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Peterson

[11] **3,838,234**

[45] **Sept. 24, 1974**

[54] **HINGE THROUGH WHICH AN ELECTRICAL CIRCUIT IS COMPLETED WITH MEANS TO INTERRUPT THE CIRCUIT**

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[73] Assignee: **C. Hager & Sons Hinge Manufacturing Company,** St. Louis, Mo.

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[52] **U.S. Cl.** **200/61.7,** 339/4

[51] **Int. Cl.** **H01h 3/16**

[58] **Field of Search** 200/61.62, 61.82; 339/4, 339/6, 8

[56] **References Cited**

UNITED STATES PATENTS

426,705	4/1890	Bleakley	200/61.7
612,192	10/1898	Chandler	339/4
1,744,040	1/1930	Elzer	339/4
1,861,547	6/1932	Parkhurst	200/61.7
2,608,638	8/1952	Daiger	339/4 UX
2,778,000	1/1957	Mills	339/4

FOREIGN PATENTS OR APPLICATIONS

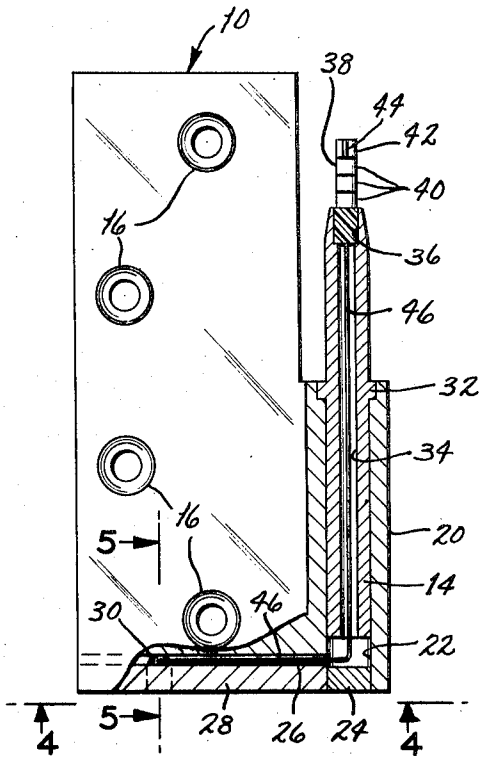
1,132,635	11/1956	France	339/4

Primary Examiner—James R. Scott
Attorney, Agent, or Firm—Gravely, Lieder & Woodruff

[57] **ABSTRACT**

A hinge has leaves provided with aligned knuckles through which a hinge pin extends. The pin is anchored to the knuckle of one of the leaves and carries a dielectric contact spindle on which slip rings are mounted. The knuckle of the other leaf has a dielectric receptacle provided with contact blades which engage the slip rings. The engaged contact blades and slip rings complete electrical circuits through the hinge, but do not interfere with disassembly of the hinge. One slip ring is split so that the circuit through it is interrupted when the hinge reaches a prescribed position. Wires extend from the slip rings and contact blades through the hinge knuckles and also through grooves milled into the end edges of the leaves, and are thereby completely concealed.

16 Claims, 10 Drawing Figures



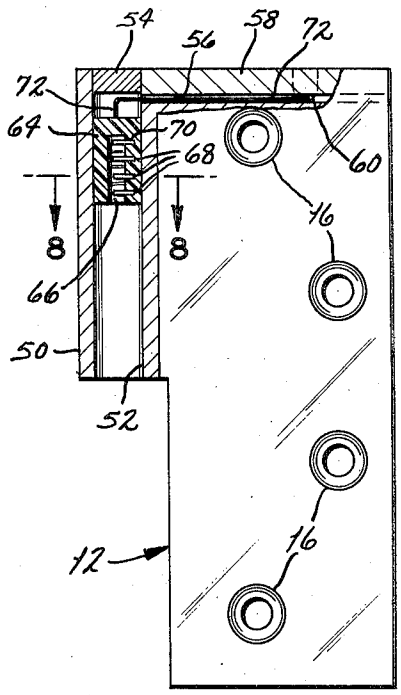
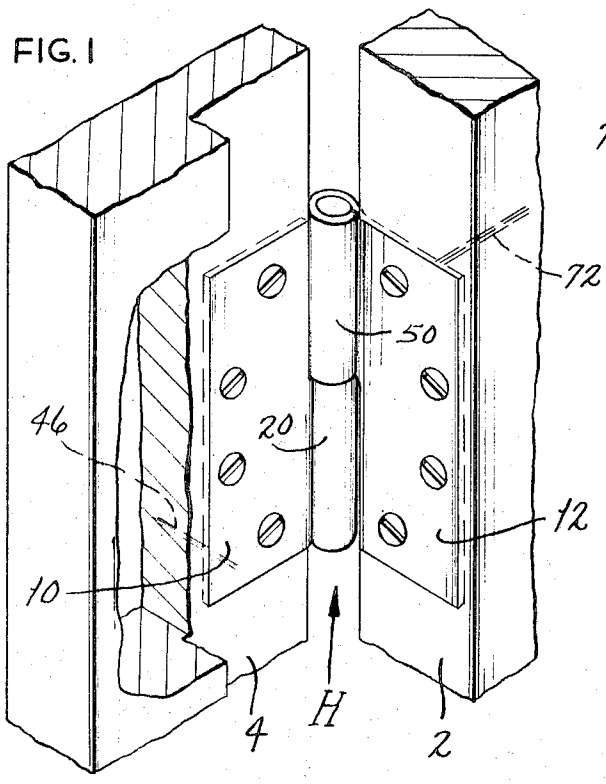


FIG. 1



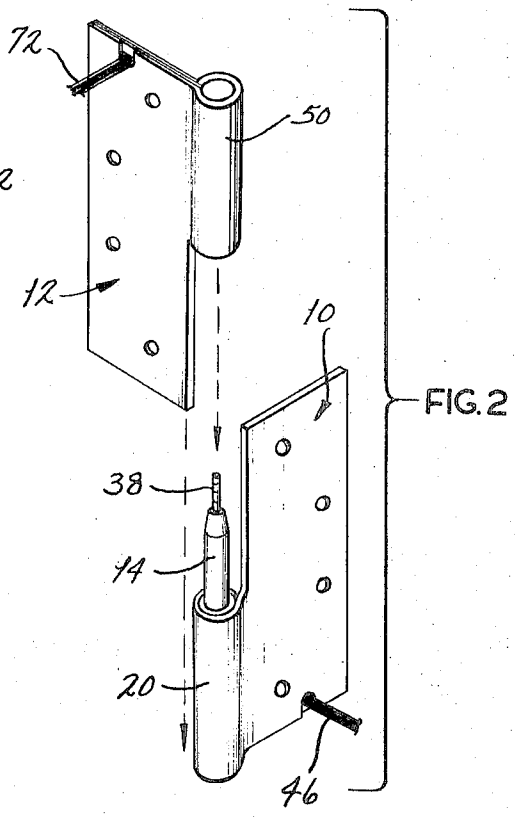


FIG. 2

FIG. 3

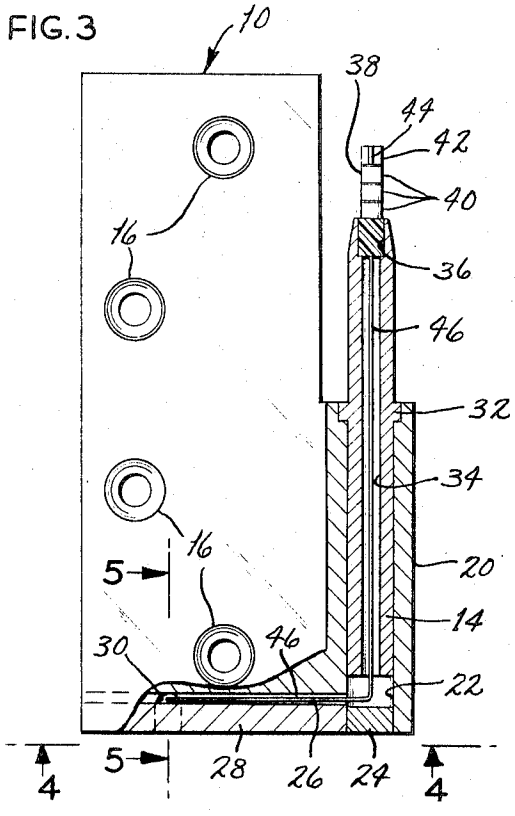


FIG. 7

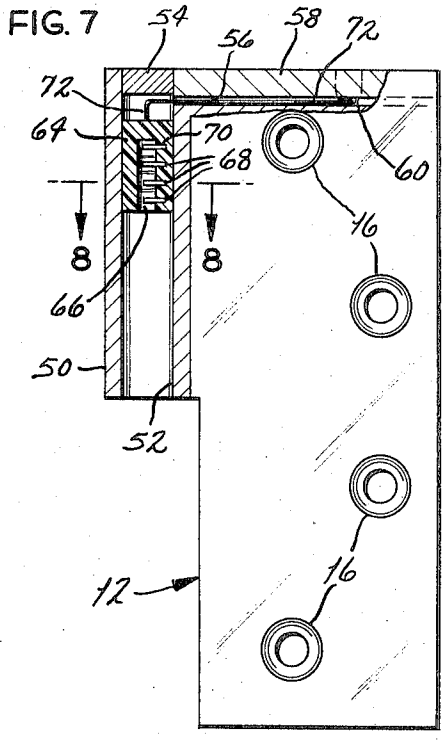


FIG. 4

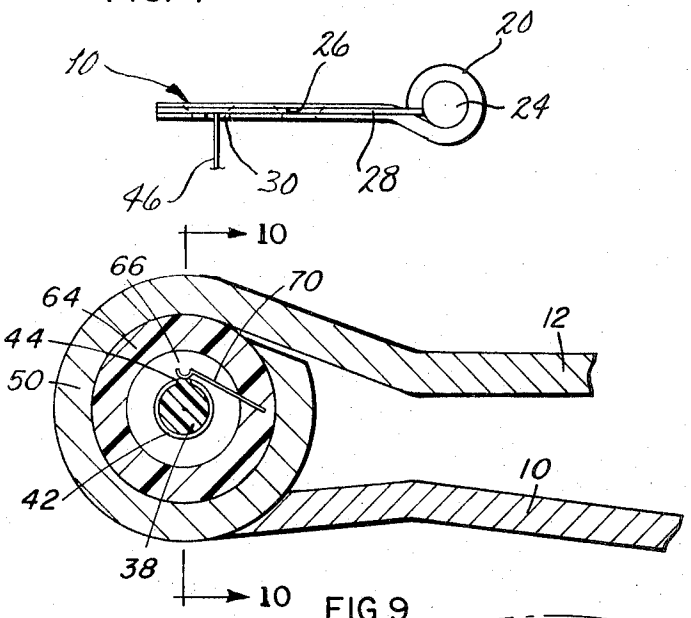


FIG. 5

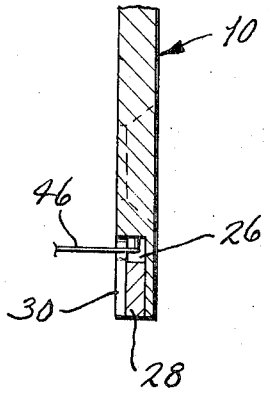


FIG. 9

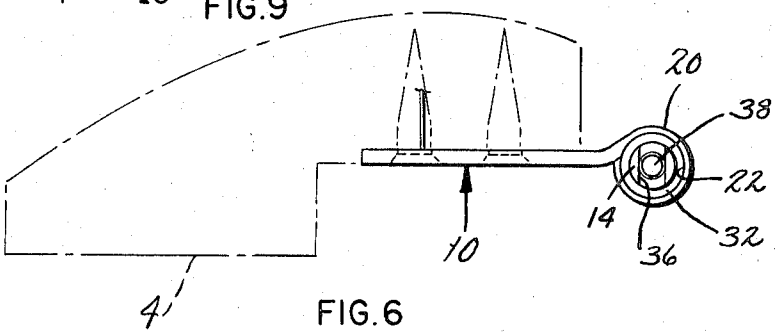


FIG. 6

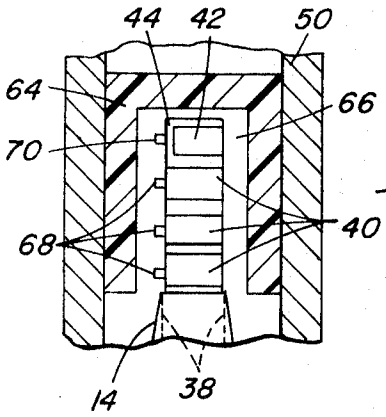
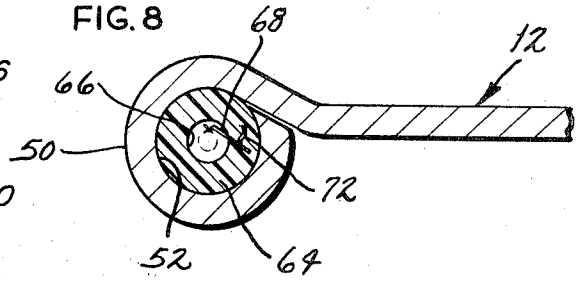


FIG. 10

FIG. 8



HINGE THROUGH WHICH AN ELECTRICAL CIRCUIT IS COMPLETED WITH MEANS TO INTERRUPT THE CIRCUIT

BACKGROUND OF THE INVENTION

This invention relates in general to hinges and, more particularly, to a hinge through which an electrical circuit is completed.

To provide better security for office and other types of commercial buildings, the owners of such buildings are turning more and more to electrically operated surveillance systems. These systems monitor doors at critical locations in the buildings as well as the locks on such doors, and energize an alarm in a remote security office when a door is opened by an unauthorized person or when the lock for the door is not properly set.

One way to maintain surveillance over a door and its lock is to hinge the door on a so-called contact hinge. A hinge of this nature is disclosed in U.S. Pat. No. 3,659,063 and includes spring loaded contactors in one leaf and a corresponding number of contacts in the other leaf. When the door is closed the contactors engage the contacts, thus enabling electrical circuits to be completed through the hinge. In more sophisticated arrangements, several circuits are completed through the hinge, and most of them are extended to the lock for controlling it or maintaining surveillance over it. However, one of the circuits usually maintains surveillance over the hinge itself, and the circuit sounds an alarm when broken at the hinge, thus indicating that the door is open. In a contact hinge of the foregoing type, the contacts and contactors are exposed when the door is open or slightly ajar, and one knowing the circuitry could foil the security system by shorting out the proper contacts or contactors.

A way to maintain surveillance over the door alone is to use a so-called switch hinge. A hinge of this type is disclosed in U.S. Pat. No. 3,715,537 and one leaf of the hinge has a switch which is actuated when the hinge opens. Again the switch is exposed when the door is open or slightly ajar.

Hinges also exist having hollow pins through which wires extend. These hinges are of course suitable for maintaining surveillance over locks in the doors on which they are installed, but they do not permit easy removal of the door for repairs of refitting. Moreover, hinges of this nature usually have holes drilled transversely through the leaves thereof to house wires without exposing those wires when the door is open. These holes are extremely difficult to drill and result in many rejected hinge leaves.

SUMMARY OF THE INVENTION

One of the principal objects of the present invention is to provide a hinge for extending an electrical circuit into a door without exposing any of the wires of the circuit either when the door is open or closed. Another object is to provide a hinge which alters an electrical circuit as the door moves away from its fully closed position without exposing any of the electrical circuitry, either when the door is open or closed. A further object is to provide a hinge of the type stated which enables the door to be easily removed from its door frame. An additional object is to provide a hinge of the type stated which is easily manufactured and does not result in a high parts rejection rate. These and other objects and advantages will become apparent hereinafter.

The present invention is embodied in a hinge having slip rings and contact elements carried by different knuckles thereof so that an electrical circuit can be completed through the hinge. One of the slip rings is split to break a circuit when the hinge reaches a prescribed position. The leaves have grooves in which the wires of the circuit are contained. The invention also consists in the parts and in the arrangements and combinations of parts hereinafter described and claimed.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form part of the specification and wherein like numerals and letters refer to like parts wherever they occur.

FIG. 1 is a perspective view of the hinge of the present invention set into a hinge jam and door;

FIG. 2 is an exploded perspective view showing the hinge from its back side;

FIG. 3 is an elevational view, partially broken away and in section, of the frame leaf of the hinge;

FIGS. 4 and 5 are sectional views taken along lines 4—4 and 5—5, respectively, of FIG. 3;

FIG. 6 is a top view of the frame leaf and hinge pin;

FIG. 7 is a elevational view, partially broken away and in section, of the door leaf of the hinge;

FIG. 8 is a sectional view taken along line 8—8 of FIG. 7;

FIG. 9 is a sectional view taken perpendicular to the hinge axis at the split slip ring when the contact blade for that ring is at the slit so that the blade is electrically isolated from the ring; and

FIG. 10 is a sectional view taken along line 10—10 of FIG. 9.

DETAILED DESCRIPTION

Referring now to the drawings (FIG. 1), H designates a full mortise hinge of the loose joint variety for supporting a door 2 on the hinge jamb 4 of a door drame. The hinge H is used in conjunction with at least one other hinge and preferably two other hinges. These other hinges (not shown) are also full mortise hinges set into the door 2 and hinge jamb 4 and may likewise be of the loose joint variety or they may be of the more typical hinge construction with three or more interlocking knuckles. The hinge H differs from the other hinges in that it possesses the capability of extending electrical circuit from the hinge jamb 4 into the door 2 for remotely operating a lock on the door 2 or for maintaining surveillance over the lock or door 2 or both. If further possesses the capability of breaking or otherwise changing an electrical circuit as it is opened to signal when the door 2 is ajar or is opened.

The hinge H includes (FIGS. 1 and 2) a frame leaf 10 and a door leaf 12, both of which are preferably formed from steel or some other suitable metal and are held together by a hinge pin 14 secured in the frame leaf 10. Each leaf 10 and 12 has a plurality of countersunk holes 16 for accommodating flat head screws used to secure the leaves 10 and 12 to the frame 4 and door 2, respectively.

The frame leaf 10 is mortised into the hinge jamb 4 with one of its side edges generally aligned with the edge of that jamb, and along the lower half of that side edge the leaf 10 is rolled into an integrally formed

knuckle 20 having a bore 20 which is counterbored at its upper end. The hinge pin 14 is pressed into the bore 22 and projects upwardly from the upper end of the knuckle 20 (FIG. 3), but does not extend all the way through the knuckle 20. Fitted into the lower end of the bore 22 is a plug 24 which closes the lower end of the knuckle 20.

Milled into the lower edge of the frame leaf 10 is a downwardly opening groove 26 (FIGS. 3–5) which extends from the bore 22 of the knuckle 20 all the way across the lower end of the leaf 10. The groove 26 receives a metal closure strip 28 which fits snugly therein, but can be easily pried out of the leaf 10 to expose the groove 26 when the leaf 10 is removed from the hinge jamb 4. The mortising of the leaf 10 conceals the closure strip 28 and prevents it from being removed when the leaf 10 is secured to the hinge jamb 4. One end of the closure strip 28 abuts the plug 24, while the other end is flush with the other side edge of the leaf 10. The closure strip 28 is not as deep as the groove 26 and as a result a small cavity exists within the leaf 10 immediately above the closure strip 28 (FIGS. 3 and 5). This cavity opens into the bore 22 of the knuckle 20 below the hinge pin 14. The cavity formed within the groove 26 opens toward the hinge jamb 4 through a notch 30 which aligns with a hole extending through the hinge jamb 4.

The hinge pin 14 is formed from steel or some other suitable metal and intermediate its ends it is provided with a flange 32 which fits into the upper counterbore in the bore 22 and locates the pin axially within the knuckle 20 (FIG. 3). The hinge pin 14 has a bore 34 extending completely through it and at its upper end is tapered and provided with a cross slot 36 (FIG. 6).

Fitted into the cross slot 36 at the upper end of the hinge pin 14 is a contact spindle 38 (FIG. 3) which is formed from a dielectric material such as "Lexan." The dielectricspindle 38 is anchored firmly in the slot 36 of the pin 14 and projects upwardly from the tapered end of the hinge pin 14, remaining coaxial therewith. Embracing the spindle 38 are a plurality of metallic slip rings 40, which are axially spaced and electrically isolated from one another by the dielectric material of the spindle 38. The slip rings 40 are anchored firmly on the spindle 38 and extend 360° around it. In addition to the full slip rings 40, the dielectric spindle 38 also carries a split slip ring 42 which is anchored firmly on it. The ring 42 is much like the slip rings 40 and is electrically isolated from these rings by the dielectric material of the spindle 38. However, the slip ring 42 does not extend a full 360° around the spindle 38. On the contrary, it possesses an axially extending slit 44 which is occupied by the dielectric material of the spindle 38 (FIGS. 9 and 10). In this regard, the dielectric material extends out to the outer surfaces of the slip rings 40 and 42 so that the exposed circumferential surfaces of the slip rings 40 and 42 and of the spindle 38 are flush. In other words, the slip rings 40 and 42 are embedded in the dielectric material of the spindle 38.

Each slip ring 40 and 42 on its inside face is connected to a separate wire 44 and these wires are embedded in the dielectric material of the spindle 38. The wires 44 leave the spindle 38 and pass through the bore 34 of the hinge pin 14. At the lower end of the pin bore 34, the wires 44 enter the bore 22 of the hinge knuckle and then pass into the groove 26 extending along the bottom of the frame leaf 10. The wires 44 leave the frame leaf 10 at the notch 30 in the back thereof and pass into the hinge jamb 4 (FIG. 1), beyond which they may be connected to an alarm or remote control switch for operating a lock on the door 2.

The door leaf 12 (FIG. 7) is practically identical to the frame leaf 10, only it turned upside down with respect to the frame leaf 10. The door leaf 12 includes a knuckle 50 having a bore 52 extending through it, and this bore is sized to receive the portion of the hinge pin 14 projecting upwardly from the knuckle 20 on the frame leaf 10. A clearance fit exists between the pin 14 and the bore 52 so that the leaf 12 will pivot easily with respect to the leaf 10. The upper end of the bore 52 is fitted with a plug 54. Along the upper edge of the leaf 12 an upwardly opening groove 56 is milled into the leaf 12 and this groove 56 opens into the bore 52 of the knuckle 50. The groove 56 receives a closure strip 58 which is not as deep as the groove 56, so that a portion of the groove 56 exists below the strip 58. The strip 58 may be pried out of the groove 56, but only when the leaf 12 is removed from the door 2, since the mortising prevents such removal when the leaf 12 is attached to the door 2. The groove 56 opens rearwardly through a notch 60 in the door leaf 12, and this notch registers with a hole in the door 2 (FIG. 1).

The bore 52 of the knuckle 50 on the door leaf 12 contains a receptacle 64 (FIGS. 7 and 8) which is formed from a dielectric material such as "Lexan." The receptacle 64 is fitted tightly in the bore 52 and has a downwardly opening socket 66 which loosely receives the contact spindle 36 projecting from the hinge pin 14 on the knuckle 20 of the frame leaf 10. Embedded into the dielectric material of the receptacle 64 are metal contact blades 68, the spacing between which corresponds to the spacing between the slip rings 40 on the contact spindle 36. EAch contact blade 68 is spring loaded to bear against one of the slip rings 40 when the hinge H is assembled, and the spring loading results from the natural resiliency of the metal. Likewise, another contact blade 70 identical to the blades 68 is embedded in the dielectric material, and this blade is positioned to align with and contact the split slip ring 42. In this regard, the axial position of the receptacle 64 in the bore 52 of the knuckle 50 is such that when that knuckle 50 is fitted over the hinge pin 14 and brought against the knuckle 20, each of the contact blades 68 in the receptacle 64 will bear against a different full slip ring 40, while contact blade 70 will bear against the split slip ring 42. As to the circumferential position of the receptacle 64 with respect to the knuckle 50, it is such that the blade 70 bears against the split slip ring 42 when the leaves 10 and 12 face each other, as would be the case when the door 2 is closed, but moves across the slit 44 immediately upon the opening of the hinge 14 (FIG. 9), that is as the door 2 is opened. Moreover, the contact between the contact blade 70 and the split slip ring 42 is one of line contact so that the blade 70 does not bridge the slit 44 as it moves across it. The contact blades 68 and 70 and the contact spindle 38 are configured such that the receptacle 64 can be fitted over and removed from the spindle 36 without bending or otherwise damaging the contact blades 68 and 70. Thus, the leaves 10 and 12 of the hinge H are easily separated.

Each of the contact blades 68 and 70 is connected to a different thin wire 72 which passes through the dielectric material of the receptacle 64 and into the bore

52 of the knuckle 50. The wires 72 also pass through the groove 56 along the upper edge of the door leaf 12 and leave the leaf 12 through the notch 60 in the back face thereof. Beyond the notch 60, the wires 72 pass into the door (FIG. 1). Some of the wires 72 may be connected to an electrically operated lock for the door 2.

INSTALLATION AND OPERATION

The frame leaf 10 is installed on the hinge jamb 4 of the door frame with the hinge pin 14 projecting upwardly, while the door leaf 12 is installed on the side edge of the door 2 (FIG. 1). Both installations are of the mortise variety. The wires 72 leading from the frame leaf 10 are connected to an alarm in a remote security room, while the wires 46 leading from the door leaf 72 are connected to the lock in the door 2.

To install the door 2 in its frame, the door 2 is elevated slightly to a position in which the knuckle 50 of the door leaf 12 is above the hinge pin 14 on the frame leaf 10 (FIG. 2). With the bore 52 of the knuckle 50 aligned with the hinge pin 14, the door 2 is lowered and the hinge pin 14 enters the bore 52 of the knuckle 50. When the knuckle 50 comes to rest on knuckle 20, the contact spindle 38 will be in its proper position within the socket 66 of the dielectric receptacle 64, and in that position each contact blade 68 will engage a different full slip ring 40, while the contact blade 70 will engage either the split slip ring 42 or the slit 44 in that ring. The other hinges for the door are installed in the usual manner.

When the door 2 is completely closed, the contact blade 70 engages the split slip ring 42. However, when the door 2 opens the receptacle 64 rotates with the knuckle 50, and this rotation causes the contact blade 70 to move over the slit 44 between the ends of the ring 42 (FIG. 9). The circuitry is such that the break in the circuit through the blade 70 and the slip ring 42 causes an alarm to be energized at a remote control room. The circuits through the other contact blades 68 and their corresponding slip rings 40 remain complete irrespective of the position of the hinge.

None of the wires 46 or 72 is exposed or easily accessible so that the alarm system is almost impossible to defeat. Nevertheless, the door 2 can be removed from the hinge jamb 4 without cutting or separating any wires. Thus, maintenance work is not in any way impeded.

This invention is intended to cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure which do not constitute departures from from the spirit and scope of the invention.

What is claimed is:

1. A hinge comprising first and second leaves having aligned knuckles; a hinge pin fixed in the knuckle of the second leaf and projected beyond that knuckle into the knuckle of the first leaf for holding the leaves together while allowing them to pivot relative to each other; an insulative spindle on the hinge pin and being located within the knuckle of the first leaf, the spindle being made from a dielectric material; a slip ring on the spindle and being fixed in position with respect to the second leaf, the slip ring having a slit therein which is occupied by the dielectric material of the spindle; a contact element carried by the knuckle of the first leaf and generally fixed in position with respect to the first leaf, the contact element being positioned opposite the slip ring on the spindle such that it will contact either the slip ring or the dielectric material in the slit of the slip ring, depending on the position of the leaves, whereby at a prescribed position of the leaves the slip ring and contact element will not be in electrical contact so that an electrical current will not be conducted through the hinge and in other positions the contact element and slip ring will be in contact to conduct an electrical current through the hinge.

2. A hinge according to claim 1 wherein the slip ring is arcuate and has its center of curvature at the axis of the hinge pin.

3. A hinge according to claim 1 wherein the contact element is flexible and carried by a receptacle fixed in position in the knuckle of the first hinge, the receptacle having a socket which receives the spindle mounted on the hinge pin.

4. A hinge according to claim 1 wherein a wire extends from the slip ring axially through the knuckle on the second leaf.

5. A hinge according to claim 1 wherein each leaf has only one knuckle which extends substantially to one end edge thereof.

6. A hinge according to claim 5 wherein wires lead from the contact element and slip ring; and wherein the wire leading from the slip ring extends through the knuckle of the second leaf and the wire leading from the contact element extends through the knuckle of the first leaf.

7. A hinge according to claim 6 wherein each leaf has a goove along that end edge thereof leading to its knuckle, and the wires further extend through grooves so they are not outwardly exposed.

8. A hinge comprising: first and second leaves having aligned knuckles; a hinge pin extending through the knuckles for holding the leaves together while allowing them to pivot relative to each other, each leaf having a groove along an end edge thereof leading to the interior of the knuckle thereon; a contact element in one of the knuckles and fixed in position with respect to the first leaf; a slip ring engaged by the contact element and issulatively mounted fixed position with respect to the second leaf; a wire extending from the contact element and through the knuckle and groove of the first leaf; and another wire extending from the slip ring and through the knuckle and groove of the second leaf the wires when the hinge is open being completely obscured at the normally exposed side of the hinge.

9. A hinge according to claim 8 wherein the grooves are formed in and open out of the end edges of the first and second leaves.

10. A hinge according to claim 9 wherein each hinge has only one knuckle.

11. A hinge according to claim 10 wherein closure strips are fitted into the grooves to close the grooves.

12. A hinge according to claim 10 wherein the leaves have apertures which open into the grooves and the wires leave the hinge through the apertures.

13. A hinge according to claim 12 wherein the leaves have front and back faces with the front faces being presented opposite and in close proximity to each other when the hinge is closed; and wherein the apertures open out of the back faces but not the front faces of the leaves.

14. A hinge comprising first and second leaves formed from metal and having knuckles aligned along a common axis and connected together so that the leaves can pivot relative to each other about the common axis of the knuckles; a first insulative element formed from a dielectric material and fixed in position with respect to the knuckle of the first leaf; an arcuate slip ring mounted firmly on the first insulative element concentric to the common axis, the slip ring being electrically conductive and having an axially extending slit therein which is occupied by the dielectric material of the first insulative element; a second insulative element formed from a dielectric material and fixed in position with respect to the second leaf, an electrically conductive contact element mounted on the second insulative element and positioned opposite the slip ring on the insulative material such that it will contact either the slip ring or the dielectric material in the slit of the slip ring, depending on the position of the leaves, whereby at some positions of the leaves the slip ring and contact element will be in electrical contact and in other positions they will not so that when in said other positions an electrical current will not be conducted through the hinge by way of the contact element and slip ring; the insulative elements, the slip ring, and contact element all being wholly contained in and completely obscured by at least one of the hinge knuckles, and the electrically conductive slip ring and contact element being electrically isolated from the metal hinge leaves by the insulative elements.

15. A hinge according to claim **14** wherein the second insulative element has a socket therein which receives the first insulative element.

16. A hinge according to claim **14** wherein the leaves are connected together by a hinge pin which is mounted firmly in the knuckle of the first leaf and projects into the knuckle of the second leaf; and wherein the first insulative element is a spindle which is mounted firmly on that portion of the hinge pin which projects into the knuckle of the second leaf.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,838,234 Dated September 24, 1974

Inventor(s) Francis C. Peterson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 48 the second occurrence of the preposition "of" should be "or".

Column 6, claim 8, line 44 "issulatively" should be "insulatively", and "fixed" should be "in fixed".

Signed and sealed this 3rd day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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☆ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

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