Jan. 6, 1948. D. P. MOSSMAN 2,433,920

ROTARY SWITCH

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Fig. 1

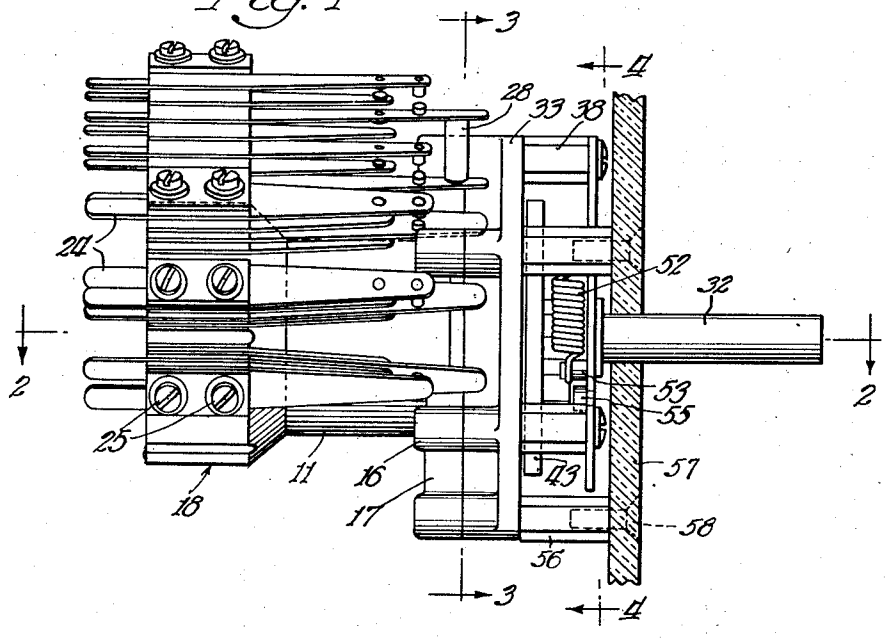


Fig. 5

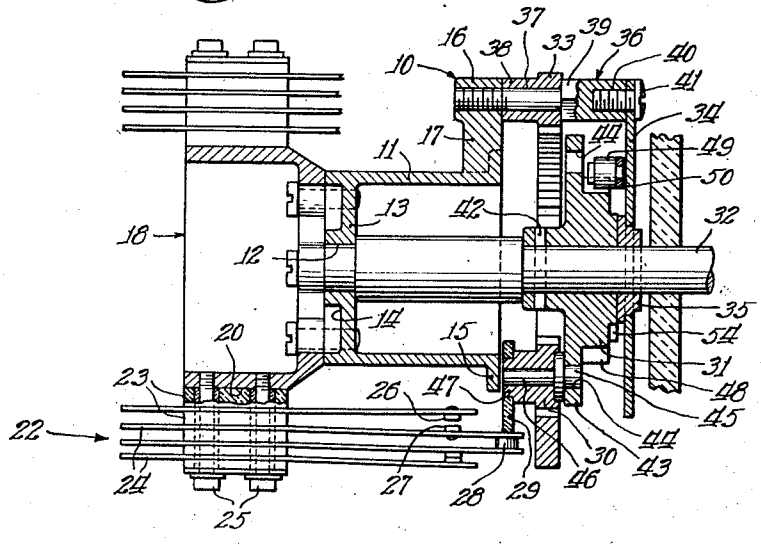
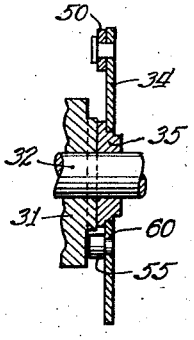


Fig. 6



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Fig. 2

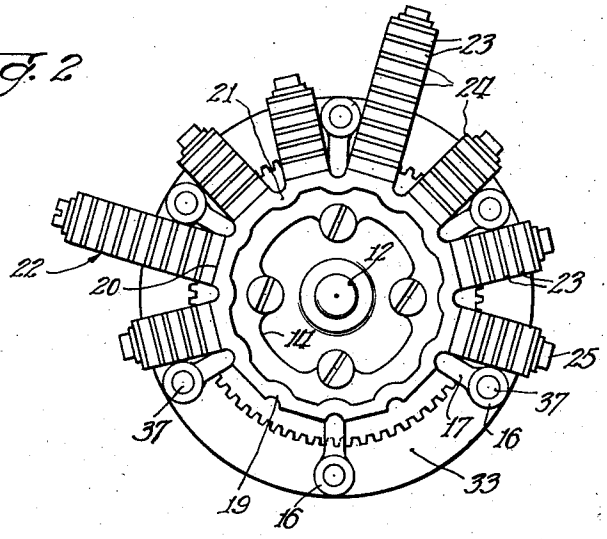


Fig. 3

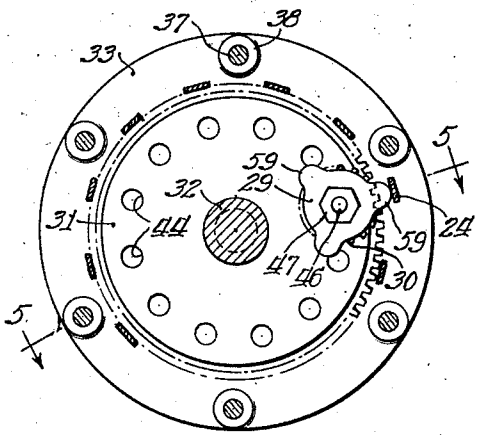


Fig. 4

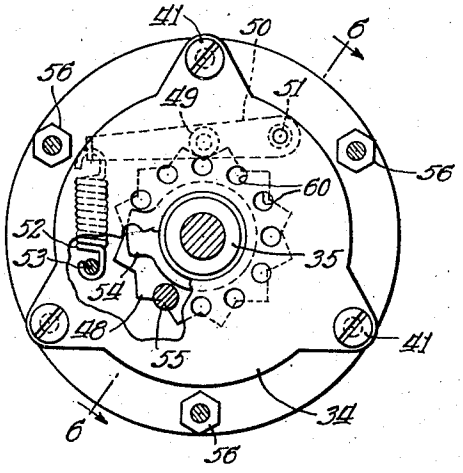
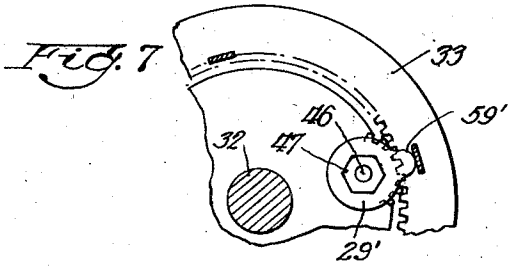


Fig. 7



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Fig. 8

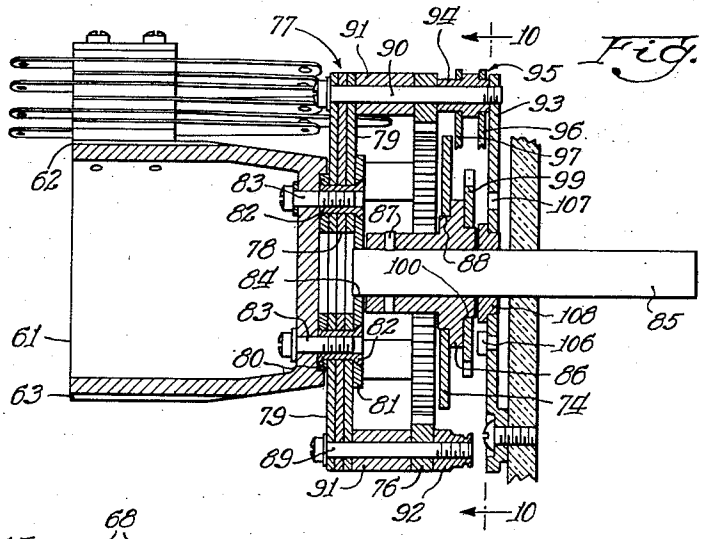


Fig. 9

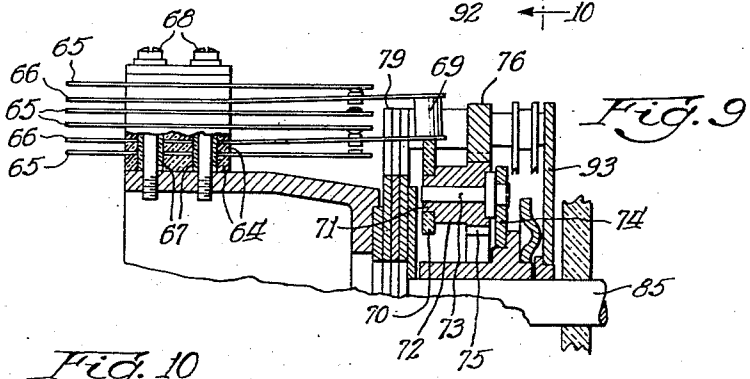
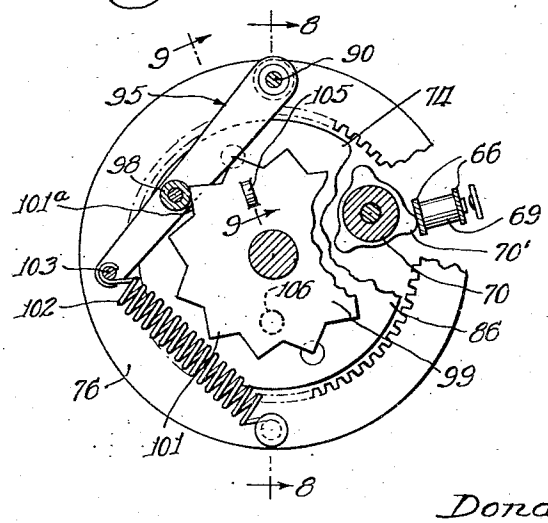


Fig. 10



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UNITED STATES PATENT OFFICE

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ROTARY SWITCH

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Application October 7, 1944, Serial No. 557,595

7 Claims. (Cl. 200—1)

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The present invention relates to rotary switches and is particularly directed to a rotary switch which can be utilized to actuate a multiplicity of piles of spring contacts in succession. The switch finds particular utility in those situations where a dozen or more circuits must be checked repeatedly to see if they are in working order. It is a difficult matter to mount a row of switches by which you could individually check such circuits in a small space. Also, the individual mechanisms required for the several switches make them expensive.

It is the principal purpose of my invention to provide a rotary switch with a single operating shaft so arranged as to coordinate the snap action of a spring pressed roller on a notched driving member with the spring action of the contacts so that the springs help rather than oppose each other.

My invention contemplates the provision of a rotary switch wherein a single shaft and operating mechanism can be utilized as the means of controlling a relatively large variety of circuits without the necessity of changing anything more than the number of individual banks of contacts to correspond to the circuits to be controlled. The contemplated switch is of such construction as to adapt itself readily to a wide variation of sizes and numbers of circuits controlled, thus making it possible to standardize most of the parts and yet selectively fill the requirements of the users on a cost basis comparable to mass production even though the requirements of the user are only for a small number of switches.

Other detailed objects and advantages of the present invention will appear more fully as the description proceeds, reference being had to the accompanying drawings wherein a preferred form of the invention is shown. It is to be understood however that the drawings and description are illustrative only and are not to be taken as limiting the invention except insofar as it is limited by the claims.

In the drawings:

Fig. 1 is a view in side elevation of a rotary switch embodying my invention;

Fig. 2 is an end view of the switch shown in Fig. 1;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 3;

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Fig. 6 is a fragmentary sectional view taken on the line 6—6 of Fig. 4;

Fig. 7 is a fragmentary sectional view similar to Fig. 3 showing a modified cam construction;

Fig. 8 is a longitudinal sectional view through another form of the invention;

Fig. 9 is a fragmentary sectional view through the modified device on line 9—9 of Fig. 10; and

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 8 with certain parts broken away.

Referring now in detail to the drawings, the rotary switch is made up primarily of a few simple parts. The body parts are preferably die castings or molded plastics which are readily assembled with springs, levers and plates by screws and posts that are accessible for the assembler. The basic part of the switch construction comprises a switch frame 10. This switch frame comprises a barrel portion 11 which has one end closed except for a central aperture 12 to receive an operating shaft. The end closure 13 in which the aperture 12 is provided is cored out as indicated at 14 to reduce the amount of metal necessary to make it. At the opposite end of the barrel from the closure 13 an annular flange 15 is provided and on this flange there are a series of six mounting lugs 16. The several mounting lugs have web portions 17 extending to the barrel 11 so as to give them sufficient strength. The mounting lugs are screw threaded to receive certain mounting studs and bearing plate studs that will be more fully described hereinafter.

A contact support 18 is adapted to be mounted on the end closure 13 of the barrel 11. This contact support is substantially cup shaped with the bottom of the cup cut out as indicated at 19. Around the outer periphery of the contact support I provide a multiplicity of flat faces 20 on which several piles 22 of spring contacts can be mounted. The piles of spring contacts are shown as consisting of sheets 23 of insulation alternating with strips 24 of suitable spring material such as phosphor bronze. The entire spring contact assembly is held together by screws 25 that thread into the flat faces 20 on the contact support 18. It will be noted from an inspection of Fig. 2 that the contact support which is also a die casting has inwardly curved sections 21 between the flat faces 20 so that there is a gap between adjacent faces 20. This construction is also quite strong. Contact springs 24 are provided with suitable contacts 26, 27 and where a plurality of the contact springs are mounted suitable spacers such as 28 (see Fig. 1) may be used in accordance with well known practice.

The contact springs are adapted to be operated by means of a cam 29 that is mounted on a cam pinion 30 which in turn is carried by a cam support 31. The cam support 31 preferably is a metal casting. It is keyed to an operating shaft 32 which is journaled in the bearing 12. The cam pinion 30 is adapted to engage a ring gear 33 so as to rotate the cam 29 as the pinion is carried around by the support 31. The ring gear is fastened to the lugs 16.

A bearing plate 34 carrying a bushing 35 is mounted to the lugs 16 by studs 36. There are three of the studs 36 and as shown they extend through apertures 37 provided in the ring gear and through spacing bosses 38 on the ring gear into the lugs 16 which are screw threaded to receive the screw threaded ends of the studs. The studs have hexagonal portions 39 which are provided with screw threaded holes 40 to receive headed screws 41. The screws 41 clamp the bearing plate 34 in place. The bushing 35 and the bearing opening 12 serve to support the shaft 32 for rotation in the barrel 11. The bushing 35 is staked on the plate 34.

Referring now to the cam support 31, it will be noted that a key 42 secures this support to the shaft 32. The support 31 has a peripheral, radially extending flange 43 which is provided with a series of apertures 44, any one of which may receive the base 45 of a stub shaft 46 on which the cam pinion 30 is mounted. The cam 29 is fixed on the pinion 30 by staking it on a polygonal projection 47 of the pinion.

The cam support 31 also has a series of teeth 48 formed thereon in a circle about the axis of the support. These teeth are adapted to cooperate with a roller 49 on a detent lever 50 which is pivoted at 51 to the bearing plate 34. The detent lever is yieldingly urged toward the teeth 48 on the cam support by a spring 52, one end of which is secured to the lever and the other end of which is secured to a pin 53 that is provided on the bearing plate 34.

The cam support 31 has a stop shoulder 54 formed thereon, the stop shoulder being on a smaller radius than the teeth 48, and being axially offset toward the bearing plate 34 from the teeth 48. This stop shoulder is adapted to engage a pin 55 which is mounted on the bearing plate 34.

The frame 10 is shown by Fig. 2 to have six of the lugs 16. Three of these lugs have been described as receiving the bearing plate studs 36 so as to connect the frame 10 and the bearing plate together and provide the spaced bearings 12 and 35 for the shaft 32. The other three lugs 16 are screw threaded to receive three mounting studs 56 which in turn have screw threaded holes therein so that they may be utilized to mount the switch upon a panel 57 by means of screws 58 (see Fig. 1). The six studs 36—56 are all used in securing the ring gear 33 to the frame 10.

Referring now particularly to Figs. 3 and 7, the operation of the cam 29 will be described. It will be noted that this cam, as shown in Fig. 3, has three projections 59, one of which is shown as engaging the contact spring 24 and lifting it to its maximum position. The projections 59 have their cam surfaces circular with the center of the surface at the same distance from the axis of the cam as the teeth on the pinion 30 extend from the axis of the pinion. Now as the cam moves into position to engage a contact spring 24 it brings a side face of the projection 59 against the spring 24 and then as the pinion and cam

advance the projection merely rolls on the contact spring surface as it lifts the contact spring thus practically avoiding any appreciable side thrust on the contact spring. Also, the peculiar shape of the projection 59 makes it raise and drop the spring contact in a very short angular movement of the cam about the shaft 32 so that a quick make and break can be had between the contacts 26 and 27 on the contact springs.

The cams 29 are made with the desired number of projections 59 to fit the needs of the contact piles 22. For example, if the contact piles are spaced 90° apart one may use a single pointed cam 29' as shown in Fig. 7. In some instances you would want to use more points on the cam and have the spring contact piles closer together. The extent to which the switch can be multiplied with respect to the number of contact piles depends somewhat upon the diameter of the cup 18 and the number of teeth 48 that are provided upon the cam support 31. It is obvious that if the diameter of the rotary switch is expanded the angular displacement between the spring contact piles can be reduced and thus more and more spring contact piles can be put in a single unit. It will be noted also that the shaft 32 is so positioned with respect to the switch assembly that if desired it can be extended and additional switch assemblies can be mounted in tandem utilizing the same shaft to operate contacts of more than one switch assembly. The shaft 32 has not been shown with any particular operating means connected to it. The operating means may be manual, in which case it would be provided with a handle, or a suitable motor may be connected to the shaft for turning it.

The rotary switch hereinbefore described, in addition to having the advantage of being quite flexible as to the number of circuits it may control, has the advantage that the contact springs are exposed where they can be reached readily for wiring. In addition the parts of the switch, that is, the barrel 11, cup 18, ring gear 33, cam support 31 and bearing plate 34, are so constructed that the same parts are utilized for a large variety of spring contact assemblies and different cams 29. The bearing plate 34 is shown as provided with a multiplicity of apertures 60 to receive the stop pins 55 so that the stop pins can be put in different positions to match the assembly of spring contacts on the cup 18. Likewise the pinion 30 can be mounted in any one of the openings 44 and more than one pinion can be used when desired. This makes the switch quite flexible as to ultimate design without any appreciable variation in the basic construction of the parts 11, 18, 31, 33 and 34.

Figs. 8, 9 and 10 illustrate a somewhat modified form of construction. The construction however functions just the same as that shown in the main form of the invention. In the modified construction a contact mounting cup 61 is provided. This cup has a multiplicity of flat exterior faces such as 62 and 63 upon which banks of contact springs can be mounted. These banks of contact springs are essentially the same as the banks 22 shown in connection with the main form of the invention. As shown in Fig. 9 of the drawings a bank comprises alternate insulating strips 64 and contact elements 65 and 66. The stationary contact elements are indicated by the numeral 65 and the movable ones by the numeral 66. The springs 65 and 66 and the strips 64 are apertured to receive insulating sleeves 67 and securing screws 68. A spacer 69 is mounted on the

upper contact spring 66 so that when the lower contact spring 66 is actuated the motion will be transmitted to the upper contact spring.

In order to actuate the movable contacts I utilize a cam 70 which is similar in all respects to the cam 29. This cam is staked on a reduced end portion 71 of a pinion hub 72. The pinion hub is fixed on a shaft 73 which is rotatably carried by a cam support 74. The hub 72 has a pinion portion 75 thereon meshing with a ring gear 76.

There may be as many of the cams 70 and pinions 75 in this form of the invention as may be desired. For example, in Fig. 10 of the drawings provision has been made for four of the cams and pinions.

The cam pinion and ring gear assembly are connected with the contact bank carrying cup by means of the construction shown best in Fig. 8 of the drawings. A series of flat pieces of insulating material, indicated at 77, are formed with a central opening 78 and six radially projecting portions 79. These pieces 77 have apertures around the central opening 78 by which they are riveted between two metal washers 80 and 81. Four rivets 82 are used to clamp the pieces 77 between the washers 80 and 81. The rivets 82 are hollow and interiorly threaded so that the cup member 61 can be fastened to these rivets by suitable screws 83.

The washer 81 has a central aperture 84 which serves as a bearing for one end of a shaft 85. The shaft 85 carries the cam support 74, there being a hub 86 keyed to the shaft by a key 87 on which the cam support 74 is secured. The hub 86 may be made of a die casting or suitable material of that type. The cam support 74 is simply a ring of any suitable material to which the cams and pinions can be mounted. Any suitable method of mounting the cam support on the hub 86 may be used. For example, I provide a shoulder 88 on the hub and stake the cam support onto the shoulder.

The ring gear 76 is secured to the radially projecting portions 79 of the pieces 77 by long screws 89 and 90 that extend through the portions 79 then through suitable spacers 91 and through the ring gear 76. The screws 89 are somewhat shorter than the screws 90 and they receive nuts 92 so as to clamp the ring gear against the spacers 91. There are three of the screws 89 spaced 120° apart. There are also three of the screws 90 alternating with the screws 89. The three screws 90 serve to secure the mechanism to a combination mounting and bearing plate 93. Suitable spacers 94 are provided between the ring gear 76 and the plate 93 and one of these spacers provides a bearing for a lever arm 95, the lever arm 95 being made up of two spaced bars 96 and 97. These bars carry a roller 98 between them, the roller being situated between the ends of the bars. The roller 98 is adapted to engage a notched member 99 that is also fixed on the hub 86.

The notched member comprises a star wheel which is staked on a shoulder 100 provided on the hub 86. This star wheel and the roller 98 are preferably made of hardened steel capable of withstanding hard wear. The roller 98 is pressed against the teeth 101 of the star wheel 99 by a spring 102, one end of which is hooked over a pin 103 which connects one end of the bars 96 and 97. The other end of the spring is secured on a pin 104 that is provided on the mounting plate 93. The star wheel 99 has a lug 105 struck up therefrom toward the mounting plate 93 and the mounting plate 93 has a stop pin 106 thereon so as to limit the rotation of the star wheel in either direction. The stop pin 106 can be mounted in any one of a plurality of positions since the mounting plate 93 is provided with an annular series of openings 107 in which the stop pin can be placed. The mounting plate 93 also serves as a support for a bearing 108 for the shaft 85. The bearing is staked in the mounting plate in a well known manner.

It is believed that the details of the modified construction shown in Figs. 8 to 10, inclusive, will be clear from the foregoing description. This form of the invention and the main form of the invention operate in essentially the same manner. One particular feature of importance in the operation of these devices is the arrangement whereby the cams 29 and 70 are caused to actuate the movable contact springs. In a heavy bank of contact springs the resistance of the springs is quite substantial and this normally places quite a heavy load on the shaft 32 or 85 as the case may be. The present design is such that the spring which presses the detent lever against the star wheel in both forms of the invention is utilized to counteract or offset the resistance of the contact springs. This is best illustrated by comparing the positions of the roller 98 and the cam 70 in Fig. 10 of the drawings.

The cam 70 has one of its projections 70' in engagement with the contact spring 66 and lifting the spring. Note that the roller 98 is moving down the inclined surface 101a of the projection 101 with which it is engaged. This movement is being aided by the spring 102 which is a substantial spring so that there is a force tending to rotate the star wheel 99 in the right direction to complete the lifting of the spring 66. The parts are so arranged that when the roller 98 is climbing out on the face of the projection 101 against the force of the spring 102 a projection 70' is being moved inward in the direction of the force of the contact spring 66, so that in all positions the spring 66 and the spring 102 act to offset each other and reduce the power necessary to rotate the shaft 85.

The construction is also advantageous in another respect. When the cam support 86 is moving in a clockwise direction with the star wheel 99 the cam itself is moving in a counterclockwise direction. The result is that a linkage is accomplished between the axis of the shaft 85, the axis of the cam 70 and the point of engagement between the spring 66 and the projection 70' whereby a greater lever advantage is obtained against the spring 66 as the spring is moved farther out. This arrangement also tends to reduce the load on the shaft 85.

We have described the particular functioning of the cams with a star wheel and the spring in connection with Fig. 10. The same relation exists in the mechanism shown in Figs. 1 to 7, inclusive. However, it is believed that the single showing in Fig. 10 and the foregoing description are adequate to illustrate this important feature of the invention.

From the foregoing description it is believed that the nature and advantages of the present invention will be readily apparent to those skilled in this art.

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

1. A switch of the character described, comprising a spring contact bank carrying frame having circumferentially arranged mountings for the

banks of contacts, means for mounting a shaft for rotation about the axis on which the banks of contacts are arranged, said means comprising spaced bearings fixed to said frame, a ring gear fixed to said frame, a cam support keyed to said shaft, a pinion on said cam support engaging said ring gear, a cam fixed to said pinion having its surface formed to engage and lift the movable contact springs of said banks of contact, a notched member fixed on said shaft, and a spring pressed lever having a roller riding on the notches of said member, the contact spring lifting surface on the cam and the notches on said notched member being so mounted with relation to each other that the spring pressure on the lever and the spring pressure of the spring contact offset each other.

2. A switch of the character described, comprising a spring contact bank carrying frame having circumferentially arranged mountings for the banks of contacts, means for mounting a shaft for rotation about the axis on which the banks of contacts are arranged, said means comprising spaced bearings fixed to said frame, a ring gear fixed to said frame, a cam support keyed to said shaft, a pinion on said cam support engaging said ring gear, a cam fixed to said pinion having a projection operable to engage the movable contact springs of said banks of contacts, a notched member fixed on said shaft, and a spring pressed lever having a roller riding on the notches of said member, the contact spring lifting projection on the cam and the notches on said notched member being so mounted with relation to each other that the spring pressure on the lever and the spring pressure of the spring contact offset each other, the contact bank mounting portion of the frame comprising a cup shaped member separably mounted to the frame.

3. A switch of the character described, comprising a circular series of banks of spring contacts, supporting means for said banks of contacts, a shaft, bearing means for said shaft mounting the shaft centrally with respect to the series of banks of contacts, a cam support on said shaft, a cam pivoted on the support means operable by rotation of the shaft to turn the cam on its pivot in the opposite direction to the rotation of the shaft, said cam having a cam surface operable to move certain of the spring contacts of a bank radially as the shaft is rotated to move the cam past the bank, and means cooperating with the shaft to oppose the force of said spring contacts on the cam, said means comprising a spring pressed detent and a notched member over which the detent is passed by rotation of the shaft, the low points of the notched member being in engagement with the detent when the cam is positioned to give the spring contacts of the bank it is actuating the greatest deflection.

4. A switch of the character described, comprising a spring contact bank carrying frame having circumferentially arranged mountings for the banks of contacts, means for mounting a shaft for rotation about the axis on which the banks of contacts are arranged, said means comprising spaced bearings fixed to said frame, a ring gear fixed to said frame, a cam support keyed to said shaft, a pinion on said cam support engaging said ring gear, a cam fixed to said pinion having its surface formed to engage and lift the movable contact springs of said banks of contacts, and means cooperating with the shaft to oppose the force of said spring contacts on the cam, said means comprising a spring pressed detent and a notched member over which the detent is passed by rotation of the shaft, the low points of the notched member being in engagement with the detent when the cam is positioned to give the spring contacts of the bank it is actuating the greatest deflection.

5. In a switch of the character described, a spring contact bank carrying cup annular in cross section with circumferentially spaced mounting seats for banks of spring contacts, a shaft supporting member fixed to one end of said cup and operable to center a shaft with respect to the contact bank seats, a shaft extending away from the cup, banks of spring contacts on said seats projecting from the cup in the same direction as the shaft, and means secured to the cup by said shaft supporting member and extending beyond said member for mounting a second shaft supporting member in spaced relation to said first named member.

6. In a switch of the character described, a spring contact bank carrying cup annular in cross section with circumferentially spaced mounting seats for banks of spring contacts, a shaft supporting member fixed to one end of said cup and operable to center a shaft with respect to the contact bank seats, a shaft extending away from the cup, banks of spring contacts on said seats projecting from the cup in the same direction as the shaft, means secured to cup by said shaft supporting member and extending beyond said member for mounting a second shaft supporting member in spaced relation to said first named member, and contact actuating means mounted on the shaft between said shaft supporting members.

7. In a switch of the character described, a spring contact bank carrying cup annular in cross section with circumferentially spaced mounting seats for banks of spring contacts, a shaft supporting member fixed to one end of said cup and operable to center a shaft with respect to the contact bank seats, a shaft, and means secured to the cup by said shaft supporting member and extending beyond said member for mounting a second shaft supporting member in spaced relation to said first named member, said means comprising a ring with radial arms thereon, a ring gear, and a combined bearing and mounting plate all in spaced relation to each other axially of said shaft, and means connecting them together in the spaced relation.

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