Jan. 27, 1970 D. J. NEVILLE ET AL 3,492,420

PLATEN SWITCH

Filed May 29, 1967 2 Sheets-Sheet 1

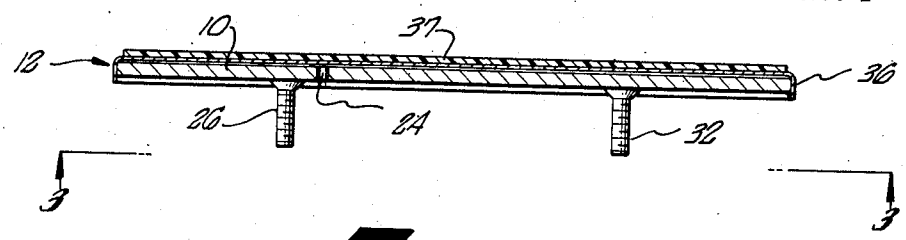


FIG. 1

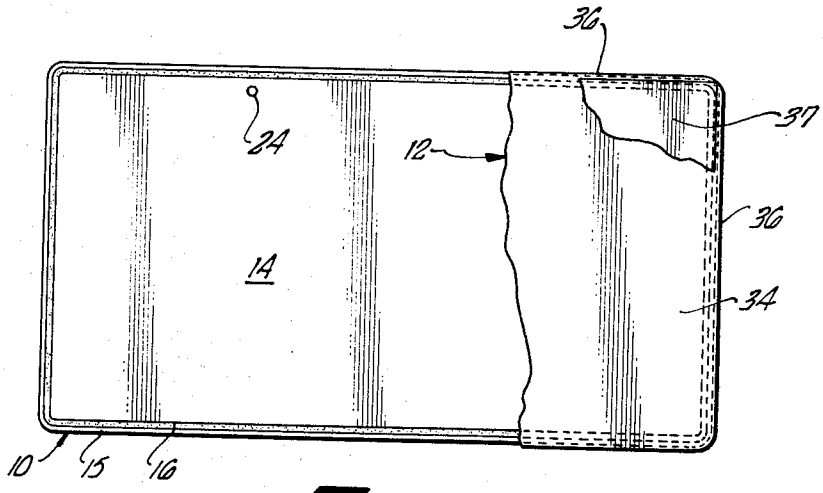


FIG. 2

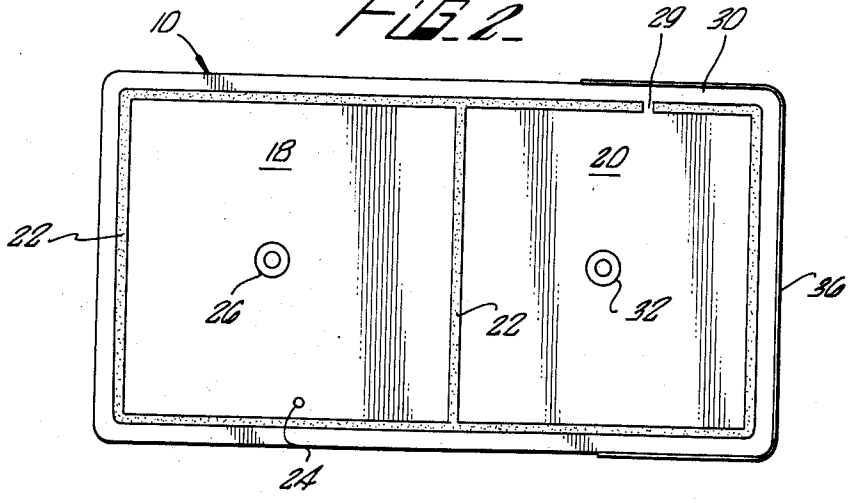


FIG. 3

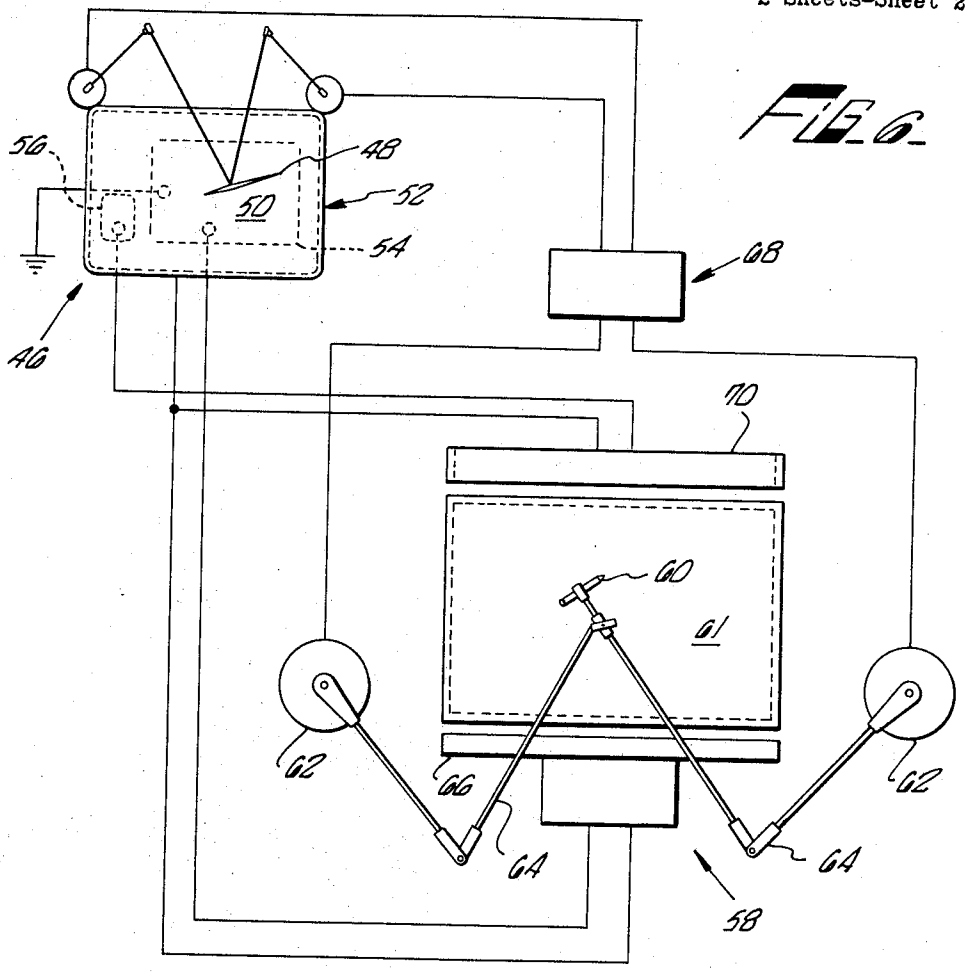
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FIG. 6



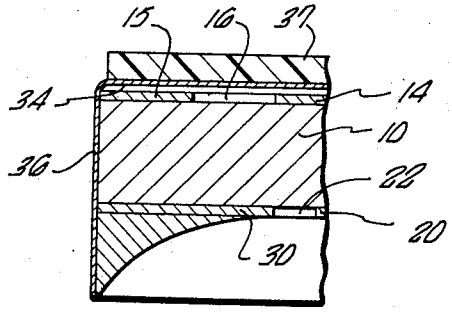


FIG. 5

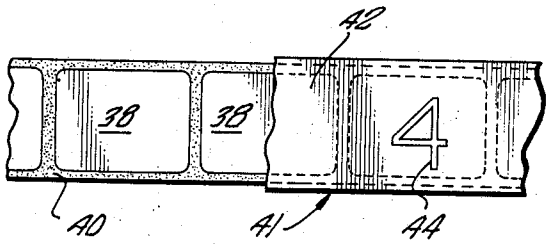


FIG. 4

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United States Patent Office

3,492,420

Patented Jan. 27, 1970

3,492,420

PLATEN SWITCH

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Filed May 29, 1967, Ser. No. 642,018

Int. Cl. G08b 5/00; H01h 43/08

U.S. Cl. 178—18 6 Claims

ABSTRACT OF THE DISCLOSURE

A platen switch having a substrate insulating base with an electrically conductive surface on its exterior that is connected with a terminal. A cup-shaped diaphragm is mounted closely adjacent the surface on the base. When depressed, the diaphragm contacts the surface and closes an electrical circuit.

BACKGROUND OF THE INVENTION

This invention relates to platen switches. Although it has a great variety of applications, it is particularly well adapted for use in conjunction with a telescriber where messages are handwritten at a transmitting station and are reproduced at a receiving station.

Platen switches have long been used but have suffered from several shortcomings. One such platen switch, for example, is disclosed in U.S. Patent 2,975,235, issued on Mar. 14, 1961 to R. G. Leitner et al. That switch utilizes a resilient plastic diaphragm coated with an electrically conductive material on one side. The switch requires a relatively large force to sufficiently deflect the diaphragm. In order to obtain a diaphragm of sufficient strength it must be constructed of a relatively thick material. Moreover, the resiliency of the plastic material varies with temperature changes. To insure proper functioning at all temperatures, the travel of the diaphragm must be relatively large. If the force applied to the diaphragm is small, as in the case where the switch is used in conjunction with a telescriber, it might fail to make contact, thereby causing a failure of the telescriber.

Other switches that are actuated by pressure applied to a surface include pivotally mounted plates that are spring-biased away from a contact surface. The pressure applied when writing on the surface, for example, pivots the plate into contact with the opposing surface. These mechanically operated and controlled devices not only require a large amount of force and a relatively long travel of the pivoting plate, but they also malfunction frequently. Foreign particles collect between the contacting surfaces, or prolonged use of the pivoting plate might cause it to become warped. Any one of these side effects causes the switch to fail.

SUMMARY OF THE INVENTION

This invention provides a switch of great sensitivity, coupled with small travel which is virtually failsafe. A base plate or insulative substrate is provided with electrically conductive contact surfaces. Permanently secured to the base plate is a cup-shaped shell. The shell forms a diaphragm which is disposed parallel to and closely adjacent the electrically conductive surface. A slight amount of pressure applied to the diaphragm causes it to contact the base plate and close an electric circuit. The diaphragm is constructed such that it will contact the base plate only at those points where pressure is directly applied to it. The diaphragm and the contact surface are connected with electric terminals to enable the switch to be inserted in an electric circuit.

This platen switch eliminates the shortcomings encountered in the prior art. The diaphragm is constructed of metal which is elastically deformed when the switch is operated. The elasticity of the metal does not change within the temperature variations to which the switch is subjected. The contact is obtained by warping the metal diaphragm within the elastic range of the metal at the point where pressure is applied. Release of the pressure instantaneously returns the diaphragm to its original position. This action is obtained by constructing the diaphragm with transverse side walls that are secured to the base plate such that the diaphragm is subject to a compressive force and is biased away from the base plate. The size of the switch can thereby be substantially increased over the greatest possible size of switches constructed according to the prior art.

Since the base and the diaphragm are heremetically secured to each other, there is no danger of contaminating the space between them. Failures of the switch due to contamination of the contacting surfaces are thereby eliminated. Moreover, adjustments after the switch has been assembled are not necessary, since at no time does permanent deformation of the diaphragm material occur.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional elevation of the platen switch;

FIG. 2 is a plan view of the platen switch with portions broken away;

FIG. 3 is a plan view taken along line 3—3 of FIG. 1;

FIG. 4 is an enlarged detail in cross-section of an edge of the platen switch;

FIG. 5 is a plan view of another embodiment of the invention; and

FIG. 6 is a schematic drawing showing the platen switch installed in a telescribing apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1 through 4 show a platen switch constructed according to this invention. The switch comprises a base plate **10**, a shell **12** and a contact surface **14**. The base plate is preferably constructed of an electrically insulating material, such as printed circuit fiberboard which is customarily used in conjunction with electric circuit boards. The surfaces of the base plate receive a metal coating such as copper. The metal coating is suitably etched away to insulate the desired electrically conductive surfaces described below. One such surface is contact surface **14**, best shown in FIG. 2. The contact surface substantially covers one side of the base plate. It is insulated from a narrow strip **15** of metal coating along the outside edge of the base plate by etching away the coating to form an insulating strip **16** parallel to the contour of the base plate.

The opposite side of the base plate is also metal-coated and is etched to form first and second terminal surfaces **18** and **20**. The two surfaces are insulated from each other by an insulating strip **22** that is most conveniently obtained by etching away the metal coating. The first terminal surface **18** is suitably connected to the contact surface **14**, such as by drilling a hole **24** through both surfaces and the base plate and then metal-coating the hole, as shown in FIG. 1. A terminal pin **26** is secured to the first terminal surface.

As best seen in FIG. 3, the second terminal surface **20** includes an approximately square center portion which is electrically connected at **29** to a narrow metal strip **30** that follows the contour of the base plate substantially like the metal strip **15** on the opposite side of the

base plate. A second terminal pin **32** is secured to the center portion of the second terminal surface **20**.

As best seen in FIGS. 1, 2 and 4, the shell **12** includes a diaphragm portion **34** and side walls **36** that extend transversely to and that are preferably integral with the diaphragm. The shell is formed from a flat sheet (not shown) on a conventional die. Care must be taken when the shell is formed to insure a radius of about .003 to .006 inch between the side wall and the diaphragm and to not crimp the transitional portion of the shell. See FIG. 4. The radius between the diaphragm and the side walls biases the diaphragm away from the base plate such that the distance between the diaphragm and the base plate is slightly more at the center of the diaphragm than adjacent the radius. The magnitude of the difference is less than about ½-thousandth of an inch. Its presence however is important for the proper functioning of the switch. It subjects the diaphragm to a compressive force which is overcome by an object asserting pressure thereagainst. The immediate vicinity of the pressure point is deflected and touches the contact surface **14** whereby the switch is operated. A crimped corner would bias the diaphragm toward the base plate and into a position where it touches the contact surface.

The outline of the diaphragm corresponds to the contour of the base plate **10**. To assemble the shell and the base plate, the shell is slipped over the base plate and the side walls **36** extend beyond the lower face of the base plate. Prior to securing the shell to the base plate, the shell is positioned such that a gap exists between the shell and the contact surface **14** on the base plate. This gap is between about .002 and about .004 inch to insure proper functioning of the switch together with minimal travel of the diaphragm. The gap is automatically obtained when the shell is positioned since the radius between the diaphragm and the side walls engages the metal strip **15** on the base plate. The radius determines how far the base plate can be inserted into the shell and thereby determines the magnitude of the gap. The side walls are then secured to the base plate and electrically connected with the second terminal surface **20**. Most conveniently, this is done by holding the shell against the base plate and soldering the side walls **36** to the metal strip **30**.

The contact surface **14** and the side of the diaphragm **34** facing it must be kept clean prior to assembling the parts. Foreign particles disposed between the surfaces can cause malfunctioning of the switch since they can prevent the surfaces from making contact.

The shell is constructed of a relatively springy material, having a high degree of elasticity to give an instantaneous spring back and to eliminate the danger of metal fatigue in the range of deflection it is subjected to, i.e. about .002 to .004 inch. The material must further retain its properties under the temperature variations to which the switch is exposed, say from about 0° F. to about 140° F. One such material is beryllium copper. By using beryllium copper, the spring back is instantaneous and no danger of fatigue or permanent deformation of the diaphragm exists. To insure against oxidation of either the contact surface **14** or the diaphragm, both are plated with a non-corrosive material, such as gold, for example.

If the platen switch is actuated by a sharp object, as where it is used in conjunction with a telescriber where the switch is actuated by writing on the exterior surface of the diaphragm, the diaphragm is preferably coated on the outer surface with a thin layer **37** of a resilient material, such as vinyl. The coating prevents the diaphragm from becoming embossed by the writing instrument. Furthermore, it gives a comfortable, pad-like feeling while writing on it.

In operation, the terminals **26** and **32** of the platen switch are connected to a power source in an electric circuit which is interrupted between the contact surface **14** and the shell **12**. The diaphragm **34** is closely adjacent the contact surface **14** and at a substantially uniform distance from it. A slight depression of the diaphragm causes it to contact the contact surface **14**, whereby the electric circuit is closed. Due to its thinness and elasticity, the diaphragm contacts the contact surface only at those points that are directly pressurized. All other points of the diaphragm are disengaged from the contact surface. This makes the platen switch particularly well adapted for use in a telescriber which electrically senses the writing point.

Where the switch is exposed to substantial atmospheric pressure changes, it is desirable to include a vent hole in the base to eliminate any pressure differential between the space between the diaphragm and the contact surface and the outside atmosphere. The vent hole may be the hole **24** used for establishing electric contact between the contact surface **14** and the first terminal surface **18**.

In an alternative embodiment of this invention, the space between the diaphragm **34** and the contact surface **14** is filled with an electrically insulating liquid, such as oil. Depression of the diaphragm displaces the oil under the pressure point and establishes contact. When the pressure is released, the oil aids in returning the diaphragm to its original position. This is especially desirable and helpful in instances where the platen switch is of a large size. Instead of using a liquid, gas of a pressure greater than that of the environment where the switch is located may be utilized. Although gas tends to pillow the diaphragm in the center, it is more desirable than a liquid because it reacts more quickly to the release of the pressure on the diaphragm. A third variation is to place a pressure sensitive insulating coating such as an oxide, a semiconductor or carbon on the diaphragm or the contact surface **14**. Pressure applied to the diaphragm temporarily displaces or electrically breaks the coating under the pressure point and permits the two surfaces to make an electric contact.

FIG. 5 shows a second preferred embodiment of the platen switch and employs a plurality of contact surfaces **38** which are insulated from each other. Preferably, the contact surfaces are metal coatings applied to an insulating base plate **40** as described in conjunction with contact surface **14** and base plate **10**. The contact surfaces **38** are spaced in any convenient manner such as in a row, as shown in FIG.5, or in a square (not shown). A shell **41**, including a diaphragm **42**, is constructed in the same manner as shell **12**. Each contact surface **38** is provided with a terminal (not shown) to connect it with an electric circuit. To identify the various contact surfaces **38** and the corresponding electric circuits, the diaphragm **42** is embossed with an identifying mark **44**, which may be a letter, a number, or any other symbol. Alternatively, the marks are stenciled, stamped, or otherwise applied to the exterior face of the diaphragm **42**.

This embodiment of the invention is particularly advantageous for use in conjunction with data collection equipment where a large number of circuits are selectively energized to emit electric signals which are recorded on magnetic tape, coded onto punched cards, etc.

Referring now to FIG. 6, a platen switch **46** constructed according to this invention is shown in conjunction with a telescriber. Messages are written with a transmitting stylus **48** on paper (not shown) located on a diaphragm **50** of the platen switch at a transmitting station **52**. The diaphragm overlies first and second contact surfaces **54** and **56**.

The receiving station **58** includes a receiving stylus **60** adjacent a writing surface **61**. The stylus is connected to a pair of electric motors **62** by a linkage **64**. A solenoid-actuated lifter **66** is adjacent the linkage and, when energized, engages the stylus with the writing surface **61**. Transmitting means **68** are electrically connected with contact surface **54** and actuate motors **62** in response to movements of the transmitting stylus **48**. The linkage **64**

relates the movements of the motor to the receiving stylus **60** whereby the movements of stylus **48** are reproduced.

An electric circuit connects lifter **66** with the platen switch such that the circuit is interrupted between the diaphragm **50** and the first contact surface **54**. As long as the circuit is interrupted, the receiving stylus is disengaged from the writing surface **61**. Any movements of the receiving stylus **60** will therefore leave no visible marks. When the transmitting stylus **48** is placed on the paper on diaphragm **50**, the light pressure exerted thereby is sufficient to depress the diaphragm. This closes the electric circuit, energizes the lifter **66** and causes the receiving stylus **60** to engage the writing surface **61**. Its movements now leave visible marks and the message written at the transmitting station **52** is reproduced on the writing surface at the receiving station. If the writer lifts the transmitting stylus from the paper, as where he changes lines, for example, the lifter disengages the receiving stylus since the diaphragm **50** returns to its original position the instant the pen is removed therefrom.

The second contact surface **56** is utilized to accomplish any one of a number of desired operations. As shown in FIG. 6, contact surface **56** is electrically connected with a paper feed **70** at the receiving station. In order to advance additional paper, the writer, at the transmitting station, touches the diaphragm overlying the second contact surface **56**. The resulting electric signal energizes the paper feed to advance additional paper at the receiving station. Preferably, a similar paper feed (not shown) advances paper at the transmitting station and actuated by the same electric signal.

The use of the platen switch in a telescriber as shown in FIG. 6 offers a number of advantages. The minute travel of the diaphragm to establish contact whereby the receiving stylus begins to reproduce the message on the paper at the receiving station is not noticeable by the writer. The switch conveys the feeling as if the writing surface were solid. The proximity of the second contact surface **56** to actuate the paper feed, for example, is convenient to the writer and permits him to concentrate on the messages he is to write down rather than on the operation of the telescribing machine.

What is claimed is:

1. In a transmitting apparatus including a stylus for writnig messages on a first surface at a transmitting station, a stylus at a receiving station for reproducing the messages from the transmitting station on a second surface, means for providing displacements of the receiving stylus in response to and in accordance with displacements of the transmitting stylus, and means for disengaging the receiving stylus from contact with the second surface in response to the lifting of the transmitting stylus from the first surface, the improvement which comprises a substantially planar base plate provided with an electrically conductive contact surface a cup-shaped shell including a substantially flat diaphragm overlying parallel to and closely adjacent the contact surface and providing a writing surface, the shell being secured to the side of the base plate, electrically insulated from the contact surface, and constructed such that the diaphragm contacts the contact surface only at points where pressure is directly applied to the diaphragm by the transmitting stylus and means for connecting the contact surface and the shell with the means for disengaging the receiving stylus.

2. Apparatus according to claim **1** wherein the exterior surface of the diaphragm is coated with a layer of a resilient, insulating material.

3. Apparatus according to claim **1** wherein the diaphragm travels about 0.002 inch to about 0.004 inch to contact the contact surface.

4. Apparatus according to claim **1** wherein the shell includes a side wall transverse to the diaphragm and the transition between the walls and the diaphragm includes a radius.

5. Apparatus according to claim **4** wherein the base plate includes a conductive surface along the periphery of the base plate which is electrically insulated from the contact surface and wherein the side walls are soldered onto the conductive surface.

6. Apparatus according to claim **1** wherein the base plate is provided with a plurality of contact surfaces that are electrically insulated from each other and including means for connecting the shell and each contact surface to an electric potential to permit emission of a plurality of independent electric signals.

References Cited

UNITED STATES PATENTS

3,008,122	11/1961	Anderson et al.	178—18
3,196,974	7/1965	Barnes	200—83.8
3,308,253	3/1967	Krakinowski	200—86

THOMAS A. ROBINSON, Primary Examiner

U.S. Cl. X.R.

200—46, 83, 86