

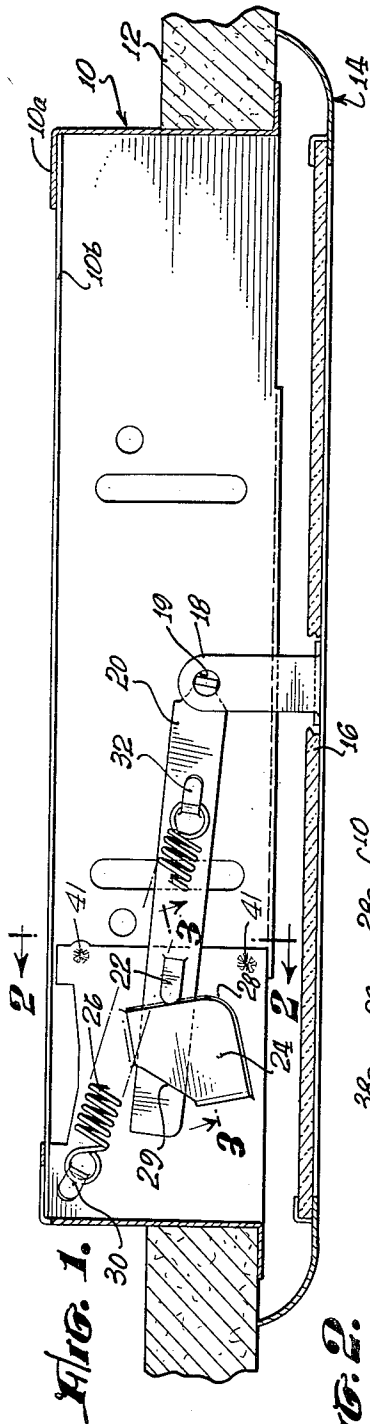
July 17, 1962

R. A. PAPSDORF

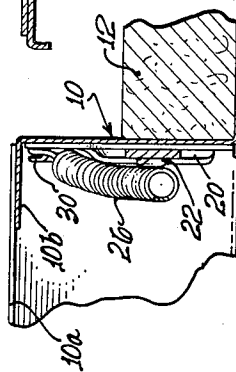
3,044,106

COVER ATTACHING ASSEMBLY

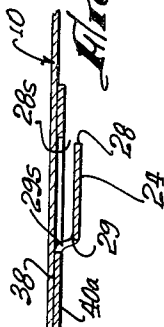
Filed April 19, 1960



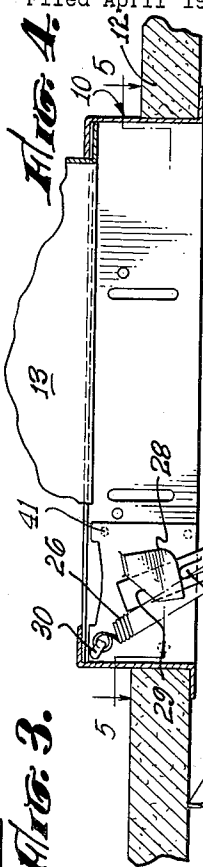
**FIG. 2.**



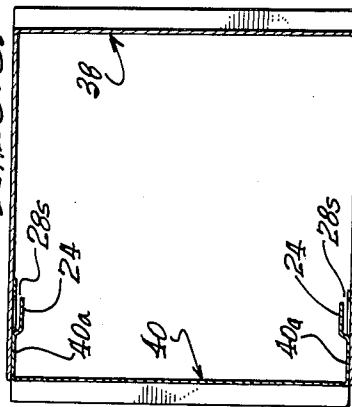
**FIG. 3.**



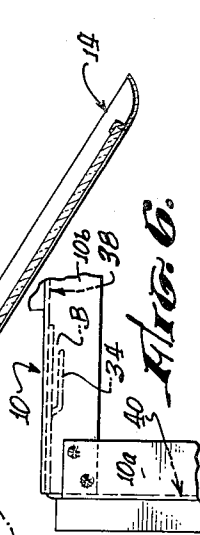
**FIG. 4.**



**FIG. 5.**



**FIG. 6.**



ROBERT A. PAPSDORF,  
INVENTOR.

BY  
*Knight & Rodgers*  
ATTORNEYS

1

3,044,106

## COVER ATTACHING ASSEMBLY

Robert A. Papsdorf, Claremont, Calif., assignor to Emerson-Pryne Company, Pomona, Calif., a corporation of Delaware

Filed Apr. 19, 1960, Ser. No. 23,171

11 Claims. (Cl. 16—179)

This invention relates to means for removably attaching a cover to a housing, and more particularly to a means which is movable between a first position in which the cover closes the housing and a second position in which the cover is spaced from the housing.

A typical application of such closure means is found in a sheet metal housing for enclosing a fan or electric light recessed into the wall or ceiling of a room. As a rule such housings have an open side which is closed by a cover consisting of a perforated grill, in the case of a fan, or a frame holding a glass lens, in the case of a light.

With equipment of this character, it is important to have easy access to the interior of the housing for service and replacement of parts. An electric light burns out after a time and needs replacing. A ventilating fan needs periodic oiling or cleaning. These requirements for periodic and sometimes frequent access to the interior of the housing make it desirable that the cover be easily removable, preferably without the use of any tools at all. Yet the cover must be held firmly in place in order to perform its primary function.

In the case of lighting and ventilating equipment which is often recessed into the ceiling of a room, the person servicing the equipment must stand on a ladder and hold a fresh bulb or oil can in one hand while steadying himself with the other hand. Under these conditions it is obviously desirable that the cover be easily removable, without tools, by a simple hand movement. Also, to avoid burdening the workman with an extra item to hold and to eliminate danger of cover breakage, it is desirable that the cover be securely held by the attachment means even after it has been moved from its closed position to an open position which permits access to the interior of the housing. In addition, it is desirable that the attachment means should firmly hold the cover in either the open or closed position, but yet be easily movable from one to the other.

Accordingly, one general object of this invention is to provide novel attachment means for removably attaching a cover to a housing in which the attachment means is movable between a first position in which the cover closes the housing and a second position in which the cover is spaced from the housing.

A second object of this invention is to provide attachment means of this character wherein the cover is firmly held in either of its two positions, but is easily movable from one position to the other by a simple hand movement.

Another object of this invention is to provide a closure means of the above-noted character which is simple and sturdy in structure, inexpensive in manufacture, and reliable in operation.

An additional object of this invention is to provide a novel mechanical linkage which is formed from simple stamped parts and which provides a smooth movement without fixed pivots or bearings.

To embody all of these desirable features in a simple, sturdy, and inexpensive structure there has been devised a novel mechanical arrangement which contains a flat arm pivoted at one end to the cover and having an abutment formed on one surface thereof. A socket is stamped into the housing with openings cut therein to receive the arm, and spring means holds the arm engaged in the socket with the abutment bearing against one edge of the socket.

2

Although the arm is not attached to the socket in any way, it is firmly held in place by the top of the socket and the spring means, and it can be moved through an arc by a free pivoting movement.

One edge of the offset piece of the housing forming the socket engages the abutment and is shaped to form a cam surface which interacts with the abutment, and the spring means, to develop a force holding the arm in either of two stable positions: one position corresponding to the closed position of the cover, and the other corresponding to the open position of the cover.

Both the arm and the socket in the housing can be very inexpensively formed by simple operations on a punch press, and the linkage can be very quickly assembled by simply sliding the arm into the socket and attaching the spring means to the arm and to the housing. It can be just as quickly disassembled by removing the spring means and sliding the arm out of the socket.

In a preferred embodiment of the invention two such linkages are employed, one on each of two opposing sides of the housing. In this embodiment the housing is made in two sections which fit together in overlapping relation at the two sides carrying the linkages, and the sockets for the linkages are stamped into the inner section in the area of overlap, such that the opening left by the socket is covered and sealed by the overlapping section. The covering of the socket area by an overlapping section is a valuable feature of this invention, because if the sockets were not covered they might become filled with plaster when the wall or ceiling around the housing is finished, and the arms would not swing freely as required for proper operation.

Another very important feature of this invention is arrangement whereby a smooth swinging movement in either of two directions is accomplished without a pivot pin or the like making a fixed connection. To achieve this, the arm is allowed to project through the back of the socket through an opening whose length is approximately equal to the width of the arm divided by the cosine of the arc through which the arm is movable. When the arm is moved in one direction it pivots freely against the socket at one end of this opening, and its movement in that direction is limited by abutment of the arm against the other end of the opening. When the arm is moved in the other direction it pivots freely against the other end of the opening, but since the arm is in contact with both ends of the opening at the end of its travel, the transfer of the pivot point from one end of the opening to the other is achieved very smoothly.

The spring means comprises an expansion spring stretched between two hooks, one lanced into the arm and the other lanced into the housing near the socket. These hooks can be formed inexpensively by the same type of operation which forms the socket and the abutment.

How the above and other objects and advantages of this invention have been achieved will be apparent to those skilled in the art from the following description of one illustrative embodiment thereof, in connection with the annexed drawings, in which:

FIG. 1 is a median section of a preferred embodiment of the invention showing the attachment means and cover in closed position.

FIG. 2 is a fragmentary section of the housing on line 2—2 in FIG. 1.

FIG. 3 is a fragmentary section of the housing wall on line 3—3 in Fig. 1.

FIG. 4 is a partial section and elevation at reduced scale showing the cover and attachment means in open position.

FIG. 5 is a horizontal section taken on the line 5—5 of FIG. 4.

3

FIG. 6 is a fragmentary plan view of one corner of the housing made in two overlapping sections, with the socket on the housing formed in the area of overlap.

Referring now to FIG. 1 there is shown a housing 10 recessed into a ceiling 12 for the purpose of holding a fan, electric lamp, or the like. The housing 10 serves as a plaster frame to define an opening in wall 12 into which a fan, light fixture, or the like is recessed. As may be seen from FIG. 5, the housing is normally rectangular in outline, though I am not necessarily limited to any exact shape. The housing is open at the top side between the inwardly turned flanges 10a and 10b. This opening may be closed by any suitable member; but as illustrative of such closure members there is here shown in FIG. 4 a portion of a reflector 13 for a light fixture. For additional details of the construction of this member and its functions, reference may be had to my co-pending application filed March 14, 1960, Serial No. 14,880 for "Recessed Lighting Fixture having a Separable Pre-Wired Section."

The lower face of the housing, which is also open, is normally closed by a cover assembly comprising a frame 14 that supports a perforated grill, or glass lens 16. An angle bracket 18 attached to the side of frame 14 is provided to receive the arm 20 of an attachment assembly.

It will be understood that two attachment assemblies are commonly employed for housings of this character, and that an identical assembly, not shown, is attached as indicated in FIG. 5 to the side of the housing opposing the side viewed in FIGS. 1, 2 and 3.

The attachment assembly comprises an arm 20 which is arcuately movable in a socket 24 formed in housing 10. The lower end of arm 20 is bent to pivotally engage an opening 19 cut into bracket 18 to support the cover assembly. In the closed position (FIG. 1) arm 20 is spring loaded upwardly and holds frame 14 firmly against ceiling 12. But arm 20 can be swung downwardly against the force of the spring to lower the cover assembly to a spaced, or open position as shown in FIG. 2. When moved to the open position, the direction of spring loading on arm 20 shifts and it becomes spring loaded in a direction to hold the conveyor assembly in the open position as shown in FIG. 2. In the open position, frame 14 can be pivoted about the ends of arms 20 to the position 14a as indicated by the dotted lines in FIG. 4, for convenient access to the interior of the housing for service or replacement of the apparatus within the housing.

When the cover assembly is moved from the open position (FIG. 4) toward the closed position (FIG. 1) the spring loading on arm 20 shifts back again, and arm 20 becomes spring loaded to hold frame 14 against ceiling 12. This change in the spring loading of arm 20 is achieved by the interaction of an abutment 22 on arm 20, a cam surface 28 on housing 10, and spring means 26 pressing abutment 22 against cam surface 28.

Cam surface 28 is shaped like a broad, round-bottomed V. Cam surface 28 has two substantially straight sections connected by an intermediate rounded section. The angle between the straight sections is here shown as about 90° but it may be increased or decreased as desired to suit conditions. As a possible variation, the entire surface 28 may be curved but having a changing radius to approximate the shape illustrated. Abutment 22 bears against one straight side section when the cover is in the closed position and against the other side section when the cover is in the open position. When the cover is moved from one position to the other, abutment 22 moves over the rounded intermediate section at the bottom of the V. The spring 26 is aligned to be parallel with the axis of arm 20 when abutment 22 is aligned with the rounded cam surface, and to be at an angle to the axis of arm 20 when the abutment 22 is displaced in either direction from the intermediate section of the cam surface.

When abutment 22 is on the upper straight section of the cam surface, as shown in FIG. 1, spring 26 develops

4

an upward or counter-clockwise moment on arm 20. When abutment 22 is on the lower straight section as shown in FIG. 4, spring 26 develops a downward or clockwise moment on arm 20. The switchover in the direction of the moment occurs when spring 26 is parallel with the axis of arm 20, i.e. when abutment 22 is aligned with the center of the rounded section of the cam surface.

It will be noted in FIG. 1 that in the closed position of the cover, abutment 22 is only slightly past the apex of the V, while in the open position it is extended almost to the end of the cam surface. There is a three-fold reason for this arrangement. First, it is desirable that the cover assembly be pressed firmly against ceiling 12. Therefore the upward movement on arm 20 is so directed by the position of arm 20 that it will securely hold frame 14 against the ceiling. It will be understood that this is accomplished by having abutment 22 close to the apex of the V in the closed position, since the upward moment increases in proportion with the distance of abutment 22 from the point of the V. Secondly, it is desirable to have arm 20 completely retracted inside housing 10 when the cover assembly is detached for shipping, and this requires that arm 20 be spring loaded to move upwardly beyond the closed position of the cover assembly, as shown in FIG. 3, when the cover assembly is removed. And thirdly, it is desirable for ease of lowering the cover that arm 20 be spring loaded downwardly during a large proportion of the final downward swing of arm 20. This is accomplished by locating the abutment close to the apex of the V of cam surface 28 in the closed position of the cover.

In addition to providing a moment on arm 20, as described above, spring 26 serves a second important function in holding arm 20 engaged in socket 24.

Referring especially to FIGS. 1, 2 and 3, it will be seen that socket 24 is formed by cutting the side wall of the housing along the line of cam surface 28 and then offsetting inwardly the wall at one side of the cut. Thus one cut edge is spaced inwardly of the other cut edge and becomes cam surface 28. Another cut is made at the opposite side of socket 24 and here also one cut edge 29 is offset inwardly by pressing on the area of socket 24. Thus there are two slots 28s and 29s formed in the side wall.

Referring to FIG. 3, socket 24 will be seen to be spaced from the inner face of the housing by a distance slightly greater than the thickness of arm 20. Two openings 28s and 29s are formed at opposing sides of the socket mound, one below the cam surface 28, and the other generally opposite the apex of the V on surface 28. Arm 20 is slid under the socket 24 and through the two openings 28s and 29s to bring abutment 22 against cam surface 28, where it is held by spring 26. Spring 26 extends between a hook 30 on the housing and a hook 32 on the arm.

Since the space between the socket wall 24 and the inner surface of housing 10 is approximately equal to the thickness of arm 20, the arm is restrained from movement in all planes except one parallel to the plane of the wall against which it rests. However, it can be swung in either direction by pivoting against the socket at either end of opening 29s. When moved downwardly, the lower edge of the arm pivots against the lower end of opening 29s and when moved upwardly the upper edge of the arm pivots against the upper end of opening 29s.

When arm 20 is raised to the position of FIG. 1, spring 26 lies against the upper side of socket 24. As the arm swings down to the lowered position of FIG. 4, the spring rides up onto the surface of socket 24 which is offset inwardly from the plane of the surrounding metal plate. This causes spring 26 to bow, as seen in FIG. 2 wherein the spring is shown in a position between FIGS. 1 and 4. Also spring 26 is slightly elongated. These effects combine to resist movement of the arm downward from

5

the position of FIG. 1 and insure that the front 14 is held securely in place when fully raised.

An important feature of this invention is the arrangement whereby the transfer of pivot points from the downward to the upward movement is made smoothly. The length of opening 29s is approximately equal to the width of the arm divided by the cosine of the arc through which the arm is movable. Therefore, when the arm approaches its lower limiting position, as shown in FIG. 3, the side of the arm opposing the pivot point comes into contact with the other end of opening 29s. Thus at the extremes of arcuate travel the sides of arm 20 are in contact with both ends of opening 29s, such that the transfer of pivot point from one end of opening 29s to the other is made smoothly. In this arrangement it is preferable that the downward movement of the arm be limited by abutment of arm 20 against the ends of opening 29s, to insure absolutely smooth transfer of the pivot point, but this is not essential to the invention.

In the preferred embodiment of the invention described, socket 24 and hook 32 are formed in the sheet metal wall by lancing, an operation in which sheet metal is simultaneously cut and punched. In this embodiment, openings 23s and 29s are formed by shear cuts made during the lancing operation, and widened to the appropriate width when the material between the cuts is punched to form the mound. The boundaries of the hook are also defined by lanced cuts. A similar operation may be used to form abutment 22 in arm 20.

In FIG. 5 is shown a sectional view of the entire housing illustrating two sockets 24 which are located on opposing sides of the housing. The housing is preferably but not necessarily made of two overlapping sections 38 and 40. Both sections are stamped from a flat blank of sheet metal and are then bent into a U-shape, one section having longer arms than the other. One section 38 forms three full sides of the rectangular frame and the other section 40 forms the fourth side. This latter section has a tab 40a at each end bent at 90° to the intervening side of the frame and thus overlapping end portions of the two opposite sides of the housing formed by section 38. The tabs are preferably joined to the other section by spot welding at 41 but other suitable means may be employed. The sockets 24 are each lanced in one of the tabs 40a. Since the tabs are inside the finished housing, the section 38 lies over or covers the outer surface of the tabs 40a on section 40 and the area of overlap is such that the openings formed by the sockets are outwardly sealed by the overlapping portions of housing section 38. This arrangement is very important in housings which are to be recessed into ceilings, since the cover afforded by the overlapping section prevents plaster from entering the sockets, which are usually located near the plaster level. Since housings of this character are generally made in two sections for practical reasons, this protection is gained at no extra cost in material or time.

From the foregoing description it will be apparent that this invention provides a novel cover attachment means which is simple and sturdy in structure, inexpensive to manufacture, and reliable in operation. It should be understood that this invention is not limited to the specific structures disclosed herein, since many modifications can be made in the structure without departing from the basic teaching and scope of this invention.

I claim:

1. Means for attaching to a housing or the like a cover closing an opening in the housing, comprising:

an arm pivotally connected near one end to the cover; arm mounting means on the housing slidably receiving the other end of the arm, the arm being free to move both longitudinally and swingingly between a first position in which the cover closes the opening and a second position in which the cover is spaced from the opening;

a cam follower on the arm engaging a cam on the

6

mounting means, said cam having two cam surfaces disposed at an angle to each other and connected by an arcuate junction;

and spring means acting to press the cam follower against the cam, the spring means being adapted to produce a component of force acting to move the cam follower along one of said cam surfaces and away from said junction when the cam follower is displaced in either direction from said junction.

2. Means for attaching to a housing or the like a cover closing an opening in the housing, comprising:

an arm pivotally connected at one end to the cover; arm mounting means on the housing slidably receiving the other end of the arm, the arm being movable both longitudinally and through an arc relative to the housing between a first position in which the cover closes the opening and a second position in which the cover is spaced from the opening; a cam follower on the arm engaging a cam surface on the mounting means, said cam surface having two substantially straight sections connected by a rounded section;

spring means acting to press the cam follower against the cam surface, the cam follower bearing against one of the straight sections when the arm is in its first position, and bearing against the other of the straight sections when the arm is in its second position, and being movable over the rounded section when the arm is moved from one position to the other;

the spring means being connected to the housing and to the arm at positions located to develop a force parallel with the axis of the arm when the cam follower is positioned centrally of the rounded section and to develop a force at an angle to the axis of the arm when the cam follower is displaced in either direction from the rounded section, and the force developed by the spring means having a component directed along a straight section whenever the cam follower is displaced in either direction.

3. Means for attaching to a housing or the like a cover closing an opening in the housing, comprising:

a relatively long flat arm pivoted at one end to the cover and having an abutment protruding from one surface thereof near the other end thereof;

a relatively flat base plate attached to the housing, the plate having a depression punched into one surface thereof to form a raised socket protruding from the other surface thereof, the height of the socket being greater than the thickness of the base plate plus the thickness of the arm;

first and second openings formed in the plate at opposing sides of the socket, each opening being slightly wider than the thickness of the arm and longer than the width of the arm;

the arm being positioned between the socket and said other surface of the base plate, said abutment bearing against the edge of the socket above the first opening therein, and said other end of the arm extending beyond the socket through the second opening therein;

the arm being movable parallel with the surface of the plate; and spring means acting to press said abutment against the edge of the socket at the first opening therein.

4. The combination defined in claim 3 wherein the periphery of the socket at the first opening therein has two substantial branches disposed at an angle to each other and connected by an intermediate rounded section;

and wherein the spring means is adapted to produce a force parallel with the axis of the arm when the abutment is aligned with said intermediate section and to produce a force at an angle to the axis of the arm when the abutment is displaced in either direction from said intermediate section.

7

5. The combination defined in claim 3 wherein the arm is movable toward a first extreme position by pivotal contact with the side wall of the socket at a first end of the second opening therein, and movable toward a second extreme position by pivotal contact with the side wall of the socket at the second end of the second opening therein.

6. The combination defined in claim 5 wherein said first position of the arm is defined by abutment of the arm against the side wall of the socket at the second end of the second opening therein;

and wherein said second position of the arm is defined by abutment of the arm against the side wall of the socket at the first end of the second opening therein.

7. The combination as defined in claim 3 wherein the housing is made of two sections attached together in overlapping relation, and wherein said socket is formed on the inner one of said two sections within the area of overlap such that the depression under the socket is covered by the overlapping portion of the other section.

8. A mechanical linkage for linking together two members, one of which is movable relative to the other, comprising:

a relatively long flat arm adapted at one end to be attached to one member and having a raised abutment protruding from one surface thereof near the other end thereof;

a relatively flat base plate attached to the other member, the base plate having a flat area punched from one side of the plate to form a raised area protruding from the other surface of the plate;

a first and a second opening formed in the plate at opposing sides of the raised area, each opening being wider than the thickness of the arm and longer than the width of the arm;

the arm being positioned between the raised area and said other surface of the base plate with said abutment bearing against a cut edge of the raised area along the first opening, and said one end of the arm extending through the second opening; spring means acting to press said abutment against the cut edge of the raised area along the first opening;

and the arm being movable parallel with the surface

8

of the base plate by swinging movement about a pivot substantially at the second opening in the base plate.

9. The combination defined in claim 8 wherein the arm is movable in one direction by pivotal contact with the side wall of the raised area at one end of the second opening, and movable in the other direction by pivotal contact with the side wall of the raised area at the other end of the second opening therein, and wherein the length of the second opening is approximately equal to the width of the arm divided by the cosine of the arc through which the arm is movable.

10. Means for attaching to a housing or the like a cover closing an opening in the housing, comprising:

a pair of parallel, spaced plates mounted in fixed positions on a wall of the housing;

an arm pivotally connected at one end to the cover, and slidably and swingingly received at the other end between said plates to swing through an arc relative to the housing between a first position in which the cover closes the opening and a second position in which the cover is spaced from the opening;

a fixed cam on one of said plates and a cam follower on said arm at a position between the ends of the arm actuating the arm to move it longitudinally relative to said plates and the housing as the arm moves between said first and second positions;

and spring means connected between a fixed anchor and the arm and acting to press the cam follower against the cam said spring means being the sole means resisting slidable withdrawal of the arm from between said plates.

11. Means for attaching to a housing or the like a cover as in claim 10, in which one of the plates provides stop means spaced apart a distance greater than the width of the arm and engageable with opposite edges of the arm near said other end to provide fixed points about which the arm pivots in moving from one position to the other.

#### References Cited in the file of this patent

#### UNITED STATES PATENTS

2,639,368	Pryne	May 19, 1953
2,728,849	Beber et al.	Dec. 27, 1955