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2,369,616

CONTACTING DEVICE

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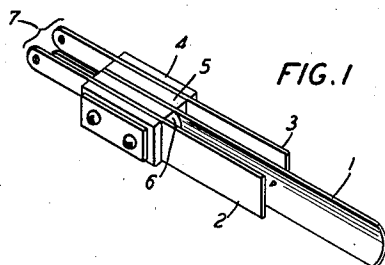


FIG. 1

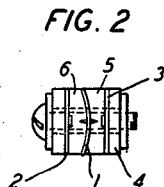


FIG. 2

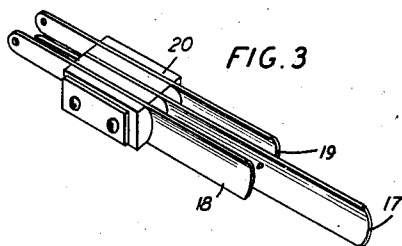


FIG. 3

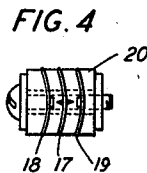


FIG. 4

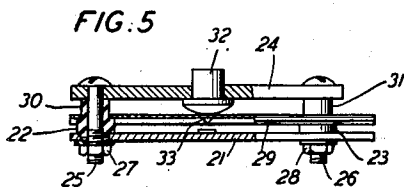


FIG. 5

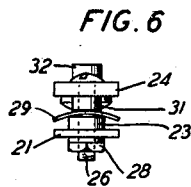


FIG. 6

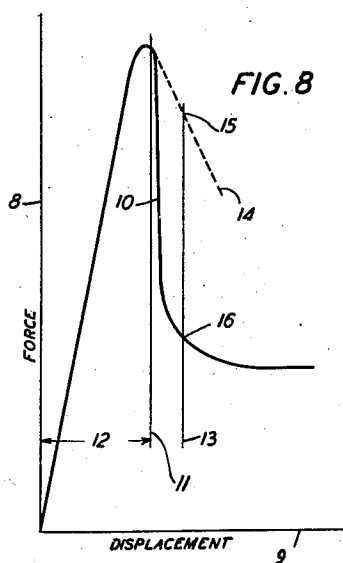


FIG. 8

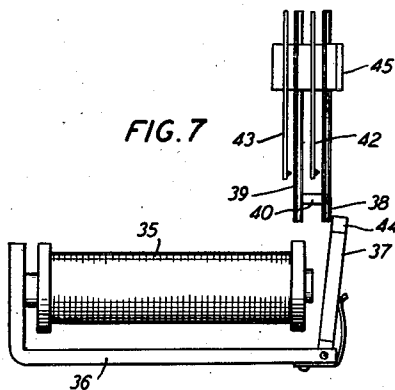


FIG. 7

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CONTACTING DEVICE

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Application July 9, 1941, Serial No. 401,593

2 Claims. (Cl. 200—67)

This invention relates to contacting devices and particularly to such devices employed in establishing electrical connections.

The objects are to obtain an improved distribution of the operating forces for contact springs, to secure a more reliable pressure between the cooperating contacts, and to obtain other improvements in devices of this character.

Heretofore contact devices have been provided in which two or more contact springs are arranged in a pile-up having contact surfaces or contact points for establishing connections when these springs are actuated upon by an operator. These pile-ups usually consist of flat flexible springs supported at one end and free for movement at the opposite ends.

A feature of the present invention is an arrangement of two or more contact springs in a pile-up in which one or more of these springs are curved perpendicularly to their longitudinal axis so that when such curved springs are actuated upon to make contact with the other springs, an increasing pressure must be exerted, either mechanically or by an operator, to bend these springs until the so-called "break-through" or breaking point is reached, at which time the pressure required to bend these springs further to make the connections desired decreases at a rate faster than an operator is able to decrease the pressure. Thus, a good contact pressure is secured without the danger of failure in making the connection which may be the case where pressure is exerted to bend an ordinary flat spring.

It is evident that the operating force for bending these curved springs may be either manually or mechanically applied and it is another feature of the applicant's invention to arrange spring pile-ups containing one or more such curved springs to be operated upon by a button controlled either manually by an operator or mechanically by any other physical forces as for example, by an armature of a relay which when moved by the energization of the relay exerts the desired pressure to operate the spring pile-up.

The invention is illustrated in the accompanying drawing, in which

Fig. 1 shows one embodiment of the applicant's invention;

Fig. 2 shows a front view of the arrangement shown in Fig. 1;

Figs. 3 and 4 show a similar arrangement of another embodiment of applicant's invention;

Figs. 5 and 6 show an arrangement in which a button operates on a curved spring;

Fig. 7 shows a relay having an armature operating on curved springs in accordance with the applicant's invention; while,

Fig. 8 shows curves of the operating forces required for the displacement of a curved spring in accordance with the applicant's invention.

Referring now to the drawing, Fig. 1 shows an assembly comprising a long narrow spring 1 curved transversely to have, for example, a semi-circular cross section. On either side of this spring are two somewhat shorter springs 2 and 3 having rectangular cross sections. These three springs are assembled as shown at 4 by means of intermediate insulation plates and bolts or screws to hold the springs together but insulated from each other. As shown in Fig. 2, the curved spring 1 is held by a concave insulation plate 5 on one side and a convex insulation plate 6 on the other side to maintain the curvature of this spring. Terminals as shown at 7 may extend from the assembly 4 for making the desired electrical connections for these springs. In this case, the curved spring 1 may be moved or bent by an operator in one direction or the other to make connection with the spring 2 or 3. Regardless of which direction spring 1 is bent, it requires a certain amount of increasing pressure to move it until the breaking point is passed when the pressure required for bending the spring 1 further to contact with spring 2 or 3 will be considerably less than the pressure required to make the spring reach this breaking point. This required pressure to bend the spring further decreases a great deal more rapidly than the operator is able to control the pressure exerted on the spring so that the operator will continue to act on spring 1 with a greater pressure than is required to bend it beyond the breaking point, and in exerting this pressure the operator causes the spring 1 to contact with spring 2 or 3 with considerable contact pressure to make a positive connection.

To illustrate the forces or pressures required for operating the spring 1, reference may be made to Fig. 8 in which the ordinate 8 indicates force expended and the abscissa 9 indicates displacements of the spring. The curve 10 indicates the varying pressure required for different displacements in regard to these two coordinate axes. For example, the displacement from rest to the breaking point 11 may be indicated by the distance 12 and it will be noted by curve 10 that a slow constantly increasing pressure is required for the bending of the spring to the breaking point 11. If now the spring is bent further, for example, from the point 11 to the point 13, it should be noted by the curve 10 that a rapidly decreasing pressure is required for the bending of the spring to the point 13. If it is considered that when the point 13 is reached, the spring 1 has been bent sufficiently to contact with the spring 2 or 3, it is evident that this rapid decrease in pressure required to move the spring from 11 to 13 is at a more rapid rate than the operator is able to control his rate of decrease in pressure on the spring which may be indicated by the dotted line curve 14. Therefore, when the spring is bent to the

point 13 it makes contact with one of the springs 2 or 3 with a great deal more pressure exerted by the operator than was required to actually move the spring from point 11 to point 13 and hence a good electrical connection is obtained. That is, the actual pressure exerted by the operator is of the value as at point 15 while the value of the pressure required to bend the spring to the contacting point 11 is of the value as at the point 16.

Figs. 3 and 4 show another arrangement of the applicant's invention in which the curved spring 17 is located between two other similarly curved springs 18 and 19 and these three springs are mounted as shown at 20 in curved insulation strips clamped together by screws. The purpose of the curved springs 18 and 19 in this case is to enable the use of somewhat thinner spring material than for the springs 2 or 3 and yet retain the same rigidity of these springs by having them curved in the same manner as spring 17, while the spring 17 will act in the same manner as spring 1 to secure a substantial contact pressure for establishing electrical connections.

In Figs. 5 and 6 has been shown a somewhat different arrangement in which the flat spring 21 is mounted rigidly on two insulation studs 22 and 23 on which are secured also a parallelly located supporting plate 24 by means of bolts 25 and 26 and associated nuts 27 and 28. Between the spring 21 and plate 24 on studs 22 and 23 a curved spring 29 is mounted. Stud 22 is provided with a decreased portion 30 on which spring 29 is mounted by having a hole cut in this spring 29 to fit over the portion 30. The opposite end of the spring 29 may be provided with an oblong hole for the free movement longitudinally of the spring 29 on the decreased portion 31 of stud 23. This permits the spring 29 to be bent downwardly looking at Fig. 5. In the middle of the plate 24 is placed a button 32 which engages with its enlarged lower surface the curved spring 29 and the spring 29 and plate 21 are provided with normally opened contacts 33. If pressure is exerted on the top of the button 32 to press it downwardly, it will act to bend the curved spring 29 downwardly approximately at its center to make spring 29 contact with plate 21. In this case, of course, as the spring 29 is prevented from longitudinal movement by being secured on the stud 22, it will as it is bent by button 32 shift at its right-hand end on the stud 23, clearance for this movement being provided by the oblong hole in the spring 29 at this end. In this case, also, a constantly increasing pressure is required to bend the spring 29 up to the breaking point and after that connection is made between springs 29 and plate 21 with considerable pressure as the operator will not be able to decrease the pressure on the button 32 at the fast rate at which the pressure required for bending the spring 27 beyond the breaking point decreases. It is, of course, understood that the button 32 may be operated either manually by an operator putting his finger on the button or by any mechanical means such as levers or cams operated by some external force.

In Fig. 7 is shown a relay 35 having a return pole-piece 36 and armature 37 arranged so that when the coil 35 is energized the armature 37 will be drawn towards the core of this coil. Associated with this armature is a pile-up of springs similar to those disclosed in Figs. 1 to 4, except that in this case the pile-up consists of two

curved springs 38 and 39 separated by an insulation stud 40 and two associated flat stationary springs 42 and 43. The armature 37 engages normally through its insulated end-piece 44 and spring 38 so that when the armature 37 is operated these two springs 38 and 39 will be moved towards the left to engage respectively with the stationary springs 42 and 43. These springs 38, 39, 42 and 43 may be mounted in any suitable manner at a support 45 and connections may be extended from the springs for establishing any desired electrical connections. In this case when the armature 37 is attracted, a certain amount of force is required to move the springs 38 and 39 until the breaking point is reached. From this point on the required force is less but as the armature continues to exert the same or in fact somewhat increased pressure, due to the nearness of the armature to the magnet, a good contact pressure will be secured between the curved and the stationary springs. It is evident that by arrangements, for example, as shown in Fig. 7, the inertia of the armature 37 may be sufficient to move the springs 38 and 39 after the breaking point has been reached even though the energizing current through coil 35 may be discontinued before the armature has actually completed its stroke. The operation of the armature under ordinary circumstances will provide a quick snap action for closing the contacts after the breaking point has been reached which, of course, is desirable to prevent chattering of the contacts and sparking which may occur when uncertain connections are made to establish electrical connections.

It should be understood that the curvature of the operating springs may be varied to suit particular requirements and these springs may either be prepressed before they are assembled with other contact springs on a support or be pressed by clamping them between curved supporting plates while assembling with other contact springs without departing from the spirit of the invention.

What is claimed is:

1. A contact-making device comprising a long narrow spring curved transversely to its longitudinal axis, a rigid support for said spring at one end thereof, a support at the other end of said spring permitting movement of said spring only along its longitudinal axis, and fixed contact members for establishing connections with said spring when pressure is exerted on said spring between its supports to bend it.

2. In a contact making device comprising a long, narrow spring, curved transversely to its longitudinal axis, a rigid contact plate below the convexed surface of said spring, supporting means associated with said plate for holding one end of said spring rigid to the plate and the other end movable longitudinally but rigid transversely, a contact on said spring located centrally between its ends, a contact on said plate in position to connect with the contact on the spring, said spring and plate and contacts thereof being so located that when pressure is applied to said curved spring in the center thereof to bend it towards the plate, the connection between the contacts of the spring and plate is not effected until the spring has been bent beyond its break through point.

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