

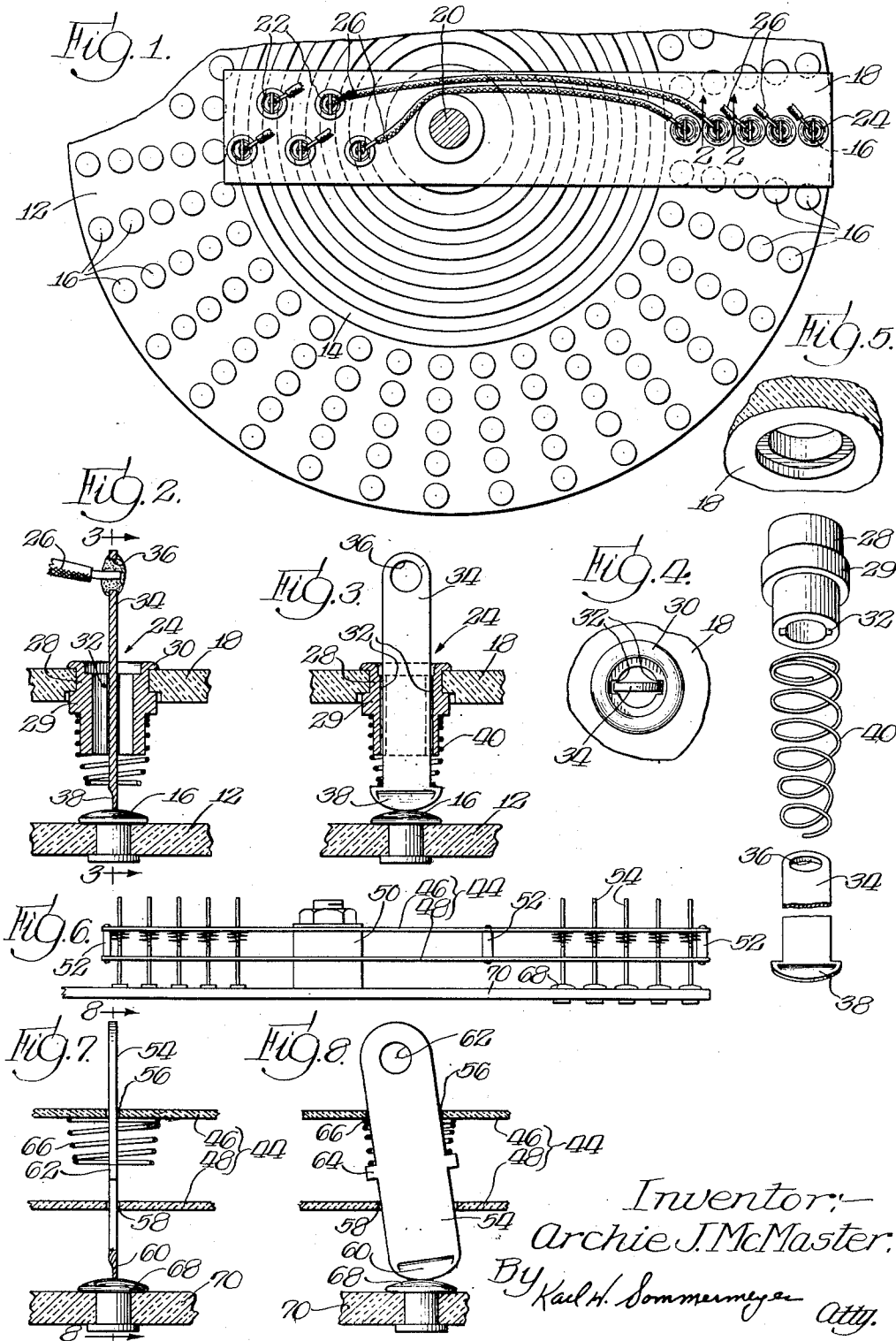
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A. J. McMASTER

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ELECTRIC CONTACT

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Inventor:—
Archie J. McMaster.
By Karl H. Sommermeier Atty.

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ELECTRIC CONTACT

Archie J. McMaster, Highland Park, Ill., assignor
to G-M Laboratories, Inc., Chicago, Ill.

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The present invention relates to sliding electric contacts such as are used in electric commutators and the like.

Objects of the invention include the provision of a low cost contact assembly of simple, rugged and compact construction which is reliable in operation, which maintains itself in proper adjustment, which can operate over an uneven contact surface, which will establish contact through a layer of accumulated dirt, lint or muck and which in operating tends to keep itself clean. These and other objects and advantages will appear as the description proceeds.

In order better to acquaint those skilled in the art with the teachings of my present invention, and also to illustrate the manner in which my invention may be put into practice, I now shall describe certain specific embodiments thereof by way of example. However, the invention is not to be construed as limited to any particular embodiment and a description of a particular example is not intended to exclude others. In the drawing:

Fig. 1 is a general plan view of a commutator assembly including contacts embodying my present invention;

Fig. 2 is an enlarged sectional elevation of one of the contact assemblies of Fig. 1, Fig. 2 being taken along the line 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a plan view of the detail of Figs. 2 and 3 and therefore constitutes an enlarged detail of Fig. 1;

Fig. 5 is an exploded view in perspective of the component parts of the unit contact assembly of Figs. 2, 3 and 4;

Fig. 6 is an elevational view of a commutator assembly employing contacts embodying my invention but of a somewhat modified construction;

Fig. 7 is an enlarged sectional elevational detail view of one of the contacts of the assembly of Fig. 6; and,

Fig. 8 is a sectional view taken along the line 8—8 of Fig. 7.

In Fig. 1 a circular plate 12 of insulating material carries a series of concentric contact rings 14 and also a number of contact buttons 16 spaced on a series of concentric circles so as to lie also in radial rows. A contact arm 18 of insulating material is arranged to rotate about the center 20 of the disc 12. This contact arm 18 carries ten individual contact assemblies 22 and 24. Of these, each of five contacts 22 engages

a separate one of the concentric contact rings 14, and each of five contacts 24 is adapted to engage separately the contact buttons 16 which lie in one circle. Each of the contacts 22 is connected to one of the contacts 24 by means of wire connector 26. As the contact arm 18 rotates about the center 20 the five contacts 24 are brought into successive engagement with the contacts 16 of the separate radial rows whereby each of the contact rings is successively connected electrically to separate ones of the contacts 16. The commutator disc 12 and contact arm 18 constitute parts of a multiple circuit step switch or indexing switch. The arm is adapted to be indexed to move the contacts 24 from one row of contact buttons 16 to the next. The manner in which the disc 12 and contact arm 18 are supported and rotated relative to each other forms no part of the present invention and a description thereof is unnecessary.

The details of the construction of one of the contacts 24 are shown in the enlarged view of Figs. 2, 3 and 4. A metal bushing 28 having shoulder 29 is riveted in a hole in the insulating contact arm 18 by staking at 30. This bushing 28 has a pair of internal opposed flutes 32 broached therein, and a metal slider or plunger 34 of phosphor bronze slides easily in the flutes 32. The slider 34 consists of a thin flat strip of phosphor bronze of uniform width having a soldering eye 36 at its upper end and an enlarged contact portion 38 swedged thin at its lower end. The swedging hardens the metal of the contact portion 38 to improve its wearing qualities and also thins the contact as best shown in Fig. 2 to accentuate its knife like character. A coil compression spring 40 is interposed between the shoulder 29 of the bushing 28 and the shoulder formed by the enlargement 38 at the contact portion of the slider 34. This spring urges the slider 34 in the direction of its contact portion 38 so as to hold the contact portion 38 firmly in engagement with the disc 12 and the contact buttons 16 disposed thereon.

As the contact arm 18 rotates, the contact portions 38 ride across the contact buttons 16 and across the surface of the disc 12 between contact buttons 16.

As is shown in Fig. 1, the contact sliders 34 and the contact portions 38 thereof are oriented in the contact arm 18 so that the knife like edge of the contact portion 38 lies in the direction of the motion of the contact assembly 24 relative to the disc 12.

The present construction provides the spring

40 with ample size and volume so that the spring may be designed to provide ample contact pressure while having a low modulus. Accordingly the present construction provides ample and substantially uniform contact pressure in spite of variations in the spacing between contact arm 18 and disc 12. The firm contact pressure together with the knife-like edge of the contact portion 38 enable the switch to make reliable contact even though the surface of disc 12 and contact buttons 16 be covered with a layer of a muck-like mixture of grease with lint and dirt. It is desirable in a low cost switch that grease be applied to the contact surfaces in lieu of plating them with non-corrosive metals, and the accumulation of some lint and dirt on a greasy surface is unavoidable.

Inasmuch as the contact portion 38 is required to engage separately a large number of contacts 16 as it moves around the disc 12, each of the contact portions 38 is subjected to considerably more wear than is any one of the contact buttons 16. Because the contact portion 38 is hardened by swedging as described, it is prevented from wearing more rapidly than the contact buttons 16 with which it engages. The curvature of the contact portion 38, the easy action of plunger 34 in bushing 28 and the uniform pressure of spring 40 all combine to make the contact plunger 34 ride easily up onto the buttons 16 which protrude above the surface of the disc 12.

The connecting wire 26 soldered to the plunger 34 at eye 36 prevents the plunger 34 from dropping out of the bushing 28 should the contact arm 18 be separated from the disc 12.

The present invention provides a contact assembly giving a knife-like contact whose tension may be easily regulated in production, whose moving parts are small and rigid, which is simple in construction and which is entirely reliable in operation. In addition, the construction is compact so that a large number of contacts may be grouped in a small space.

Fig. 6 is an elevational view of a modified construction. In Fig. 6 a rotatable contact arm 44 includes a pair of parallel similar insulating strips 46 and 48 which are spaced apart slightly by means of spacers 50 and 52. These insulating strips 46 and 48 carry a number of contact sliders 54. The construction of these sliders and the manner in which they are supported in the insulating strips 46 and 48 is best seen in the enlarged sectional views of Figs. 7 and 8. The contact slider or plunger 54 is reciprocally carried in a pair of slots 56 and 58 in the strips 46 and 48 respectively. A swedged contact portion 60 is provided at the lowermost end of the contact slider 54 and a soldering eye 62 is provided at its upper end. A pair of shoulders 64 extend laterally from the slider 54 intermediate its ends. The apparatus is assembled so that these shoulders 64 come in the space between the two insulating strips 46 and 48 of the rotatable contact arm 44. An helical compression spring 66 is interposed between the strip 46 and the shoulders 64 to urge the contact slider downward into firm engagement with a cooperating contact button 68 in a contact plate 70. Like the spring 40 of Figs. 2 and 3, spring 66 has a low modulus so as to provide a firm uniform contact pressure regardless of the position of plunger 54 in the slots 56 and 58 in the separate strips 46 and 48. The strips 46 and 48 are so located relative to each other that the direction in which the slider 54 reciprocates in the contact arm 44 is inclined slightly to bring the upper end of the slider 54 slightly be-

hind the lower or contact end 60 of the slider with respect to the direction in which the contact 60 moves across the contact button 68. As viewed in Fig. 8 contact piece 54 is intended to move toward the right with respect to its cooperating contact, and accordingly its upper end is slightly to the left of its lower end 60. As the two strips 46 and 48 carry the contact slider 54 toward the right as viewed in Fig. 8, the contact portion 60 rides on and off the contact rivets 68. Whenever the contact portion 60 encounters a rise or bump such as one of the contact buttons 68, the resistance to the forward motion caused by that bump produces a component of force tending to lift the contact slider 54 against the force of the spring 64. Accordingly any resistance encountered by the contact portion 60 against forward motion, that is, motion towards the right, as viewed in Fig. 8, tends to lift the contact portion 60 over the obstruction which causes that resistance. Therefore the inclined contact piece 54 moves from one contact to the other more easily than does the erect arrangement shown in Figs. 2 and 3.

The inclined contact plunger of Figs. 7 and 8 is particularly adapted to operate with a minimum resistance to forward motion over rough and uneven commutator surfaces, but is generally limited to motion in only one direction. The erect contact plunger of the construction of Figs. 2 and 3 is adapted to move in either direction relative to the contact disc 12.

The construction of Figs. 6, 7 and 8 wherein the contact slider 54 is supported directly in the insulating contact arm 44 is particularly adapted for use when a large number of identical units are to be manufactured. It employs a somewhat simpler construction than the arrangement of Figs. 1 to 5, inclusive, but it requires more complete and precise tools for the convenient and accurate punching of the slots 56 and 58 to insure that the contacts will be properly aligned in the completed assembly. The construction of Figs. 1 to 5 inclusive, wherein the contact slider is carried in internal flutes in a circular bushing is particularly adapted for use in apparatus where comparatively small numbers of identical units are to be built. The contact assembly can be mounted easily in a contact arm such as contact arm 18 wherever a plain round hole of proper size can be provided.

While I have shown and described certain specific illustrative embodiments of my present invention, it will be apparent that such embodiments are by way of example only, and are capable of many modifications and variations. For example, the bushing construction of Figs. 1 to 5 may be inclined in the same manner as is the non-bushing construction of Figs. 6 to 8, and if desired, contact slider 54 of Figs. 6 to 8 may be made erect or inclined at any other convenient angle. Accordingly, I do not intend to be limited except by the scope of the appended claims. The term knife-like edge or knife-like portion is employed to mean an edge or portion in which the longitudinal dimension is appreciably greater than the transverse dimension, and wherein the latter dimension is small enough whereby to facilitate breaking through a layer of foreign matter lying on the surface of a cooperating contact and the opposite dimension is great enough to promote sliding action.

I claim:

1. In combination in a sliding electrical contact, a guide, movable means for supporting said

guide, an elongated metal plunger longitudinally reciprocable in said guide, said plunger having a knife-like contact portion on an end thereof aligned in the direction of movement thereof resulting from movement of said guide supporting means, means urging said plunger in the direction of said knife-like contact portion, said knife-like contact portion adapted to engage a stationary contact member with a sliding action whereby to cause said knife-like portion to cut through surface matter on the stationary contact whereby to form good electrical engagement between said stationary contact and said knife-like contact portion, and an uneven contact surface over which the said knife-like contact portion of said elongated metal plunger is adapted to slide, said guide being tilted with respect to the direction of sliding so that the end of said guide nearest said contact surface moves in advance of the other end thereof.

2. In combination, a sliding electric contact and a contact surface over which said sliding contact is adapted to slide, said sliding contact including: a guide, an elongated plunger longitudinally reciprocable in said guide toward and away from said contact surface, said plunger having a contact end adapted to engage said contact surface, and means yieldably urging said contact end of said plunger into engagement with said contact surface, said guide being so inclined to the direction of motion of said sliding contact relative to said contact surface that said contact end of said plunger leads.

3. In combination, two contact support members, means for supporting said contact support members to permit relative movement therebetween while maintaining the distance of their separation substantially constant, a plurality of aligned contact members fixed to one of said contact support members, a plurality of metal sliders carried by the other contact support member, each having a knife-like contact portion adapted to engage a plurality of said aligned contacts, said knife edge being aligned in the direction of relative movement with the said aligned contacts whereby to engage said contacts with a knife-like cutting action and cut through non-conductable surface matter, guide means to prevent movement of said metal sliders except in a direction longitudinal thereof whereby said alignment in the direction of relative movement is maintained, said guide means forming a part of said second contact support member and including fluted portions in which the said sliders have longitudinal movement, spring means urging said sliders in the direction of said

first-mentioned aligned contact members, said second-mentioned contact support member including two spaced strips having aligned, keyed apertures therein, said slider being reciprocable in said apertures, and said apertures comprising said guide means.

4. In combination in a sliding electric contact, a contact support member consisting of two spaced strips having aligned apertures therein, an elongated integral thin flat bronze slider longitudinally reciprocable in said apertures, said slider having a curved end constituting a knife like contact portion, said slider being swaged hard at said end whereby the metal of said contact portion is hard, said slider having integral lateral projections, and a coil compression spring encircling said slider and interposed between said projections and one of the strips of said support.

5. In combination in a sliding electric contact, a disc of insulating material, a plurality of button contacts supported in an orderly path on one face of said disc, a contact arm of sheet-like insulating material pivoted to rotate about an axis vertical to said disc at a mid-point thereof, whereby said arm is adapted to move in a plane parallel to the plane of said disc, at least one bushing secured to extend through said contact arm at a position to follow the path defined by said button contacts on said disc when said contact arm is moved relatively to said disc, said bushing having a pair of opposed internal flutes together defining a slot extending longitudinally through said bushing and through said contact arm, a metal slider in the form of a flat strip slidable in the slot defined by the flutes in said bushing, said slider extending entirely through said bushing and being of uniform transverse dimension except for integral projections near that end thereof extending toward said button contacts, and a coil spring surrounding said bushing and slider and having one end engaging said projections to force said slider in a direction toward said button contacts, said slider having a knife-like edge at that end thereof adapted to engage said button contacts, and said edge being aligned in the direction of movement thereof.

6. The combination defined in claim 5, wherein said bushing comprises a metal part of generally tubular form with an outside annular shoulder, said shoulder bearing against one face of the sheet-like material comprising said arm, and an integral out-flared portion engaging against the opposite face of said sheet-like material comprising said arm.

ARCHIE J. McMASTER.