

- [54] **FLUID OPERATED WEB BREAK
DETECTOR ASSEMBLY WITH
PERIPHERAL FLANGE FOR
MICROSWITCH OPERATOR**
- [75] Inventor: **George W. Bregar**, Des Plaines, Ill.
- [73] Assignee: **Korthe Engineering Corporation**,
Schiller Park, Ill.
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Primary Examiner—James R. Scott

Attorney, Agent, or Firm—St. Onge Mayers & Reens

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200/172 A
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- [58] Field of Search..... 200/61.04, 61.07, 61.13,
200/61.18, 168 G, 153 T, 172 R, 172 A;
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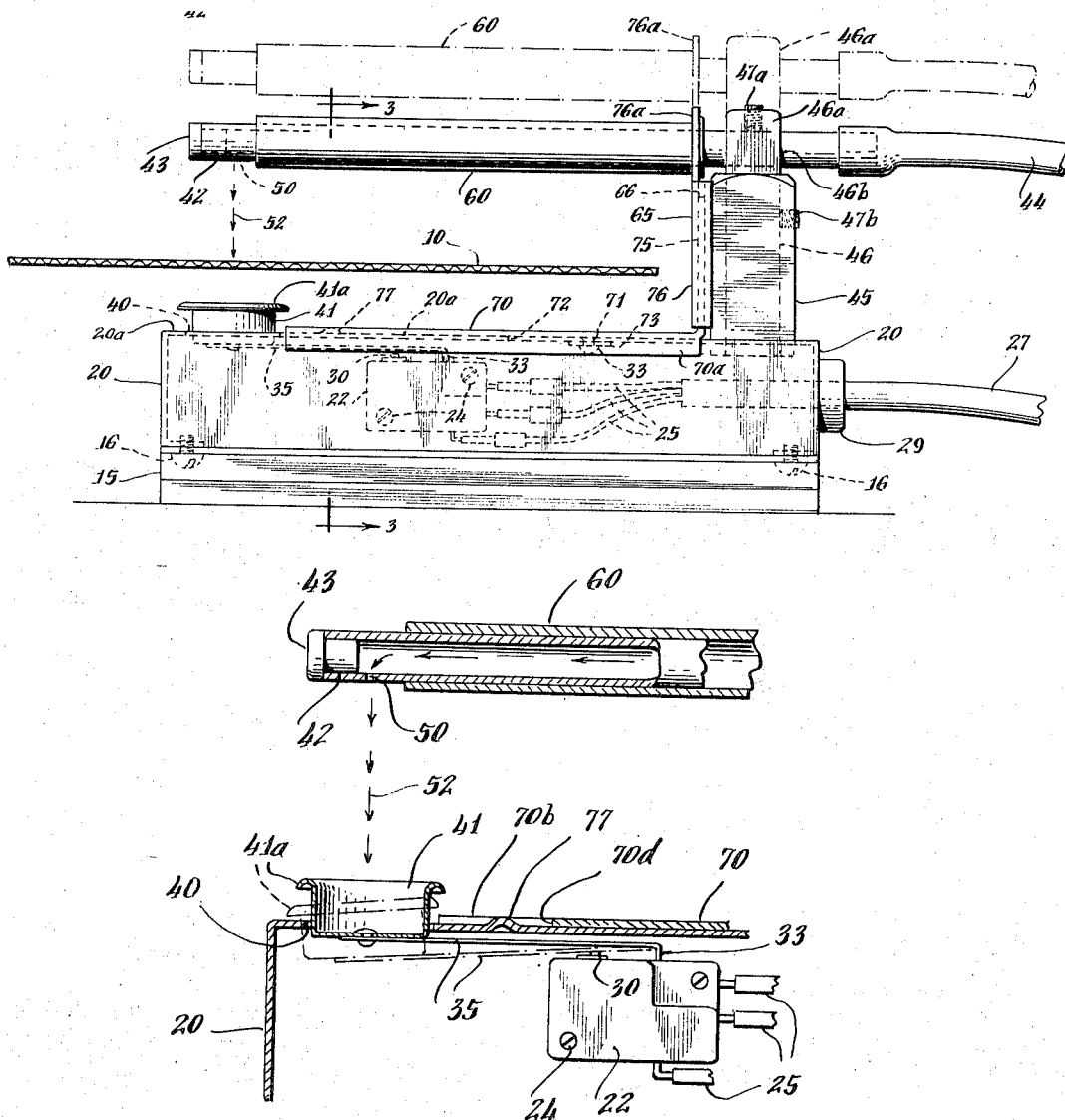
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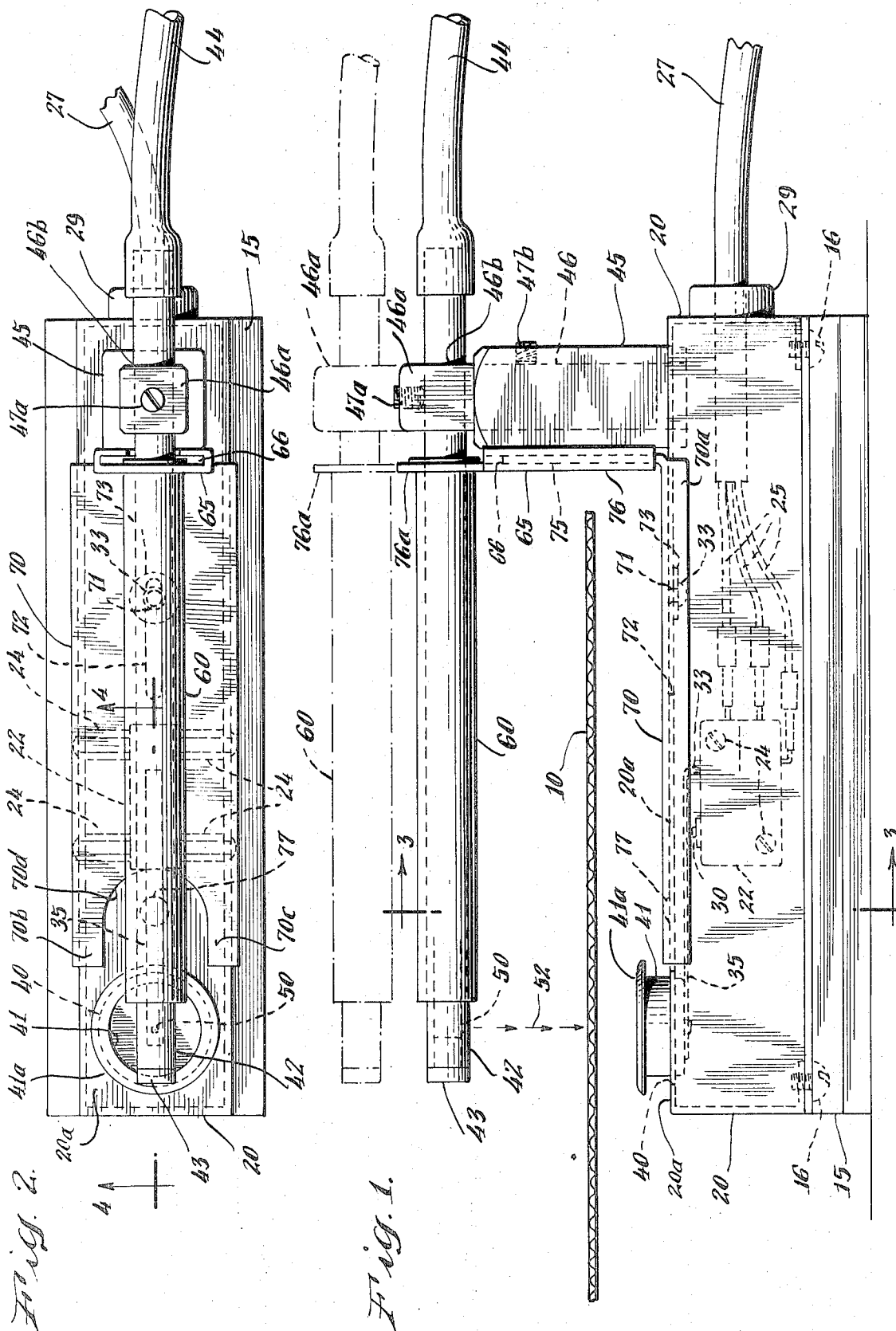
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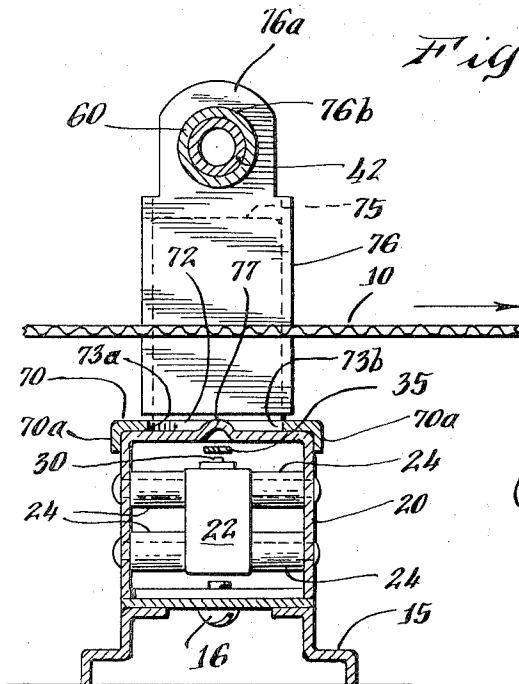
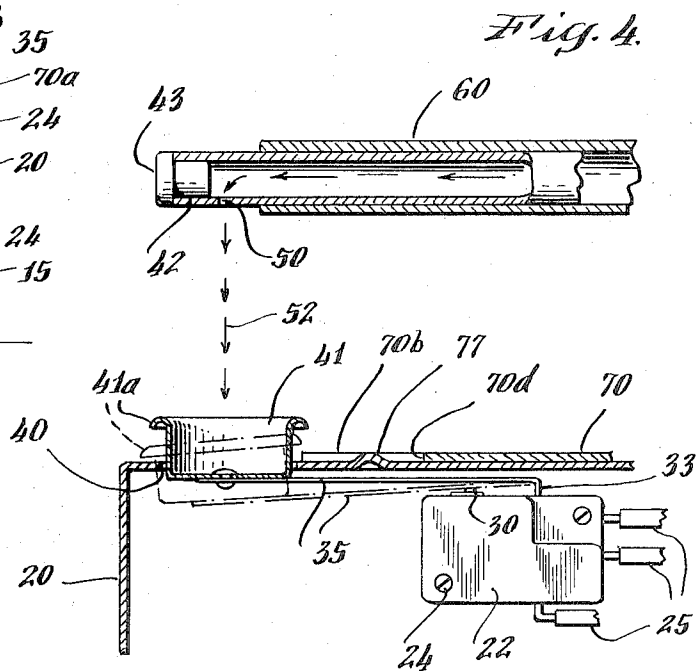
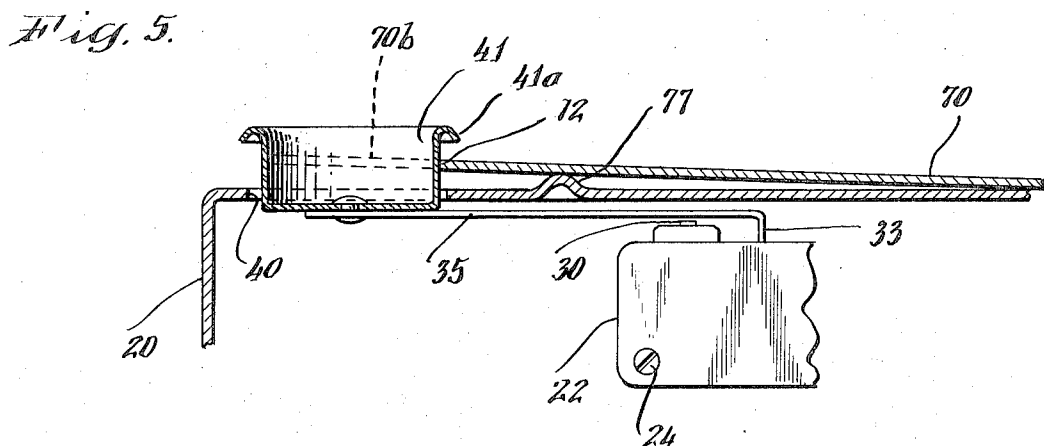
[57] **ABSTRACT**

In air stream actuated web-break detectors an air-deflectable cup-like switch actuator is formed with a surrounding lip which shields the partially enclosed switch assembly from incursion of fiber and like particles otherwise tending to obstruct the switching function.

3 Claims, 5 Drawing Figures







FLUID OPERATED WEB BREAK DETECTOR ASSEMBLY WITH PERIPHERAL FLANGE FOR MICROSWITCH OPERATOR

BACKGROUND AND OBJECTS OF THE INVENTION

This invention relates to improvements in web-break detectors and more particularly to improvements in the type of detector which, for its operation, depends upon the impingement of a directed airstream or the like upon a control element.

The air stream-actuated form of detector, as such, is known, being described, for example, in U.S. Pat. No. 3,178,527, granted Apr. 13, 1965 in the name of Otha Cooksey and in U.S. Pat. No. 2,405,552, granted Oct. 15, 1968 in the name of Thomas J. Luckett. It has been observed, however, that such detectors, particularly as used for control of machinery for moving webs composed of fibrous materials, such as paper or textiles, are subject to occasional malfunction as a result of accumulation of fiber particles in their working parts. It is an object of the present invention to provide an improved web-break detector construction which minimizes these undesirable occurrences and which further guards against destructive interaction of the detector's external structure with a broken or sagging web coming into moving contact with it.

SUMMARY OF THE INVENTION

As in the prior art constructions described above, the improved web detector of the present invention employs a deflectable switch-actuating member adapted to be supported on one side of a moving web (e.g., of paper, fabric or plastic composition). Further in accordance with the prior art, the invention also makes use of a stream of air (or other propulsive fluid) intended to originate on the side of the web remote from the deflectable member and so directed as to impinge on the deflectable member if, because of breakage of the web or otherwise, the web ceases to be interposed between that part and the source of the stream. The deflectable member is so constructed and arranged that it can be moved in a switch-actuating direction either by impingement of the fluid stream or by contact with the web, as caused, for example, by sagging of the latter. Switch actuation shuts down or otherwise controls the web-moving machinery.

In the construction contemplated by the present invention, the switch linkage with which the deflectable member coacts is shielded by a protective housing. Both the housing and the deflectable member are so formed that upon movement of the member, either by impingement of the fluid stream or by the impact of a sagging web, the member itself seals the protective housing to a degree which greatly lessens the likelihood that dust, lint, or other web-generated particles will be blown into the more obstruction-prone parts of the control mechanism. It also proves compatible with, and indeed promotive of, the accomplishment of this primary function to so construct the displaceable member as to minimize the possibility that it will tear or otherwise destructively engage a sagging web with which it may be brought in contact (i.e., in a web-breakage situation). The shape preferred for this purpose is that of a cup-like structure having an annularly projecting, reversely curved lip which presents a wholly smooth sur-

face to the opposing web but which in its deflected position also assumes a sealing relationship with the switch-enclosing housing.

The more detailed aspects of the invention are specified in the following description taken in connection with the accompanying drawing. In the drawing:

FIG. 1 is a side elevation of a preferred embodiment of the invention;

FIG. 2 is a top view of the embodiment of FIG. 1;

FIG. 3 is a section taken on line 3—3 of FIG. 1;

FIG. 4 is a fragmentary break-away view of a segment of FIG. 1; and

FIG. 5 is a view similar to FIG. 4, but showing some of the parts in an altered relationship.

FIG. 1 presents a side view of the apparatus of the invention, shown in its intended working relationship with a web 10 (e.g., of paper or fabric) which is assumed to be moving either into or out of the plane of the paper. Only an edge portion of the web is shown, and the means employed for supporting and driving the web are not illustrated, being well-known in the art, as exemplified by Cooksey U.S. Pat. No. 3,178,527. The web-break detecting apparatus of the present invention includes a base plate 15 by which it may be assumed to be mounted in the appropriate relationship to the surface of the web 10. Surmounting the base plate and attached to it by securing means 16 located near its extremities is a housing 20 which, with the base plate, constitutes a substantially complete enclosure for a microswitch assembly of which the switch-containing component is indicated at 22. As is shown in FIG. 3, this assembly is supported laterally from the housing 20 by support members 24 and includes (FIG. 1) conventional external circuit connections 25 which are adapted for connection with an appropriate control system through an extended cable 27. The cable 27 in turn is supported by and carried through the end wall of the housing 20 by means of a grommet 29.

The microswitch 22 is further provided with a movable actuating element (i.e. a depressable rod) 30 which protrudes above its upper surface and which, when depressed, (depending upon whether the switch is designed to be of the normally "on" or normally "off" variety) opens or closes switch contacts contained within the switch housing 22. The element 30 is in its turn subject to actuation by a flexible spring arm 35 which is supported in cantilever fashion at its right end by being attached to the upper surface of the switch enclosure 22, as indicated at 33. The working relationship between the actuating element 30 and the spring arm 35 is shown more clearly in FIG. 5, in which Figure it is apparent that when the spring arm 35 is in its uppermost or normal position it has no engagement with the element 30. On the other hand, when it is deflected into its "activated position" as indicated in dotted outline in FIG. 4, it engages the element 30 so as to depress that element and actuate the switching elements contained within the microswitch 22. Depending upon the nature of the control system employed, this actuation may serve either to open or close the associated switch contacts, but in either case the normal effect of actuation would be to de-energize the machinery driving the web 10 and to produce any other control action appropriate to shutting down the system as a whole so that repair operations might be undertaken. The relevance of this mode of operation to the pur-

poses of the present invention as a whole will be further explained in the following.

As clearly appears in FIGS. 1 and 2, the upper surface 20a of the enclosure 20 has near one end a circular opening 40 within which a cup-like member 41 is supported by attachment to the underlying extremity of the deflectable spring arm 35. Such attachment may, of course, be by brazing, by screw connection or otherwise. The function of the cup-like member 40 may best be understood by referring to the further apparatus part 42 which, as appears most clearly in FIGS. 1 and 2, is supported above it and has a center line that perpendicularly intersects the vertically projected center line of the member 40. The part 42 is a hollow elongated tube of metal or other structurally rigid material which is closed at the end nearest the cup-like member 40 by a cap 43, and which at its other end, is connected to a flexible tube 44 through which, in the intended use of the apparatus, it will be supplied with compressed air or other actuating fluid. The part is held in fixed relation to the enclosure 20 by means of a rigid bridging column 45 which extends between the two and which encloses in telescoping relation a slidable shaft 46 which terminates at its upper end in an exposed extension 46a. This extension in turn has a circular opening 46b which loosely engages the part 42 so that that part may be positioned in its desired relationship to the cup-like member 41. Moreover, the telescoping relationship of the shaft 46 and the surrounding column 45 permits the former to be moved up and down to a limited degree in order that the distance between the parts 41 and 42 can be varied to suit the conditions of use of the apparatus. Set-screws 47a and 47b are provided to lock the parts 42 and 46 in their preferred locations.

At a point directly above the center of the cup-like member 41 the tubular part 42 is provided with a small opening 50 through which compressed air (or other gaseous fluid received from the tube 44) can be directed against the upper surface of the web 10 as suggested by the directed dash line 52. Under the conditions just postulated and as long as the web 10 is maintained intact and in normal tension in the position indicated, the air stream 52 will simply be deflected by the web and will not impact on or otherwise influence the cup-like member 41. However, upon breakage of the web 10 in the area between the opening 50 and the member 41, the air stream 52 will immediately impinge on the latter member, as indicated in FIG. 4, driving it in a downward direction with resulting deflection of the flexible spring arm 35. Similar deflection of the member 41 will also occur if the web break is elsewhere than in the immediate vicinity of the member, because, under these conditions, the web will go slack and the impinging air stream 52 (as well as the force of gravity) will cause it to bear down upon the member 41 with resultant downward deflection of the spring arm 35. In either of these cases, the switch-actuating element 30 will be moved by the spring arm 35, and the control contacts of the microswitch 22 will be actuated with the result that the web-driving machinery will be shut down before damage to either the web or the machinery can occur.

As so far described, the apparatus resembles generally that described in Cooksey U.S. Pat. No. 3,178,527. However, the apparatus of the present invention realizes a significant improvement over earlier constructions in its provision of more effective means for pro-

tecting the working elements of the switch-actuating mechanism 22 from fouling or obstruction by dust, lint or fibrous particles. In many conditions of operation of the apparatus, such particles tend to be driven into the interior of the enclosure 20 because of the continuous movement of the web 10 in close proximity to the opening 40. The present invention largely overcomes this difficulty by providing in connection with the cup-like part 41 an annular outwardly extending lip 41a which overhangs the bounding edge of the opening 40. This lip partially shields the opening during normal web movement but, more importantly, engages in a closer shielding relationship the upper perimeter of the opening 40 — as most clearly shown in FIG. 4 — when the member 41 is driven into its depressed or activated position by impingement of the air stream 52 or by engagement with the web 10. The effect of this interaction between the lip 41 and the upper surface of the enclosure 20 is twofold. First, it prevents the cup from being depressed so far toward the interior of the enclosure that dust and lint may be swept over the edge of the cup into the enclosure and second, as clearly appears in FIG. 4, it tends to provide a partial seal around the periphery of the opening 40. The conjoint result of these effects is a significant extension of the period of reliable operation of the apparatus.

While the precise configuration of the lip 41a is not crucial, it has been found advantageous to give it a smoothly curvilinear, slightly re-entrant sectional profile as indicated in FIGS. 4 and 5. A particularly beneficial result of this construction is that a cup lip so formed minimizes the likelihood of destructive engagement or entanglement with a web surface which may be drawn into contact with the lip upon the occurrence of web breakage at a point displaced from the path of the air stream 52.

It will be noted also that the apparatus shown in the drawings includes, in addition to the features already described, a sleeve 60 which is slidably positioned about the outer surface of the tubular part 42 in such a way that it may be moved axially to close the opening 50 and thus shut off the air stream 52 for the purpose of temporarily disabling the web-break detection function. While this feature is not new in itself, it is, in the present mode of application, combined with additional structure in a novel and especially useful way. More specifically, by means of a bridging assembly shortly to be described, the sleeve 60 is coupled with a generally rectangular sliding member 70 which rides on the upper surface of the enclosure 20 with its depending lips 70a overlapping the side walls of the enclosure. This member is attached to the enclosure by a pin 71 which passes through a slot 72 formed in the enclosure surface and which is held in the slot by an attached flexible and spring-like washer 73 large enough to overlies the edges of the slot.

In order that the sliding member 70 and the tubular sleeve 60, previously described, may be moved in unison, they are interconnected by a bridging assembly which includes, in the first instance, a tongue 75 which is integrally joined to the end of member 70 but turned to be perpendicular to it. The tongue 75 in turn is externally engaged in telescoping fashion by a metal form 76 bent around it and terminating at its upper end (FIGS. 1 and 3) in a rounded end part 76a. This is provided with a hole 76b of such size as snugly to engage the tubular sleeve 60, which is rigidly fixed in the hole, for ex-

ample, by a combination of peening and brazing. The telescoping arrangement of the parts 75 and 76 permits the bridge which they jointly create between slidable member 70 and the sleeve 60 to be maintained, whether the sleeve is in either the lower or the upper of the two positions in which it is shown in FIG. 1. Accordingly, the bridge can be manually grasped to move it — and with it the parts 60 and 70 — to the left of the position shown in FIGS. 1 and 2. As previously explained, such motion closes the air stream opening 50.

It next needs to be noted (by reference to FIG. 2) that the part 70 has a U-shaped cutout 70d which, as 70 is moved to the left (along with the sleeve 60), will embrace and engage the outer periphery of the part 41. It will readily be seen that when the part 70 is relocated to the left as just described, its terminal extensions 70b and 70c will underlie the lip 41a (see FIG. 5) in such fashion as to limit downward deflection of the cup by any force which may be brought to bear upon its upper surfaces. This is with the object that microswitch 22 shall not be unintentionally activated while the apparatus is supposedly in disabled condition as the result of the movement of the tubular part 60 to the position in which it cuts off the air vent opening 50. Therefore, the sleeve 60 and the plate 70 conjointly provide means by which, upon their simultaneous displacement in the left hand direction, both the air stream 52 and the deflectable arm 35 can be concurrently disabled from performing their normally intended functions. This feature, including the described structure for accomplishing it, is the separate invention of Clifford L. Larson, claimed as such in U.S. application for Patent Ser. No. 389,889, filed Aug. 20, 1973, and is not claimed in the present application. The blocking effect of the part 70 is made still more positive in the arrangement of FIGS. 1 through 4 by providing on the upper surface of the plate 40 a small protrusion or embossment 77 which operates to lift the plate 70 as the plate moves to the left in such a way that its terminal parts 70b and 70c will more closely underlie the lip 41a of the cup-like member 41 as indicated in FIG. 5, thus reducing its range of possible downward movement to a few millimeters.

While the invention has been described by reference to a particular embodiment, it will be understood that the following claims are intended to cover all variations and equivalents which fall within its true spirit and scope.

What I claim as new and desire to secure by Letters Patent is:

1. For use in apparatus which is to be mounted in proximity to a moving web for detecting and reacting to breaks and voids in the web and which includes as one part thereof a source of pressurized fluid to be directed against one side of the web and as a further part thereof control means for governing the starting and stopping of movement of the web, the improvement which consists in

- A. a structure to be positioned in facing relation to, but on the opposite side of the web from, the pressurized fluid source, said structure comprising
 1. a deflectable part operable when deflected to actuate a controlling element of the said control means for stopping movement of the web,
 2. a housing at least partially enclosing the deflectable part and having an opening directed toward

the normal path of the web surface in facing proximity to the said pressurized fluid source, and

3. a member mounted on said deflectable part and movable when subjected to surface pressure to deflect the deflectable part, said member
 - a. extending through and generally conforming to said opening,
 - b. having a surface perpendicularly opposed to the normal flow of fluid from said pressurized fluid source, and also
 - c. having a lip extending peripherally from said member in a region between the outer peripheral portion of the opening and the normal path of the web, whereby the lip, upon movement of the member away from the pressurized fluid source under the influence of pressurized fluid from that source, acts
 - i. to cover the peripheral portion of the opening, and
 - ii. to prevent movement of the member through the opening.

2. For use in apparatus which is to be mounted in proximity to a moving web for detecting and reacting to breaks and voids in the web and which includes as one part thereof a source of pressurized fluid to be directed against one side of the web and as a further part thereof control means for governing the starting and stopping of movement of the web, the improvement which consists in

- A. a structure to be positioned in facing relation to, but on the opposite side of the web from, the pressurized fluid source, said structure comprising
 1. a deflectable part operable when deflected to actuate a controlling element of the said control means for stopping movement of the web,
 2. a housing at least partially enclosing the deflectable part and having an opening directed toward the normal path of the web surface in facing proximity to the said pressurized fluid source, and
 3. a cup-like member mounted on said deflectable part and movable when subjected to axially directed surface pressure to deflect the deflectable part, said member
 - a. having its lateral wall portion projecting through said opening so that its open face is directed toward the pressurized fluid source, and
 - b. having its open face surrounded by a peripherally extending lip which upon movement of the member away from the pressurized fluid source under the influence of pressurized fluid from that source, acts
 - i. to cover the peripheral portion of the opening, and
 - ii. to prevent movement of the member through the opening.

3. A control structure according to claim 2 in which

- A. the lateral walls of the cup-like member conform generally to the inner periphery of the opening, and
- B. the peripherally extending lip is curved away from the normal path of the web to provide a smoothly contoured surface unlikely to damage the web in event of their interengagement.