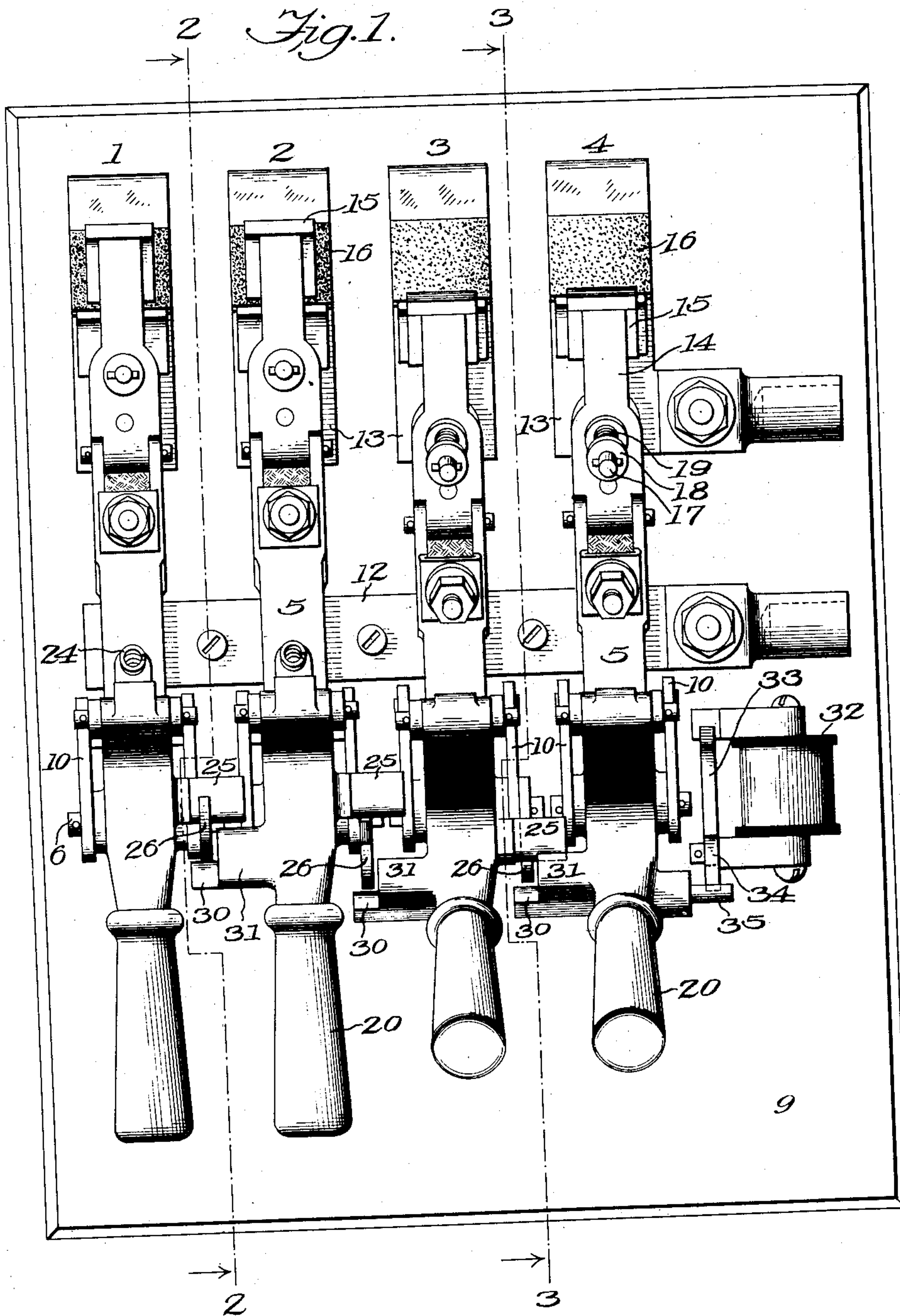


T. E. BARNUM.
 MULTIPLE SWITCH STARTER.
 APPLICATION FILED JULY 26, 1909.

Patented May 31, 1910.

2 SHEETS—SHEET 1.

959,910.



Witnesses:

George Haynes
 J. W. F. F. F.

Inventor:

Thomas E. Barnum.

By Edwin B. F. Tower, Jr.
 Atty.

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Fig. 2.

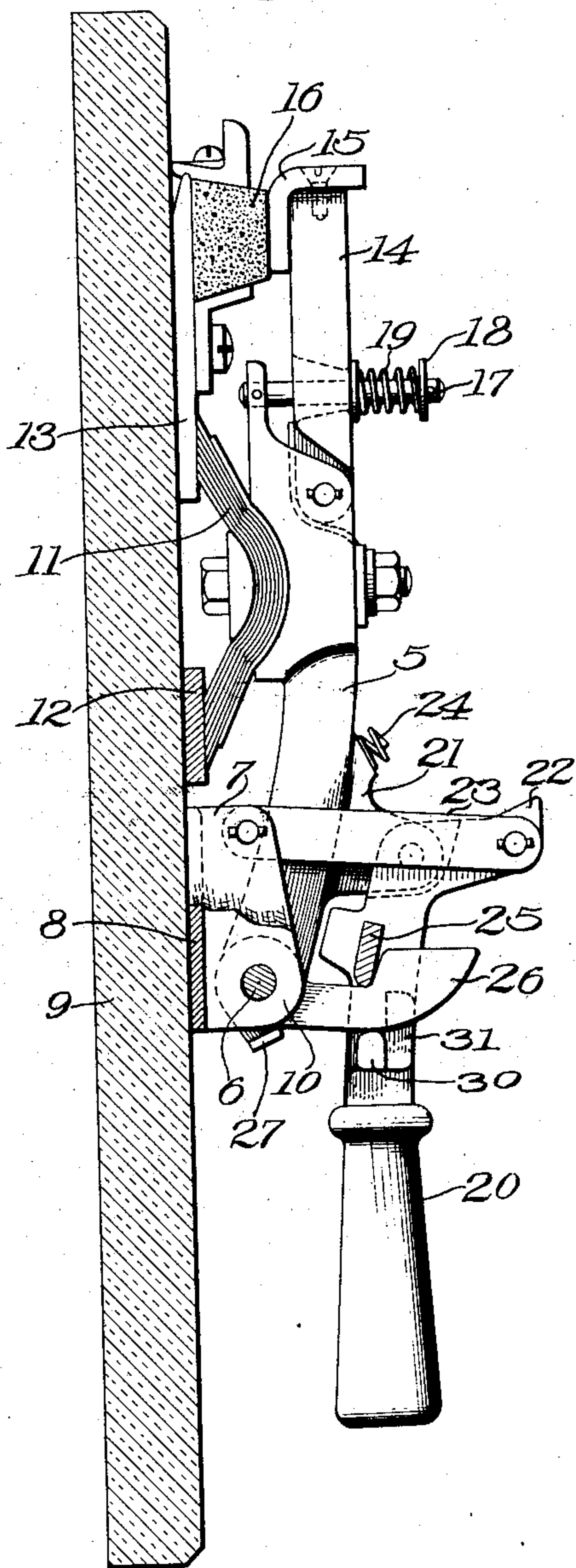
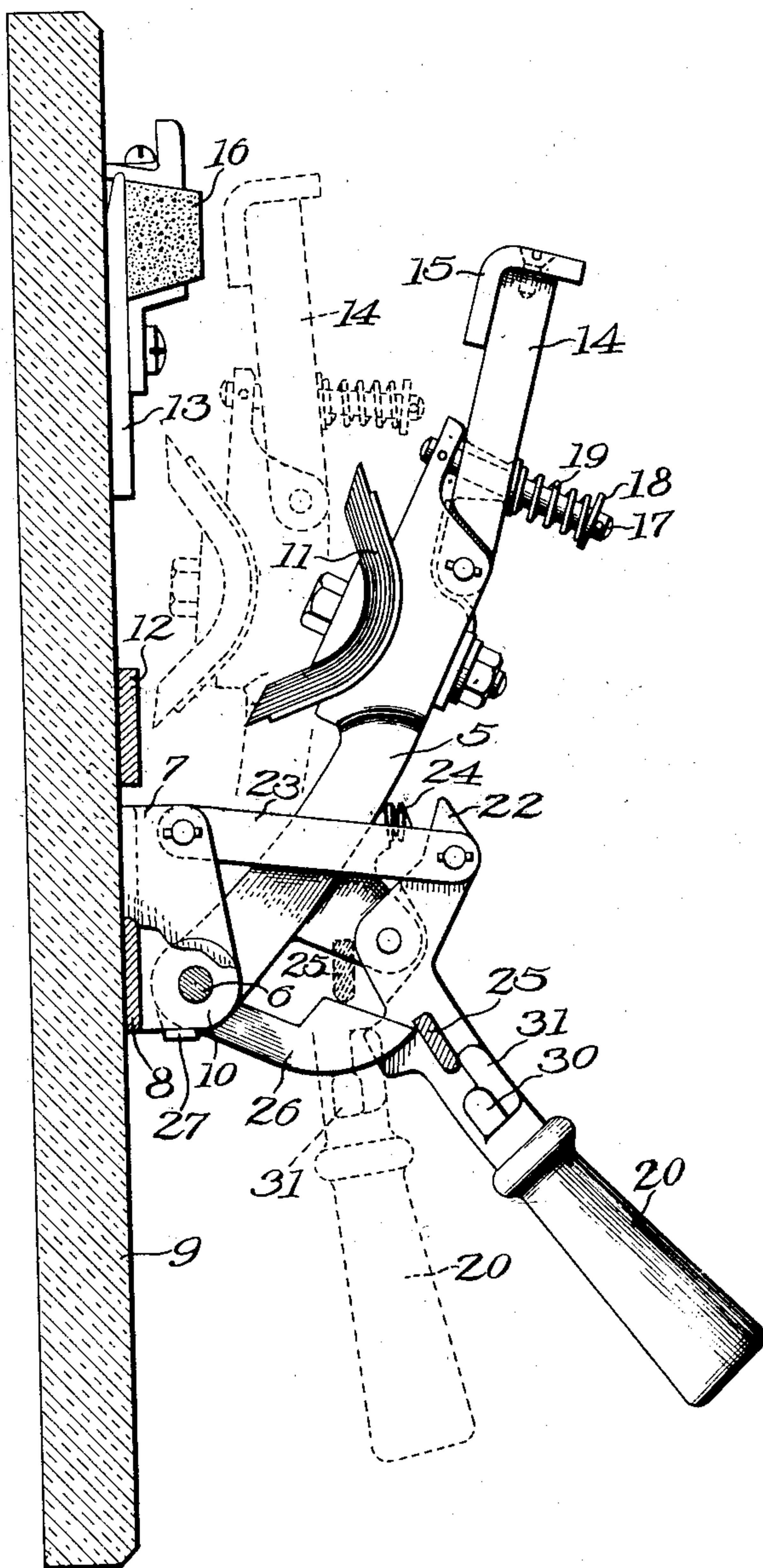


Fig. 3.



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UNITED STATES PATENT OFFICE.

THOMAS E. BARNUM, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE CUTLER-HAMMER MFG. CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

MULTIPLE-SWITCH STARTER.

959,910.

Specification of Letters Patent.

Patented May 31, 1910.

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To all whom it may concern:

Be it known that I, THOMAS E. BARNUM, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Multiple-Switch Starters, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in multiple switch devices particularly appropriate for starting electric motors.

More particularly, my invention relates to multiple switch devices in which each switch, when closed, is arranged to hold a preceding switch closed. This arrangement enables the switches to be closed by a hand-over-hand movement. In such devices it is desirable to arrange the switches so that they will have a tendency to move into open position. Consequently, if each switch is held closed under the pressure of another switch, each switch, and particularly the last switch of the sequence, will be placed under a considerable strain due to the tendency of the several switches to move to open position. This not only renders it difficult for the operator to close the switches in the predetermined order, but also tends to cause the release of all of the switches if the last operated switch is not firmly held in closed position. That is to say, if the pressure upon the last operated switch is momentarily decreased, all of the closed switches have a tendency to immediately return to open position. Even though the switches do not have an opportunity to open, yet they are apt to move sufficiently to prevent closure of the remaining switches. This, of course, necessitates reclosure of all of the switches.

It is, therefore, the object of my invention to provide means for positively locking each switch in closed position in such a manner that practically no pressure upon any of the switches will be required to hold the preceding switches closed. Consequently, there will be practically no strain upon any of the switches due to the tendency of preceding switches to move to open position.

Various other objects and advantages of my invention will be hereinafter more fully set forth.

In order to more clearly disclose the nature of my invention, I shall describe the

embodiment thereof illustrated in the accompanying drawing. It should, of course, be understood that my invention is not limited to the exact construction shown in the drawing, but is capable of various modifications.

In the accompanying drawing, Figure 1 is a front elevation of one form of my invention; Fig. 2 is a sectional view taken on line 2—2, Fig. 1; and Fig. 3 is a sectional view taken on line 3—3, Fig. 1.

In the embodiment of my invention illustrated, I have shown four switches 1, 2, 3 and 4, it, of course, being understood that the number of switches may be increased or decreased as desired. Each of the switches is of substantially the same construction and I shall, therefore, describe only one of the same in detail. The construction of the several switches is best illustrated in Fig. 2. Each switch includes a switch arm 5 fulcrumed on a pin 6. In practice, the several switch arms might be fulcrumed upon a single rod, but, in the present instance, I have shown an individual supporting bracket 7 for each of the switch arms. The bracket 7 merely comprises a plate 8, adapted to be secured to a suitable insulating panel 9, said plate having perpendicular side pieces 10. The pin 6 is preferably supported by the side pieces 10 of the bracket. The switch arm carries a laminated contact brush 11, one end of which is adapted to engage a contact plate 12, and the other end of which is adapted to engage a contact plate 13. In practice, the contact plates 12 of the several switches are preferably formed integrally as illustrated in Fig. 1. In addition to the laminated contact, the switch arm carries a pivoted extension 14, upon the end of which is secured an arcing contact 15. The arcing contact 15 is adapted to engage a carbon contact 16 which may be mounted in any suitable manner and electrically connected to the contact plate 13. Connected to the switch arm 5 and passing through the pivoted extension 14 thereof is a pin 17 carrying a collar 18. Interposed between the collar 18 and the extension 14 is a coiled spring 19 which tends to hold the extension 14 in such position that the arcing contact will engage the carbon contact before the laminated brush engages its stationary contacts.

The switch arm is provided with an ac-

uating lever 20 connected thereto in the following manner. One end of the lever 20 is fulcrumed to an extension 21 upon the switch arm. The switch arm has an extension 22 which is connected by links 23 to the supporting bracket 7, the links 23 being fulcrumed to both the extension and the bracket. This connection, in effect, forms a toggle whereby, when the operating lever 20 is forced inwardly, it forces the switch arm 5 in the same direction. With the particular arrangement illustrated, each of the switches tends to automatically return to initial position without the aid of any special spring for this purpose. This tendency is increased by the spring 18 and the resiliency of the laminated brush. As the switch arm is adapted to fall outwardly with some force, I preferably provide the same with a spring buffer 24 adapted to engage the extension 22 of the operating lever. The operating lever of each switch, except the last of the sequence, is provided with a laterally extending lug 25 projecting from the right hand side thereof. These lugs are best illustrated in Fig. 1. The lug 25 is arranged to be engaged by a pivoted latch 26 to hold the switch which carries said lug in closed position. The function of the lug 25 and the latch 26 is illustrated in Fig. 2, it being understood that the lug and latch illustrated therein belong to the switch 1. The latch 26 is fulcrumed on the rod 6 to the right of the switch arm and normally stands in the position illustrated in Fig. 3, the downward movement thereof being limited by a stop 27 adapted to engage the bracket 7. Thus in normal position, the latch will not engage the lug 25 to hold the switch closed. It, therefore, becomes necessary to raise the latch 26 in order to lock the switch in closed position. For accomplishing this result, I have provided on the left hand side of each switch, except the first, a laterally extending lug 30, adapted to engage the underside of the latch of the next preceding switch. The underside of the latch 26 is preferably so curved that when the lug 30 is forced inwardly it will raise said latch into the path of the lug 25.

Owing to the connection between the operating lever and the switch arm when the switch is open, the lug 25 will engage the front end of the latch 26 as illustrated in Fig. 3. Furthermore, the enlarged portion 31 of the lug 30 of the next succeeding switch will engage the lug 25. This arrangement, as will be hereinafter more clearly set forth, forms an interlock for preventing closure of the switches, except in a predetermined sequence.

I shall now describe the operation of the switches. In Fig. 1, I have shown switches 1 and 2 in closed position and switches 3 and 4 in open position. Let it be assumed,

however, that all of the switches are open. Under these conditions, all of the switches would be in the position illustrated in full lines in Fig. 3. Consequently, the lug 25 of switch 1 would be disposed between its latch 26 and the lug 30 of switch 2, as shown in Fig. 3. If now it be attempted to close the switch 2 before closing the switch 1, it will be found that movement of the switch 2 is blocked by the lug 25 of switch 1. Assuming, however, that the operating lever of switch 2 could be moved into the position shown in dotted lines, thereby forcing the operating lever of switch 1 into such a position that its lug 25 would assume the position shown in the dotted lines, then further movement of said lever would be absolutely blocked, as the latch 26 virtually forms a wedge between the lugs 25 and 30. It is not likely that switch 2 could be moved into this position, but, even if such movement was possible, said switch would not be closed. The lugs on the remaining switches cooperate in a similar manner, and it is, therefore, apparent that the switches must be closed successively, beginning with switch 1.

Let it now be assumed that switch 1 is first moved to closed position. This results in moving the lug 25, carried thereby, into the position shown in Fig. 2, the latch 26, however, remaining in the position shown in Fig. 3, thereby leaving the switch 1 free to return to initial position. Upon closure of the switch 2, however, the lug 30, carried thereby, engages and raises the latch 26 of switch 1 into the position illustrated in Fig. 2. This positively locks the switch 1 in closed position and the same may thereupon be released. The lug 30 of switch 2 merely supports the latch 26, and, consequently, after said switch 2 is closed, practically no pressure is required to hold the switch 1 in closed position. Upon closure of switch 2 the lug 25, carried thereby, is moved into the position shown in Fig. 2, the latch 26 thereof remaining in the position shown in Fig. 3. Upon closure of switch 3 the lug 30 thereof engages the latch 26 of switch 2 and moves the same upwardly into the path of the lug 25 of said switch 2 as illustrated in Fig. 2. Again, closure of the switch 3 moves its lug 25 into the position shown in Fig. 2, while the switch 4, when closed, raises the latch 26 of the switch 3 into the path of its lug 25, thereby locking said switch 3 in closed position.

For holding the switch 4 in closed position, I have shown a retaining magnet 32, having a pivoted armature 33, provided with a hooked portion 34, adapted to engage a pin 35 projecting laterally from the switch 4. In practice, the magnet 32 might be of the low voltage type, so that if the voltage failed for any reason, it would release switch 4, which would then fall to open po-

sition. The opening of the switch 4 would release the latch of switch 3, thereby permitting the latter switch to open. Switch 3 in opening would release switch 2 and switch 2, in opening, would release switch 1, thereby permitting all of said switches to return to open position.

With the arrangement illustrated, it will be seen that instead of each switch holding a preceding switch closed, by pressure, each switch is positively locked in closed position, and its succeeding switch is merely required to retain its latch in holding position.

Having thus described my invention, what I claim and desire to secure by Letters Patent, is:—

1. In combination, a plurality of switches tending to stand in open position, and a plurality of latches for holding said switches in closed position, said latches tending to move into a position to release said switches, and each of said switches being adapted, when closed, to retain the latch of a preceding switch in holding position.

2. In combination, a plurality of switches tending to stand in open position, and a plurality of latches for holding said switches in closed position, said latches tending to stand in position to release said switches, and each of said switches, when closed, being adapted to move the latch of a preceding switch into holding position.

3. In combination, a plurality of switches tending to stand in open position, and a plurality of latches for holding said switches in closed position, said latches tending to move into position to release said switches and to insure closure of said switches in a definite sequence, and each of said switches being adapted, when closed, to retain the latch of a preceding switch in holding position.

4. In combination, a plurality of switches tending to stand in open position, and a plurality of latches for holding said switches in closed position, said latches tending to move into position to release said switches and to insure closure of said switches in a definite sequence, and each of said switches being adapted, when closed, to move the latch of a preceding switch into holding position.

5. In combination, a plurality of switches tending to stand in open position, a plurality of latches for holding said switches in closed position, said latches tending to move into position to release said switches, and to insure closure of said switches in a definite sequence, each of said switches being adapted, when closed, to retain the latch of a preceding switch in holding position, and an electromagnet for retaining the latch of the last switch of the sequence in holding position.

6. In combination, a plurality of switches tending to stand in open position, a plurality of latches for holding said switches in closed position, said latches in normal position being adapted to release said switches, and lugs on said switches arranged to cooperate with said latches to necessitate closure of said switches in a definite sequence, a lug on each switch being arranged to maintain the latch of a preceding switch in holding position.

7. In combination, a plurality of switches tending to stand in open position, a plurality of latches for holding said switches in closed position, said latches in normal position being adapted to release said switches, and lugs on said switches arranged to cooperate with said latches, when in normal position, to necessitate closure of said switches in a definite sequence, one of the lugs on each switch being adapted to move the latch of a preceding switch into holding position.

8. In combination, a plurality of switches tending to stand in open position, a plurality of latches tending to stand in position to prevent the closure of all but one of said switches, each switch being adapted, when closed, to render one of said latches ineffective to retard the operation of a succeeding switch and to retain another latch in position to hold a preceding switch closed.

9. In combination, a plurality of switches tending to stand in open position, a latch for holding each switch in closed position, each of said latches having a tendency to release its corresponding switch, and a lug on each switch for retaining the latch of a preceding switch in closed position, each latch being arranged to prevent closure of a succeeding switch while its corresponding switch remains open.

10. In combination, a plurality of switches tending to stand in open position, an operating lever for each switch having a toggle connection therewith, a plurality of latches, a locking lug arranged on the operating lever of each switch to be engaged by one of said latches, another lug on the operating lever of each switch for retaining one of said latches in engagement with the locking lug of a preceding switch, said latches tending to release said switches, and being arranged to cooperate with said lugs to insure the closure of said switches in a definite sequence.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

THOMAS E. BARNUM.

Witnesses:

FRANK H. HUBBARD,
S. W. FITZGERALD.