

May 18, 1948.

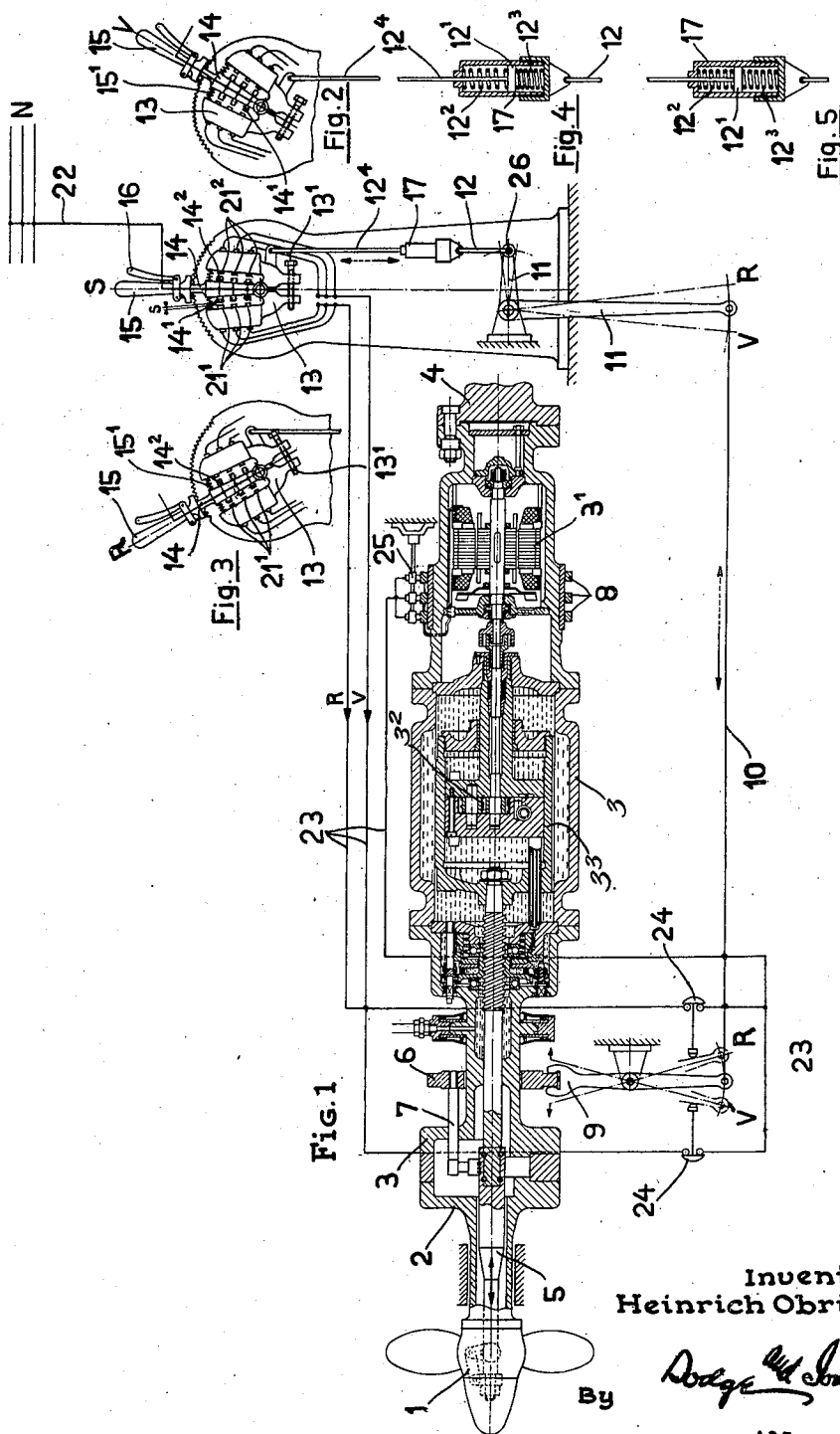
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CONTROL MEANS FOR VARIABLE-PITCH PROPELLERS

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2 Sheets-Sheet 1



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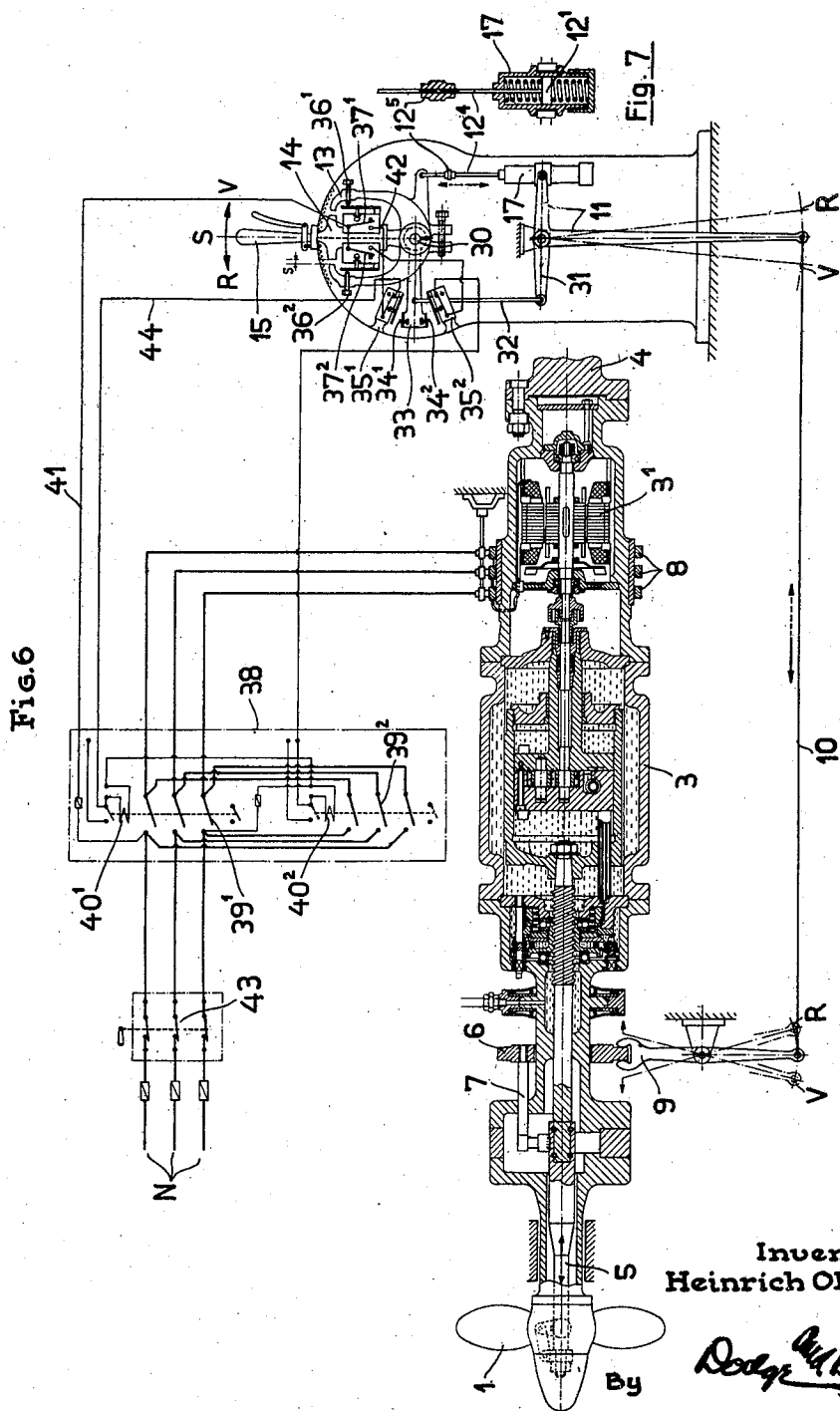
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CONTROL MEANS FOR VARIABLE-PITCH PROPELLERS

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5 Claims. (Cl. 170-163)

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This invention relates to control means for variable-pitch propellers, especially for marine propellers, which means comprise a reversible electric motor serving to vary the pitch of the blades and an operating lever which determines the rotation of the said motor and the angular adjustment of which indicates the magnitude of the variation in pitch of the blades aimed at in each particular case.

The object of the invention is to provide control means of this kind which shall be simple in construction and will work in a safe and effective manner. For this purpose according to the present invention the operating lever is mounted between at least two contacts of a rotatably mounted, forked-shaped contact carrier. This contact carrier is moved, after the electric motor has been switched into circuit, through a transmitting mechanism by a member operated in dependence on the variation in the pitch of the blades which is taking place, such movement of said contact carrier being in the direction in which the contacts open.

While being moved in the direction in which the contacts close, the operating lever may conveniently effect, through an equalising device, a shortening of the mechanical connection between the contact carrier and the member operated in dependence on the variation in the pitch of the blades, in which case this shortening is then gradually nullified automatically until the variation in the pitch of the blades corresponding to the movement of the operating lever is reached, with the result that the contact connection between the operated operating lever and the contact carrier is then released.

Constructional forms of the subject matter of the invention are shown in the drawing in which:

Fig. 1 shows, in simplified form, partly in longitudinal section and partly in elevation a variable-pitch ships' propeller and an electric controlling mechanism which controls the working of a mechanism for varying the pitch of the propeller blades.

Figs. 2 and 3 show the operating lever in the positions in which respectively the propeller blades are adjusted for the ahead and astern movement of the ship.

Figs. 4 and 5 are sections through an equalising device provided with a piston controlled by two

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springs and shown in different working positions in the two figures.

Fig. 6 shows a second embodiment of the invention, and

Fig. 7 shows a detail of this second embodiment in section.

In Fig. 1 of the drawing 1 denotes a variable-pitch propeller, which is connected by a hollow shaft 2 to a shaft section 3, the latter being in turn driven by a shaft 4. Into the shaft section 3 above mentioned is built in well known way an electric motor 3¹ driving a pump 3² which supplies liquid under pressure for shifting the position of a servomotor casing 3³ also arranged in the interior of the shaft section 3. To this casing 3³ is rigidly connected a rod 5, so that the movements of said casing 3³ are imparted to this rod. The latter is in operating connection with the blades of the propeller 1, so that when the rod 5 moves longitudinally these blades have a corresponding pitch changing movement imparted to them. This mechanism for hydraulically varying the pitch of the propeller 1 is of the construction described and claimed in my application Serial No. 604,476, filed July 11, 1945, and since its details do not form part of the present invention they need not be set forth in great detail. The movement of a ring 6 is also derived from the operating rod 5, to which it is connected by a follower 7. 8 denotes slip rings, through which the motor 3¹ in the shaft section 3 receives current. In operative connection with the ring 6 is a lever 9, which, in cooperation with a transmitting device constituted by a rod 10 and a bell crank lever 11 transmits longitudinal movements of the ring 6 to a rod 12. This latter is rigidly connected to the spring housing 17 of an equalising device. In the housing or box 17 is mounted a piston 12¹ which is adapted to move longitudinally and is acted on by two initially equally stressed springs 12² and 12³. Said piston 12¹ is also connected rigidly by a rod 12⁴ to a rotatably mounted contact carrier 13 constructed in the form of a forked lever. On the contact carrier 13 are mounted two groups of contacts 21¹ and 21², between which a lever 14 provided with a handle 15 and a locking detent 16 is likewise mounted to rotate. On this lever 14 are mounted two groups of switch contacts 14¹ and 14² respectively. The arrangement is such that

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the cooperating switch contacts 14¹ and 21¹ and 14² and 21² respectively are situated opposite each other on the same radius. The contacts of the groups 14¹, 14² are connected to a main N by a conductor 22, while the contacts of the groups 21¹, 21² of the fork carrier 13 are connected through conductors 23 and switches 24 to the brush holders 25 of the motor 3¹. Between the contacts of the groups 14¹ and 21¹ and 14² and 21² respectively, are arranged springs 15¹ (Figs. 2 and 3) which are weaker than the springs 12², 12³ and which tend to maintain normally a clearance *s* (see Fig. 1 of about 1 mm. between the groups of contacts in question. This clearance *s* can be varied by means of a screw 13¹. If therefore the lever 14 for example be moved out of its central position shown in Fig. 1, which position corresponds to the stop position S, the clearance *s* must first be bridged before the contacts of groups 14¹ and 21¹ and 14² and 21² respectively will come into engagement. Only then will the motor 3¹ in the shaft section 3 be started and only then will the adjustment of the blades of the propeller 1 into the desired position be initiated.

According to the desired direction of adjustment of the blades of propeller 1 the handle 15 must be brought out of the stop position S either into the position V (Fig. 2) for running ahead of position R (Fig. 3) for running astern. Assuming that the switch lever 14 has been moved into the position V shown in Fig. 2, and that this movement of the lever has caused the motor 3¹ to start running as soon as the clearance *s* has been overcome, the ring 6 can, for the present, not follow the movement of the switch lever 14 quickly enough so that the end 26 of the lever 11 acts as a fixed point as regards the parts 12, 17, 12⁴. The result of this is that on the rapid movement of the switch lever 14, 15 out of the position S into the position V the piston 12¹ of the equalising device will be moved downwards relative to the box 17, whereby the spring 12³ will be compressed and the spring 12² on the other hand allowed to expand (see Fig. 4). This results in a shortening of the mechanical connection between the contact carrier 13 and the ring 6. During the further variation of the pitch of the blades of the propeller the ring 6 is moved in the direction of the axis of the shaft 2 in such a way that the lever 9 is rocked in a clockwise direction. As soon as this lever 9 assumes the position which corresponds to the V position of the switch lever 14, 15, the spring 12³ will have expanded to such an extent that the parts 12¹, 12², 12³ and 17 will have assumed with respect to each other the position shown in Fig. 5. The shortening above mentioned of the mechanical connection between the contact carrier 13 and the ring 6 is consequently again automatically nullified and the springs 15¹ arranged between the contact groups 14² and 21² are now able to remove the right hand forked part of the contact carrier 13 away from the switch lever 14 by the amount of the slight clearance *s* referred to above, so that the supply of current to the motor 3¹ will be interrupted and the adjustment of the propeller blades in the direction in question interrupted also.

If the handle 15 and therewith also the switch lever 14 be brought into the position R shown in Fig. 3, the motor 3¹ will be driven in the opposite direction to that in which it has run hitherto, so that the blades of the propeller 1 will also be adjusted in the opposite direction to that

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produced when the handle 15 is moved into the position V. In other respects the operations take place as required in the corresponding way, as above described.

The arrangement may also be built in such a way that the operating lever worked by a handle controls only the flow of controlling currents, while the current which releases the motor movements can be controlled by a relay. This latter is in such a case influenced by a controlling current which is under the control of the above mentioned operating lever.

Such an embodiment is shown in Figs. 6 and 7, wherein the parts which correspond to those in Figs. 1 to 5 are denoted by the same reference numbers. The blade adjusting mechanism proper corresponds to that illustrated in Fig. 1. Thus in Fig. 6 the numeral 3¹ denotes again the electric motor built in the shaft section 3 and 4 designates the driving shaft, 5 the operating rod and 6 the ring whose movement is derived from the rod 5 by means of a follower 7. The numeral 9 designates the lever which is in operative connection with the ring 6 and the movements of which are transmitted by a rod 10 to a bell crank lever 11. The latter acts in this embodiment directly on the casing 17 of the equalising device, the piston 12¹ of which is connected rigidly by the rod 12⁴ to the contact carrier 13 rotatably mounted on the shaft 30 and having the form of a forked lever. 12⁵ designates a threaded sleeve, which has a right-handed and a left-handed thread and allows of varying the length of the rod 12⁴. The bell crank lever 11 is also operatively connected to a lever 31 which in its turn is connected by a rod 32 to a lever 33 pivoted on the above mentioned shaft 30. The outer end of this lever carries two adjusting screws 34¹, 34² co-operating with two terminal switches 35¹ and 35² respectively. On the contact carrier 13 are mounted two contacts designed as adjusting screws 36¹ and 36², each of which co-operates with an allotted snap switch 37¹ and 37² respectively of conventional design. These snap switches control the flow of an electric current from a main N to a relay 38 which comprises two switches 39¹, 39² allotted to the two senses of rotation of the motor 3¹. The relay 38 is further fitted with two magnetic solenoids 40¹ and 40² which serve as means for actuating the switches 39¹, 39² and the excitation of which is controlled by the snap switches 37¹ and 37² respectively. The numeral 43 designates a hand-operated switch mounted in the main N.

If the switch lever 14 by means of the handle 15 is moved out of the stop position S shown in Fig. 6 in the direction V for running ahead the snap switch 37² will be closed, the small clearance *s* between switch lever 14 and contact carrier 13 being simultaneously overcome. The result of this is that a current will now be supplied from the main N to the magnetic solenoid 40¹ through conductor 41, snap switch 37², conductor 42, terminal switch 35¹ and conductor 44, so that the switch 39¹ is closed. The motor 3¹ is now started, and consequently the adjustment of the blades of the propeller 1 into a position for ahead running will also be initiated. In dependence of this blade adjustment the transmission mechanism 6, 9, 10, 11, 17, 12⁴ causes, in a similar manner to that described in connection with Fig. 1, the opening of the snap switch 37¹ as soon as the blades have been displaced into the desired position. Immediately before this is the case, the contact screw 36¹ will disconnect from the

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snap switch 37¹, the contact carrier 13 having in the meantime been displaced automatically in such a sense that said small clearance s above mentioned is re-established before the screw 36¹ disconnects from the snap switch 37¹.

If the switch lever 14 is moved in the direction R by means of the handle 15, the snap switch 37² and the switch 39² will be closed, so that the motor 3¹ then rotates in a sense opposite to that above mentioned.

What is claimed is:

1. In a variable-pitch propeller and control mechanism therefor in combination, a plurality of propeller blades rotatably supported for pitch changing movement; a mechanism having a movable element operatively connected with said blades for effecting pitch changes; a reversible electric motor for actuating said mechanism; an operating lever which determines the rotation of the said motor, the angular adjustment of said operating lever indicating in each case the magnitude of the blade adjustment aimed at; two groups of switch contacts mounted on opposite sides of said operating lever; a rotatable, forked-shaped contact carrier having at least two contacts between which said contacts mounted on the operating lever are adjustable; means tending normally to maintain clearances between the contacts of said operating lever and of said carrier, said motor being switched in as soon as one of these clearances has been bridged owing to said operating lever having been moved out of its central position; a mechanical transmission mechanism operatively connected both to said movable element effecting pitch changes and to said contact carrier, the latter being moved, after said electric motor has been switched on, in dependence on the blade adjustment, in the direction in which the contacts in question are again opened; and means incorporated in said transmission mechanism and adapted to overcome the tendency of said means to maintain clearances between the contacts of said operating lever and of said carrier.

2. In a variable-pitch propeller and control mechanism therefor in combination, a plurality of propeller blades rotatably supported for pitch changing movement; a mechanism having a movable element operatively connected with said blades for effecting pitch changes; a reversible electric motor for actuating said mechanism; an operating lever which determines the rotation of the said motor, the angular adjustment of said operating lever indicating in each case the magnitude of the blade adjustment aimed at; two groups of switch contacts mounted on opposite sides of said operating lever; a rotatable, forked-shaped contact carrier having at least two contacts between which said contacts mounted on the operating lever are adjustable; means tending normally to maintain clearances between the contacts of said operating lever and of said carrier, said motor being switched in as soon as one of these clearances has been bridged owing to said operating lever having been moved out of its central position; a transmission mechanism operatively connected both to said movable element effecting pitch changes and to said contact carrier, the latter being moved, after said electric motor has been switched on, in dependence on the blade adjustment, in the direction in which the contacts in question are again opened; and an equalising device incorporated in said transmission mechanism producing, when said operating lever is moved in a direction in

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which said contacts are closed, a shortening of the mechanical connection between said contact carrier and said movable element effecting pitch changes, said shortening being gradually nullified automatically until the blade adjustment corresponding to the movement of said operating lever is attained, whereupon the connection between the moved operating lever and the contact carrier is released.

3. In a variable-pitch propeller and control mechanism therefor in combination, a plurality of propeller blades rotatably supported for pitch changing movement; a mechanism having a movable element operatively connected with said blades for effecting pitch changes; a reversible electric motor for actuating said mechanism; an operating lever which determines the rotation of the said motor, the angular adjustment of said operating lever indicating in each case the magnitude of the blade adjustment aimed at; two groups of switch contacts mounted on opposite sides of said operating lever; a rotatable, forked-shaped contact carrier having at least two contacts between which said contacts mounted on the operating lever are adjustable; springs inserted between said contact carrier and said operating lever and tending normally to maintain clearances between the contacts of the carrier and of the operating lever, said motor being switched in as soon as one of said clearances has been bridged owing to said operating lever having been moved out of its central position; a mechanical transmission mechanism operatively connected both to said element effecting pitch changes and to said contact carrier, the latter being moved, after said electric motor has been switched on, in dependence on the blade adjustment, in the direction in which the contacts in question are again opened; and an equalising device incorporated in said transmission mechanism producing, when said operating lever is moved in a direction in which said contacts are closed, a shortening of the mechanical connection between said contact carrier and said movable element effecting pitch changes, said shortening being gradually nullified automatically until the blade adjustment corresponding to the movement of said operating lever is attained, whereupon the release of the connection between said contact carrier and said operating lever is effected by said springs.

4. In a variable-pitch propeller and control mechanism therefor in combination, a plurality of propeller blades rotatably supported for pitch changing movement; a mechanism having a movable element operatively connected with said blades for effecting pitch changes; a reversible electric motor for actuating said mechanism; an operating lever which determines the rotation of the said motor, the angular adjustment of said operating lever indicating in each case the magnitude of the blade adjustment aimed at; two groups of switch contacts mounted on opposite sides of said operating lever; a rotatable, forked-shaped contact carrier having at least two contacts between which said contacts mounted on the operating lever are adjustable; means tending normally to maintain clearances between the contacts of said operating lever and of said carrier, said motor being switched in as soon as one of these clearances has been bridged owing to said operating lever having been moved out of its central position; and a mechanical transmission mechanism operatively connected both to said movable element effecting pitch changes

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and to said contact carrier, the latter being moved, after said electric motor has been switched on, in dependence on the blade adjustment, in the direction in which the contacts in question are again opened; a piston connected rigidly to said contact carrier; a sleeve in which said piston is mounted; two initially equally stressed springs housed within said sleeve and acting on both sides of said piston; and a system of rods and levers connecting said sleeve to said movable element effecting pitch changes;

5 In a variable-pitch propeller and control mechanism therefor in combination; a plurality of propeller blades rotatably supported for pitch changing movement; a mechanism having a movable element operatively connected with said blades for effecting pitch changes; a reversible electric motor for actuating said mechanism; an operating lever which controls the flow of controlling currents and the angular displacement of which indicates in each case the magnitude of the blade adjustment aimed at; a relay controlling the current which releases said electric motor and influenced in its turn by said controlling currents; switch contacts mounted on said operating lever; a rotatable, forked-shaped contact carrier having contacts between which are mounted said switch contacts provided on the operating lever, clearances being normally present between the contacts of the latter and the contacts mounted on said carrier and one of said controlling currents being switched in as

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soon as one of these clearances has been bridged owing to said operating lever having been moved out of its central position; a mechanical transmission mechanism operatively connected both to said movable element effecting pitch changes and to said contact carrier, the latter being moved, after said electric motor has been switched on, in dependence on the blade adjustment, in the direction in which the contacts in question are again opened; and means incorporated in said transmission mechanism and adapted to overcome the tendency of said means to maintain clearances between the contacts of said operating lever and of said carrier.

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