May 10, 1966 W. HOLZER 3,250,885

FLAT CONTACT PIECE

Filed May 14, 1964 2 Sheets-Sheet 1

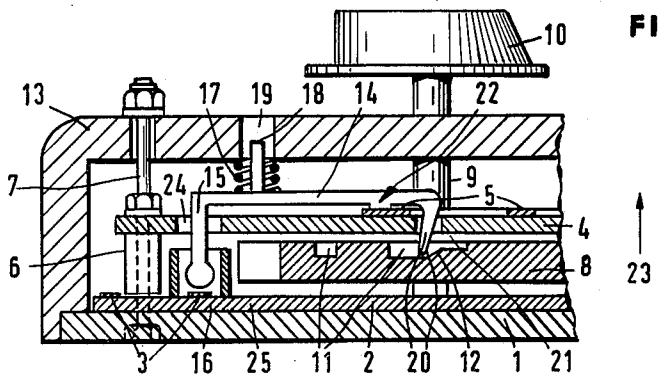


FIG. 1.

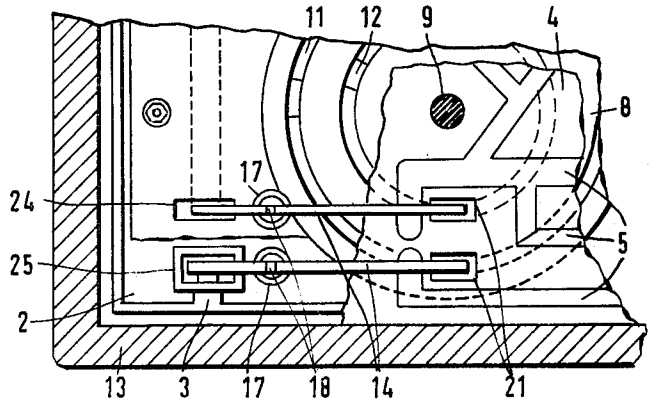


FIG. 2.

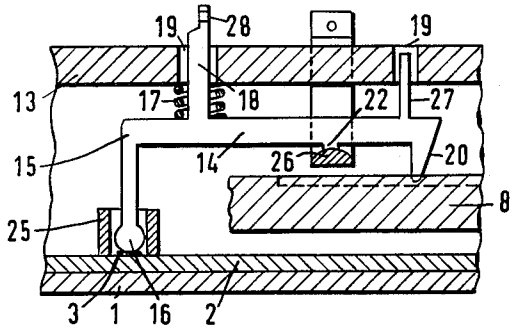


FIG. 3.

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FIG. 4.

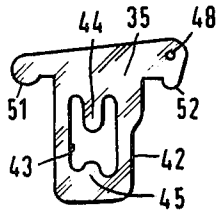




FIG. 6.



FIG. 5.

FIG. 7.

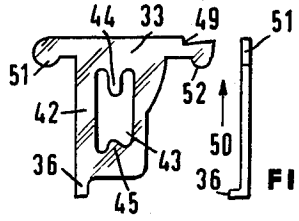


FIG. 9.

FIG. 8.

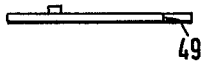


FIG. 10.

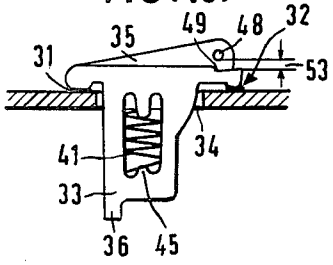


FIG. 11.

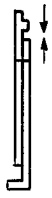
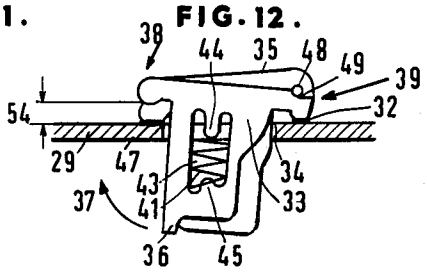


FIG. 12.



39 FIG. 13.

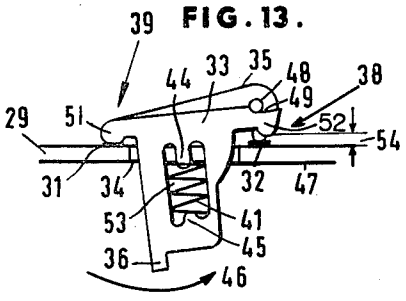
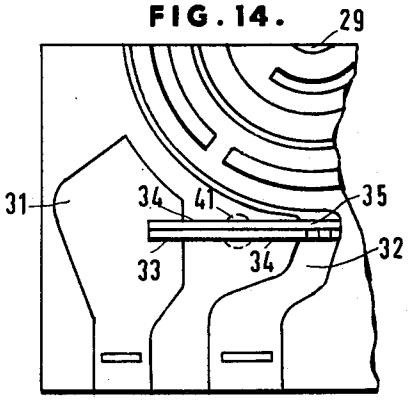


FIG. 14.



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FLAT CONTACT PIECE

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Claims priority, application Germany, May 18, 1963, H 49,212; June 11, 1963, H 49,413
20 Claims. (Cl. 200—166)

The invention relates to a flat contact in the form of a stamped member and for use chiefly in printed circuits where the circuits are provided an on insulating base. The contact is connected to the base without screws by means of springs, and is moved by switching cams. The contact-making part of the flat contact, which remains connected to the base, is additionally designed as a bearing so that movement is possible when the raising contact making part, which co-operates with an opposed contact and which is moved by an actuating cam, operates satisfactorily.

In a flat contact of this type which is connected to and co-operates with a base, the invention aims to design the contact both so that it is accessible from one side when a plurality of bases with circuits printed on them are superimposed and also so that two adjacent flat contacts can act as a double contact.

In one embodiment in which a plurality of superimposed bases printed with circuits are provided the problem of the invention is solved, in that the flat contact has a portion, for example an angled portion, extending through the base, that said portion ends in an electrically conductive bearing lying on the undermost base, that the connection to the base is provided by springs bearing on the cover of the casing, and that the springs also press the actuating cam for the raising contact on the upper most base of the flat contact onto the switching cam located, for example, between the bases.

In this embodiment the switching cam is provided between two circuit-carrying bases. It may, for example, be a control disc having concentric tracks, raised and lowered portions being provided within the tracks. The raised and lowered portions are sensed by the actuating cam and thereby move the part of the flat contact which has to be raised.

An important factor is that one can assemble and dismantle the flat contact from one side without removing the switching cam or having to dismantle the bases.

An important feature of another embodiment is that adjacent flat contacts can be fixed together and can be used both as double contacts and as main and preliminary contacts. This last term refers to the fact that the contacts open and close in succession; the last contact to be lifted off and then replaced on the opposed contact or printed circuit is defined as the preliminary contact. This suffers all the consumption so that the following contact, which is provided with particularly good contact material, is spared.

In one embodiment wherein superimposed printed circuits are provided with the switching cam arranged anywhere between them the problem of the invention is solved, in that the flat contact has a portion, for example an angled portion, extending through the top-most and upper bases, that said portion ends in an electrically conductive bearing lying on the undermost base, that the connection to the base is provided by a spring bearing on the cover of the casing, and that the spring also presses the actuating cam for the raising contact on the top-most base of the flat contact onto the switching cam provided, for example, between the bases.

This embodiment requires only one spring to press on the part of the flat contact above the top-most base. The flat contact then has portions extending through the top-most and/or all the bases and acted on by the spring. The portion which is connected to the flat contact and which is pressed onto the undermost base (by) the spring is in the form of a bearing so that there is a rolling movement rather than a sliding one when the actuating cam is moved by the switching cam.

According to the invention the spring, which provides the resilient non-positive connection between the bearing and the printed circuit, is mounted on a guide pin located above the top-most base and guided in the cover of the casing.

This construction ensures that the minimum of labour is required for assembly and dismantling; the cost of making it is also very low.

If a switching cam in the form of a control disc is used it is essential for the angled end of the flat contact to be far enough away from the actuating cam to extend outside the control disc comprising the switching cam.

Another possibility is for the bearing to rest on the conductive track of a printed circuit and for the sensing contact to co-operate with a stationary contact mounted on a stationary opposed bearing surface, for example on a casing.

In order to make the flat contact stand upright the stationary contact can either be in the form of an upright guide or an upright guide for the second angled arm of the flat contact may be provided on the printed circuit, on the conductive tracks of which the bearing rests.

Further according to the invention an additional guide pin is provided and extends through a slot in an opposed bearing surface, for example through the cover of the casing, thus providing a very simple upright guide for the flat contact.

In the double contact embodiment where there are two adjacent flat contacts acting as a double contact the raisable ends of the flat contacts are, according to the invention, interconnected by an entrainment member provided on one flat contact.

This member guarantees that the contact making ends are either lifted simultaneously or else are lifted in succession always in the same sequence. Thus the contact resistence is decreased in any event, for either the contact surface is enlarged by the simultaneous operation of the contacts or one contact—if there is a preliminary and a main contact the main contact—is provided with contact material which greatly reduces the transitional resistance; this contact material can be used because a preliminary contact closes or is lifted first and keeps the main contact free from consumption.

The entrainment member may take a great many different forms. One is a shoulder provided on the flat contact which is raised first. When the contact has been raised the shoulder bears on a projection from the other flat contact arranged at a spacing above the first, so that the flat contact having the projection is the preliminary contact for the other flat contact.

If there is a spacing between the entrainment member and the projection moved thereby, then the two contacts act as a preliminary and a main contact.

In another construction the entrainment member is a shoulder provided on the flat contact which is lifted first, and the projection from the other flat contact rests on the entrainment member when the contact is closed.

In this embodiment the two double contacts operate simultaneously.

In the embodiment where the double contact is formed by a preliminary and a main contact it is desirable for the raising ends of the flat contacts to comprise different material known per se for main and preliminary contacts.

For example, the preliminary contact may be provided with a tungsten-alloyed material capable of absorbing

contact consumption, in which case the main contact would be only a silver-alloyed material.

The double contacts may be used both with printed circuits and with other opposed contacts allowing a high degree of contact consumption.

It is important that the first flat contact to be raised should have the actuating cam.

The term "first flat contact to be raised" refers to the time when the entrainment member is spaced from the projection from the other flat contact to be entrained. If both contacts are raised simultaneously the actuating cam must be provided on the one with the entrainment member.

It is desirable for the actuating cam to be provided near the opposite end of the flat contacts on which there is an entrainment member and projection.

Another possibility is for the shoulder of one flat contact, which acts as an entrainment member, to be designed as a bearing for the projection from the other contact arranged at a spacing thereabove, so that when the actuating cam is moved towards the entrainment member each end of the double contact is raised, acting as a main and preliminary contact, and when the actuating cam is moved towards the other end this other end is also raised, acting as a main and preliminary contact, the ends which are not raised always resting resiliently on the opposed contact, for example a printed circuit.

If the actuating cam is arranged as described it is possible to raise both sides of the flat contact either as a main or preliminary contact or as simultaneously operating contacts. The cam must then always be actuated only in the direction of the contact to be raised. In this way the life of the contacts can be greatly lengthened since there are now, so to speak, four contacts available, located on one or other side of the flat contact depending on the direction in which the cam is actuated.

Manufacturing technique may be simplified if the projection from one flat contact is pressed out in the form of a lug.

The double contact may also be in the form of a stamped portion.

It is desirable for the portion stamped out of the flat contacts to receive the cylindrical fastening spring to be asymmetrical, so that the apertures are aligned when the projection from one flat contact lies in the aperture in the other contact.

The spring, which also serves to fasten the flat contacts, acts as a returning force when the contact has been raised. If the contacts are not raised simultaneously, i.e., if they are used as a preliminary and main contact, then the asymmetrical aperture ensures that both contacts are always spring-fettered. This measure is particularly important if the contacts are used, for example, in washing machine controls, where vibration is inevitable.

If the contacts are used as preliminary and main contacts it is important that the flat contact carrying the actuating cam should be the preliminary one.

The preliminary contact, i.e., the one carrying the actuating cam, also carries the entrainment member. As the entrainment member is first moved a sufficient distance and the contact is thus lifted off the base as a preliminary contact until it reaches the projection, the correct sequence is always followed in contact making, or when the process is reversed this contact is again the first to touch down on the base.

Examples of the invention are illustrated in the drawings which, in conjunction with the description thereof, contains further features.

In the drawings:

FIG. 1 is a part sectional diagram showing the flat contact according to the invention mounted in a cam switch with two superimposed printed circuits,

FIG. 2 is a part sectional plan view of the cam switch according to FIG. 1,

FIG. 3 shows a modified embodiment of a flat contact according to the invention mounted as a switching member between a printed circuit and a stationary contact,

FIG. 4 is a front elevation of one flat contact with the projection,

FIG. 5 is a plan view of FIG. 1,

FIG. 6 is a side elevation of FIG. 1,

FIG. 7 is a front elevation of the other flat contact with the entrainment member or bearing,

FIG. 8 is a plan view of FIG. 7,

FIG. 9 is a side elevation of FIG. 7,

FIG. 10 is a front elevation of the two flat contacts forming the double contact in an embodiment where they act as preliminary and main contact,

FIG. 11 is a side elevation of FIG. 10,

FIG. 12 shows the preliminary contact already raised and the main contact still making contact as the actuating cam moves in one direction shown by the arrow,

FIG. 13 shows the preliminary contact raised and the main contact still making contact as the cam is actuated in the other direction shown by the arrow, and

FIG. 14 is a plan view of a printed circuit comprising the double contact.

FIG. 1 shows a cam switch with a printed circuit in the form of a base 2 with conductive coatings 3 printed on it provided on the base plate 1 thereof. A second printed circuit, also comprising an upper base 4 with conductive coatings 5 printed on it, is provided parallel with and above the base 2 and is attached, for example, by means of spacing sleeves 6 and screws 7. A cam plate 8 is fixed on a shaft 9 between the bases 2, 4 and can be turned axially by means of a rotary knob 10. The cam plate 8 is provided in known manner with concentric grooves 11 having cam-like raised or lowered portions 12 depending on the application. The cam switch is suitably covered, for example by a casing cap 13 detachably fixed to the base plate 1. In the embodiment illustrated the angled end is provided at the end of the flat contact so that the latter has an angular shape. Reference will hereafter be made to a first angled arm, which is provided above the topmost base, and to a second angled arm, which adjoins the first at right angles and extends through the bases.

FIGS. 1 to 3 show the first angled arm 14 and the second angled arm 15, which together form the flat contact. The end of the second arm 15 forms a bearing 16, is substantially semi-circular and bears on the conductive coating 3 with a resilient frictional connection owing to the action of a spring 17. The spring 17 is pushed over a guide pin 18 mounted on the first angled arm 14 near the vertex and in the opposite direction from the second arm 15. The guide pin 18 extends into a slot 19 in the casing cap 13, in the inner wall of which the spring 17 is supported. The simplest way of mounting the flat contact in the switch is to push the second angled arm 15 through a guide slot 24 in the upper base 4 and to insert the cam slide 20 at the free end of the first arm 14 through a guide passage 21 through the upper base 4 into the concentric groove 11 in the cam plate 8 below. When all the flat contacts have been arranged as described above the casing cap 13 is put on, so that the guide pins 18 enter the guide slots 19 and the springs 17 receive a bias whereby, as already described, the bearing 16 makes contact with the conductive coating 3 and the sensing contact 22 near the cam slide 20 forms a resilient frictional connection with the conductive coating 5 of the upper base 4. As the guide pin 18 is nearer to the bearing 16 than to the sensing contact 22, the bearing 16 will move along the conductive coating 3 with a resilient frictional connection even if the cam slide 20 is raised by a cam 12 on the rotating cam plate 8 and the sensing contact 22 is consequently also raised in the direction of the arrow 23. Although the flat contact is kept upright by the guide slots 19, 24 and the guide aperture 21, it may be an advantage to provide a guide sleeve 25 for the second arm 15 on the base 2.

FIG. 3 shows a modified embodiment of this flat contact according to the invention in the form of a switching member between the conductive coating **3** on the base **2** and a stationary contact **26**, the latter being mounted on a stationary opposed bearing surface, for example on the casing cap **13**. It will be seen from FIG. 3 that a second guide pin **27** may be arranged on the first angled arm **14** near the cam slide **20** also in the opposite direction from the second arm **15**. The pin **27** may extend into a guide slot **19** in the casing cap **13**, thereby greatly improving the upright guidance of the flat contact. As FIG. 3 also shows, the guide pin **18** and, if desired, the guide pin **27** may be extended and provided with a terminal strip **28**, for example for attaching flexible leads (not shown) in a conductive manner.

FIGS. 10 to 14 show the base **29**. This may be made of hard paper or a piece of sprayed plastic. Conductive contact tracks **31**, **32** are provided on the top **30** of the base in known manner. The base contains a flat slot **34** also acting as a guide for the flat contacts **33**, **35** which together form the double contact. The flat contacts are arranged upright as stamped members and can either be raised in the direction of the arrow **37** by the actuating cam **36** or vertically reciprocated in the direction of the arrow **46** also.

Depending on the direction **37**, **46** in which the cam **36** is moved, the raising contact **38** will be on one side of the flat contacts **33**, **35** and the stationary contact **39** on the other. The raising contact **38** is at the left in FIG. 12 and at the right in FIG. 13, relatively to the stamping **43**. The stamping **43** has two lugs **44**, **45** which act as a guide for the cylindrical spring **41**. The spring **41** is supported against the underside **47** of the base **29**, as the slot **34** is correspondingly narrower. This attachment can be seen in FIG. 14 and in the main application. The width of the projection **42** from the two flat contacts **33**, **35** is approximately equal to the length of the slot **34**.

In FIG. 4 one flat contact **35** also has a projection **48** which is marked in it as a lug during the stamping process. The other flat contact **33** has a shoulder **49** which entrains the projection **48** when the contact **33** moves in the direction of the arrow **50**. The flat contacts **33**, **35** carry lugs **51**, **52** at both ends, these being designed as contacts to form a connection with the opposed contacts provided by the conductive tracks **31**, **32**.

In FIG. 10 the projection **48** is provided at a distance **53** above the shoulder **49**. In this position, however, the lugs **51**, **52** rest firmly on their opposed contacts, i.e., on the conductive contact tracks **31**, **32** by the action of the cylindrical spring **41**. If, as shown in FIG. 12, the actuating cam **36** is moved in the direction of the arrow **37**, then the lug **51** of the flat contact **33** is first lifted off the contact track **31** until the shoulder **49** acting as an entrainment member is applied to the projection **48**. The gap **54** now left between the lug **51** and the contact track **31** as shown in FIG. 12 makes this lug into a preliminary contact for the subsequently moved flat contact **35**, the lug **51** of which is raised later.

If the entraining cam **36** is moved in the direction of the arrow **46** as shown in FIG. 13, then it is the lugs **52** which now act as stationary contacts **39** and remain on the conductive contact track **31**, the lug **51** of the flat contact **33** being lifted off the contact track **32** first until there is a gap **54** corresponding to the gap **53** in FIG. 10. The shoulder **49** then entrains the projection **48**. The shoulder **49** may also be rounded, i.e., designed as a bearing for the projection **48**, in which case, as shown in the rest position in FIG. 10, there is no gap **53** between the projection **48** and the shoulder or entrainment member **49** designed as a bearing. Here the lugs **51** or **52** will be lifted off the conductive tracks **31** or **32** whether the cam is actuated in the direction of the arrow **46** or **37**, so that there is now a true double contact.

I claim:

1. In a switch gear assembly having at least a first printed circuit plate, a flat contact piece of stamped metal disposed in an upright position within said switch gear assembly, one end of said contact piece being adapted to act simultaneously as a contact and as a bearing surface, and the other end of said contact piece having a contact portion and a cam follower portion, a cam movably mounted within said switch gear assembly, said contact piece having a projection disposed between the ends thereof and off center with respect thereto, said projection of said contact piece projecting into a guide aperture in a stationary portion of said switchgear assembly and a helical spring disposed on said projection, said spring being compressed between said contact piece and a portion of said switchgear assembly, said spring urging said one end of said contact piece into contact with said printed circuit plate and said cam follower portion of said other end of said contact piece into contact with said cam.

2. The flat contact piece of claim **1** including a second flat contact piece disposed within said switchgear assembly adjacent said flat contact piece, said contact piece being connected to said second contact piece by an entrainment member such that when said contact piece is caused to be raised, said second contact piece is raised by said entrainment member.

3. The flat contact piece of claim **1** wherein said projection on said contact piece is a guide pin, and said spring is mounted on said guide pin and wherein said switchgear assembly includes a casing cover, said casing cover having a guide aperture into which said guide pin projects.

4. The flat contact piece of claim **1** wherein said other end of said contact piece is in the form of a first angled arm and said one end of said contact piece is in the form of a second angled arm, said second angled arm being in the form of a bearing.

5. The flat contact piece of claim **4** including a second printed circuit plate disposed parallel to said first plate, wherein said bearing of said second angled arm contacts a conductive coating on said first printed circuit plate and the contact portion of said first angled arm contacts a conductive coating on said second printed circuit plate, said second plate having a guide slot through which said second angled arm is passed.

6. The flat contact piece of claim **4** including a stationary contact on a stationary bearing surface mounted on said switchgear assembly wherein said bearing of second angled arm contacts a conductive coating on said printed circuit plate and said contact portion of said first angled arm contacting said stationary contact.

7. The flat contact piece of claim **6** wherein said stationary contact is designed as an upright guide for said first angled arm.

8. The flat contact piece of claim **5** wherein said first printed circuit plate is provided with a guide sleeve for keeping said second angled arm in an upright position.

9. The flat contact piece of claim **4** wherein said first angled arm is provided with a second projection in the form of a guide pin, said second projection being disposed near the free end of said first angled arm, said second projection projecting in a direction opposite from said second angled arm, said switchgear assembly having a slot through which said second guide pin extends.

10. The flat contact piece of claim **3** wherein said guide pin is elongated, the end of said pin being designed in the form of a connecting cover plate for flexible leads.

11. The flat contact piece of claim **9** wherein said second guide pin is elongated, the end of said second pin being designed in the form of a connecting cover plate for flexible leads.

12. The flat contact piece of claim **2** wherein said entrainment member comprises a shoulder provided on said first flat contact piece and a projection provided on said second contact piece at a distance above said shoulder such that when said first contact piece is raised, said shoulder thereon will bear against said projection on said second contact piece thereby to raise said second contact

piece, said second contact piece being the preliminary contact for said first contact piece.

13. The flat contact piece of claim 2 wherein said entrainment member is a shoulder provided on said first flat contact piece, said second flat contact piece having a projection which bears against said shoulder of said first contact piece when said first contact piece is closed.

14. The flat contact piece of claim 2 wherein the end of said first contact piece adapted to be raised and the end of said second contact piece adapted to be raised are comprised of different contact materials.

15. The flat contact piece of claim 2 wherein said first flat contact piece is adapted to be raised first by the action of said cam on said cam follower portion of said first contact piece.

16. The flat contact piece of claim 2 wherein said entrainment member comprises a projection on said second contact piece and said cam follower portion of said first contact piece is disposed near the opposite end of said first contact piece from said projection on said second contact piece.

17. The flat contact piece of claim 2 wherein said entrainment member comprises a shoulder on said first contact piece and a projection on said second contact piece spaced above said shoulder such that when said cam follower portion of said first contact is caused to move in a direction towards said entrainment member, the ends of said contact pieces nearest said entrainment

member will be raised, said contact pieces thus acting as a main and preliminary contact and such that when said cam follower portion is moved towards the ends opposite from said entrainment member, the opposite ends of said contact pieces will be raised, thus also acting as main and preliminary contacts whereby the ends of said contact pieces which are not raised always remain in contact with their respective opposed contact surface.

18. The flat contact piece of claim 2 wherein said entrainment member includes a projection pressed out in the form of a lug from said first contact piece.

19. The flat contact piece of claim 2 wherein said first and said second contact pieces have asymmetrical apertures which are adapted to receive said spring, said apertures being aligned when said entrainment member acts on said second contact piece.

20. The flat contact piece of claim 12 wherein contact piece having said cam follower portion is designed as the preliminary contact.

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