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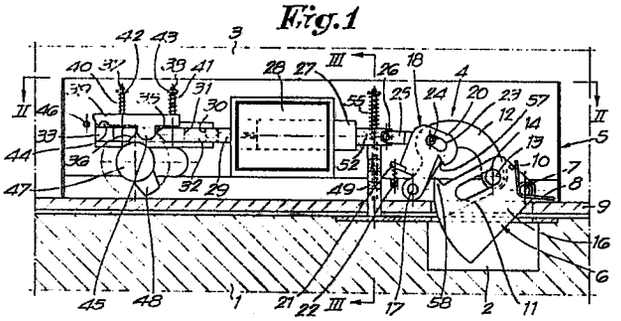
(54) Electrical safety lock.

(57) Electrical safety lock, with the characteristic that it consists essentially of: a latch (6); a spring (8) which operates on this latch (6); a lever (12) and a shaft mechanism (25) between the latch (6) and the armature (27) of a solenoid (28); and a mechanism (32-39-46-48) at the other end of the armature (27) of the solenoid (28), which enables the latch (6) to be moved back into or out of the lock case (5) by means of a key and a cylinder lock (47) whenever the solenoid (28) is not energized.

Fig.1



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Description

Electrical safety lock

This invention concerns an electrical safety lock, in particular a lock that can be incorporated in a door panel or door jamb, preferrably enclosed in a burglar-proof lock case.

More particularly, the invention concerns a safety lock of this type which is controlled electro-mechanically.

Various types of electro-mechanically controlled safety locks are already known; in all them, the electromagnet is kept energized in order to hold the latch in the lock, so that whenever power to the electromagnet is interrupted, either deliberately or inadvertently, the latch emerges from the lock and so automatically locks the door.

A disadvantage of this technique that in panic situations it is not possible to open the door except by using a key to move the whole lock mechanism, and, since the latch is forced out of the lock mechanically, the key must be brought into a certain position and held there in order to keep the door open. If the key is released, the latch emerges from the lock and the door is locked.

The aim of the present invention is to circumvent this disadvantage of known types of safety lock, by providing an electro-mechanical safety lock which can be brought, by mechanical means using a key, into either of two positions and held there automatically, ie. with the latch either in or out of the lock. In either case the key may be withdrawn from the lock.

A safety lock according to the invention which offers a solution for this consists essentially of: a latch; a spring which acts on this latch, so continually trying to force it out of the lock case; a lever and shaft mechanism between this latch and the armature of a solenoid, such that the latch is drawn back into the lock case when the solenoid is energized, or, when the solenoid is deenergized, the latch is forced out of the lock case by the action of the abovementioned spring; and, at the other end of the solenoid armature, a mechanical device which enables the latch to be moved back into or out of the lock case by means of a cylinder lock and key when the solenoid is not energized.

In order to demonstrate the characteristics of the invention, by way of example only and without being limitative in any way, the following two preferred embodiments of a lock according to the invention are described with reference to the accompanying drawings, where:

- fig. 1 is a schematic view of a safety lock according to the invention, shown in the locked position;
- figs. 2 and 3 are cross-sections along the lines II-II and III-III respectively in fig. 1;
- fig. 4 is a view similar to that in fig. 1, but with the lock held electromagnetically in the unlocked position;
- fig. 5 is a view similar to that in fig. 4, but after the door has been opened;
- fig. 6 is a view similar to that in fig. 1, but with the lock brought mechanically into the unlocked position;
- fig. 7 is a schematic view similar to that in fig. 1, but for a variant of the invention;
- fig. 8 is a view in the direction of the arrow F8 in fig. 7;
- fig. 9 is a cross-section along the line IX-IX in fig. 7;
- fig. 10 is a view similar to that in fig. 7, but in a condition where sabotage or movement of the door has occurred;
- fig. 11 is a cross-section along the line XI-XI in fig. 10;
- fig. 12 is a view similar to that in fig. 7, but with the door open;
- fig. 13 is a cross-section along the line XIII-XIII in fig. 12;
- fig. 14 shows the part indicated in fig. 7 by F14;
- figs. 15 and 16 are views similar to that in fig. 14, but showing respectively an intermediate position and the position where the latch has been moved back into the lock by mechanical means;

figs. 17 and 18 show the electrical circuit diagram for a lock according to the invention, in the open and closed position respectively;

- figs. 19 and 20 show a variant of the circuit diagram shown in figs. 17 and 18, for an open and closed door respectively.

Figs. 1 to 6 show schematically a door panel 1 with a mortice 2, and opposite a fixed section of wall 3 in which is fitted a lock 4 according to the invention, preferably mounted in a burglar-proof lock case 5.

The lock 4 consists essentially of a latch 6 which is freely hinged on an axis 7. Around the axis 7 is a torsion spring 8 with two arms, one of which acts against the outer wall of the base plate 9 and the other against a stop 10 on the latch 6.

The latch 6 has a recess 11 into which fits the end of a a curved lever 12. This lever 12 has a pin 13 which projects on either side of it. The projecting ends of the pin 13 slide in slots 14 in the cheeks 15-16 on either side of the recess 11. The other end of the lever 12 hinges freely on an axis 17 mounted on the base plate 9.

A second lever 18 is also freely hinged on the axis 17. This second lever 18 consists of two parts 19 and 20 situated on either side of the first lever 12. These two parts 19 and 20 are attached to each other at the base by a bridge 21 underneath which there is a spring 22 which continually tries to make the lever 18 hinge towards the latch 6.

In each of the parts 19 and 20 of the lever 18 there is a slot 23 in which slide the ends of a pin 24 mounted in the lever 12 and to which are attached the end of a forked shaft 25. The other end of this shaft 25 is attached to the end of the armature 27 of a solenoid 28 via an axis 26 on which it hinges freely.

The other end of the armature 27 is extended by a shaft 29 which emerges from the solenoid 28 and which terminates in a pusher block 30.

The pusher block 30 can move within a hollow space 31 in a slider 32 which slides in guide blocks 33-34 mounted on the base plate 9. The slide 32 has a groove 35 with sloping edges 36.

On the slider 32 are two pins 37 and 38 along which a locking bar 39 can slide against the resistance of two springs 40 and 41, which are mounted between the locking bar 39 and stops 42 and 43 on the pins 37 and 38 .

The locking bar 39 has on the front a notch 44 which forms a sort of hook, and also a projection 45 opposite the groove 35.

In line with the locking bar 39 there is a pin 46 over which the notch 44 of the locking bar 39 can hook, as explained later.

Underneath the slider 32 is a key-operated cylinder lock 47 with a projecting bit 48.

Near the link between the forked shaft 25 and solenoid armature 27 is a bolt 49 with a suitably rounded end and which operates on the door 1 or similar. At the other end of the bolt 49 is a bridge 50 which passes over the extension of the solenoid armature 27 and whose two feet 51-52 are wide at the base. The bolt 49 is guided by the bridge 50 sliding on two pins 53 and 54 attached to the base plate 9. On each of the pins 53 and 54 there are springs, respectively 55 and 56, between the base plate 9 and the bridge 50, such that these springs try to force the bolt 49 out of the lock.

The operation of the safety lock, as described below, is extremely simple.

In the normal locked position the lock is in the position shown in figs. 1 and 2.

In these figures the solenoid armature 27 is forced out to the right; the levers 12 and 18 are swung and the latch reaches into the mortice 2.

Here it should be noted that in this position the lever 18 is swung by the spring 22 so that the notch 57 in the lever 18 comes opposite a spur 58 on the latch 6. The purpose of this is to make it impossible for the latch to be pushed out of the mortice in any way by inserting some type of instrument or any other object between the base plate 9 and the door 1. This is prevented by the spur 58 engaging in the notch 57.

The latch is held in the mortice 2 essentially by the action of the torsion spring 8. At this moment the solenoid is not energized.

Whenever the door 1 has to be opened, the solenoid 28 is energized so that, as shown in fig. 4, the latch 6 is withdrawn from the mortice 2 against the resistance of the spring 8. When the solenoid armature 27 moves towards the left in the figures, it first swings the lever 18 counterclockwise and simultaneously through the action of lever 12 swings the latch clockwise, which is possible because the lever 18 will first have moved out of the way.

When the door 1 is then opened, the bolt 49 emerges from the lock case, as shown in fig. 5, so that the wide feet 51 and 52 of the bridge 50 press on the bridge 21 of the lever 18, against the resistance of the spring 22, thus locking the lever 18 in the position shown in fig. 5.

Fig. 6 shows the final position in which the lock according to the invention is held open.

In this situation, if the door 1 is inadvertently locked, for example due to the power supply being cut off, the cylinder 47 may be turned with a key so that the bit 48 also turns and engages in the groove 35 and operates on the projection 45 of the locking bar 39, thus forcing the locking bar upwards against the resistance of the springs 41 and 42, so that when the locking bar subsequently comes back down again when the slider 32 is slid, the notch 44 hooks over the pin 46, with the result that the lock is brought into the position shown in fig. 6 and held there until the cylinder 47 is turned in the other direction, thus returning the lock to the position shown in fig. 5.

As a result of the locking bar 39 moving to the left in the diagram, not only is the slider 32 slid, but by means of the shaft 29 and the pusher block 30 the armature 27 of the solenoid 28 is also moved, so that the lever 12 is swung counterclockwise and the latch 6 is withdrawn from the mortice 2 and held.

Figs. 7 to 16 show a variant which is essentially similar to the variant shown in figs. 1 to 6, with the same parts indicated by the same numbers.

In this variant the lock is fitted with a proximity switch 59 which terminates on the outside surface of the base plate 9 and which is influenced by the steel door or a steel part mounted on the door, so that the lock may react when the door approaches.

On the latch 6 is a stop 60 which can come up against the inside of the base plate 9 in order to prevent the latch coming too far out of the lock.

Also in this variant, an L-shaped lever 61 with arms 62 and 63 hinges freely on an axis 17. This lever replaces the stop 21 in the first variant. Arm 62 of the lever 61 can be operated on by foot 52 of the bridge 50, while the other arm 63 is situated behind a projection 64 on the lever 18.

A torsion spring 65 is wound around the axis 17, with one arm of the spring round the projection 64 and the other arm resting against the base plate 9. This spring has essentially the same function as the spring 22 in the first variant.

The purpose of the lever 61 is to draw back the lever 18, i.e. to make it swivel counterclockwise whenever the bolt 49 emerges from the base plate. This is achieved by the projection 51 pressing on the arm 62 of the lever 61 under the action of springs 55 and 56, so that the other arm 63 of the lever 61 presses against the projection 64 on the lever 18. When the bolt 49 is pushed in, i.e. when the door is closed, the projection 51 is moved out of the way of the arm 62, thus enabling the torsion spring 65, which presses against the projection 64, to bring the lever 18 into the safety or locked position, ie. with the notch 57 of the lever 18 above the 58 spur of the latch 6.

In this variant, there is a second bridge 66 opposite the first bridge 50 and joined to it.

The shaft 25 is joined to a projecting part of the solenoid armature 27 and has a cam 67.

The bridge 66 operates in conjunction with the cam 67 of the shaft 25 in order to prevent sabotage.

If the bridge 66 and the cam 67 were not there, then if the door were to be moved either deliberately or inadvertently, e.g. if it should sag (see fig. 10), the

bolt 49 would emerge from the lock so that the lever 18 would swivel counterclockwise in the diagram, so that the latch 6 would no longer be secured and could be simply pushed aside with a screwdriver, bank card or similar instrument and the door opened.

This is completely prevented by the bridge 66 operating in conjunction with the cam 67.

If the lock according to the invention is used in combination with a so-called "crook lock", then either the bridge 66 will not be present or the lever 25 will be reversed so that the cam 67 points downwards.

The lever 18 has on its other side a projection 68 that can operate in conjunction with a microswitch 69 on a mounting plate 70 attached to the base plate 9.

The purpose of the microswitch is to indicate whether the latch 6 is in the locked position, when the lock is connected to a signalling system.

In this variant, the mechanical locking is also provided by a slider 32 with a groove 35 into which the end 45 of the locking bar 39 fits.

In this variant however, the locking bar 39 is positioned transversely with respect to the length of the lock, and can be moved to one side or other of a ridge 71 on the guide blocks 33 and 34.

Underneath the slider 32 is an integrated circuit 72 which controls the operation of the lock and which contains amongst other things a microswitch 73 operated by the pusher block 30 of the solenoid 28.

When it is wished to draw the latch 6 back into the lock, the solenoid 28 is energized so that the pusher block 30 depresses the microswitch 73, in order to reduce the power drawn by the solenoid to a level sufficient to hold it in that position, so that it heats up less.

The integrated circuit 72, the circuit diagram of which is shown in figs. 17 and 18, consists essentially of: a transformer 74 to reduce the voltage to 24 volts; a rectifier bridge 75 to convert the 24 V AC to 24 V DC; a capacitor 76 to smooth the output from the rectifier bridge 75; four rectifiers 77-78-79-80 connected in bridge configuration to supply the solenoid 28; a printed circuit relay 81 to switch a signalling contact and to switch the solenoid 28; and, in combination with the microswitch 82 and printed circuit relay 81, the proximity switch 59.

The operation of the lock shown in figs. 7 to 16 is near enough the same as described with reference to the variant shown in figs. 1 to 6.

The integrated circuit 72 is connected to a control and signalling panel (not shown) on which there is a pushbutton S together with LEDs indicating the position of the lock at any given moment.

When the door is closed, the lock according to the invention is in the position shown in fig. 7.

If the pushbutton S is pressed when the lock is in this position, i.e. if current is supplied to the solenoid 28, the lock is brought into the position shown in fig. 12, that is, the lever 18 is first turned counterclockwise, and then the latch 6 is withdrawn into the lock.

At that moment, the pusher block 30 of the solenoid 28 operates the microswitch 78, so reducing the power drawn by the solenoid to a level sufficient to hold the solenoid in a drawn-in position.

The latch 6 is thus drawn into the lock, so that the door can be opened.

When the door opens, the proximity switch 59 connects the printed circuit relay 81, thus closing the relay contact.

When the pushbutton S is released, a contact on the printed circuit relay 81 signals the position of the door by making one of the abovementioned LEDs light up.

When the door is closed again, the proximity switch 59 reconnects the printed circuit relay 81 once more, so that the abovementioned relay contact opens once more.

The current supply is thus again interrupted, thus deenergizing the solenoid 28, so that, under the action of the torsion spring 8, the latch 6 comes into the position shown in fig. 7, i.e. comes into the locked position. In this position, the bolt 49, which is pushed in by the door, causes the lever 18 to move so that the notch 57 is positioned over the spur 58 on the latch 6.

Clearly, this gives an electrical safety lock which has a very small number of parts and which can whenever necessary be brought into and held in an unlocked position in a simple, mechanical way.

Clearly, the present invention is in no way limited to the variants described by way of example and shown in the accompanying figures; on the contrary, such a lock can be made in various forms and dimensions while still remaining within the scope of the invention.

Claims

1. Electrical safety lock, with the characteristic that it consists essentially of a combination of: a latch (6); a spring (8) which operates on this latch (6) in such a way that it continually tries to force the latter out of the lock case (5); a lever (12) and a shaft (25) between the latch (6) and the armature (27) of a solenoid (28), by means of which the latch (6) is drawn into the lock case (5) when the solenoid (28) is energized, and by means of which also the latch (6) is forced out of the lock case (5) under the action of the abovementiond spring (8) when the solenoid is deenergized; a mechanism (32-39-46-48) at the other end of the armature (27) of the solenoid (28), which enables the latch (6) to be moved back into or out of the lock case (5) by means of a key and a cylinder lock (47) whenever the solenoid (28) is not energized.

2. Electrical safety lock as in claim 1, with the characteristic that the latch (6) hinges on an axis (7) attached to the base plate (9) of the lock case (5), with around the axis (7) a torsion spring (8) which acts against the outer wall of the base plate (9) and against a stop (10) on the

latch.

3. Electrical safety lock as in claims 1 or 2, with the characteristic that freely hinged on the latch (6) is a lever (12) whose other end is attached to the armature (27) of a solenoid (28).

4. Electrical safety lock as in claim 3, with the characteristic that the lever (12) is curved, with one end hinging on an axis (17) which is attached to the lock case (5), and with the other end hinging on an axis (13) which slides in a slot (14) in the latch (6).

5. Electrical safety lock as in claim 4, with the characteristic that between the abovementioned attachment points (17) and (13), the lever (12) hinges freely on an axis (24) via which it is attached to a shaft (25) whose other end is connected to one end of the armature (27) of the solenoid (28).

6. Electrical safety lock as in one of the above claims, with the characteristic that also hinged freely on the abovementioned axis (17) is a second lever (18) which is acted upon by a spring (22) or (65), which continually tries to swing the lever towards the latch.

7. Electrical safety lock as in claim 6, with the characteristic that near the lever (18) is a bolt (49) which emerges from the lock case (5) and which can be forced back into the lock case against the resistance of springs (55-56) by the action of the door (1), where this bolt (49) has at least one stop (51-52) which when the door is open acts on a stop (21) on the lever (18) in order to turn the latter against the resistance of the spring (22) so that it comes in the way of the latch (6).

8. Electrical safety lock as in claim 6, with the characteristic that near the lever (18) is a bolt (49) which emerges from the lock case (5) and which can be forced back into the lock case against the resistance of springs (55-56) by the action of the door (1), where this bolt (49) has at least one stop (51-52) which when the door is open operates in conjunction with one arm (62) of an L-shaped lever (61) which hinges freely on the abovementioned axis (17), and where the other arm (63) of this lever is situated behind a projection (64) on the lever (18) in order to turn the latter against the resistance of the spring (65) so that it comes in the way of the latch (6).

9. Electrical safety lock as in any of the above claims, with the characteristic that on the latch (6) is a projection which when the bolt (49) is forced back into the lock case (5) can operate in conjunction with a notch (57) in the lever (18).

10. Electrical safety lock as in any of the above claims, with the characteristic that the other end of the armature (27) of the solenoid (28) has an extension (29-30) which operates in conjunction with a slider (32) in which there is a groove (35) in which the bit (48) of a cylinder lock (47) can engage so as to move the slider in one direction or the other and thus operate on the latch (6) via the armature (27), the shaft (25) and the lever (12).

11. Electrical safety lock as in claim 10, with the characteristic that the extension (29-30) is formed by a shaft (29) which passes through the free end of the slider (32), where the latter has a hollow space (31) in which a pusher block (30) attached to the free end of the shaft (29) can move.

12. Electrical safety lock as in claim 11, with the characteristic that underneath the slider (32) and in the path of the pusher block (30) there is a microswitch (73) which is operated by the pusher block (30) when the solenoid is actuated, in order to reduce the power supplied to the solenoid to a "hold" level.

13. Electrical safety lock as in claim 11, with the characteristic that the length of the space (31) is slightly larger than the width of the pusher block (30) situated within it plus the distance which the solenoid armature (27) must travel in order to bring the latch (6) back into the lock case (5).

14. Electrical safety lock as in claim 10, with the characteristic tht the slider (32) operates in conjunction with a locking bar (39) which has a hook-shaped notch (44) which can hook over a pin (46).

15. Electrical safety lock according to claim 10, with the characteristic that the slider (32) operates in conjunction with a locking bar (39) which can be moved to either side of a ridge (71) on the guide blocks (33-34).

16. Electrical safety lock as in claim 14 or 15, with the characteristic that the slider (32) can slide in guide blocks (33-34).

17. Electrical safety lock as in claim 14 or 15, with the characteristic that the locking bar (39) has a projection (45) which engages in the groove (35) in the slider (32) and upon which the bit (48) of the cylinder (47) can act.

18. Electrical safety lock as in claim 14 or 15, with the characteristic that the locking bar (39) is attached to the slider (32) by means of pins (37-38) on which it can slide, with springs (40-41) fitted over the pins (37-38) between the locking bar (39) and stops (42-43) on the ends of the pins (37-38).

19. Electrical safety lock as in any of the above claims, with the characteristic that on the shaft (25), which is mounted above the bolt (49) and between the springs (55) and (56), there is a cam (67), while around the shaft (25), or around the end of the solenoid armature (27) to which the shaft (25) is attached, there is a bridge (66) attached to the bolt (49), so that when the solenoid (28) is not energized the bolt (49) cannot move sufficiently far out of the lock case to permit the lever (18) to move back.

20. Electrical safety lock as in any of the above claims, with the characteristic that the lever (18) has a sideways projection (68) which can operate in conjunction with a microswitch (69) to inform a display panel about the position of the latch (6).

21. Electrical safety lock as in any of the above claims, with the characteristic that it is fitted with a proximity switch which projects from the

base plate (9).

Fig.1

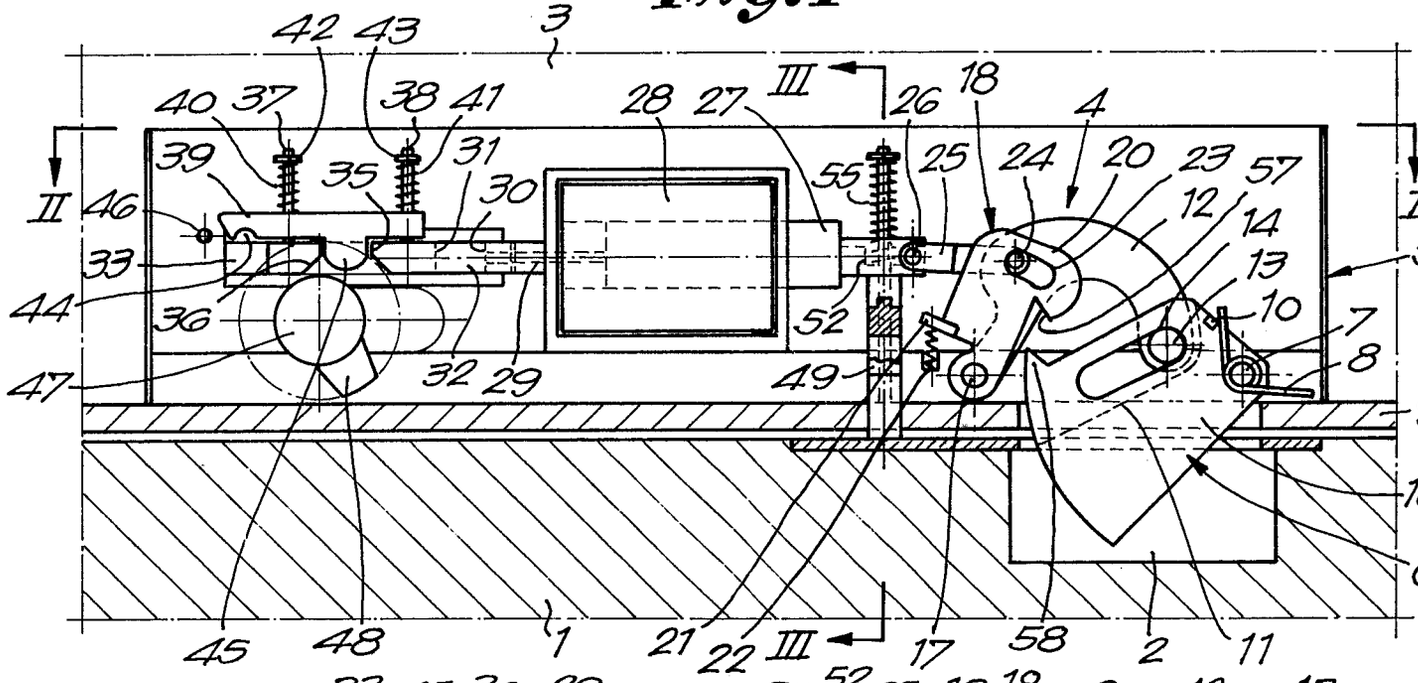
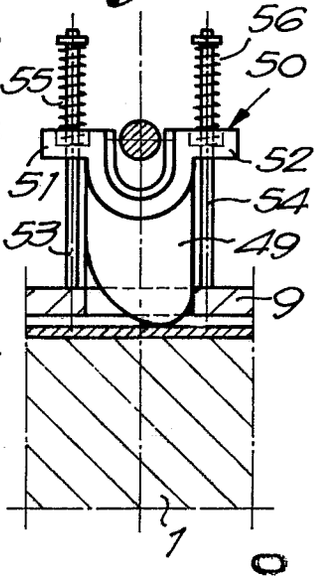


Fig.3



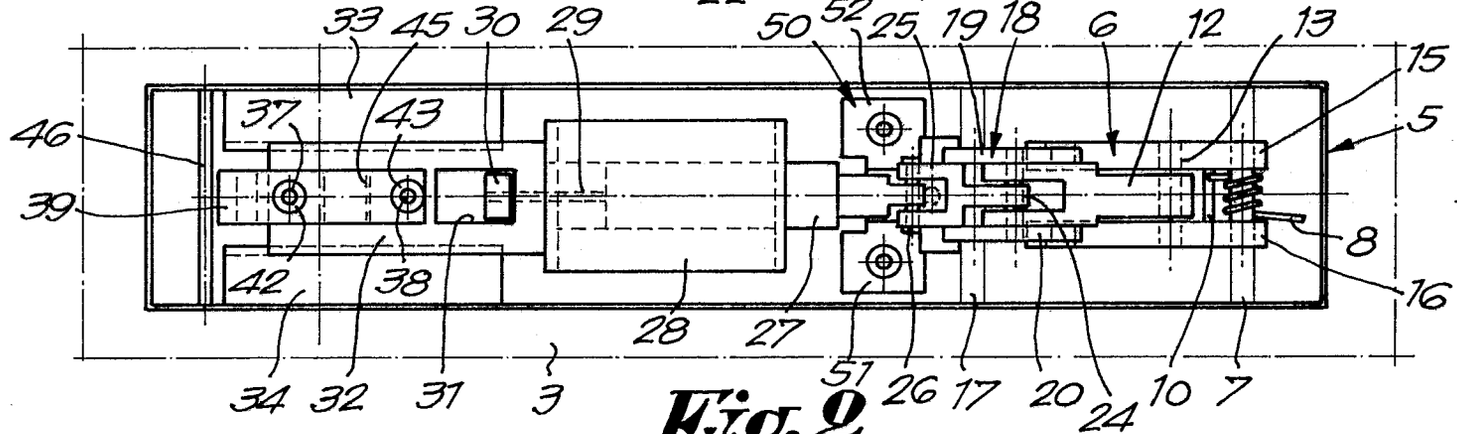


Fig.2

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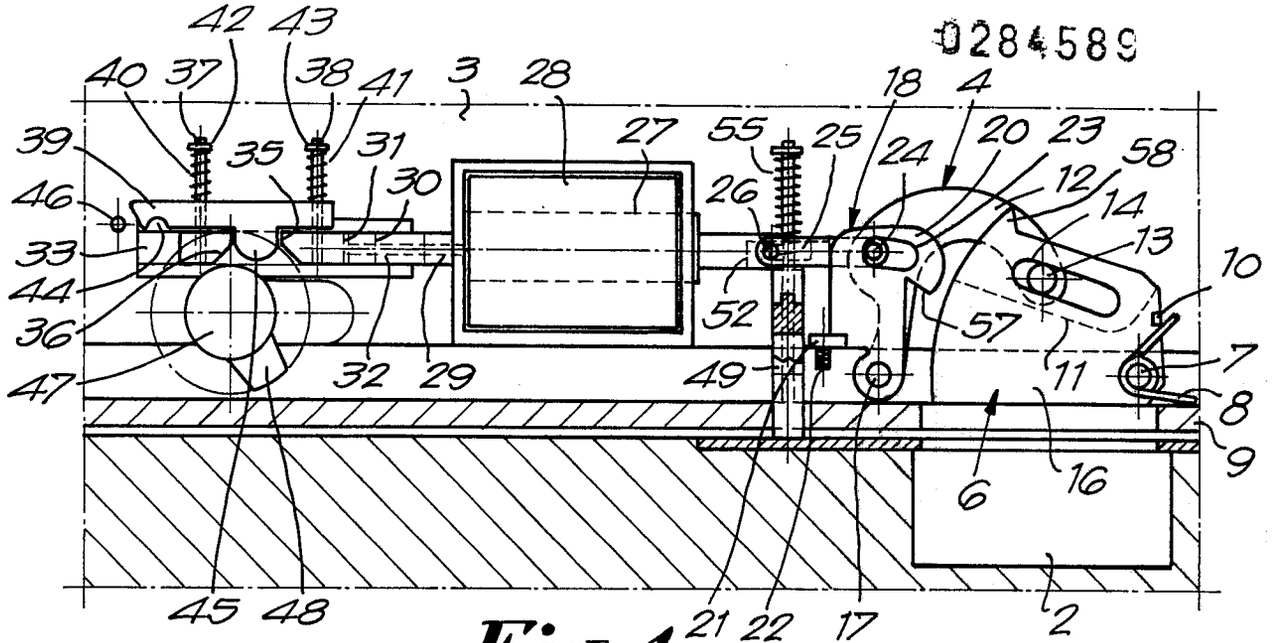


Fig.4

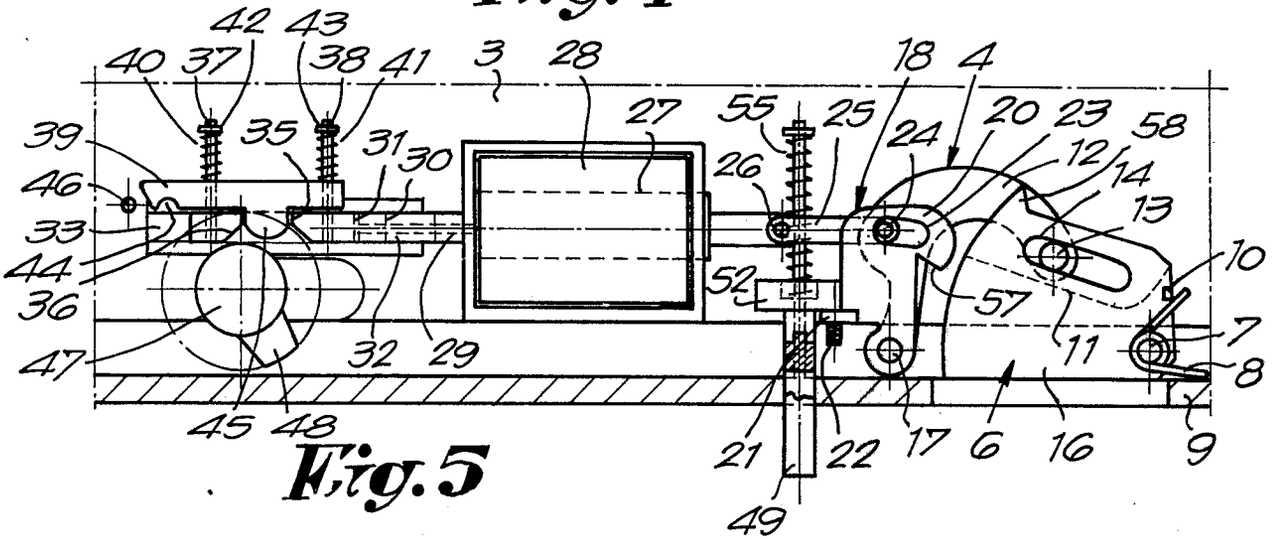


Fig.5

Fig.6

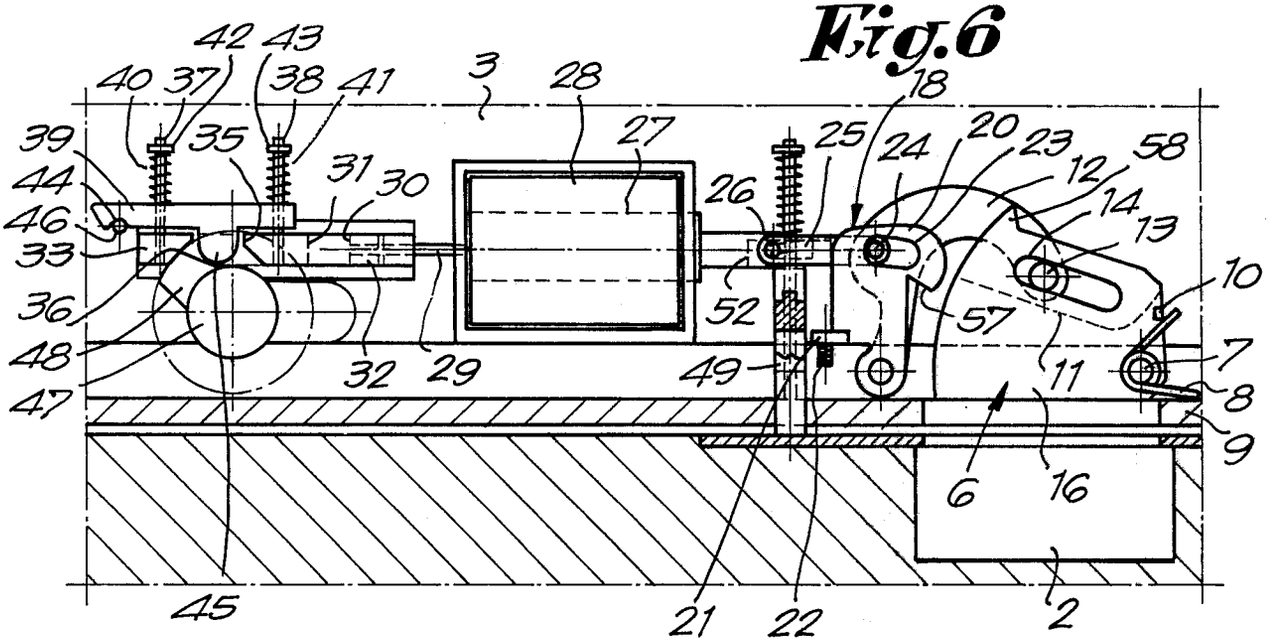


Fig. 7

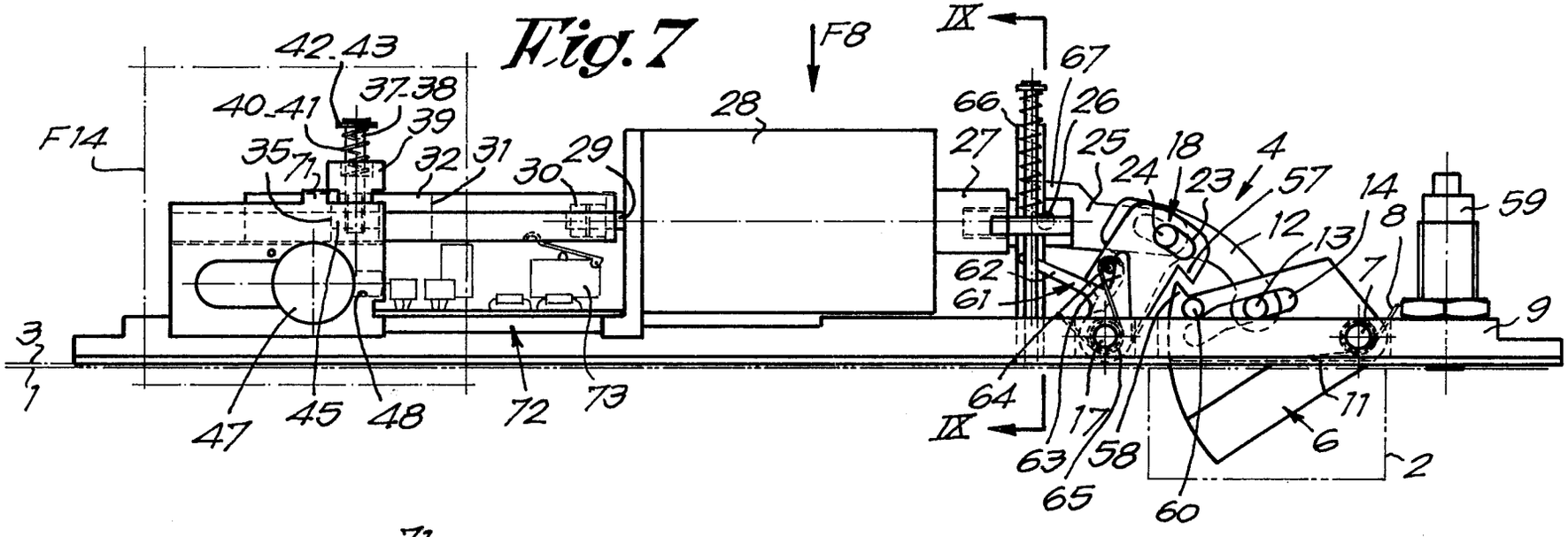
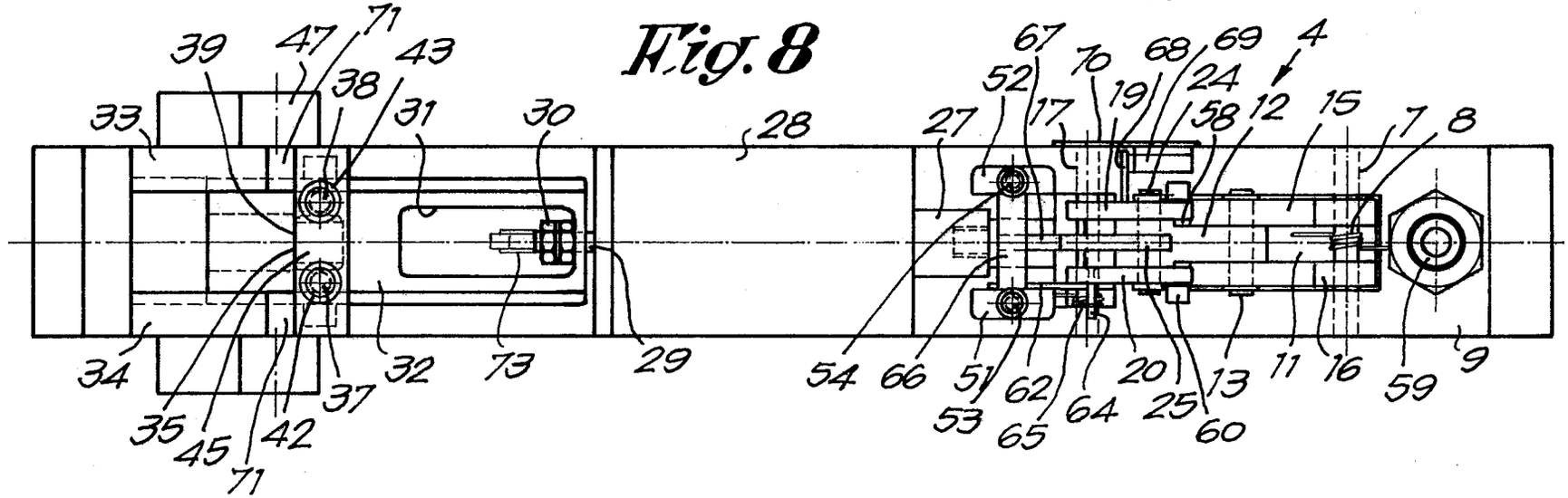


Fig. 8



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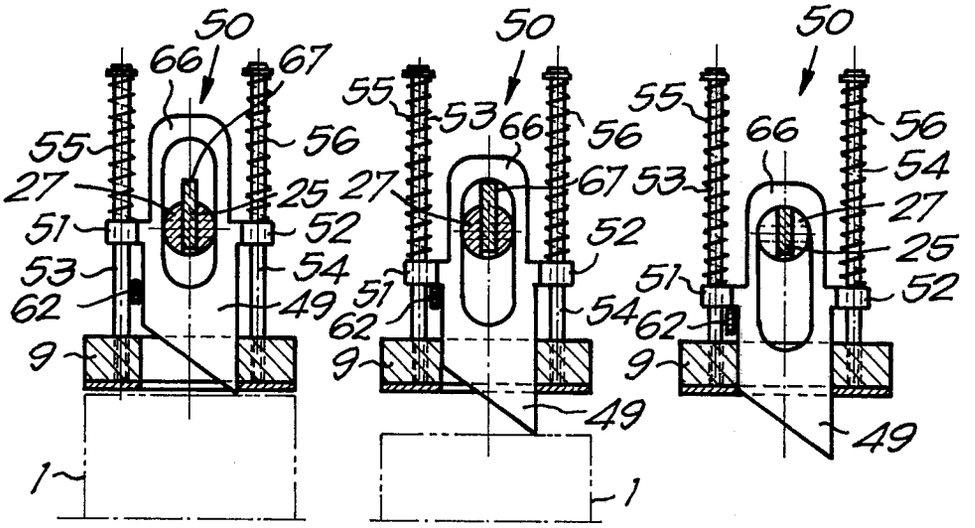

Fig.9 Fig.11 Fig.13

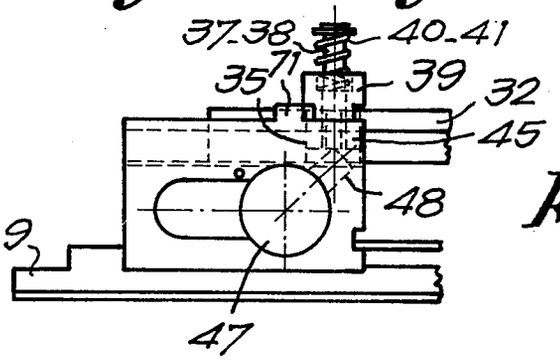

Fig.14

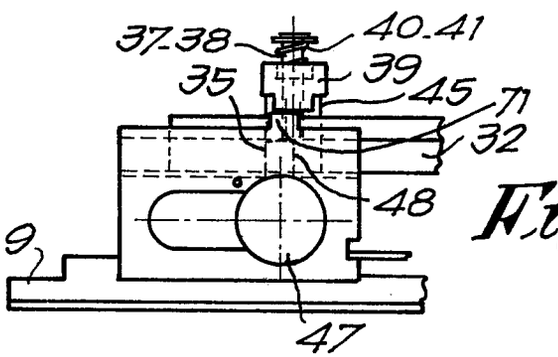

Fig.15

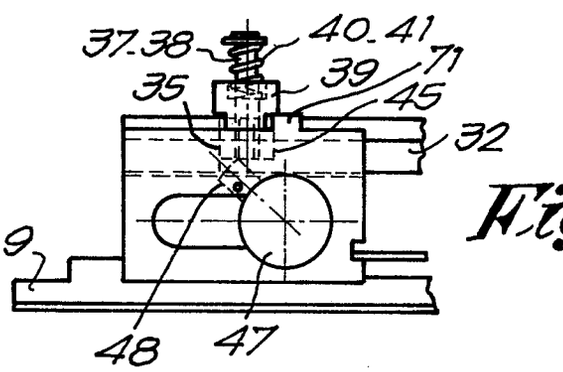

Fig.16

Fig. 10

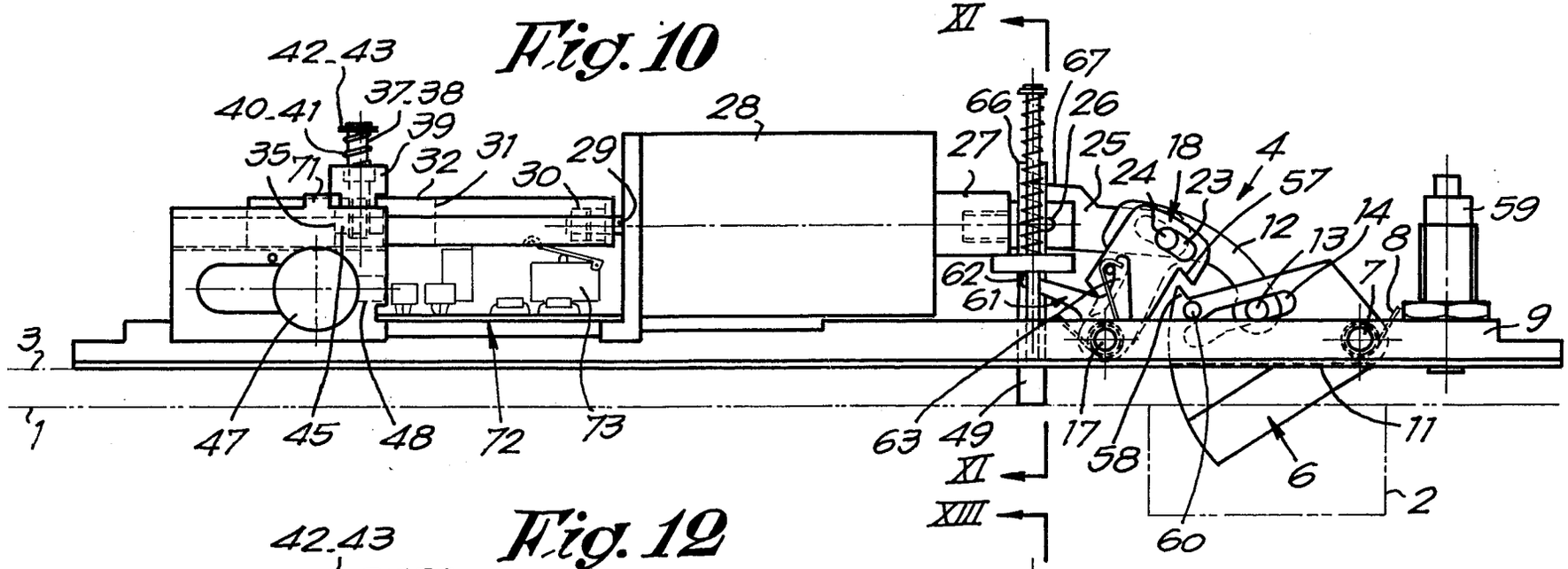

Fig. 12

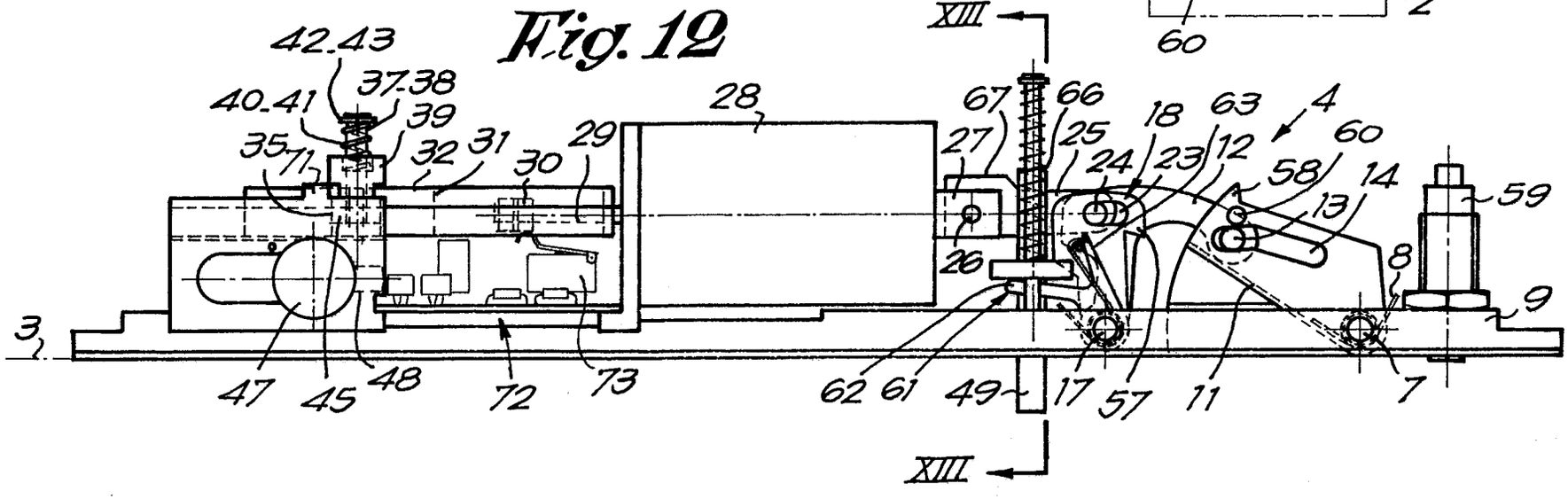

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Fig. 17

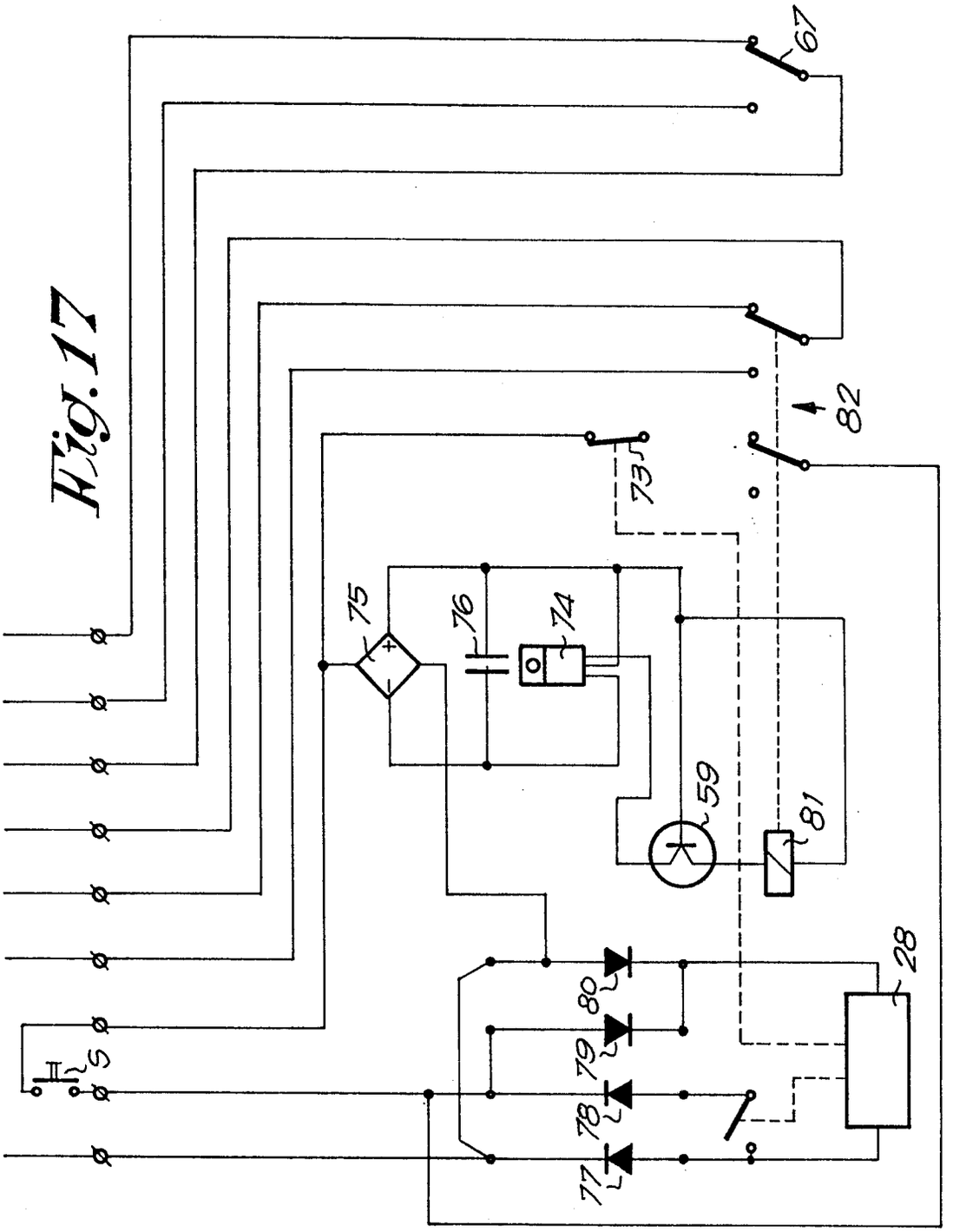

Fig. 18

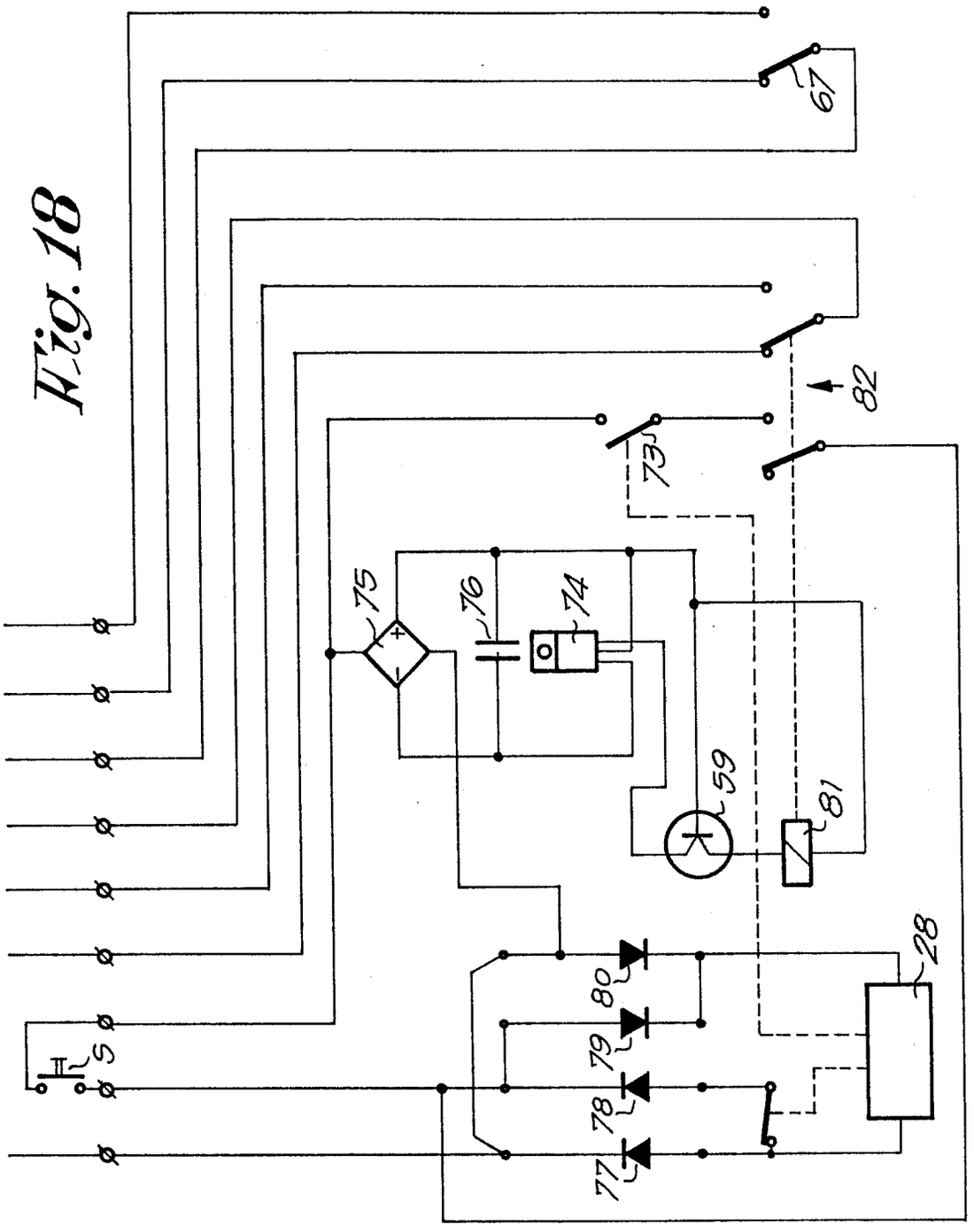

Fig. 19

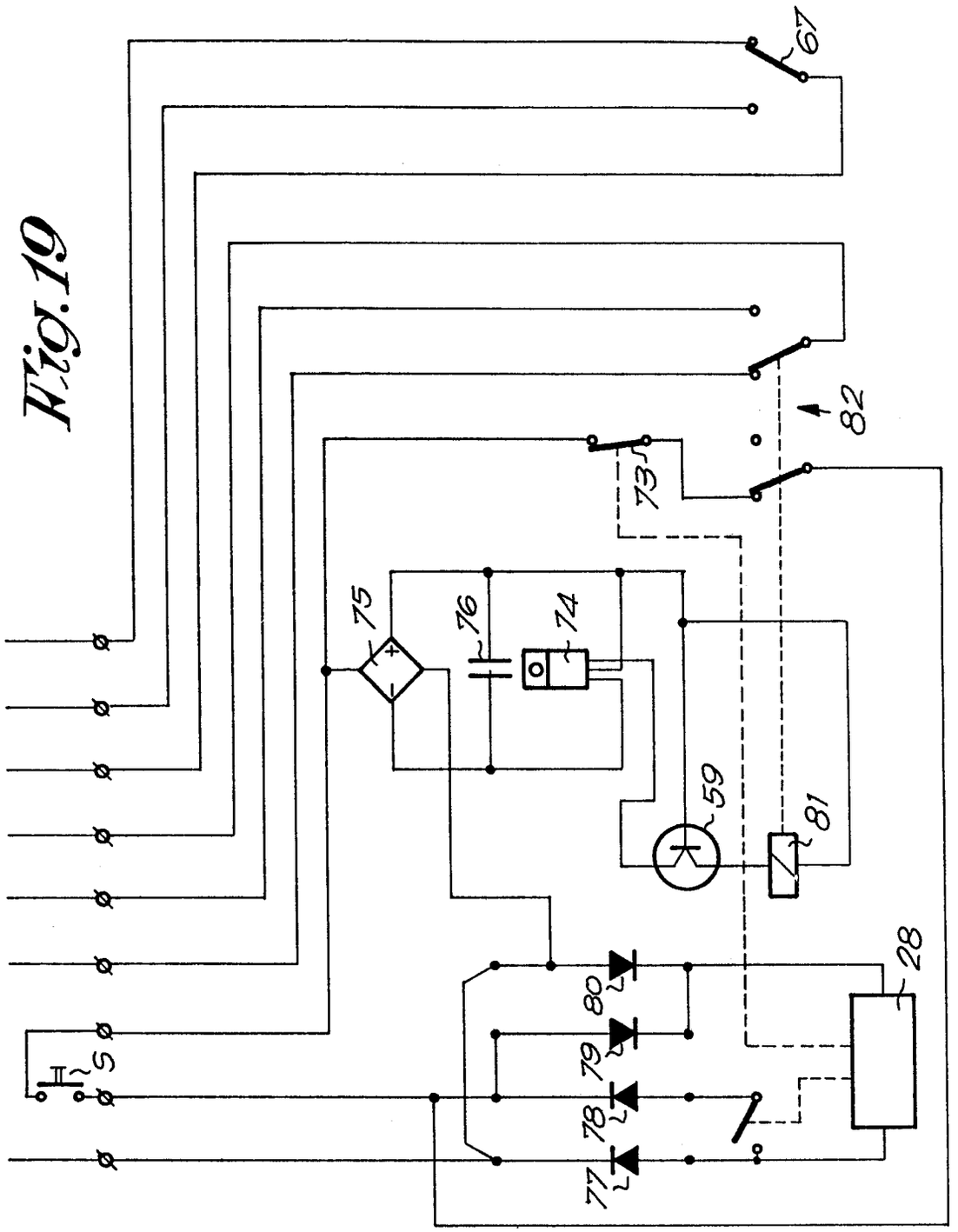

Fig. 20