Aug. 16, 1938. K. H. BLOMBERG 2,127,322

SELECTOR

Filed July 5, 1935 2 Sheets-Sheet 1

Fig. 1.

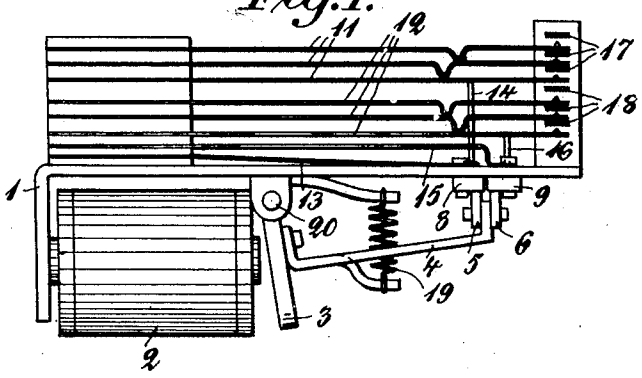

Fig. 2.

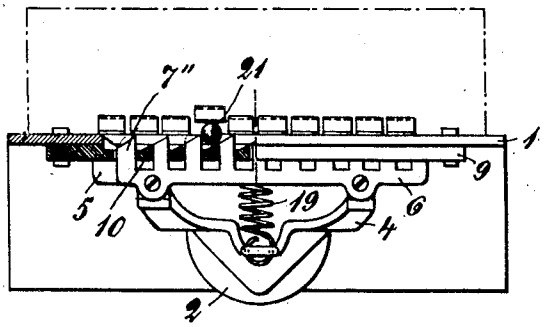

Fig. 3.

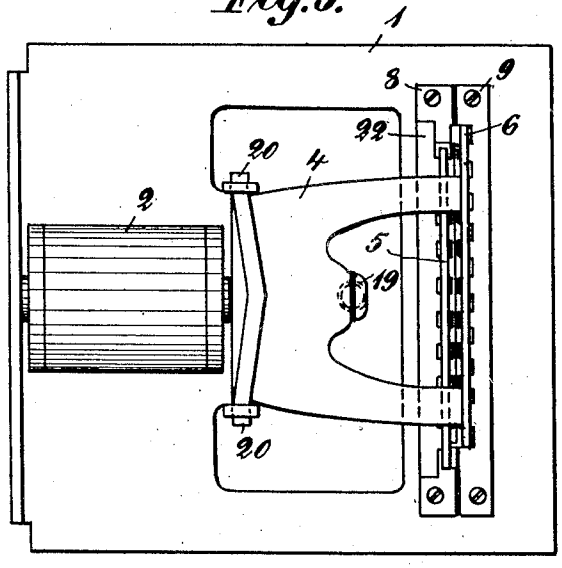

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Fig. 4.

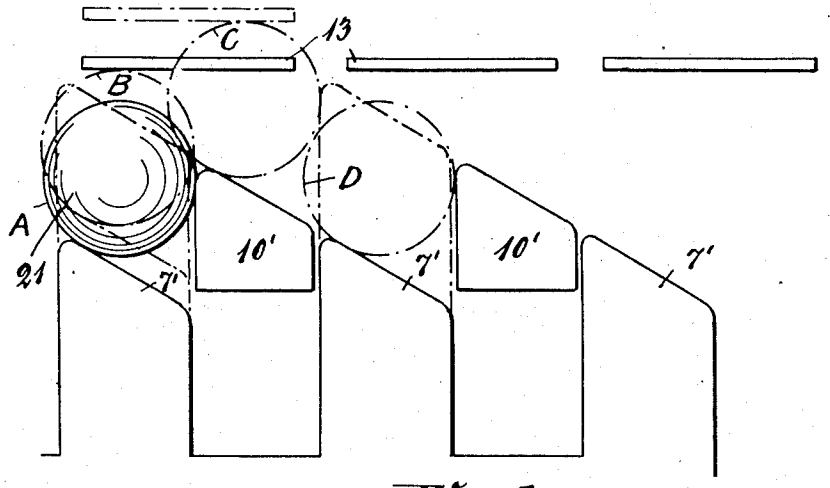


Fig. 5.

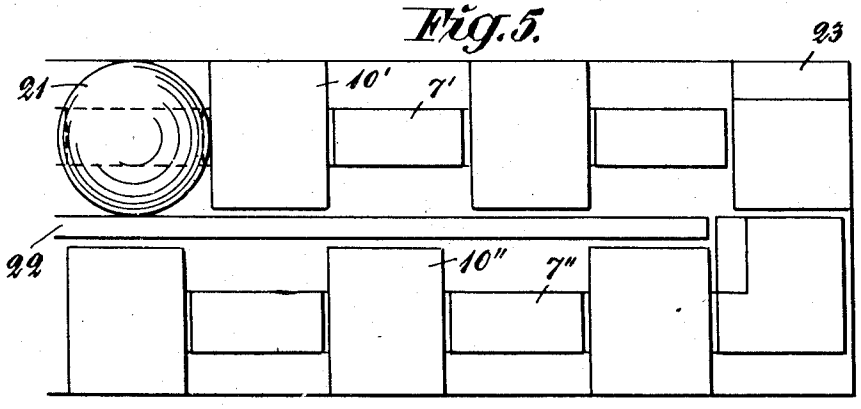


Fig. 6. Fig. 7.

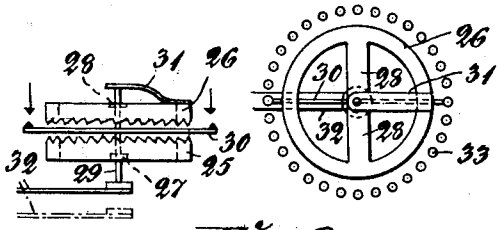
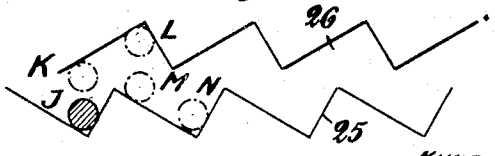


Fig. 8.



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Patented Aug. 16, 1938

2,127,322

UNITED STATES PATENT OFFICE

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In Sweden July 6, 1934

12 Claims. (Cl. 200—1)

The present invention relates to an arrangement for selecting and actuating an arbitrary contact group or the like among a plurality of contact groups positioned beside one another. The invention is applicable particularly in telephone and signalling systems.

The invention is characterized substantially therein that the contact groups are actuated in sequence by a common driving member having a reciprocating movement—for instance the armature of an electromagnet operated by current impulses or a push button actuated repeatedly by hand—through the intermedium of a movable contact actuating member which is adapted to be moved to operative position in relation to the respective contact groups, said contact actuating member being arranged to cooperate in such a manner with a guide positioned along the row of contact groups that upon a reciprocating movement of said driving member it is moved stepwise from contact group to contact group in a path extending along the contact groups, the contact actuating member being forced by the guide during each such movement to a position for actuating the contact group in question. The contact actuating member can also itself constitute a contact closing member the contact actuating member being then included in the electric circuit which is closed when the member proper makes contact with a contact spring in the contact group to be actuated.

The contact actuating member can either be made as a body resting freely on its support without a definite bearing point, for example a small ball or cylinder, or also as a rotatable journalled arm or the like the free end of which serves as a contact actuating member and is stepped forward in the above mentioned manner along the row of contact groups while rotating the arm about its centre of rotation.

The arrangement is particularly suitable for application in selectors of the kind used in automatic telephone systems, and more particularly in selectors of the type termed relay selectors. Its field of application is, however, not limited to automatic selectors in telephone systems but the arrangement can be used to advantage for instance for signalling purposes when it is desired to select and light by hand or in other manner a certain lamp in a signalling panel or the like, and, generally, when it is desired to make a selection of some kind for the purpose of actuating contacts or contact operating members.

The invention will now be described in detail with reference to the accompanying drawings which show two examples on the application of the principle of the invention in selecting arrangements for selectors used in automatic telephone systems. Figures 1 to 5 show a relay selector the contact bank of which consists of a number of contact groups placed side by side and composed of flat relay springs. Figures 6 to 8 show a selecting arrangement for another type of selector the contact bank of which consists of a number of point contacts arranged on the circumference of a circle, an embodiment which on account of its light construction is particularly suitable for selectors of the kind used in party lines. Of Figures 1 to 5, Figures 1, 2 and 3 show a side view, a front view and a bottom view respectively of the relay selector, and Figures 4 and 5 enlarged details of the selecting arrangement of the selector. Figures 6 and 7 show, as already mentioned, a selecting arrangement of another kind in vertical and in horizontal projection respectively entirely and Figure 8 an enlarged detail of said selecting arrangement.

In the relay selector shown in Figures 1 to 3 the numeral 1 designates an angular relay bridge to one leg of which the electromagnet 2 of the relay is secured. In front of the electromagnet is positioned the armature 3 on which is arranged a bifurcated holder 4 for two bars 5 and 6 secured at opposite sides of the holder. The bar 5 is provided with a plurality of obliquely cut teeth 7', the shape of which is best seen from the enlargement in Figure 4. The bar 6 is provided with a plurality of teeth 7'' which are shaped in similar manner but are cut obliquely in an opposite direction to that of the teeth 7. On the underside of the relay bridge and in line with an oblong rectangular aperture therein are secured two plane bars, the guide bars 8 and 9, which are also provided with obliquely cut teeth 10' and 10'' respectively. Of the teeth the teeth 10' are positioned on the front side of the guide bar 8 and project into the spaces between the teeth 7' whereas the teeth 10'' are positioned at the back of the guide bar 9 and project into the spaces between the teeth 7'' in a manner clearly indicated in Figure 5.

On the upper side of the relay bridge are arranged two rows of contact groups 11 and 12, which are shown in Figure 1 but not in Figures

2 and 3. Under each one of the contact groups 11 is positioned a flat spring 13 the free forward end of which bears against the relay bridge. When brought upwards from the relay bridge the spring 13 actuates by means of an insulated pin 14 the contact group 11, the pin 14 passing through holes made in the contact springs appertaining to the corresponding contact group 12. Under each one of the contact groups 12 there is also arranged a spring 15 bent at its outermost end in the manner shown in Figure 1 and arranged to actuate, when lifted from the relay bridge, the contact group 12 by means of an insulated pin 16. The contact springs in the contact groups 11 and 12 are so arranged in known manner that they when lifted make contact with the horizontal contact bars 17 and 18 positioned above their front ends, the contact bars being shown in section only in Figure 1.

A helical spring 19 tends to hold the armature 3 away from the electromagnet 2, the armature then taking up the position shown in Figures 1 to 3. The selector can, however, instead be made direct driven, i. e. so constructed that the armature is held by the spring in the position in which the contact springs are not actuated and is brought to the position shown on the drawings when the electromagnet is energized. When current impulses are sent through the winding of the electromagnet shown in the drawings the armature 3 is attracted and turns about its pivots 20, the bars 5 and 6 then performing a substantially vertical reciprocating movement. Said movement causes a ball 21 resting on one of the teeth 10' or 10'' to move along the row of contact groups. During this movement the ball 21 is guided laterally by one of the side walls of the aperture in the relay bridge and by a strip 22 of thin metal plate which serves as a partition wall between the anterior and the rear feeding paths in which the ball 21 moves during operation of the relay selector.

The manner in which the selecting arrangement functions when successively selecting and actuating the contact groups 11 and 12 respectively is as follows. When current impulses are sent through the electromagnet 2 causing the bars 5 and 6 to move up and down the ball 21 is moved in a closed path first, for instance, from the left to the right (the selector being viewed from the front) in the rear feeding path the springs 13 being then actuated in due order, and thereafter from the right to the left in the anterior feeding path, the springs 15 being then actuated. The movement of the ball in the first mentioned one of the feeding paths is illustrated in Figures 4 and 5. In the sectioned portion of Figure 2 the ball is positioned in the anterior feeding path and will thus during the up and down movement of the armature first be moved to the left and upon reaching the end of the anterior feeding path it will be transferred to the rear one. The ball in moving actuates the springs 13 and 15 which in turn actuate the contact groups 11 and 12 so that the latter make contact in sequence with the bars 17 and 18 respectively.

In Figures 4 and 5 are shown to an enlarged scale some of the teeth 7' on the movable bar 5 and some of the teeth 10' on the stationary guide bar 8. In Figure 4 the teeth are viewed from the front and in Figure 5 from the top. Above said teeth are shown in Figure 4 the corresponding springs 13 and the ball 21. A current impulse through the electromagnet 2 is assumed to have attracted the armature 3 wherefore the teeth 7' occupy their lowermost position which is shown in Figure 4 in full lines. The ball 21 is assumed then to occupy the position shown in full lines and designated with the letter A. Upon the ceasing of the current impulse the electromagnet is deenergized, the armature starts to move upwards under the action of the spring 19, at the same time lifting the ball. When reaching the position B shown in Figure 4 in dot and dash lines the ball starts to bear against the spring 13 positioned right above and lifts said spring upwards, the contact spring in the contact group 11 being then actuated by means of the insulated pin 14 so as to make contact with the contact bar 17. When the teeth 7' have reached their uppermost position the ball 21 occupies the position C and remains in said position until the armature is attracted in consequence of the next current impulse. When this occurs the bar 5 is brought downwards, the ball then rolling on account of its own weight and of the downward pressure of the spring along the obliquely cut sides of the teeth 10' and 7' to position D. After the current impulse has ceased the bar is lifted anew, the above described cycle of movements for the ball is repeated and the next spring 13 actuated. In consequence of the reciprocating movement of the armature the ball thus moves from tooth to tooth along the row of contact groups.

Figure 5 also shows how the ball is transferred from the rear feeding path to the anterior one. In the stationary guide bar 8 the last tooth 23 is cut obliquely in such a manner that the ball during its movement downwards will move in a path which is perpendicular to the preceding path the ball then getting into engaging position for the anterior feeding bar 6. During the upwards movement of the anterior feeding bar the ball is stepped forward in the same manner as described above for the rear path.

In similar manner the ball is transferred from the anterior path to the rear path when the ball has reached the other end of the path.

The selecting arrangement can be modified in many different ways. It is obviously not necessary for the ball to actuate contact groups in both of its feeding paths, but if for lack of space or for other reasons it should be desired to carry out the construction so that only one row of contact groups is provided the ball can, after having been moved along said row while actuating contact groups, be restored in similar manner to the first contact in said row through a new impulse series while being moved in another feeding path in which it has no possibility of actuating any contacts, or, alternatively, it can actuate in said path the same contacts but in opposite sequence. Such an arrangement would be obtained for instance by removing the springs 11, the pins 14, and the contact groups 17 in the selector shown in Figures 1 to 3. Or also two balls can be used; while one ball moves in the feeding path in which contact groups are actuated the othr ball will be restored in the feeding path in which no contact groups are actuated, the two balls simultaneously changing feeding paths. Two or more balls can also operate in such a manner that both simultaneously actuate contact groups which are displaced certain steps from each other, for example the first, the sixth, the eleventh group, etc., whereby a greater number of contact springs can be actuated simultaneously. Another manner of restoring the ball from the last contact to the first contact in the same feeding path is to use only one feeding path according to the above

description and a particular restoring path extending between the end points of the feeding path, said restoring path consisting either of an empty somewhat sloping groove or channel or of a tube filled with balls lying side by side. In the former case the ball is simply permitted to roll along the sloping channel back to its starting point. The selecting arrangement should in this case have a certain slope in respect to the horizontal plane. In the latter case the restoring is effected in such a manner that the ball after having been moved along the row of contact groups in the manner described is pushed into said tube by the last tooth at the end of the last current impulse, all the balls positioned in the channel being then displaced a distance corresponding to the diameter of one ball. The last one of the balls contained in the restoring tube is then pushed from the tube into a position above the first tooth in the feeding path of the balls, whereupon said ball is moved in the feeding path in the manner described by the following current impulses while successively actuating the contact groups.

In case two feeding paths having actuable contact groups 11 and 12 are used said feeding paths need not necessarily be positioned above each other as in Figure 1 but can be placed in such a manner that the fixed ends of the contact springs are directed towards different directions.

As has been previously mentioned the contact actuating member, i. e. the ball 21 can itself constitute a contact closing member, the relay selector in its entirety with the exception of the insulated contact springs being then supplied with, for instance, earth potential. The ball is permitted to actuate the contact springs directly and will, during the operation of the selector, itself connect earth potential to the springs in due order then forming itself a part of the electric circuit.

It is not necessary to shape the contact actuating member as a ball; it can be given other desired shapes, for instance cylinder shape, provided that the feeding path is shaped accordingly.

The contact actuating member can also be rotatably journalled about a certain point. An example is represented by the selecting arrangement shown in Figures 6 to 8 where the contact actuating member consists of an arm arranged on a rotatable shaft. In said selecting arrangement are included two stationary cylindrical rings 25, 26 the upper and lower sides of which are toothed in the manner illustrated in Figure 8. In two diametrically extending small bars 27 and 28 is rotatably journalled a vertical shaft 29. On said shaft is arranged a contact arm 30 which normally rests on the lower ring 25 and which is pressed thereagainst with a light spring pressure by a small spring 31. In Figure 8 the contact arm 30 is shown in section positioned between two teeth on the ring 25. This position is designated in Figure 8 with the letter J. Under the shaft 29 is arranged a driving member 32, for instance the armature of an electromagnet. Normally said driving member occupies the position shown in dot and dash lines in Figure 6; the member is also shown in full lines in an intermediate position. A number of fixed contacts 33 are arranged in the manner shown in Figure 7 under the circumference of a circle which is concentric with the rings 25, 26.

The manner of operation of the selecting arrangement is as follows. When moving upwardly the driving member lifts against a slight counter pressure from the spring 31 the shaft 29 and the contact arm 30 mounted thereon. After the contact arm has been lifted a predetermined distance it strikes against a tooth on the upper ring 26—the position K in Figure 8—and is turned during its continued upward movement together with the shaft 28 about the geometrical axes of the latter until it reaches position L. When occupying said position the contact arm makes contact with a pair of the fixed contacts 33, and, if the arm is made of electrically conducting material, a circuit can then be closed through the contact arm and the two fixed contacts. When the driving member 32 again moves downwards the contact arm 30 is displaced downwards on account of its own weight and the pressure from the spring 31 to position M and then slides along a tooth on the ring 25 to position M. The contact arm has thus been moved from one tooth on the ring 25 to the next one. Upon receipt of the next current impulse the cycle is repeated, the contact arm turning from one contact 32 to the other during the up and down movement of the driving member. The contact arm can of course be constructed in several different ways, for example be one-armed, multi-armed, insulated, etc., ways on which it is not necessary to enter more closely in this connection.

In applying the invention it is not necessary to let the driving member serve both as a selecting and as an actuating member for the contact groups. The arrangement can also be such that selection is effected without actuation of any contact group and first when the desired contact group has been selected, the selected group only being actuated through the operation of a separate actuating member, for example an electromagnet. In the arrangement according to Figure 6 this operation can be obtained for instance by selecting such a distance between the contact arm 30 and the contact 33 that no contact closing takes place during selection but first after selection has been completed, another member, for instance an electromagnet armature in the shape of a ring positioned under the contact arm inside the rings 25 and 26, then lifting the contact arm 30 a further distance thereby pressing it against the contact 33.

The selecting arrangement described with reference to Figures 1 to 5 is suitable for application also in coordinate selectors. Several different ways of arranging selection both in horizontal and vertical direction are conceivable. As an example can be mentioned the arrangement of horizontal coupling rods along the superposed rows of contact groups and vertical coupling rods along the piles of contact groups formed by the contact groups positioned immediately above each other, said horizontal and vertical coupling rods being so arranged in relation to each other in a manner known in such coordinate selectors that the contact group positioned at the crossing point of an actuated horizontal coupling rod and an actuated vertical coupling rod is actuated. A selecting arrangement corresponding substantially to the one shown in Figures 1 to 5 is arranged perpendicularly to the vertical coupling rods and the ball 21 is permitted to operate on said coupling rods through the intermedium of, for instance, the springs 15, another similar selecting arrangement being arranged perpendicularly to the horizontal coupling rods. By passing first a certain number of current impulses

through the driving magnet of one selecting arrangement and then a certain number of impulses through the other an arbitrary contact group can be selected and actuated.

Another manner of constructing the coordinate selector is to arrange along each one of the superposed rows of contact groups a selecting arrangement substantially of the construction shown in Figures 1 to 5 and to arrange along the ends of said horizontal selecting arrangements a vertically operating selecting arrangement. Said latter selecting arrangement can then either be made so as to release the horizontal selecting arrangement in that row, which has been selected, so that only said selecting arrangement will operate during the following selection in the row, the releasing being effected for instance by connecting the electromagnet of the corresponding arrangement into circuit or by releasing a mechanical ratchet coupling or the like, or so that a ball is moved to the selected horizontal row and into the selecting arrangement thereof. When later the selecting arrangements of the horizontal rows operate only the selected row will be active since only said row contains a ball, whereas the others are idle. In this case the driving member, i. e. the electromagnet armature, can preferably be common to all horizontal selecting arrangements.

I claim:—

1. A selecting mechanism comprising a plurality of contact groups arranged side by side, a driving member having a reciprocating movement, a separate movable contact actuating member of relatively small mass for allowing quick operation of said driving member, a stationary guide arranged along the row formed by said contact groups, said stationary guide provided with resting positions cooperating with said contact actuating member so as to advance the latter one stepwise from one contact group to a following one if said driving member is reciprocated, said contact actuating member being forced by said guide at each step into a position for actuating a selected one of said contact groups.

2. A selecting mechanism according to claim 1, in which said contact actuating member proper forms a contact closing and current breaking member.

3. A selecting mechanism comprising a plurality of contact groups arranged side by side, a driving member having a reciprocating movement, a stationary guide arranged along the row formed by said contact groups, a ball forming a movable contact actuating member of small mass freely resting on said driving member, said stationary guide provided with resting positions corresponding to and substantially in alignment with said groups and cooperating with said contact actuating member so as to advance the latter one stepwise from one contact group to another if said driving member is reciprocated, said contact actuating member being forced by said guide for each step into a position for actuating a selected one of said contact groups.

4. A selecting mechanism comprising a plurality of contact groups arranged side by side, a driving member having a reciprocating movement, a stationary guide arranged along the row formed by said contact groups, a ball forming a movable contact actuating member of small mass freely resting on said stationary guide, said stationary guide provided with resting positions corresponding to and substantially in alignment with said groups and cooperating with said contact actuating member so as to advance the latter one step from one contact group to another if said driving member is reciprocated, said contact actuating member being forced by said guide for each step into a position for actuating a selected one of said contact groups.

5. A selecting mechanism comprising a plurality of contact groups arranged side by side, a movable guide having a reciprocating movement, a stationary guide arranged along the row formed by said contact groups, a ball forming a movable contact actuating member of relatively small mass freely resting on said driving member, said stationary guide provided with resting positions corresponding to and substantially in alignment with said groups and copoerating with said contact actuating member so as to advance the latter stepwise from contact group to contact group if said movable guide reciprocates, said contact actuating member being forced by both guides for each step into a position for actuating a selected one of said contact groups.

6. A selecting mechanism comprising a plurality of contact groups arranged side by side, a movable guide having a reciprocating movement, a stationary guide arranged along the row formed by said contact groups, a ball forming a movable contact actuating member of relatively small mass freely resting on said stationary guide, said stationary guide provided with resting positions corresponding to and substantially in alignment with said groups and cooperating with said contact actuating member so as to advance the latter stepwise from contact group to contact group if said movable guide reciprocates, said contact actuating member being forced by both guides for each step into a position for actuating a selected one of said contact groups.

7. A selecting mechanism comprising a plurality of contact groups arranged side by side, a driving member having a reciprocating movement, a separate movable contact actuating member of relatively small mass consisting in an arm rigidly secured to an axis, said axis arranged displaceably in axial direction, means for stepwise rotating said axis if thus advanced, a stationary guide arranged along the row formed by said contact groups, said stationary guide provided with resting positions corresponding to said groups and cooperating with said contact actuating member so as to advance the latter stepwise from contact group to contact group if said driving member reciprocates, said contact actuating member being forced by said guide for each step into a position for actuating a selected one of said contact groups.

8. A selecting mechanism comprising a plurality of contact groups arranged side by side, a driving member having a reciprocating movement, a separate movable contact actuating member of relatively small mass consisting of a rotatably journalled arm arranged to rotate if moving along the row of said contact groups, a stationary guide arranged along the row formed by said contact groups, said stationary guide provided with resting positions corresponding to and substantially in alignment with said groups and cooperating with said contact actuating member so as to advance the latter stepwise from contact group to contact group if said driving member reciprocates, said contact actuating member being forced by said guide for each step into a position for actuating a selected one of said contact groups.

9. A selecting mechanism comprising a plu-

rality of contact groups arranged side by side, a driving member having a reciprocating movement, a separate movable contact actuating member of relatively small mass allowing quick operation of said driving member, a stationary guide arranged along the row formed by said contact groups, said guide comprising a number of teeth arranged along the row of contact groups, said driving member comprising a corresponding number of teeth, said contact actuating member adapted to cooperate with said stationary guide so as to be advanced stepwise from contact group to contact group by said reciprocating driving member, said contact actuating member being forced by said guide for each step into a position for actuating a selected one of said contact groups.

10. A selecting mechanism comprising a plurality of contact groups arranged side by side, a driving member having a reciprocating movement, a stationary guide arranged along the row formed by said contact groups, said guide comprising a number of teeth arranged along the row of said contact groups, said driving member provided with a corresponding number of teeth, a separate movable contact actuating member of relatively small mass consisting of a body freely resting on said driving member, said movable contact actuating member adapted to cooperate with said stationary guide so as to be advanced stepwise from contact group to contact group by said reciprocating driving member, said contact actuating member being forced by said guide for each step into a position for actuating a selected one of said contact groups.

11. A selecting mechanism comprising a plurality of contact groups arranged side by side, a driving member having a reciprocating movement, a stationary guide arranged along the row formed by said contact groups, said guide comprising a number of teeth arranged along the row of said contact groups, said driving member provided with a corresponding number of teeth, a separate movable contact actuating member of relatively small mass consisting of a body freely resting on said stationary guide, said movable contact actuating member adapted to cooperate with said stationary guide so as to be advanced stepwise from contact group to contact group by said reciprocating driving member, said contact actuating member being forced by said guide for each step into a position for actuating a selected one of said contact groups.

12. A selecting mechanism comprising a plurality of contact groups arranged side by side, a driving member having a reciprocating movement, a separate movable contact actuating member of relatively small mass consisting of an arm rigidly secured to an axis, said axis arranged displaceably in axial direction and stepwise rotating when advanced, a stationary guide arranged along the row formed by said contact groups, said guide consisting of a number of teeth arranged along the row of said contact groups, said driving member provided with a corresponding number of teeth, said contact actuating member adapted to cooperate with said stationary guide so as to be advanced stepwise from contact group to contact group by said reciprocating driving member, said contact actuating member being forced by said guide for each step into a position for actuating a selected one of said contact groups.

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