Oct. 19, 1965 L. TORRES 3,213,225

FEELER FINGER FOR DETECTION EQUIPMENT

Filed Dec. 6, 1961

Fig. 3

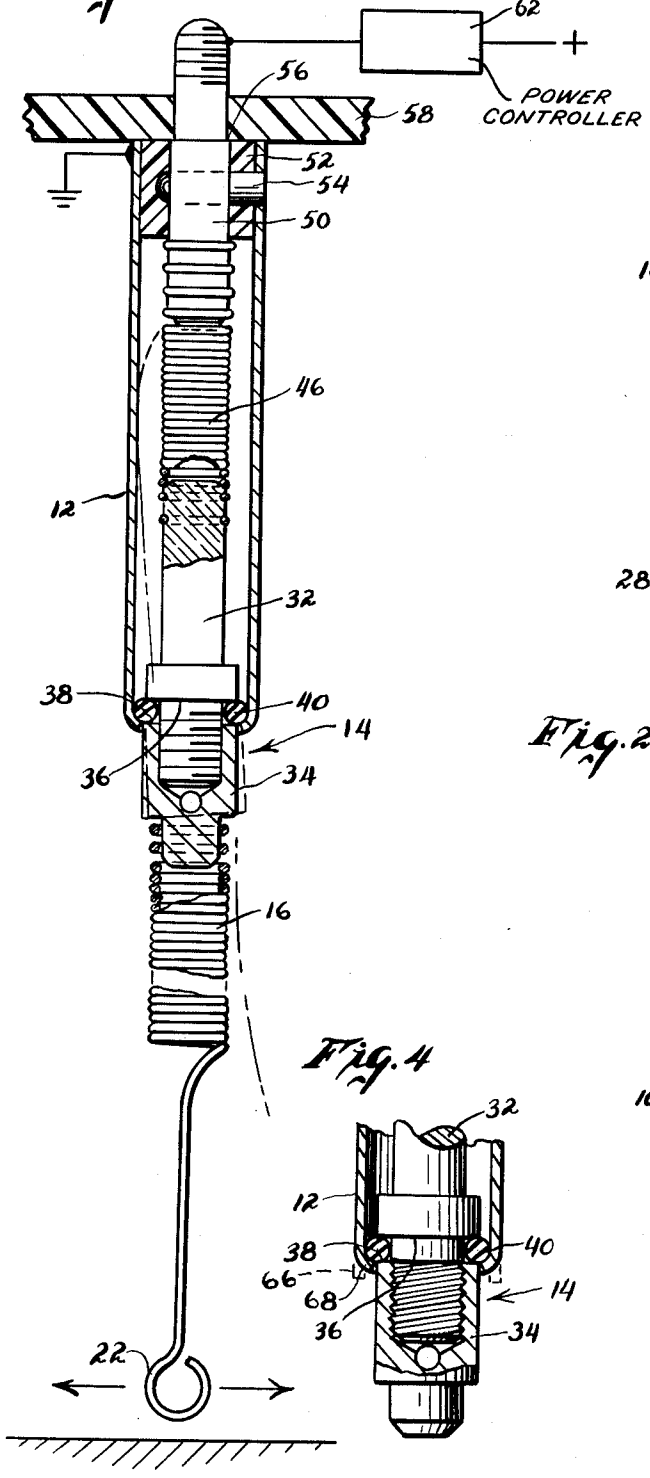

Fig. 1

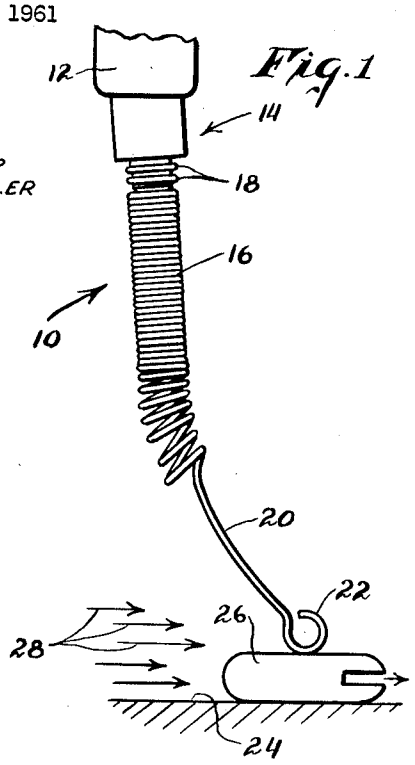

Fig. 2

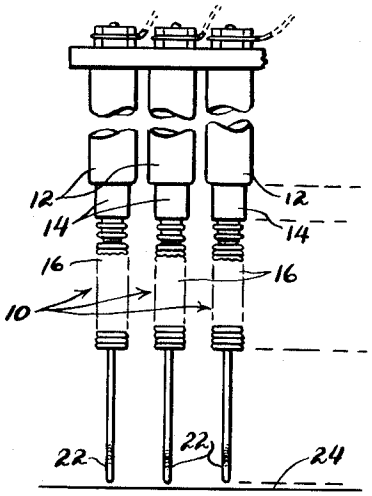

Fig. 4

INVENTOR.
Lydia Torres
BY Emery, Whittemore
Sandoe & Graham.
ATTORNEYS

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FEELER FINGER FOR DETECTION EQUIPMENT

Lydia Torres, Long Island City, N.Y., assignor, by mesne assignments, to George Wintriss

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6 Claims. (Cl. 200—61.41)

This invention relates to feeler fingers that are used for detecting operation of machines and more specially to feelers that are located in the path of parts delivered along a discharge chute and in position to be displaced by a part moving along the discharge chute at the end of each cycle of the machine. Such feelers are connected with an electric circuit and are used to control the automatic stopping of a machine, or for signalling irregularity in the operation, in the event that a part is not delivered when it should be, such failure to deliver being an indication of some malfunctioning of the machine or the feeding of material to the machine.

Feelers of the prior art have not been satisfactory when used in conductive environs, such as water, and chip-laden lubricant; and it is an object of this invention to provide a new feeler construction which is not affected in its operation if splattered with water, chip-laden lubricant, or other electrically conducting material that would short circuit conventional feeler fingers.

It is an object of the invention to provide a feeler in which the bending of a bottom portion of the feeler causes distortion of an upper portion that is enclosed in a protecting casing. All of the electrically conducting parts are enclosed in the protecting casing.

In thep referred embodiment of the invention, the construction involves relatively few parts, and a simple assembly which produces an efficient, rugged and reliable apparatus.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

In the drawing, forming a part thereof, in which like reference characters indicate corresponding parts in all the views:

FIGURE 1 is a side elevation showing the lower part of a feeler finger made in accordance with this invention, and showing the feeler in the course of being operated by passage of a work piece;

FIGURE 2 is a front view, on a reduced scale, showing a plurality of feelers such as illustrated in FIGURE 1 and placed in a row across a delivery chute of an automatic machine;

FIGURE 3 is an enlarged sectional view through the feeler finger shown in FIGURES 1 and 2; and

FIGURE 4 is an enlarged sectional view showing the support and sealing means by which the movable portions of the feeler are connected with the casing.

FIGURE 1 shows a feeler **10** having a fixed casing **12** which is of cylindrical shape. A connector **14** extends from the lower end of the casing **12** and the feeler has a lower portion **16** which is flexible and which consists of a helical spring having its upper convolutions **18** fitting around the lower end of the connector **14** and securing the lower portion **16** to the connector **14**.

For a part of its length at the bottom of the feeler, the lower portion **16** is formed with a straight section **20** having a loop **22** at its bottom end and this loop **22** is normally located close to a bottom surface **24** of a delivery chute along which work pieces **26** are discharged from an automatic machine in the direction indicated by the arrows **28**.

FIGURE 2 shows the way in which the loops **22** extend close to the bottom **24** of the delivery chute and there are a plurality of feelers **10** spaced from one another across the full width of the delivery chute and close enough together so that a work piece cannot pass between successive feelers. The number of feelers necessary, therefore, depends upon the width of the work pieces with which the apparatus is to be used.

FIGURE 1 is a view looking at right angles to the direction of the view shown in FIGURE 2 and illustrates the way in which the lower portion **16** of the feeler is bent and the upper part of this lower portion, together with the connector **14**, is rocked counter-clockwise by the force of the work piece in bending the spring **16**.

FIGURE 3 shows the internal construction of the feeler. The connector **14** consists of an upper part **32** made of electrical insulating material and is screwed into an adapter **34**. There is a shoulder **36** on the insulation part **32** of the connector, and the upper end face **38** of the adapter **34** provides another shoulder confronting the shoulder **36**. Sealing means consisting of an O-ring **40** is held in the circumferential groove provided by these shoulders **36** and **38** and the exposed portion of the connector between the shoulders.

This O-ring **40** serves as the support for the movable portion of the feeler. When the lower portion **16** is rocked toward the right in FIGURE 3, by deflection of the loop at the bottom of the feeler, as indicated in dotted lines, the connector **14** rocks counter-clockwise about the O-ring **40** as a fulcrum.

The feeler has an upper portion **46** which is made of a helical spring similar to the lower portion **16** but without the straight bottom end. This upper portion **46** has some of its lower convolutions fitting around and gripping the upper part of the insulation part **32** to connect the spring **46** with the connector **14**.

At the upper end of the spring, it has a number of convolutions surrounding and gripping a stud **50**, which is in alignment with the longitudinal axis of the casing **12**.

The stud **50** extends through an electrical insulating bushing **52** fitted into the upper end of the casing **12** and secured in place by a pin **54**. This pin also anchors the stud **50** to the bushing **52**.

In the illustrated construction, the stud **50** has a shoulder **56** flush with the top surface of the bushing **52** and the top edge of the casing **12**. The upper end of the stud **50** extends through a fixed support **58** by which all of the feelers are carried. This support **58** is made of electrical insulating material.

The stud **50** is preferably made of metal and so is the flexible upper portion **46** of the feeler. This upper portion **46** is distorted, as indicated by dotted lines, when the connector **32** is rocked about the O-ring as a fulcrum. When so distorted, the spring or upper portion **46** of the feeler touches the inside surface of the casing **12** which is also made of metal.

The circuit for the feeler is illustrated in FIGURE 3. A controller **62**, connected with a suitable source of power, has a ground lead connected with the stud **50**. The spring, or upper portion **46** of the feeler, being made of metal and connected with the stud **50**, constitutes part of the electric circuit. So long as the spring **46** does not touch the sides of the casing **12** the controller **62** is not grounded through the feeler; but when the spring **46** does touch the side of the casing **12**, it grounds the controller **62**.

The way in which the controller apparatus functions in response to grounding of the controller **62** by passage of a work piece which deflects the feeler, forms no part of the present invention and is adequately described in Patent No. 3,023,283, dated Feb. 27, 1962.

FIGURE 4 shows the construction by which the connector **14** is held in the lower end of the casing **12**. When the connector is originally inserted into the casing, the lower edge of the casing has a straight bottom portion

indicated by the reference character 66. After the connector and the O-ring 40 have been pushed up into the casing 12, this lower portion 66 is bent over to form a lip 68 which leaves an opening at the bottom of the casing slightly larger than the outside diameter of the adapter 34 but smaller than the overall diameter of the O-ring 40 so that the O-ring cannot drop out of the casing 12, but there is clearance enough between the adaptor 34 and the lip 68 to permit the connector 14 to rock about the O-ring 40 as a fulcrum.

From the description it will be apparent that the feeler of this invention has all of its electrical contacts and conducting parts enclosed within the casing 12 which has the O-ring 40 sealing its lower end against entrance of water, chip-laden lubricant, or other material that may be splattered on the outside surfaces of the feeler, particularly, with automatic machines where an air blast is used to discharge the work pieces down a delivery chute.

It will also be apparent that the upper flexible portion 46 and the parts which distort it into contact with the casing 12 are symmetrical about the vertical axis of the feeler so that it does not make any difference whether the loop at the lower end of the lower flexible portion 16 is in the same phase relation in one feeler as in another, or whether it changes its position with respect to the upper portions of the feeler at various times. The connector can rock in any direction and regardless of the direction in which it rocks, the same displacement will result in a contact between the spring or upper flexible portion 46 and and the wall of the casing 12.

The preferred embodiment of the invention has been illustrated and described, but changes and modifications can be made, and some features can be used in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. A feeler assembly including a lower flexible portion for location in the path of a work piece to be detected, a casing above the lower portion and from which the lower portion of the feeler assembly is supported, the casing having a side wall extending upwardly away from the lower portion of the feeler assembly, an upper flexible portion of the feeler assembly including spring means supported at both ends of the casing and deflectable transversely toward and from the side wall of the casing, the feeler assembly having an electric contact surface on the spring means intermediate the ends of the spring means, and another electric contact surface on a wall of the casing, the spring means being deflectable transversely toward and from the side walls and between two positions in one of which the contact surface on the spring means touches the contact surface on the casing, an electric circuit connected to the contact surfaces and closed by touching of the contact surfaces, connector means joined at opposite ends to said lower and upper portions of the feeler assembly and through which flexing that displaces said lower portion deflects the upper portion transversely from one of its positions to the other, said casing protecting the contact surfaces therein from splatter of material outside of the casing and projected in the direction of travel of the work piece.

2. The feeler assembly described in claim 1 characterized by the contact surface on the casing being a part of the area of the side wall of the casing.

3. The feeler assembly described in claim 1 characterized by the spring means being a helical spring with its longitudinal axis extending downwardly in the casing and toward the lower portion of the feeler assembly, the lower portion which displaces the connector means being movable in a direction to rock the connector means and to bend the helical spring in producing the deflection that moves the contact surface on the spring into contact with said contact surface on the side wall of the casing.

4. The feeler assembly described in claim 3 characterized by the connector means between the lower and upper portions of the feeler assembly being made of electrical insulating material and serving to insulate the lower portion of the feeler assembly from the upper portion that is in the casing.

5. A feeler assembly including a cylindrical casing, connector means extending through a lower end of the casing, bearing means at the lower end of the casing on which the connector means rock about an axis transverse of the longitudinal axis of the casing, a lower portion of the feeler assembly attached to the connector means and extending downwardly from the connector means for location in the path of a work piece to be detected and for deflection by said work piece, the casing having a side wall extending upwardly away from the lower portion of the feeler assembly, an upper flexible portion of the feeler assembly within the casing and attached at its upper end to a relatively fixed part of the feeler assembly and attached at its lower end to the connector means and deflectable transversely toward and from the side walls and in response to movement of the connector means by the lower portion of the feeler assembly, and electric contact surfaces in the casing, one of which is on the flexible portion of said upper portion of the feeler assembly intermediate the ends thereof, and the other of which is on the wall of the casing, one of the contact surfaces being moved with respect to the other in response to the transverse deflection of the upper portion of the feeler assembly.

6. The feeler assembly described in claim 5 characterized by the bearing means including a flexible seal for preventing water and other electrical conductive material from being splattered into the casing, said flexible seal and bearing means including an O-ring that supports the connector means, said connector means having a circumferential groove in which the O-ring is held, and the cylindrical casing having a lip at its lower end extending under the O-ring and holding the O-ring against displacement from the casing, a stud extending upwardly above the top of the cylindrical casing and constituting an electrical conductor, the stud being said relatively fixed part of the feeler assembly and having a portion beyond the upper end of the casing adapted to extend through a block of electrical insulating material for supporting the cylindrical casing therefrom, an electric insulating bushing in the upper part of the cylindrical casing and connecting the casing with the stud, the upper portion of the feeler assembly including helical spring means with its top part fitting over the lower end of the stud for connecting the spring means to the stud, the connector means being constructed partially of electrical insulating material and the lower part of the spring means fitting over the upper part of the connector means, an adaptor forming the lower end of the connector means and threaded to the upper part of the connector means, shoulders on the adaptor and the upper part of the connector means forming the circumferential groove for the O-ring, the lower portion of the feeler assembly including a helical spring having its upper part fitting over the adaptor and a straight lower end portion projecting substantially axially of the spring and into the path of the work piece.

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BERNARD A. GILHEANY, *Primary Examiner.*

ROBERT K. SCHAEFER, *Examiner.*