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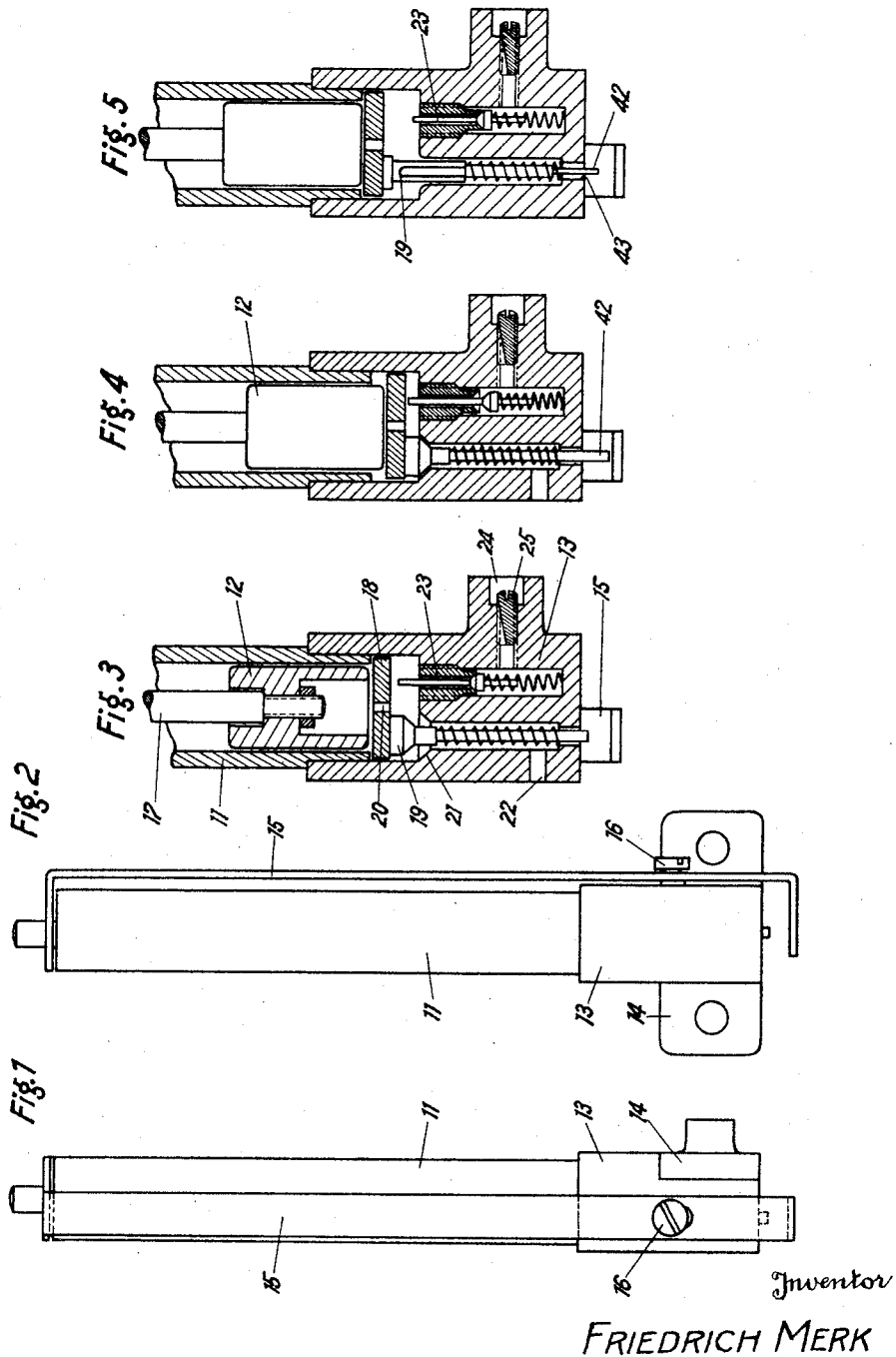
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LIFTING DEVICE FOR SELECTORS IN TELEPHONE EXCHANGES

Filed April 30, 1932

2 Sheets-Sheet 1



Inventor

FRIEDRICH MERK

By

Dowell & Dowell

Attorneys

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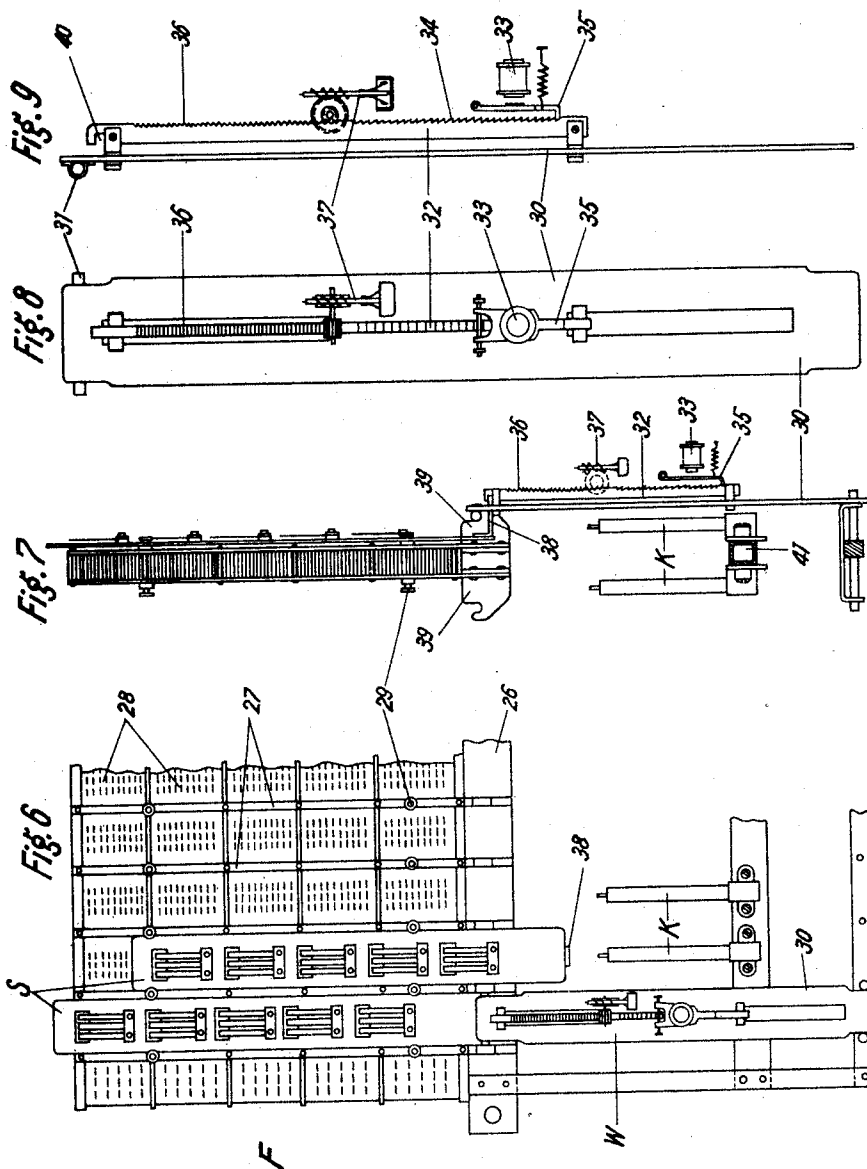
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Inventor

FRIEDRICH MERK

By

Douell & Douell

Attorneys

UNITED STATES PATENT OFFICE

FRIEDRICH MERK, OF FRANKFORT-ON-THE-MAIN, GERMANY, ASSIGNOR TO H. FULD & CO. TELEPHON- UND TELEGRAPHENWERKE AKTIENGESELLSCHAFT, OF FRANKFORT-ON-THE-MAIN, GERMANY, A CORPORATION OF GERMANY

LIFTING DEVICE FOR SELECTORS IN TELEPHONE EXCHANGES

Application filed April 30, 1932, Serial No. 608,542, and in Germany May 1, 1931.

The present invention relates to selectors which are set by stored forces (gravity, springs), of which a sufficient number are provided to produce a connection and which when returning the actuating members into the initial position, called "selector lifting", are reset. The practical use of such selectors was hitherto rendered difficult because no satisfactory means was known for lifting the selectors.

For lifting the selectors there are available impulse magnets, transmission mechanism and compressed air, which are otherwise available for setting the selectors. Only the first two arrangements were hitherto used occasionally for lifting the selectors, but they gave rise to similar objections to those referred to above, as when used for setting the selectors. The same applied to a greater extent hitherto also to actuation by compressed air suggested separately for lifting the selectors, but never used for this purpose in practice.

The present invention has for its object an efficient solution of the lifting of selectors on the basis of an arrangement using compressed air or other fluid pressure which, contrary to the existing opinion, has a predominating suitability for the purpose in view if it is carried out in the manner according to the present invention. Satisfactory results are obtained only when complying with the following conditions.

1. Lifting devices formed as a piston motor actuated by compressed air were used hitherto both for lifting the selectors and for braking the speed of movement of the selectors when setting. It is absolutely essential not to use the piston motors for an auxiliary purpose of braking, as the motors can never produce an accurately operating braking medium, which solely comes into action when setting the selector, and its capability of use for lifting the selectors thus suffers.

The braking action of an air or other fluid piston depends upon the compression or expansion of an enclosed quantity of the air or fluid, of which the amount on the one hand depends upon the uncertain pack-

ing conditions of the piston and on the other hand on the position of the actuating member, and of the piston previously coupled thereto and which in the meantime has usually commenced the initiated downward movement of the selectors or continues its movement. The braking action of the piston is very fluctuating, particularly when the variable friction is also considered. The better the packing of the piston and if desired also of the piston rod, the greater will be the action of friction on the setting speed of the selector actuating member so that, regarded as a whole, the unsuitability of the previous piston motors for lifting the selectors will be clearly understood. On the basis of the above knowledge the action of the piston motors, in accordance with the present invention, is limited to producing the forward movement of the piston, actuated by compressed air, while they are inoperative during the setting of the actuating members operated by the stored forces. In this manner, disregarding any delay of the actuating member by the piston motor, there is obtained the advantage, which must not be underestimated, of being able to connect the piston motor separately from the setting members to the air supply pipe.

2. The omission of electromagnetically controlled valves is the problem of next importance. The mechanical valve control suggested in U. S. Patent No. 1,849,986 must be simplified. In accordance with the present invention this is effected by combining the stroke of the actuating member and piston when lifting the selectors. In this manner the valve control by the piston may be effected in a very simple manner in its two end positions.

3. For ensuring the certainty of action of the valve a particular construction of the valves is necessary. This requirement is satisfied in accordance with the present invention in that two constructionally different valves are provided for the exhaust and admission, which are dependent upon one another, the exhaust valve, if desired, being in the form of a small piston valve.

4. A further necessary improvement relates to the adjustment of the speed of the actuating member during lifting and when setting the selector. In this case it is necessary to balance the inconsistencies both of the piston load and of the pressure of the compressed air within as wide limits as possible. For this purpose provision is made, in accordance with the present invention, for the selector lifting, of the insertion of a throttle in the air supply pipe of each piston motor and the use of a brake for the selector adjustment which during setting is mechanically coupled with the actuating member.

In the accompanying drawings:—

Figures 1 and 2 show a piston motor in side and front elevation.

Figures 3 to 5 show the lower portion of the piston motor in cross section with the valves.

Figures 6 and 7 show the arrangement of the piston motor in a bar selector with a flat bank multiple.

Figures 8 and 9 show a control mechanism of the selector.

The piston motor consists of a cylinder formed by a pipe 11, a piston 12 which slides easily therein while being as airtight as possible, a valve casing 13 screwed to the bottom of the pipe and provided with securing flanges 14, and a movable angle piece, a valve lifter 15, extending along the outer side of the pipe and valve casing. The valve lifter is guided and held on the valve casing by a screw 16 and at the upper end by the piston rod 17 which it embraces.

The piston normally rests under the action of gravity on the plate-shaped extension 18 of the exhaust valve 19 which is pressed upwardly by a spring. This valve connects the lower cylinder space, in the position of rest shown in Figure 3, by the opening 20, open valve seat 21 and opening 22 with the outer air. At the same time the other valve, the admission valve 23, located at the side thereof and also pressed upwardly by a spring, closes the cylinder space from the inlet opening 24 for compressed air or other fluid.

The piston motor comes into operation when the position of the two valves is reversed. This is effected when the piston is depressed by an additional load applied to its rod. In this case the plate shaped extension 18 of the exhaust valve is moved downwardly by the piston and the valve 19 is closed, but it will be obvious that it might instead be forced down directly or through the intermediary or some other means. The plate shaped member 18 moves with the valve 19 and the inlet valve 23 is thus opened (see Figure 4). Compressed air or other fluid now flows through the opening 24 into the cylinder space, this flow taking place slowly by reason of a throttle 25 fitted into the

opening 24. As the compressed fluid flows into the space under the piston the pressure exerted on the piston slowly increases. However, the piston remains in its lower position until the pressure of the inflowing fluid has reached the necessary degree for overcoming the piston load. From this moment the piston commences to move upwardly while the compressed fluid continues to flow in. The fluid pressure existing under the piston at the same time firmly holds the exhaust and inlet valves during the upward piston stroke in the operative position shown in Figure 4.

The piston when reaching the top end of the cylinder pipe 1 strikes against the valve lifter 15 and raises this somewhat. The lower angle piece of the lifter 15 strikes against the extension 42 of the exhaust valve projecting downwardly from the valve body. This valve is thus lifted and the inlet valve is released so as to enable it to be closed automatically. The supply of compressed fluid is thus cut off and the compressed fluid under the piston escapes through the exhaust valve. The piston itself then returns downwardly into the initial position under the action of gravity.

It will now be shown that the method of operation of the device described is independent within wide limits of the piston load and the pressure of the fluid which is supplied. If the piston load when allowing the compressed fluid to enter is greater than the normal load, the upward movement of the piston is, as a result, slightly delayed until the increasing pressure of the fluid acting on the underside of the piston has reached the degree necessary for overcoming the load. If, however, the piston load at the beginning is smaller than the normal load, then the upward movement of the piston is slightly accelerated. Should the piston load vary during the upward movement of the piston the speed of the piston is temporarily accelerated or decelerated, according as to whether the piston load is reduced or increased, until a balance is again produced between the piston load and the uniformly inflowing fluid. The uniform supply of fluid is sufficiently ensured for the present purpose by the known property of a throttle namely that its resistance can be varied in proportion to the square of the speed of flow. The throttle also has a strong balancing action on the supply of fluid in the case of considerable fluctuations in pressure of the fluid, and thus on the movement of the piston and of the selector which is lifted by the piston. In order to enable the average speed of movement of the piston to be adjusted, the throttle is formed as a screw with a wedge shaped groove, whereby the desired speed can easily

be obtained by more or less screwing the screw into the opening 24.

In Figure 5 the exhaust valve is in the form of a small piston valve. The valve seat 21 and the opening 22 shown in Figures 3 and 4 are omitted in Figure 5. The pin 42 of the exhaust valve is flattened on opposite sides at its lower end in such a manner that in the normal position shown communication is formed between the lower cylinder space and the outer air, while in the lowered operative position the unreduced portion of the pin 42 closes the hole 43. In comparison with the construction of Figures 3 and 4 this arrangement has the advantage that the exhaust is closed before admitting compressed fluid, while the supply of the compressed fluid is shut off before the exhaust is opened, which is favourable for the operation of the piston motor.

The connection of the piston motor with the remaining selector parts is shown in Figures 6 and 7.

F is a flat bank multiple consisting of five separate banks arranged one above the other over a carrier 26. The carrier and the separate banks are held together at the front and back by transversely (vertically) extending bars 27 and form a block. Between the bars 27 are located the contact fields 28 of the separate selectors. With each selector there is associated in addition to its contact field a brush slide S, a control mechanism W and a piston motor K. The brush slide consists of a plate shaped carrier with five sets of brushes secured thereto which pass through slots in the supporting plate and sweep over the contact field located behind it in so far as they have been released in the known manner for closing the contacts by a rigid member (not shown). Each brush slide is separately movable up and down in front of its contact field in guide members 29 secured to the bars 27. During the downward movement, which is controlled by the control mechanism, the brushes sweep over the contacts.

The control mechanism illustrated in Figures 8 and 9 shows on a base plate 30 with the supporting strap 31 only the parts which are necessary for explaining the invention, these being a rack 32 sliding in two slots of the base plate, a release magnet 33 with a ratchet pawl 35 engaging with the rack teeth 34 of the rack and a centrifugal brake 37 engaging with gear teeth 36 of the same rack. The rack 32 is coupled during operation with a brush slide S so that the rack to some extent forms an extension of the slide. The slides are provided at the lower end with a projection 38 (Figure 7) by means of which they engage with a notch 40 of the rack when the control mechanism is fitted by means of its suspension strap in the holders 39. By means of the coupling

effected in this manner the slides and rack are so connected together that they always move together and the slide loads the rack. The weight of the slide and of the rack produces the driving force during their setting.

The selector setting takes place, when the release magnet 33 is energized and the ratchet pawl is withdrawn from the rack 32 by the downward movement of the rack and of the slide. The speed of these parts in this case is limited, after a short downward movement, by the brake 37 moving therewith, to a certain maximum velocity. By shorter or longer energizations of the release magnet the adjustments can, therefore, be effected by corresponding shorter or longer distances of travel.

Separate consideration is required in the case where short energizations of the magnet occur in rapid succession as is particularly the case when selecting numbers. As in this case the selector settings are only composed of starting movements, that is to say, are themselves decelerated, a braking of the movement would be deleterious. Fortunately the brake does not act during the starting movements as for this purpose the determined velocities are not reached. However, there remains the danger of a damping of the movement by the mass inertia of the brake. In order to meet this danger the brake must run freely at each stopping of the setting members in a similar manner as in dialling discs. When this precaution is complied with then during the pauses between rapidly succeeding short movements of the selector the brake itself does not come to rest and consequently, disregarding the first actuating step, the setting movements are, therefore, also not further delayed.

In order to return a set selector into the initial position its brush slide is firstly conveyed into the lowest position by further movement. This is effected by renewed energization of the release magnet which releases the rack and slide. When reaching its lowest position the slide meets the piston rod upon which it bears with its weight. The piston motors are for the purpose secured at suitable intervals, according to Figures 6 and 7, under the slide on a carrier with the air or other fluid supply pipe 41. As soon as the slide loads the piston the piston reverses the valves, whereupon the selector lifting takes place by lifting the slide and the rack. When the slide has somewhat exceeded its highest position the piston has also reached at the top the valve lifter 15 by means of which the valves are changed into the position of rest. The lifting movement is thus completed and the piston now returns slowly into its initial position. The slide on the contrary is engaged by the ratchet pawl of the release

magnet, of which the circuit is interrupted at the end of the lifting movement by a head contact (not shown) and retained in its uppermost (initial) position. The operation of the selector is thus completed.

The feature of the invention will appear further from the following general observation. The compressed fluid is a centrally stored force (in a fluid chamber and the supply passages to the selectors). It is converted in a preparatory manner into individual stored forces by the piston motors of the selectors. If freedom is given to the central and individual force in a selector (in that for example the said ratchet pawl 35 is constantly withdrawn from the rack 32) the selector completes, while periodically releasing the two forces, upward and downward movements in the uniform cycle of a machine. The additional control by the release magnet solely serves to initiate and to interrupt entirely the mechanical operation of the machine in a manner serving to produce and terminate the passage connections. The actuating mechanism, which in every respect is advantageous for the operation of the selector, establishes the prevailing action of the inventive steps and the successful solution of the problem which has been set.

The invention is not limited to the bar selector type given by way of example. The explanations given permit of applying without difficulty the inventive ideas set out also to other arrangements of selectors and in fact to electromagnetically controlled releasing mechanisms for actuating purposes, such as control switches, number storage and so forth. The means controlling the inlet valve for example might be operated by the switch control lever or other means than that here shown, and the means controlling the outlet valve actuated by the piston, the invention being not limited in and to the particulars described and shown.

I claim:—

1. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, means for operating said locking device and a device for returning said actuating member into its initial position after being set under the action of said stored force, consisting of a cylinder and a piston movable in said cylinder, said piston being driven by a fluid pressure and connected with said actuating member only during the driving by said fluid pressure.

2. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, means for operating said locking device and a device for returning said actuating member into its initial position after

being set under the action of said stored force, consisting of a vertically disposed cylinder, a piston movable upwardly by a compressed fluid in said cylinder, said piston being connected to said actuating member only during the upward movement.

3. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, means for operating said locking device and a device for returning said actuating member into its initial position after being set under the action of said stored force, consisting of a cylinder and a piston movable in said cylinder, said piston being driven by compressed fluid and connected with said actuating member only during the driving by the compressed fluid valves, one for admission of compressed fluid into said cylinder and one for exhaust of the fluid from said cylinder, means for controlling the inlet valve and means for controlling the exhaust valve.

4. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, means for operating said locking device and a device for returning said actuating member into its initial position after being set under the action of said stored force, consisting of a cylinder and a piston movable in said cylinder, said piston being driven by compressed fluid and connected with said actuating member only during the driving by the compressed fluid valves, one for the admission of the compressed fluid to said cylinder and one for the exhaust of the fluid from said cylinder, and means for controlling both valves, said means being operated by said piston at its two end positions.

5. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, means for operating said locking device and a device for returning said actuating member into its initial position after being set under the action of said stored force, consisting of a cylinder and a piston movable in said cylinder, said piston being driven by compressed fluid and connected with said actuating member only during the driving by the compressed fluid valves, one for admission of the compressed fluid into said cylinder and one for the exhaust of the fluid from said cylinder, a plate in the lower chamber of said cylinder connected with said exhaust valve, said plate having an opening therein for the passage of the fluid, a rod connected with said inlet valve and projecting under said plate, a spring on the shaft of said exhaust valve holding said

plate in a raised position, said plate only being depressed by said piston when loaded by said actuating member, a slide, a projection on said slide located beneath the shaft of said exhaust valve, a projection of said slide located above the head of said cylinder and operated by said piston in its uppermost position.

6. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, means for braking the speed of setting of said actuating member, means for actuating said locking device and a device for returning said actuating member into the initial position after its setting under the action of said stored force, consisting of a cylinder, a piston movable in said cylinder, said piston being driven by compressed fluid and being connected to said actuating member only during the driving by said fluid valves, one for the admission of the compressed fluid into said cylinder and one for the exhaust of the fluid from said cylinder, means for controlling both valves, said means being operated by said piston in its two end positions, and means for braking the speed of the return movement of said actuating member, said means consisting of a throttle in the fluid pipe.

7. A selector, comprising an actuating member, a separate stored force for moving said actuating member, means for braking the speed of setting of said actuating member, consisting of a centrifugal brake, means for engaging said centrifugal brake with said actuating member, said means only operating in one direction of movement of said actuating member, a locking device for preventing movement of said actuating member, means for actuating said locking device and a device for returning said actuating member into its initial position after its setting, consisting of a cylinder, a piston movable in said cylinder, said piston being driven by a compressed fluid and being connected to said actuating member only during the driving by said fluid valves, one for the admission of the fluid to said cylinder, and one for the exhaust of the fluid from said cylinder, means for controlling both valves, said means being actuated by said piston in its two end positions and means for braking the speed of return movement of said actuating member, consisting of a conical screw inserted in the fluid supply pipe to said piston.

8. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, means for braking the speed of setting of said actuating member, a magnet for actuating said locking device and a de-

vice for returning said actuating member into the initial position after its setting under the action of said stored force, consisting of a cylinder, a piston movable in said cylinder, said piston being driven by a compressed fluid and being connected to said actuating member only during the driving by said fluid valves, one for the admission of the compressed fluid into said cylinder and one for the exhaust of the fluid from said cylinder, means for controlling both valves, said means being operated by said piston in its two end positions, means for braking the speed of the return movement of said actuating member, said means consisting of a throttle in the fluid pipe.

9. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, a magnet for actuating said locking device, a centrifugal brake for braking the speed of setting of said actuating member, means for coupling said centrifugal brake to said actuating member, said means only operating in one direction of setting of said actuating member, and a device for returning said actuating member into its initial position after its setting, consisting of a cylinder, a piston movable in said cylinder, said piston being driven by a compressed fluid and being connected to said actuating member only during the driving by said fluid valves, one for the admission of a fluid to said cylinder, and one for the exhaust of the fluid from said cylinder, means for controlling both valves, said means being actuated by said piston in its two end positions and means for braking the speed of return movement of said actuating member, consisting of a conical screw inserted in the fluid supply pipe to said piston.

10. A selector, comprising an actuating member, a separate stored force for moving said actuating member, a locking device for preventing movement of said actuating member, a magnet for actuating said locking device, a device for returning said actuating member into its initial position after its setting under the action of said stored force, consisting of a cylinder and a piston movable in said cylinder, said piston being driven by a compressed fluid and being connected with said actuating member only during the driving by said fluid, means for securing said actuating member to a support and means for securing said cylinder independently of the means for securing said actuating member to said support.

11. A selector, comprising a selector switch lever, an individually stored force for displacing said lever, a locking device for preventing movement of the lever, means for actuating the locking device and a de-

vice for returning the lever to its initial position after positioning by the stored force; said device comprising a cylinder, a movable piston, said piston being displaced by a pressure medium and being connected to the switch lever only during its displacement by the pressure medium, valves, one for the inlet of the pressure medium into the cylinder and one for the outlet of the pressure medium from the cylinder, means for controlling the inlet valve, said means being controlled by the switch lever in its lowest position and means for controlling the outlet valve, the last-named means being controlled by the piston in one of its end positions.

In testimony whereof I affix my signature.

FRIEDRICH MERK.

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