Oct. 25, 1938. R. E. WOOLLEY 2,134,350

COMBINATION BUSHING AND CLAMP

Filed June 18, 1937

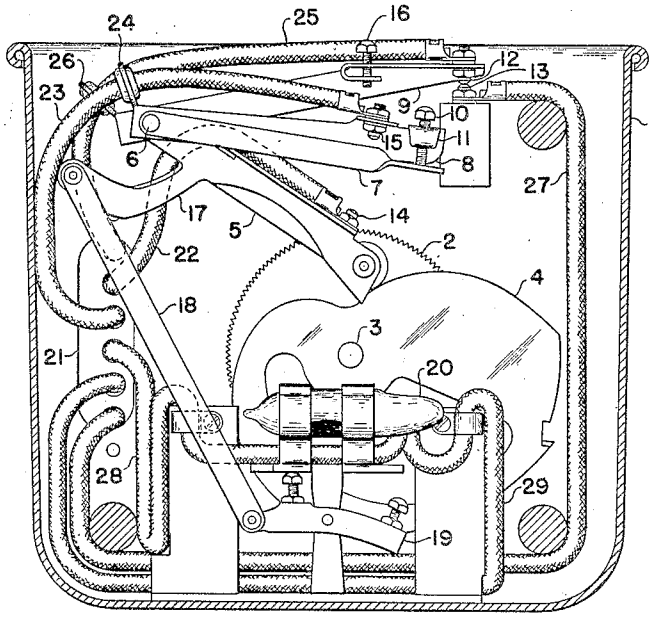


FIG. 1

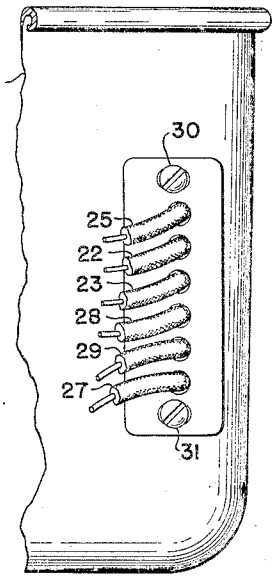


FIG. 2

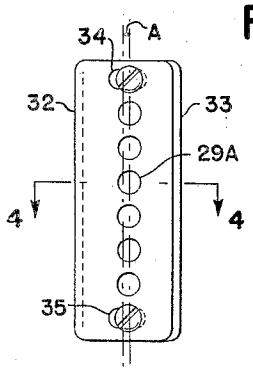


FIG. 3

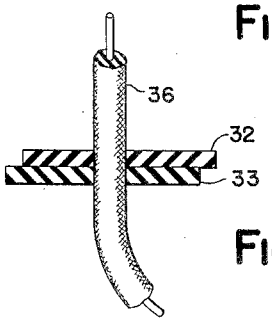


FIG. 4

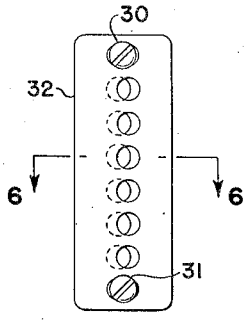


FIG. 5

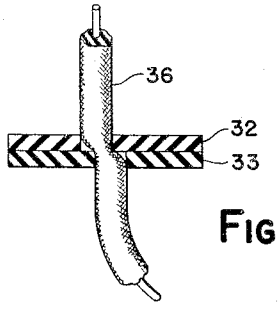


FIG. 6

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UNITED STATES PATENT OFFICE

2,134,350

COMBINATION BUSHING AND CLAMP

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Application June 18, 1937, Serial No. 148,930

3 Claims. (Cl. 247—25)

This invention relates to a combination bushing and clamp for electrical conductors.

One object of my invention is to provide a device whereby one or more electrical conductors may be carried through the wall of a metallic housing and insulated therefrom.

A further object is to provide a device whereby a plurality of individual conductors may be separately carried through the wall of a housing.

Still another object is to provide a device having clamping means whereby longitudinal movement of the conductors is prevented.

A further object is to provide a combination bushing and clamp which may be cheaply manufactured, readily installed and easily adjusted.

In the drawing:

Fig. 1 is a front elevational view of a complete instrument housing selected for purposes of illustration and showing a typical installation of my invention.

Fig. 2 is a fragmentary rear view of the housing shown in Fig. 1.

Fig. 3 is a view of my invention with the cooperating parts in the unclamped position.

Fig. 4 is a cross sectional view along the line 4—4 of Fig. 3 in the direction of the arrows.

Fig. 5 is a view similar to Fig. 3 but with the cooperating plates in the clamped position.

Fig. 6 is a cross sectional view along the line 6—6 of Fig. 5 in the direction of the arrows.

In connection with electrically operated control devices or instruments, it is frequently necessary to carry several individual conductors from the interior to the exterior of a metallic housing. Such housings are usually more or less crowded with mechanical parts and it is necessary that a minimum space be taken up by the conductors and the bushings through which they pass to the exterior of the housing. Furthermore such conductors are frequently passed to relatively delicate moving parts so that it is necessary that they be flexible and that the bushing in no way restrains the conductors from free flexing. It is further essential that such conductors be provided with a predetermined amount of slack to prevent binding and afford a maximum of flexibility. It is, therefore, desirable that the bushing be provided with suitable clamping means whereby the predetermined amount of slack will be maintained over an extended period of time.

This invention is directed to a combination bushing and clamp particularly applicable to such uses, although not limited thereto, and for purposes of illustration I have shown such a typical application of my invention in Fig. 1 wherein it is used to carry a plurality of conductors from the interior to the exterior of an instrument housing.

Referring to Fig. 1, I therein show a metallic housing 1 enclosing a mechanism for periodically making and breaking electrical contacts, of the type forming the subject matter of a United States patent to Walter E. Dueringer, No. 2,046,676, dated July 7, 1936. The specific mechanism illustrated, however, forms no part of my present invention and has been shown merely as an aid to an understanding of the advantages and principles thereof.

Within the housing 1 is a driving spur gear 2 secured to a shaft 3 journaled in the walls of the housing 1. The gear 2 may be driven by any suitable source of power, such as an electric motor, and serves to continuously rotate a cam 4 mounted on the shaft 3. A follower arm 5 is in engagement with the cam 4 and is periodically reciprocated about a shaft 6 between predetermined limits.

Also pivotally mounted on the shaft 6 are arms 7, 8 and 9. The arm 7 is arranged to be angularly positioned through suitable linkage (not shown) by a responsive or measuring device, such as a rate of flow meter, Bourdon tube, or the like, and assumes a position between established limits proportional to the magnitude of the variable measured by the responsive device. The arm 8 normally rests by gravity against the arm 7 through the agency of an adjustable stop 10 carried by an extension 11. The arm 9 carries a contact 12 normally resting by gravity against a stationary contact 13.

Carried by the follower 5 is a contact 14 which during each revolution of the cam 4 engages a contact 15 carried by the arm 8, for an increment of time determined by the position of the arm 7. During engagement of contacts 14, 15 the arm 8 is lifted to an established travel limit and then returned to its position of rest against the arm 7. At a predetermined point in the travel of the cam 4 the follower 5 engages an adjustable stop 16 carried by the arm 9 and disengages contacts 12 and 13 for a predetermined increment of time.

The follower 5 is provided with a rearwardly extending arm 17 connected by a link 18 to a pivotally mounted cradle 19. At predetermined points in the travel of the follower 5 the cradle 19 is arranged to rock a mercury switch 20 from closed to open position, and vice versa.

The various contacts made and broken through the rotation of cam 4 are utilized to control electric circuits and it will be noted that to each of the contacts there is carried an electrical conductor passing through the housing 1 through a gang bushing generally indicated at 21. Specifically, connected to the contact 14 is a conductor 22 carried along the arm 5. Connected to the contact 15 is a conductor 23 passing through an insulating eyelet 24, to the con-

26, and to the contact 13 a conductor 27. Running to the mercury switch 20 are conductors 28 and 29.

Fig. 2 is an exterior view of the part of the housing 1 in which the gang bushing 21 is located. The bushing completely covers the opening in the housing and is secured thereto by means of screws 30 and 31 which pass through suitable slots in the bushing.

With the exception of contact 13 all of the contacts are reciprocated from one position to another, and accordingly it is necessary that the conductors thereto be flexible. It is further necessary, inasmuch as the moving parts are relatively delicate and of light weight, that the conductors flex with little resistance, otherwise the accuracy of the electric signals transmitted by means of the contacts would be jeopardized. Furthermore, due to the small amount of available space present within the housing 1 it is necessary that the conductors be carried to the bushing 21 in a predetermined way and arranged in a definite configuration so that whatever pressure is impressed upon the moving parts will remain constant regardless of their positions.

Thus it will be noted that the conductor 23, for example, is arranged to form a long radius bend before being carried to the eyelet 24, so that a minimum of flexing is caused by movement of the arm 8. It is further to be noted that the housing 1 has been utilized to form a lateral support for the conductor 23, which serves to maintain the initial configuration. Such precautions are necessary due to the fact that the arm 8, which is relatively light, is positioned downwardly solely by gravity, and any variation in the initial force impressed upon it by the conductor 23 might result in the arm being held in mid air rather than returning to its position of rest against the arm 7.

It is apparent that if after conductors 22, 23, 25, 27, 28 and 29 have been properly located longitudinal movement occurs, which might be occasioned for example, in making the necessary connections exterior to the housing 1, the operation of the device might be jeopardized. In accordance with my invention therefore, and as will be explained more in detail hereinafter, the bushing 21 is arranged to clamp the conductors so that such longitudinal movement is prevented and the conductors after having been properly shaped will retain that shape indefinitely.

As shown in detail in Figs. 3, 4, 5 and 6 the bushing 21 comprises a pair of identical relatively thin plates 32 and 33 made of any suitable insulating material. Through each of the plates are a plurality of circular openings as indicated at 29A, through each of which a conductor is adapted to pass. As indicated in Fig. 3, the line of centers of the openings 29A is offset an amount A with respect to the longitudinal center line of the plate. In the initial position the plates 32 and 33 are arranged as shown in Fig. 3 so that their center lines are not aligned and the openings 29A are aligned. In this position opposite edges of the plates overlap. The screws 30 and 31 pass through the plates through suitable slots, such as indicated at 34 and 35. The slots 34 and 35 are provided with sufficient overlap so that regardless of the position of the plates the screws may be readily passed therethrough.

With the plates in the positions shown in Figs. 3 and 4 the conductors which have an outside circular openings are readily passed through the plates without distortion. In Fig. 4, for example, I have indicated a conductor 36 passing through one of the openings 29A.

After the conductors have been properly located within the housing 1 and provided with the proper amount of slack, the plates 32 and 33 are contracted or slid over each other in a direction to decrease the distance A to the positions shown in Figs. 5 and 6. In this position the plates are substantially aligned relative to each other, but the circular openings are offset by a predetermined amount which serves to clamp the conductors in position and prevent longitudinal movement thereof. It is apparent that the amount the plates 32 and 33 are moved toward alignment will depend somewhat upon the type of insulation used, the size of wire, and the clamping force exerted. I have in Fig. 6 indicated the position assumed by the conductor 36 when the plates are drawn into complete alignment.

With the plates in the position shown in Figs. 5 and 6 screws 30 and 31 are tightened, so that relative movement between plates 32 and 33 will not occur thereafter.

While in accordance with the patent statutes I I have illustrated and described the particular embodiment of my invention it will be understood that the scope of the invention should be determined by the appended claims.

What I claim as new, and desire to secure by Letters Patent of the United States, is:—

1. A clamp for supporting a conductor comprising a pair of duplicate members having flat mating surfaces and each provided with a passageway through which the conductor passes, and means operating solely between the two members adapted to clamp said members together with said passageways in misalignment whereby the conductor is firmly gripped and supported.

2. A clamping arrangement for supporting and relatively locating a plurality of electrical conductors comprising a pair of duplicate members provided with passageways for said conductors and having flat mating surfaces, and means adapted to clamp said pair of members together with said passageways in misalignment whereby said conductors are firmly gripped and supported in spaced relation, said means adjustable whereby said members may have a different degree of misalignment of the different passageways, thus providing for the simultaneous clamping and supporting of a plurality of conductors of different sizes.

3. A combination clamp and bushing for preventing longitudinal movement of a flexible electrical conductor comprising a pair of identical flat thin plates having flat mating surfaces slidable relative to each other, a circular opening through each of said plates axially aligned when the lateral edges of said plates are out of alignment and through which the conductor is adapted to pass, said openings moved out of alignment a predetermined amount when the lateral edges of said plates are moved into alignment whereby the conductor is kinked a predetermined amount in passing through said openings and held stationary longitudinally relative to said plates.

REW E. WOOLLEY.