Oct. 31, 1961 E. D. NASH 3,006,450

SHEET DETECTOR FOR USE WITH PRINTING PRESS

Filed May 2, 1958

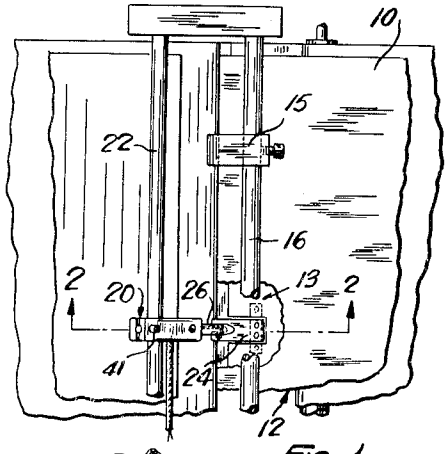


FIG. 1

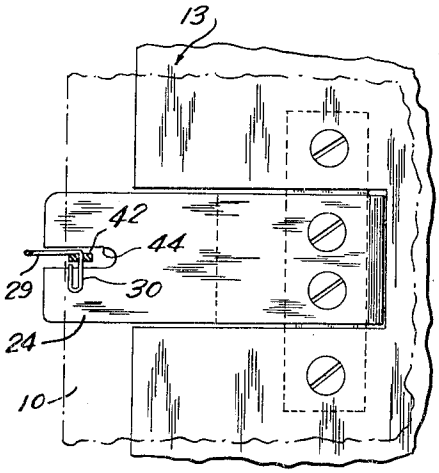


FIG. 3

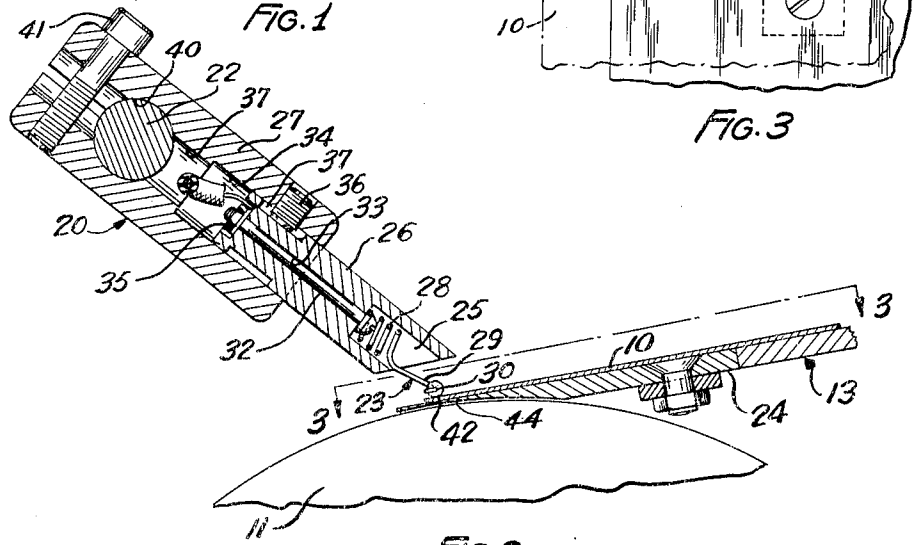


FIG. 2

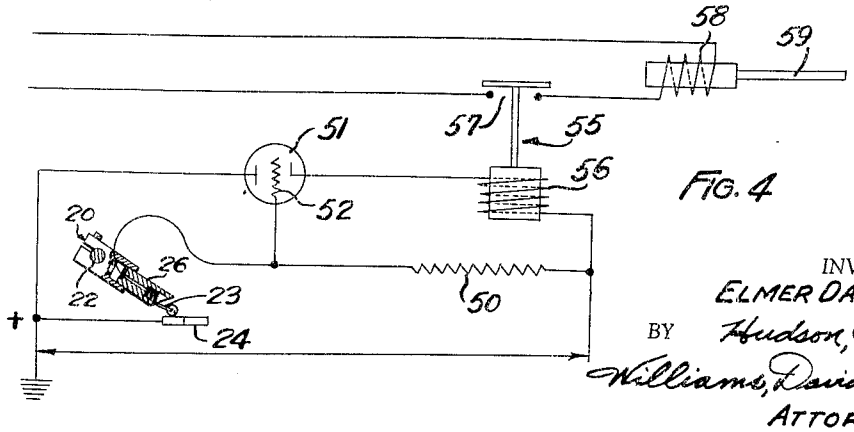


FIG. 4

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SHEET DETECTOR FOR USE WITH PRINTING PRESS

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The present invention relates to detectors, particularly sheet material detectors, for detecting whether or not sheet material is present at a predetermined position and for performing a control operation in the absence of the sheet at the position.

One type of detector to which the present invention relates includes a movable conductive member which engages one side of the sheet material being sensed when the latter is at the desired position and which is moved into engagement with a contact member disposed on the other side of the sheet material if the latter is absent from the position at the time of sensing. When the detector is detecting sheets which are successively moved to the position, the movable conductive member is oscillated in relationship to the movement of sheets to the position and is moved toward engagement with the contact member when it is desired to sense the presence or absence of a sheet. If the sheet is present at the desired location, it prevents the contact of the movable conductive member with contact member; if the material is absent, the movable conductive member engages the contact member to complete a control circuit. If the detector is sensing the presence of a continuous web, or the equivalent, it need only be urged into engagement with one side of the web rather than oscillated.

In the type of detector under consideration, the movable conductive member is normally disposed clear of the path of movement of the sheet and of the plane of the sheet. The only time the movable member is disposed in the plane of the sheet material or the path of movement thereof is when it is moved through the position normally occupied by the sheet material in the absence of the latter at the time of sensing. It can be readily understood that when the material being sensed is a thin sheet, such as a sheet of paper to be fed to a printing press, the additional movement of the finger between its position where it is in engagement with the sheet being sensed and its position where it is in contact with the contact member is very little and that, heretofore, the sheet-engaging portion of the element has, therefore, been substantially the same as the contact-engaging portion.

In operation, the type of detector described has heretofore been subject to malfunctioning since the sheet-engaging portion and the contact-engaging portion have, as mentioned above, been substantially the same and when the detector is used to sense the presence or absence of paper, particularly glossy paper, an insulating film tends to build up on the movable conducting member which interferes with the ability thereof to establish a circuit when the movable conductive member engages the contact member.

The principal object of the present invention is to provide a detector of the type referred to having a conductive member which engages a contact member when sheet material is absent from a position between the members and engages one side of the material rather than the contact member when the material is present and which is not subject to malfunctioning due to the build-up of an insulating film picked up from the material being sensed or due to an accumulation of ink and dirt.

Another object of the present invention is to provide a detector of the type referred to having a conductive

member which engages a contact member when sheet material is absent from a position between the members and engages one side of the sheet material rather than the contact member when the material is present and in which the conductive member has a contact-engaging portion different from the part thereof that engages the material.

A further object is to provide a detector of the type referred to which is suitable for use with electrically conductive sheet material as well as with sheet material of an insulating nature and which includes a sensing member having a non-conducting portion adapted to engage the sheet material and a conductive portion adapted to engage the contact member on the other side of the sheet material.

It is a still further object of the present invention to provide a sheet-handling mechanism having in combination therewith a detector for detecting the presence or absence of a sheet at a predetermined position and which includes a movable sensing element oscillatable to and from engagement with either the sheet, if the latter is positioned properly, or with a contact member in the absence of a sheet at the predetermined position, the sensing element including a wheel adapted to ride on the sheet and a conductive part different from the wheel for engaging the contact member.

Further objects and advantages of the present invention will be apparent from the following detailed description of the preferred embodiment thereof made with reference to the accompanying drawings in which:

FIG. 1 is a fragmentary plan view of a portion of a sheet-fed printing press showing the sheet feeder and the cylinder of the press which receives the sheet from the sheet feeder;

FIG. 2 is an enlarged sectional view taken approximately along line 2—2 of FIG. 1 with parts omitted;

FIG. 3 is a view taken approximately along line 3—3 of FIG. 2; and

FIG. 4 is a circuit diagram schematically showing the manner in which the sheet detector element controls the operation of the press.

While the present invention is susceptible of use in various types of detectors for detecting the presence or absence of material at a predetermined position, it is particularly useful in a sheet feeder for a printing press where the sensing element is periodically rocked to a sensing position in timed relationship to the feeding of the sheets to the press to determine whether or not a sheet is in proper position to be fed. It is particularly advantageous where sheets of conductive material or where sheets of high gloss paper are being handled. In the latter case an insulating film builds up on the portion of the detector which normally engages the sheet for, as mentioned above, the sheet-engaging portion in the type of detector involved in the present application has heretofore been conductive and engageable with a contact member in the absence of a sheet to provide a signal that the sheet is absent.

Referring to the drawings, sheets of paper or other material, designated by the reference numeral **10**, are fed to the cylinder **11** of a printing press by a sheet feeder **12**. The cylinder **11** may be an impression cylinder of a printing couple or a feed cylinder which subsequently passes sheets to the impression cylinder. In either case, the cylinder carries gripper fingers (not shown). These fingers may be what are commonly termed in the printing art "tumbler grippers," in which case they grip a sheet at rest on a feed table **13** and carry it into the press; or, they may be used in combination with conventional feed roll mechanism which drives the sheet to the grippers. The sheet feeder **12**, in the illustrated embodiment, is adapted to deliver from a pile of sheets, not shown, sheets of mate-

rial in underlapped fashion or sheet by sheet with a space between them to a position from which they move onto the cylinder **11**; and since the structure of the sheet feeder is conventional, it is not shown or described in detail. The particular manner of delivering sheets from the pile to the machine is immaterial to the invention, and the word "stream" will be used in the remainder of the specification and claims to depict any suitable method of delivering sheets in succession from a pile of sheets to a feed position from which they move in timed relationship to the operation of the machine.

The sheet feeder **12** may comprise a feed table **13** which terminates adjacent to the cylinder **11**, and moving tapes (not shown) which engage the underside of the sheets to be transferred to move the individual sheets successively into engagement with a pair of front stops or guides **15**, only one of which appears in the drawing, at the exit end of the table **13** adjacent to the cylinder **11**. The front stops or guides **15** stop the individual sheet **10** in proper position and registry for the latter to be fed to the cylinder **11** in timed relationship to the operation of the press and the stops are mounted on a rockshaft **16** supported above and extending transversely of the table **13**. The shaft **16** is rockable to move the stops **15** to a position for stopping and registering the sheets **10** and to a clear position to permit feeding of the sheets to the cylinder **11**.

An electrical sheet detector is provided to determine whether or not a sheet has been properly delivered against the stops **15** so as to be in position for transfer to the cylinder **11**. The sheet detector includes two electrically conductive members which are relatively moved into engagement with each other to complete a control circuit each time a sheet is not in the feed position at a predetermined time.

In the preferred and illustrated embodiment, the sheet detector includes a detector head or first member **20** mounted on a rockshaft **22** and including a detecting finger **23**. The detector head **20** is rocked by the rockshaft **22** from an inactive position where the finger **23** is clear of the table and the sheets thereon to a second position where the finger **23** engages a contact member or second member forming a part of the feed table **13**, or to a first position wherein the finger **23** engages the sheet **10** supported on the feed table in timed relation to the operation of the press. The movement of the rockshaft **22** is such that the finger **23** is moved toward engagement with the contact member **24** each time a sheet **10** is, if the sheet feeder is operating properly, positioned against the stops **15**. If the sheet has been delivered against the stops **15**, the presence thereof will prevent the finger **23** from contacting the contact member **24**. If, however, the sheet is absent at stops **15** when the finger **23** moves toward the contact member **24**, the finger will engage a part of the contact member **24**. Preferably, the finger **23** is rocked downwardly into momentary contact with the contact member **24** or the sheet thereon to sense the presence or absence of the sheet and then is rocked upwardly so that it does not interfere with the movement of the sheet from the feed table to the cylinder.

The finger **23** of the detector head **20** is a spring finger and is supported in and extends from a recess **25** at one end of an elongated support member **26** formed of an insulating material and supported by a holder **27** mounted on the rockshaft **22** for rocking movement therewith. The holder **27** and the elongated support member **26** all constitute a part of the detector head **20**. The spring finger **23** includes a coiled portion **28** disposed adjacent to the bottom of the recess **25** and an outer straight portion **29** disposed exteriorly of the recess **25** and bent at its outer end to provide an axle portion **30** extending transversely to the straight portion **29** and parallel to the table **13**. The coiled portion **28** of the spring finger **23** receives the head of a bolt **32** which fastens the finger **23** to the elongated support member **26**. The support member **26** has an axial bore **33** therein which receives the shank of the bolt **32**. The end of the support member **26** remote from the spring finger **23** is disposed in a counterbore **34** in the holder **27** and the corresponding end of the bore **33** is counterbored to receive a nut **35** threaded onto the end of the bolt **32**. The nut **35** secures the bolt **32** and spring **23** to the elongated support member **26** and also provides means for making an electrical connection to the bolt **32** and the finger **23**. The holder **27** is provided with a setscrew **36** for securing the support member **26** in the counterbore **34**. The setscrew **36** is received in an axially extending slot **37** in the support member **26** to permit endwise adjustment of the support member and, in turn, of the finger **23**.

The holder **27** also has a bore **37** coaxial with the counterbore **34** and extending from the counterbore **34** to the far end of the holder **27**. The side walls of the bore **37** are slotted at the far end of the holder and the holder has a bore **40** which receives the rockshaft **22** and which intersects the bore **37**. The slotted side walls of the bore **37** provide resilient jaw-like portions on the side of the rockshaft **22** remote from the finger **23** which are drawable together by a machine bolt **41** to securely clamp the holder **27** on the rockshaft **22**. The machine bolt **41** passes through an opening in one of the jaw-like portions and threads into the other.

The finger **23** of the detector head includes a wheel or first part **42**, preferably of an insulating plastic, supported on the axle portion or second part **30** of the finger which may be doubled back as shown to limit the axial movement of the wheel. The wheel **42** engages a sheet **10** if it is registered against the front stops **15** at the time the detector head is rocked toward the table **13**. If the sheet **10** is not registered against the front stops **15** and is not disposed in the path of movement of the wheel **42** when the head **20** is rocked toward engagement with the contact member **24**, the movement of the rockshaft **22** will carry the wheel **42** through the position normally occupied by the sheet **10** and into a recess **44** in the contact member **24**. The width of the recess **44** and the rocking movement of the head **20** are such that when a sheet is absent the axle portion **30** extending from the wheel **42** will engage the part of the feed table adjacent the recess **44**.

The contact member **24** engaged by the axle portion **30** is a metallic contact member set in a cutout in the part of the table **13** forming the exit end of the feed table. The conductive contact member **24** and the finger **23** are connected into an electrical control circuit for the sheet feeder and the press so that when the axle portion **30** of the finger **23** engages the contact member **24**, a circuit is completed and a control operation is performed, preferably a tripping of the press to slow speed and the throwing off of printing pressure and like devices. In the preferred form of the invention, the contact member **24** is at ground potential, as is the entire press, including the feed table **13** and front stops **15**. They are all electrically interconnected.

FIG. 4 is a simplified diagram of a circuit into which the detector **20** is connected. As is shown in FIG. 4, the contact member **24** and the spring finger **23** are connected in series circuit with a resistance **50** across a power supply for supplying the plate-to-cathode potential of an amplifying tube **51**. The tube **51** has a control grid **52** which is connected to one end of the resistance **50** and when the finger **23** engages the contact plate **24** current flows through the resistance **50** and biases the tube **51** more positively. The increase in current flow in the tube **51** effects operation of a relay **55** having its relay coil **56** connected into the cathode circuit of the tube **51**. The relay **55** has contacts **57** which close upon energization of the relay coil **56** to effect energization of a solenoid **58** for effecting reciprocation of a link **59** connected to the tripping mechanism for the press. Preferably, the magnitude of the resistance **50** is such to limit the current flow in the series

circuit including the finger **23** and the contact member **24** to a magnitude incapable of producing any noticeable sensation of shock to the operator of the press in the event he should accidentally engage the finger **23** while he is grounded.

In operation, the insulating film which normally builds up on a detecting element in the type of sheet feeder disclosed when used to detect paper will build up on the wheel **42** rather than on the part which engages the contact member **24** and, therefore, the contact resistance between the axle portion **30** and the contact member **24** is not increased due to the pickup of this insulating film during the operation of the press and sheet feeder. If the sheets being fed are of insulating material, there is no requirement that the wheel **42** has to be of insulating material. If, however, the material being fed is of a conductive material, the wheel **42** must be an insulator since otherwise the sheet would complete the circuit between the finger **23** and contact member **24** or other parts of the press electrically connected to and at the same potential as the member **24** each time a sheet is fed. The usual type of conductive material fed on such a press is foil having a non-conductive paper or coated backing. When a sheet is against the front stops and the detector moves down into engagement with the sheet, a circuit probably would be completed between the finger **23** and front stops **15** if the wheel **42** was conductive and if the stops **15** and contact member **24** were electrically connected and at the same ground potential. This is, of course, prevented by providing that the wheel **42** be an insulator.

While the portion of the detector head **20** that engages the sheet is preferably a wheel, as disclosed, it will be understood by those skilled in the art that a sheet detector will function in accordance with the disclosed invention if a conductive portion thereof different from the sheet-engaging portion engages the contact member **24**. A wheel, however, will easily ride on the sheet in the event that it is still moving when contacted by the wheel. This prevents the sensing element from interfering with the registration of the sheet being sensed.

It can now be seen that the present invention provides a new and improved detector having a conductive sensing element which is moved toward engagement with a contact member to complete a control circuit and in the presence of material being sensed engages one side of the material rather than the contact member and in the absence of the material moves through the position normally occupied by the material into engagement with the contact member, the sensing member having a contact-engaging portion which does not engage the material being sensed when the material is present. Furthermore, the sensing element is suitable for use to sense materials which are either insulators or conductors.

Having thus described my invention, what I claim is:

1. In a mechanism for continuously and successively feeding sheets to a predetermined position, a sensing device for sensing the presence or absence of a sheet at said predetermined position, said sensing device comprising a first member, means movable supporting said first member for movement from an inactive position wherein said first member is disposed to be clear of sheet material in said sheet position to a first position wherein said first member is disposed to engage one side of the sheet material disposed in said sheet position and to a second position beyond said first position from said inactive position in the absence of material at said sheet position, said first member having a first part adapted to engage said sheet material and a second part displaced from said first part to be clear of said sheet material when said first member is in its said first position, said second part comprising an electrical contact portion, a second member having an electrical contact portion, and means supporting said second member in position to be engaged by said contact portion of said second part when said first member is in its said second position.

2. In a mechanism, the combination as defined in claim 1 wherein said first part is a wheel adapted to roll on said material.

3. In a mechanism for continuously and successively feeding sheets to a predetermined position, a sensing device as defined in claim 1 wherein said members are disposed to be on opposite sides of sheet material in said sheet position.

4. In a mechanism for continuously and successively feeding sheets to a predetermined position, the structure as defined in claim 3 wherein said first part is a wheel and said second part is an axle rotatably supporting said wheel.

5. In a mechanism for continuously and successively feeding sheets to a predetermined position, the structure as defined in claim 4 wherein said second member has a recess therein receiving said wheel.

6. In a mechanism for continuously and successively feeding sheets to a predetermined position, a sensing device for sensing the presence or absence of an insulation-backed conductive sheet at said predetermined position and initiating a control operation affecting the sheet feeding mechanism in the absence of a sheet at said position, said sensing device comprising first and second conductive members disposed to be on opposite sides of a sheet in said predetermined position, means supporting said first member for periodic movement from an inactive position wherein said first member is disposed to be clear of a sheet in said predetermined position and said second member toward a first position wherein said first member is disposed to engage a sheet in said predetermined position and toward a second position beyond said first position wherein said first member is disposed to engage said second member in the absence of material in said predetermined position, said second member being electrically connected to and at the same electrical potential as the sheet feeding mechanism, the conductive side of said sheet when in said predetermined position being disposed to be engaged by portions of said sheet feeding mechanism when the first member is in its said first position and said first member having an insulated sheet-engaging portion and a conductive part different from said sheet-engaging portion displaced from said sheet-engaging portion and disposed to be clear of a sheet between said members when said first member is in its said first position, and means supporting said second member in position to be engaged by said conductive part upon movement of said first member to its said second position and circuit means connected to said conductive part and to said second member and completed upon the engagement of said part with said second member to effect said control operation.

7. In a sheet feeding mechanism, the combination as defined in claim 6 wherein the insulated sheet-engaging portion of the first member extends closer to said second member than said conductive part, and wherein clearance of said sheet-engaging portion past said second member is provided to enable physical contact of the conductive part of the first member with the second member upon absence of a sheet from the predetermined position.

8. In a sheet feeding mechanism, the combination as defined in claim 6 wherein the second member and said sheet feeding mechanism are at ground potential.

9. In a mechanism for continuously and successively feeding sheets to a predetermined position, the combination of a sensing device for sensing the presence or absence of an insulation-backed conductive sheet at said predetermined position and initiating a control operation affecting the sheet-feeding mechanism in the absence of such a sheet at said position, said sensing device comprising first and second conductive members disposed on opposite sides of a sheet in said predetermined position, means supporting said first member and operable to periodically oscillate said first member to move the latter toward and from engagement with said second member and into engagement with the conductive side of the sheet being sensed if disposed in position and into engage-

ment with said second member in the absence of a sheet in said position, said second member being electrically connected to and at the same electrical potential as the sheet-feeding mechanism, the conductive side of said sheet being engaged by portions of said sheet-feeding mechanism when the first member is in sheet-engaging position, said first member having an insulated sheet-engaging portion comprising a wheel rotatable on an axis transverse to the sheet-feeding direction and a conductive part different from said wheel and engageable with said second member in the absence of a sheet between said members, said conductive part comprising an axle for said wheel and said wheel being insulated to prevent conduction between the periphery of said wheel and said axle, said wheel extending closer to said second member than said axle and clearance of said wheel past said second member being provided to enable physical contact of said axle with the second member upon absence of a sheet from said predetermined position, and circuit means connected to said axle and to said second member and completed upon the engagement of said axle with said second member to effect the control operation.

10. In a mechanism for continuously and successively feeding sheets to a predetermined position, the combination of a sensing device for sensing the presence or absence of a sheet at said predetermined position and initiating a control operation affecting the sheet feeding mechanism in the absence of such a sheet, said sensing device comprising first and second members disposed to be on opposite sides of a sheet in said predetermined position, means supporting said first member and operable to periodically oscillate said first member to move the latter toward and from engagement with said second member and into engagement with one side of the sheet being sensed if disposed in said position and into engagement with said second member in the absence of a sheet in said position, said first member having a sheet-engaging portion of electrically insulating material adapted to engage a sheet between said members to prevent engagement thereof when said first member is moved toward engagement with said second member and a part different from said sheet-engaging portion which is at all times disposed to be clear of a sheet between said members and which is engageable with said second member in the absence of a sheet between said members upon movement of said first member toward said second member, said second member and at least said part of said first member being electrically conductive, and circuit means connected to said part and to said second member and completed upon the engagement of said part and said second member to effect a control operation.

11. In a mechanism for continuously and successively feeding sheets to a predetermined position, the combination of a sensing device for sensing the presence or absence of a sheet at said predetermined position and initiating a control operation affecting the sheet feeding mechanism in the absence of such a sheet, said sensing device comprising first and second members disposed to be on opposite sides of a sheet in said predetermined position, means supporting said first member and operable to periodically oscillate said first member to move the latter toward and from engagement with said second member and into engagement with one side of a sheet when the latter is disposed in said position and into engagement with said second member in the absence of a sheet in said position, said first member having a sheet-engaging portion of electrically insulating material adapted to engage a sheet disposed between said members to prevent engagement thereof when said first member is oscillated toward said second member and a part different from said sheet-engaging portion which is at all times disposed to be clear of a sheet between said members and which is engageable with said second member in the absence of a sheet between said members, said part of said first member being electrically conductive and said second conductive member having a recess therein which receives said sheet-engaging portion when said part is in engagement with said second member, and circuit means connected to said part and said second member and completed upon the engagement of said part and said second member to effect a control operation affecting the operation of said mechanism.

12. In a mechanism for continuously and successively feeding sheets to a predetermined position, the combination comprising a spring finger disposed to be on one side of a sheet in said predetermined position and a contact member disposed to be immediately adjacent the other side of a sheet in said predetermined position, a support member, means pivotally mounting said support member adjacent said predetermined position on said one side for oscillation about an axis and between limits, means connecting said spring finger to said support member for oscillation thereby into engagement with said contact member in the absence of a sheet in said position, a sheet when in said position preventing engagement of said contact member and said spring finger upon oscillation of the latter, and means supporting said contact member in a position to be engaged by a part on said finger different from the part thereof which is adapted to engage a sheet in said predetermined position, said spring finger including an axle portion extending generally parallel to a sheet in said position and a wheel supported on said axle portion for engaging the sheet being sensed, said contact member having a recess therein for receiving said wheel.

13. In a mechanism for continuously and successively feeding sheets to a predetermined position, the combination comprising a spring finger disposed to be on one side of a sheet in said predetermined position and a contact member disposed to be immediately adjacent the other side of a sheet in said predetermined position, a support member, means pivotally mounting said support member adjacent said predetermined position on said one side for oscillation about an axis and between limits, means connecting said spring finger to said support member for oscillation thereby into engagement with said contact member in the absence of a sheet in said position, a sheet when in said position preventing engagement of said contact member and said spring finger upon oscillation of the latter, and means supporting said contact member in a position to be engaged by a part on said finger different from the part thereof which is adapted to engage a sheet in said predetermined position, said spring finger including an axle portion extending generally parallel to a sheet in said position and a wheel supported on said axle portion for engaging the sheet being sensed, said contact member having a recess therein for receiving said wheel and said wheel being formed from a nonconductive material.

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