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L. E. DILTS

2,671,139

DETECTING DEVICE

Filed Dec. 26, 1951

Fig. 2.

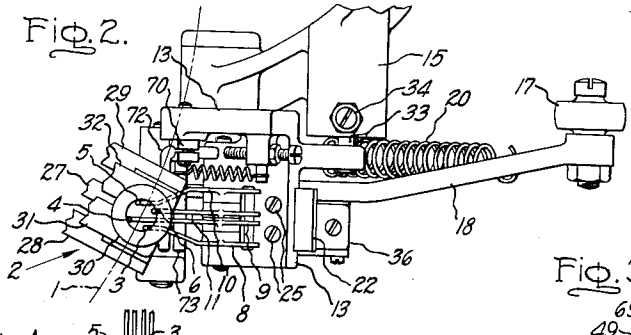


Fig. 1.

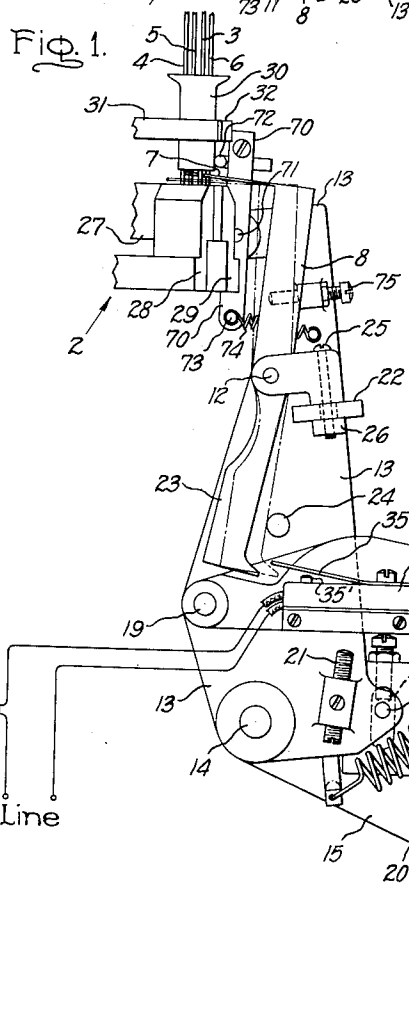
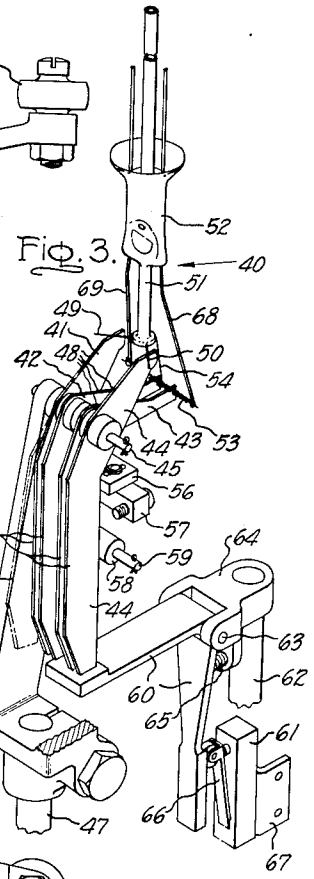


Fig. 3.



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2,671,139

DETECTING DEVICE

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Application December 26, 1951, Serial No. 263,435

10 Claims. (Cl. 200—61.42)

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My invention relates to apparatus for manufacturing electric lamps and discharge devices, and more particularly to apparatus for detecting the presence or absence or defective condition of wires or wire assemblies of mounts for lamps and other electrical devices.

Because of the automatic nature of stem and mount making apparatus and the high speeds of operation of such apparatus it is very desirable that some means be provided to determine whether the wire parts have been properly fed and assembled in the apparatus. That objective is attendant with certain difficulties inasmuch as these wire parts are relatively small and flexible and usually present only a very limited area for engagement with the detection apparatus. The high speed of operation, as well as the inherent vibration of the stem and mount making apparatus, also add to the difficulties of detecting the relatively limp wire parts of this type.

One object of my invention is to provide apparatus for detecting the presence or absence of wire-like bodies of very slight strength or delicate construction, which apparatus is suited to high operating speeds and which is suited to use in an automatic manufacturing machine. To this end, I provide a feeler of low mass and mounted for movement against, or through the normal position of, the wire-like body. One detecting device of the general class with which this invention is concerned is disclosed in Patent 2,053,137, Donovan et al., dated September 1, 1936, and assigned to the assignee of the present invention. However, in prior art devices the pressure of engagement of the feelers with the wire-like bodies has been controlled by means of weights and springs. Such means increase the test pressure during the displacement of the feelers and, accordingly, are difficult to adjust to proper operation. The weight and spring type means also cause the feelers to oscillate back and forth when removed from engagement with the mount so that successive cycles of operation of the device cannot follow too closely. Such disadvantages are obviated in accordance with one aspect of my invention by provision of magnet means arranged to control the pressure of engagement of the said feelers.

Another object of my invention is to provide a detecting device for stem machines and the like which device is well suited to feel for groups of the leading-in wires or wire-like bodies and which does not take a complex form in such applications so as to be unreliable and difficult to keep in proper operating condition. This object is attained in one application of my invention by providing a group of suitably shaped feelers on a common pivot and moving the pivot toward the holder for a corresponding group of leading-in wires or wire-like bodies to an extent which causes the feelers to be rotated out of position by engagement therewith. Preferably, a single magnet provides the means of holding all of the feelers in the test position and performs this function by attracting portions of said feelers. Switching means of suitable alarm and control means is advanced through the position normally occupied by portions of such feelers as are not displaced by the leading-in wires or wire-like bodies.

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Another object of my invention is to provide a device for detecting the absence of a leading-in wire in the holder of a stem making machine, the device being of a type suited to detect a plurality of leading-in wires in a very restricted space in said machine. To this end, means are provided for advancing a narrow feeler end foremost through the position normally occupied by the leading-in wire or, if said wire is present, to engagement therewith. Means are also provided for effecting the switching of an electrical control circuit should the feeler fail to engage a support wire and move to the full extent of its motion.

Further objects and features of my invention will appear in the following detailed description of species thereof and from the drawing.

In the drawing Fig. 1 is a side elevation of a leading-in wire detecting device comprising my invention at the moment of its arrangement at operative relation to a leading-in wire holder of a stem making machine, said figure being modified by having the control circuit diagram superimposed thereon; Fig. 2 is a plan view of the leading-in wire detecting device and the holder of Fig. 1; and Fig. 3 is a perspective view of a wire assembly inspecting device constructed according to the invention and at the moment of its movement into operative relation to a lamp mount.

The leading-in wire detecting device disclosed in Figs. 1 and 2 of the drawing is mounted below and outward from the circular path of movement, indicated at 1, of work carrying heads (one head being shown in part at 2), of a machine corresponding to the stem making portion of an automatic machine for making incandescent lamp mounts and disclosed in Patent 1,907,532 to Flaws, dated May 9, 1933. The detecting device bears a definite relation to a sta-

tion taken by each of the heads of the stem making apparatus in turn and preferably is located at a station following that at which the four leading-in wires 3, 4, 5, and 6 are fed into the head 2 inasmuch as the improper feeding of said leading-in wires 3, 4, 5, and 6 will then be discovered immediately by said device. This arrangement of the leading-in wire detecting device in the stem making apparatus also enables said device to be used to control all subsequently occurring operations performed on the stem parts in the head 2 and avoids wastage of parts in that feeding operations can be by-passed.

The detecting device is so located with respect to the station shown that the upper sensing ends 7 of each of four generally vertical feleers 8, 9, 10, and 11 on a common pivot pin 12 are carried against, or pass through the positions normally occupied by the leading-in wires 3, 4, 5, and 6 respectively, by a counter-clockwise rocking movement of the support lever 13 for the pivot pin 12 about the shaft 14. The feelers 8, 9, 10, and 11 lie at a retracted position to one side of the path of travel of the head 2 during the advance of said head 2 to the station and initiate the cycle of operation by being advanced to operative relation to the leading-in wires 3, 4, 5, and 6 in the manner described. A bracket 15 on the upper end of fixed column 16 provides the support for the shaft 14, whereas the operative functions of the device, which must be timed to the advance of a head 2 to the station, are preferably effected by means connected to the main driving means (not shown) of the stem making apparatus and effecting operation in the manner of other conventional operating means associated with said apparatus. The rocking operation of the support lever 13 is brought about by upward motion of the operating rod 17 under control of the operating means (not shown) and results in movement of the operating arm 18 together with the support lever 13 at the beginning of the cycle inasmuch as said operating arm 18, which is mounted upon the support pivot 19 on said support lever 13, is maintained at a fixed relation to said support lever 13. The contraction force of the helical spring 20 at such times causes the operating arm 18 to be held at a position where it bears against the end of a stop screw 21 in a raised lug on one side of the support lever 13.

As the rocking movement of the support lever 13 progresses, the sensing ends 7 of the feelers 8, 9, 10, and 11 either pass through the position of any of the leading-in wires 3, 4, 5, and 6 that may be missing or butt against said wires 3, 4, 5, and 6 so that they are pushed back and turn in a clockwise direction about pin 12 (Fig. 1) to the displaced position at which they appear in the drawing. The swinging movement of the feelers 8, 9, 10, and 11 is effected against the resistance furnished by the attraction of a relatively strong magnet 22 for the lower control portions 23 of each of said feelers 8, 9, 10, and 11 on the opposite side of the pivot 12 from the sensing portions 7, and displaces said control portions 23 from engagement with the post 24 projecting from the side of the support lever 13. The magnet 22 provides in one body the means of controlling the position of all of the feelers 8, 9, 10, and 11 and exerts a controlling force determined by its adjusted position on the support lever 13.

When a greater or lesser contacting force is required of the feelers 8, 9, 10, and 11, the screws 25—25 which extend through the essentially non-magnetic support lever 13 to the nut 26 are loosened and said magnet 22 is slid toward or away from said feelers 8, 9, 10, and 11, which are made of a magnetic material such as steel. The magnet 22 is adjusted to a relation to the feelers 8, 9, 10, and 11 to cause said feelers to seat firmly against the leading-in wires 3, 4, 5, and 6 without bending them from position and is so arranged that it retains control over said feelers 8, 9, 10, and 11 even after they are displaced by engagement with said leading-in wires 3, 4, 5, and 6.

In order to allow the pressure of engagement of the feelers 8, 9, 10, and 11 to be as great as possible it is preferred that the device be located at an elevation causing the sensing ends 7 thereof to engage portions of the leading-in wires 3, 4, 5, and 6 immediately above a holder comprised of a fixed center jaw 27 and a pair of separable outer jaws 28, and 29 which form wells or pockets for the retention of the lower ends of said leading-in wires 3, 4, 5, and 6. The vertical extent of the leading-in wires 3, 4, 5, and 6 which is open to engagement by feelers 8, 9, 10 and 11 is restricted by the presence of a vitreous stem tube 30 retained by a pair of jaws 31 and 32 at a position directly above the holder of the head 2. At the limit of the rocking or positioning movement of the feelers 8, 9, 10, and 11 the support lever 13 has moved to the extent that the stud 33 on the lower portion thereof bears against the end of the stop screw 34 in a clearance slot in the bracket 15.

After the feelers 8, 9, 10, and 11 have been brought to operative relation to the leading-in wires 3, 4, 5, and 6, the electrical switching means of said device is brought into position to be tripped thereby so that said means can effect control over an alarm or such stem making apparatus of the complete machine as it may be desirable to control thereby. The switching means is made effective when the continuing motion of the operating arm 18 carries the actuating blade 35 of a totally enclosed commercial form of switch 36 attached to the side thereof up against the control end 23 of such one or more of the feelers 8, 9, 10, and 11 as have not been displaced by engagement with the leading-in wires 3, 4, 5, and 6. This continuing motion of the operating arm 18 stretches the helical spring 20 (inasmuch as the support lever 13 is incapable of further movement) and can actuate the switch 36 when one of the feelers 8, 9, 10, and 11 remains in its original position (indicated in dash-dot lines, Fig. 1) and in engagement with the locating post 24. Because the actuating blade 35 comes to bear against parts of the control portions 23 of the feelers 8, 9, 10, and 11 located on the opposite side of the pivot pin 12 from sensing portions 7 thereof, the pressure of engagement causes said feelers 8, 9, 10, and 11 to be more tightly pressed against the post 24 and cannot push them from position. Movement of the actuating blade 35 of the normally open switch 36 causes said blade 35 to press the pin 35' to a position whereby the circuit therethrough is complete. Under these conditions the control circuit to the signal lamp 37 is complete and said lamp 37 is lighted and indicates a missing leading-in wire in the head 2. If other controls are to be operated by the circuit through the switch 36, they are connected in place of the signal lamp 37 or in electrically parallel relation thereto.

Under the normal operative conditions, the next operation of the leading-in wire detecting device is to withdraw from operative relation to the head 2. This operation is effected by a downward return motion of the operating rod 17 and the subsequently occurring return swing of the operating arm 18 and the support lever 13.

Means are also incorporated in the detecting device disclosed in Figs. 1 and 2 for rendering said device incapable of performing its normal leading-in wire detecting function should a stem tube 30 be missing from the head 2, a condition which exists when the stem making machine is being operated for warming up or at any time when flare tubes 30 are not being fed into the machine. The incorporation of means of this type in the detecting device introduces an overriding control for preventing the flashing of a warning when leading-in wires are purposely kept from the heads 2 during operation of the stem making machine.

The missing stem tube control means performs its overriding function according to the rotative position of a lever 70 pivoted upon pin 71 on the upper extremity of the support lever 13 and arranged so that presence of a stem tube 30 against the rod-like finger 72 on its upper end causes it to turn about said pin 71 so that the post 73 on its lower end is moved from a blocking position in front of the feelers 8, 9, 10, and 11. The lever 70 is normally under the influence of the contracting force of a helical spring 74 connected between the post 73 and a post on the support lever 13 so that it is turned into engagement with the stop screw 75 on said support lever 13, and the post 73, through engagement with the edges of the feelers 8, 9, 10, and 11, presses said feelers to the full tilted (inoperative) position. The usual movements of the support lever 13 in advancing the feelers 8, 9, 10, and 11 into contact with the leading-in wires 3, 4, 5, and 6 normally cause the finger 72 to bear against the stem tube 30 and turn the lever 70 so that the post 73 is moved away from feelers, 8, 9, 10, and 11 which are then free to swing under the influence of the magnet 22 or said leading-in wires 3, 4, 5, and 6. If the finger 72 does not contact a stem tube 30 it of course will not be moved from the position where the post 73 on its lower end blocks movement of the feelers 8, 9, 10, and 11 which will result in the actuating blade 35 of the control switch 36 passing by and not engaging the control portions 23 of said feelers 8, 9, 10, and 11.

The wire assembly inspection device shown in Fig. 3 is, like the previously described modification, arranged at a work station in automatic manufacturing apparatus and, through its ability to detect the absence or improper manufacture of certain wire-like and readily deformable parts of the incandescent lamp mount 40, provides a means of automatically determining the proper operation of said apparatus. The inspection device is located at a work station taken by the mount 40 during the course of its manufacture in a machine of the type disclosed in Flaws Patent 2,085,578, dated June 29, 1937, which is also assigned to the assignee of the present invention, and is preferably operated by the main driving means of said machine in order to cause its operative cycle to coincide with the advance of said mount 40 to and from said work station.

The inspection device corresponds generally to the device disclosed in Donovan et al. Patent 2,053,137, dated September 1, 1936, in that it provides a plurality of feelers 41, 42, 43 and 44 normally located below the mount 40 and movable upward against or through the normal position of parts of said mount 40 to determine the presence or absence of said parts. The feelers 41, 42, 43, and 44 are pivoted upon a common pin 45 carried by the bifurcate ends (only one being shown) of a bracket 46 on the upper end of a rod 47. When moved upward by movement of the bracket 46 and the rod 47 under the influence of the mount making machine, the feelers 41—44 bring their sensing end portions 48 (extending in a generally horizontal direction from said pivot pin 45) into engagement with specific portions of the mount 40. The sensing end portions 48 of the feelers 41 and 44 are so shaped that they are caused to bear against portions of laterally extending tie wires 49 and 50 at points adjacent the vitreous arbor 51 of the stem 52 of the mount 40 at the same time as the sensing portions 48 of the feelers 42 and 43 are caused to bear against portions of a coiled-coil filament 53 on opposite sides of a support wire 54 extending downward to said filament 53 from said stem arbor 51. The pressure of engagement of all of the feelers 41, 42, 43 and 44 results from forces applied to the control portions 55 thereof lying almost directly below the pivot pin 45 inasmuch as said feelers 41, 42, 43, and 44 have relatively little mass and have a weight distribution almost balancing them about the pivot pin 45. These forces are applied to each of the feelers 41, 42, 43, and 44 equally by the attraction for the control portions 55 thereof of a magnet 56 mounted upon a bar 57 of non-magnetic material connecting the bifurcate ends of the bracket 46. The extent of the vertical movement of the feelers 41, 42, 43 and 44 carries them to a higher position than shown in Fig. 3 of the drawing and advances said feelers 41, 42, 43 and 44 upward to an extent such that they are tilted about the pivot pin 45 to positions, corresponding to that indicated by the dot-dash outline 55' of the control portion 55 of feeler 41, when their respective portions of the mount 40 are engaged. On the other hand should the feelers 41, 42, 43 and 44 fail to engage portions of the mount 40, they will remain in their initial position wherein the control portions 55 thereof are held against the sleeve 58 on a stop pin 59 extending between the bifurcate ends of the bracket 46 by the attraction of the magnet 56 for said control portions 55.

The electrical circuit controlling function of the inspection device occurs during the immediately following interval when the lever 60 is moved upward through the initial positions occupied by the control portions 55 of the feelers 41, 42, 43, and 44 and, should the mount 40 be defective, said lever 60 is tilted out of position by said control portions 55 so as to effect operation of the switch 61. The motion of the lever 60 is brought about by movement effected in rod 62 in a manner corresponding to the movement in rod 47 and is in a vertical direction at the start of the cycle in that said lever 60 is kept from turning about the pivot pin 63 in the bracket 64 on said rod 62 by a helical spring 65 located between an ear on said bracket 64 and the lower or vertical arm of said lever 60. Should all of the feelers 41, 42, 43 and 44 have been tilted by engagement with the tie wires 49 and 50 and the filament 53, and the mount 40 be properly made so that said tie wires 49 and 50 and the filament 53 are retained at their proper positions therein, the outer end of the horizontal arm of lever 60 will

pass upward above the elevation of the ends of the control portions 55 of said feelers 41, 42, 43 and 44 and no further action will result. However, should one or more of the feelers 41, 42, 43, and 44 fail to have been fully displaced because of a defect in the mount 40, the said end of the lever 60 will be brought against the end of the control portion 55 thereof and will be tilted counter-clockwise (Fig. 3) about the pivot pin 63 so that the lower end thereof forces the control arm 66 of the switch 61 back sufficiently to actuate said switch 61. Actuation of the switch 61, in turn, makes an electrical circuit therethrough which may be arranged to control an indicator light and other electrical apparatus, as for instance in the manner of the previously described apparatus. The switch 61 is a stationary element of the combination fastened by the bracket 67 to the frame (not shown) of the mount making machine at a position opposite the lower end of the lever 60.

The arrangement of the feelers 41, 42, 43 and 44 is such that they engage well supported portions of the tie wires 49 and 50 and the filament 53 and accordingly will not bend said portions out of position even though the rate of operation of the inspection device is very rapid and said feelers 41, 42, 43, and 44 are carried up against said portions very speedily. It should also be noted that the effective pull of the magnet 56 for the control portions 55 of the feelers 41, 42, 43 and 44 becomes progressively less as the control portions 55 are displaced and in some measure counterbalances the increased pressure of the feelers 41, 42, 43, and 44 caused by the control portions 55 being swung to one side about the pivot pin 45. This construction prevents the application of considerably greater pressure by the feelers 41, 42, 43, and 44 during their upward motion, and reduces the tendency of the resiliency in the several parts of the mount 40 to cause oscillation of said feelers 41, 42, 43, and 44 about the pivot pin 45 which motion could interfere with the proper actuation of lever 60 and switch 61. The arrangement of the feelers 42 and 43 also permits them to detect improper conditions in the filament 53 such as those occurring when one or both ends of said filament 53 are not attached to the leading-in wires 68 and 69 of the mount 40 or when one or both of said leading-in wires 68 and 69 are missing. Downward movements of the rods 62 and 47 effect the withdrawal of the inspection device from operative relation to the mount 40 and complete the cycle of operation thereof.

It will be understood that preferred forms of the invention have been disclosed and that the specific construction and arrangement of parts in these disclosures may be modified within the spirit and scope of the invention as defined by the appended claims.

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

1. A device for detecting the presence or absence or displaced location of a wire-like body forming part of a mount structure of the class described, comprising a feeler having sensing and control portions at opposite sides of a pivot point and made at least in part of magnetic material, movable support means providing a pivot for said feeler, magnet means mounted upon the support means adjacent to said feeler and controlling the position of the feeler by magnetic attraction therefor, means for moving the support means toward the wire-like body to cause the sensing portion of the feeler to bear thereagainst and the control portion thereof to be displaced by the resulting rotation of said feeler in a direction away from said magnet means, and switch means including means for actuating the switch means upon failure of the control portion of the feeler to be displaced.

2. A device for detecting the presence or absence or displaced location of a wire-like body forming part of a mount structure of the class described, comprising a feeler having sensing and control portions at opposite sides of a pivot point and made at least in part of magnetic material, movable support means providing a pivot for said feeler, magnet means mounted upon the support means adjacent the path of rotation of the control portion of said feeler for positioning said feeler by magnetic attraction for said portion, means for moving the support means toward the wire-like body to cause the sensing portion of the feeler to bear against and be rotated by said body so that the control portion thereof is displaced in a direction away from the magnet means, and switch means including means for actuating the switch means upon failure of the control portion of the feeler to be displaced.

3. A device for detecting the presence or absence or displaced location of a wire-like body forming part of a mount structure of the class described, comprising a feeler having sensing and control portions at opposite sides of a pivot point and made at least in part of magnetic material, movable support means providing a pivot for said feeler, a stop mounted upon the support means in the path of rotation of the control portion of said feeler, a magnet mounted upon the support means adjacent said feeler to hold said feeler by magnetic attraction at a position where the control portion thereof engages said stop, means for moving said support means toward the wire-like body to cause the sensing portion of said feeler to bear against and be rotated by said body so that the control portion thereof is displaced from said stop, and switch means including means for actuating the switch means upon failure of the control portion of the feeler to be displaced.

4. A device for detecting the presence or absence or displaced location of a wire-like body forming part of a mount structure of the class described, comprising a feeler having sensing and control portions at opposite sides of a pivot point and so proportioned as to cause the control portion to take a position below the pivot point, said feeler being made at least in part of magnetic material, movable support means providing a pivot for said feeler, a stop mounted upon the support means adjacent one edge of the control portion of the feeler, a magnet mounted upon the support means adjacent the stop to attract the control portion of the feeler into engagement with said stop, means for moving said support means toward the wire-like body to cause the sensing portion of said feeler to bear against and be rotated by said body so that the control portion thereof is displaced from the stop, and switch means including means for actuating the switch means upon failure of the feeler to be displaced.

5. A device for detecting the presence or absence or displaced location of a wire-like body forming part of a mount structure of the class described, comprising a feeler having sensing and control portions at opposite sides of a pivot point and so proportioned as to cause the control por-

tion to take a position below the pivot point, said feeler being made at least in part of magnetic material, movable support means providing a pivot for said feeler, a stop mounted upon the support means adjacent one edge of the control portion of said feeler, a magnet mounted upon the support means adjacent said stop to attract the control portion of said feeler into engagement with said stop, means for moving said support means toward the wire-like body to cause the sensing portion of the feeler to bear against and be rotated by said body so that said control portion is displaced from the stop, and switch means including a member movable upward toward the pivot of the feeler and against the end of the control portion thereof to actuate said switch should said feeler remain in position against the said stop.

6. A device for detecting the presence or absence or displaced location of wire-like bodies forming parts of a mount structure of the class described, comprising a plurality of feelers each having sensing and control portions at opposite sides of a pivot point and made at least in part of magnetic material, movable support means providing a common pivot for said feelers, magnet means mounted upon the support means adjacent to said feelers and controlling the positions of the several said feelers by magnetic attraction therefor, means for moving said support means toward the wire-like bodies to cause the sensing portions of the feelers to bear against and be rotated by said bodies so that the control portions thereof are displaced by the resulting rotation of the feelers in a direction away from said magnet means, and switch means including means for actuating the switch means upon failure of the control portions of one or more of said feelers to be displaced.

7. A device for detecting the presence or absence or displaced location of wire-like bodies forming parts of a mount structure of the class described, comprising a plurality of feelers each having sensing and control portions at opposite sides of a pivot point and made at least in part of magnetic material, movable support means providing a common pivot for said feelers, a stop mounted upon said support means in the path of rotation of the control portions of said feelers, a magnet mounted upon the support means adjacent the stop to attract the control portions of said feelers into engagement with said stop, means for moving said support means toward the wire-like bodies to cause the sensing portions of said feelers to bear against and be rotated by said bodies so that the control portions are displaced from the stop by the resulting rotation of said feelers in a direction away from said magnet means, and switch means including means for actuating the switch means upon failure of the control portions of one or more of said feelers to be displaced from the stop.

8. A device for detecting the presence or absence or displaced location of wire-like bodies forming parts of mount structures of the class described, comprising a plurality of feelers each having sensing and control portions at opposite sides of a pivot point and made at least in part of magnetic material, a support lever mounted

for pivotal movement in a vertical plane, a common pivot for said feelers on said support lever, a stop mount on said support lever adjacent the control portions of said feelers, a magnet mounted upon said support lever adjacent said stop to attract the control portions of said feelers into engagement with said stop, means for pivoting the support lever toward the wire-like bodies to cause the sensing portions of the feelers to engage and be rotated by said bodies so that the control portions are displaced from the stop by the resulting rotation of said feelers, and switch means including means for actuating the switch means upon failure of the control portions of one or more of the feelers to be displaced from the said stop.

9. A device for detecting the presence or absence or displaced location of wire-like bodies forming parts of a mount structure of the class described, comprising a plurality of feelers each having sensing and control portions at opposite sides of a pivot point and made at least in part of magnetic material, a support lever mounted for pivotal movement in a vertical plane, a common pivot for the feelers on the support lever, a stop mounted on the support lever adjacent the control portions of the feelers, a magnet mounted upon the support lever adjacent the stop to attract the control portions of the feelers into engagement with the stop, an operating arm pivoted upon the support lever, means for causing movement of the operating arm to pivot the support lever toward the wire-like bodies to cause the sensing portions of the feelers to engage and be rotated by said bodies so that the control portions are displaced from the stop by the resulting rotation of the feelers, and switching means mounted upon the operating arm and including means movable against the ends of any one or more of the control means as is not displaced from the stop for actuating said switch means.

10. In a detecting mechanism of the class described, the combination of support means, at least one feeler member pivotally mounted on said support means and substantially balanced on its pivot, at least a portion of said feeler member being of magnetizable material, magnet means mounted on said support means adjacent said feeler member in a position tending to retain said finger member in a normal substantially balanced position by magnet attraction therefor, means for moving said support means to carry a portion of said feeler member into engagement with an article to be detected and to displace said feeler member, upon such engagement, in a direction away from said magnet means, and switch means including means operable to actuate said switch means upon failure of said feeler member to be displaced.

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