United States Patent

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[54] FORMS FEEDING TRACTOR AND JAM DETECTOR THEREFOR

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[52] **U.S. Cl.**.....**226/11**, 226/172, 226/74

[51] **Int. Cl.**.....**B65h 29/12**

[58] **Field of Search**.....226/74, 75, 172, 45, 11, 25; 200/61.18, 61.13; 271/57

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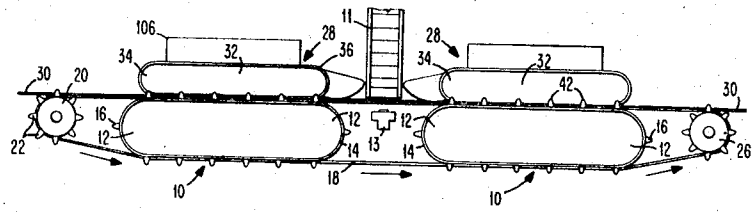
[57] **ABSTRACT**

A fixed belt support is peripherally grooved to receive headed tractor drive pins which project through perforations within an endless pin support belt conforming to the periphery of the fixed support. The ends of the pins project through similar perforations in an overlying endless drive belt and also a perforated form carried thereon. A spring biased "floating" pressure shoe carries a third endless cover belt having similar perforations which finally receive the ends of the pins and sandwichs the form between the drive belt and the cover belt to facilitate forms alignment and continuous precision in feeding.

A microswitch on a fixed block is operatively coupled to a forms detecting lever carried by the shoe to sense the absence of a form, the presence of a correct form or jamming of the form between the floating pressure shoe and the underlying drive belt.

7 Claims, 6 Drawing Figures



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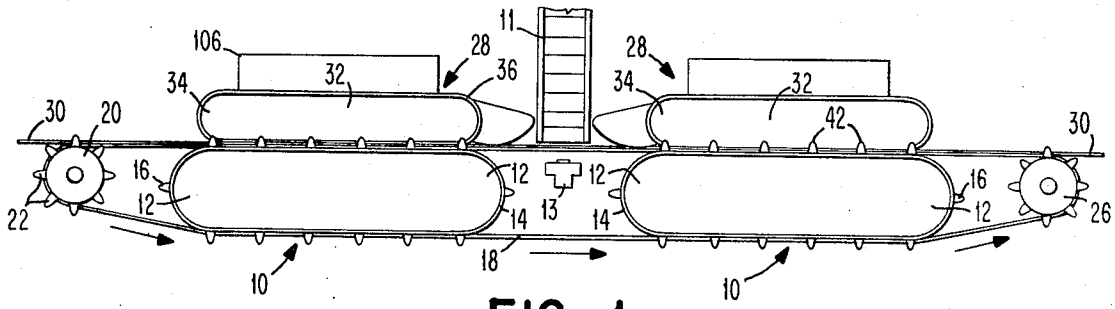

FIG. 1

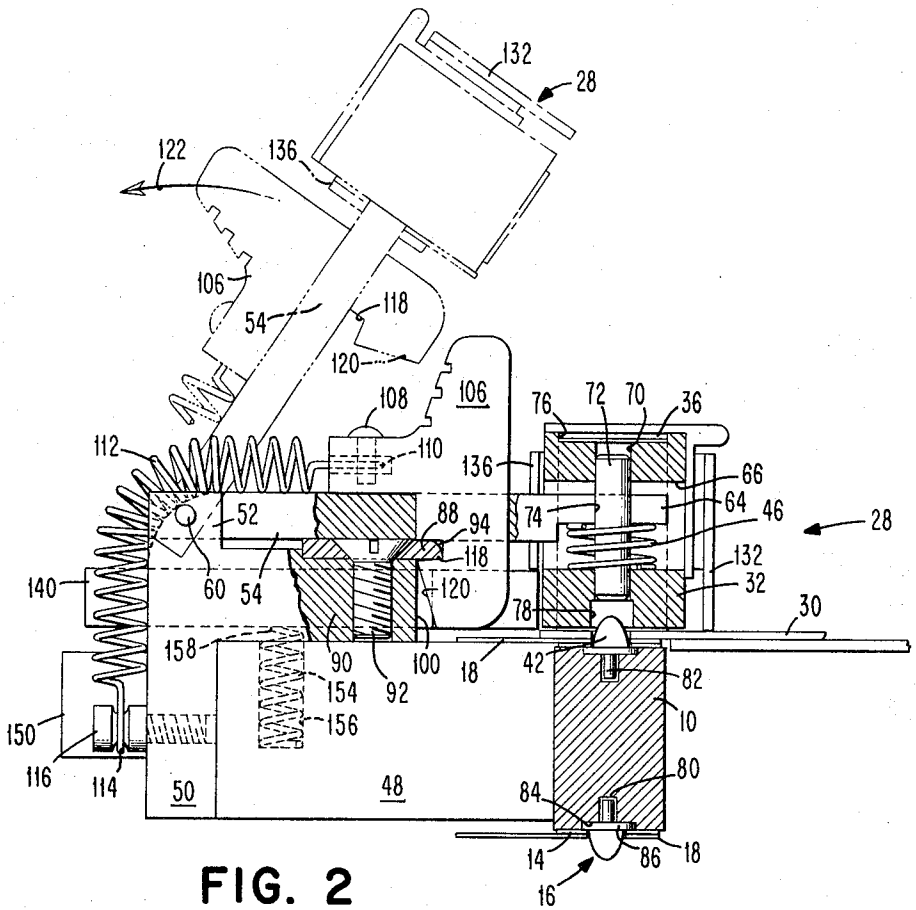

FIG. 2

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ATTORNEYS

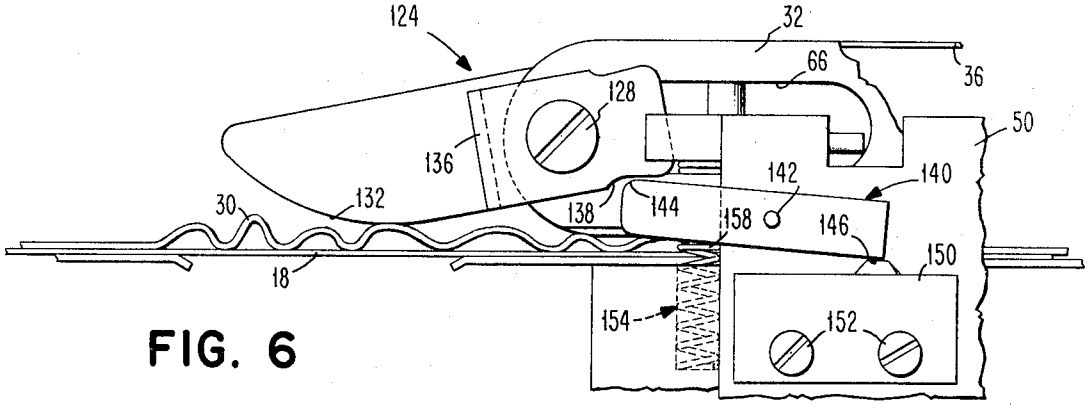
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FIG. 6

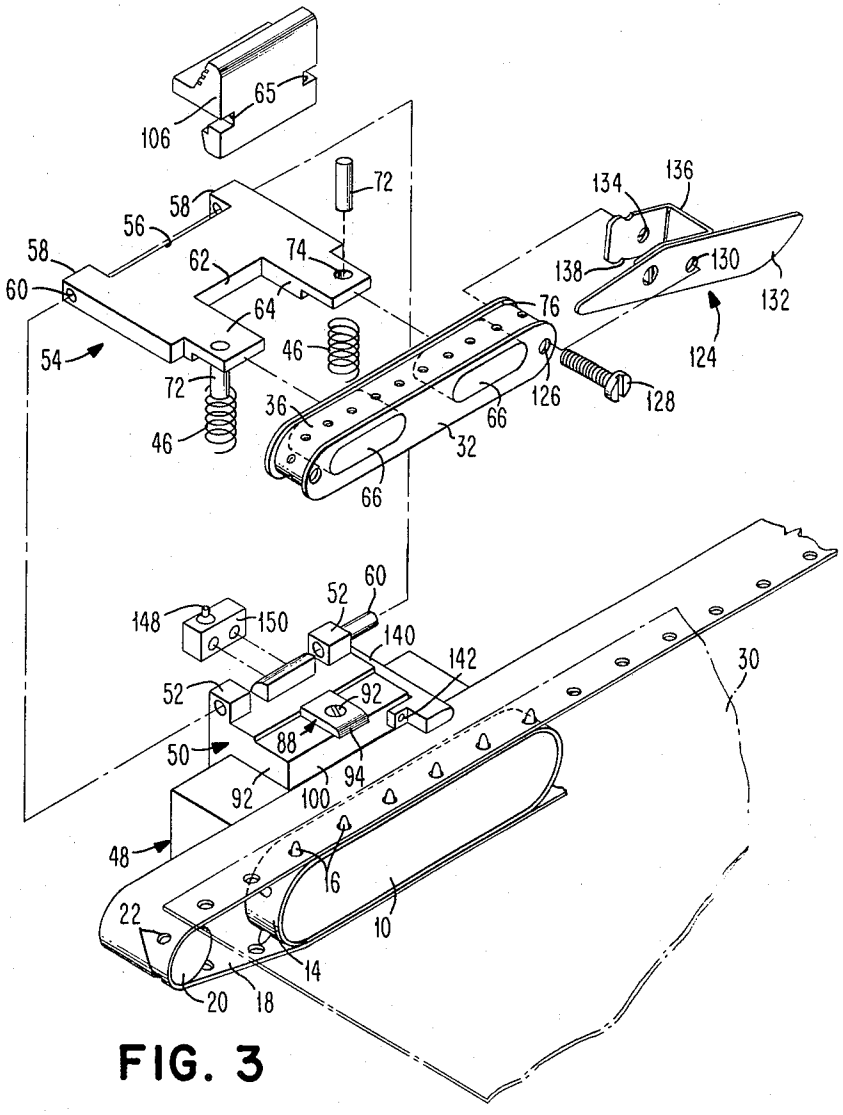
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FIG. 3

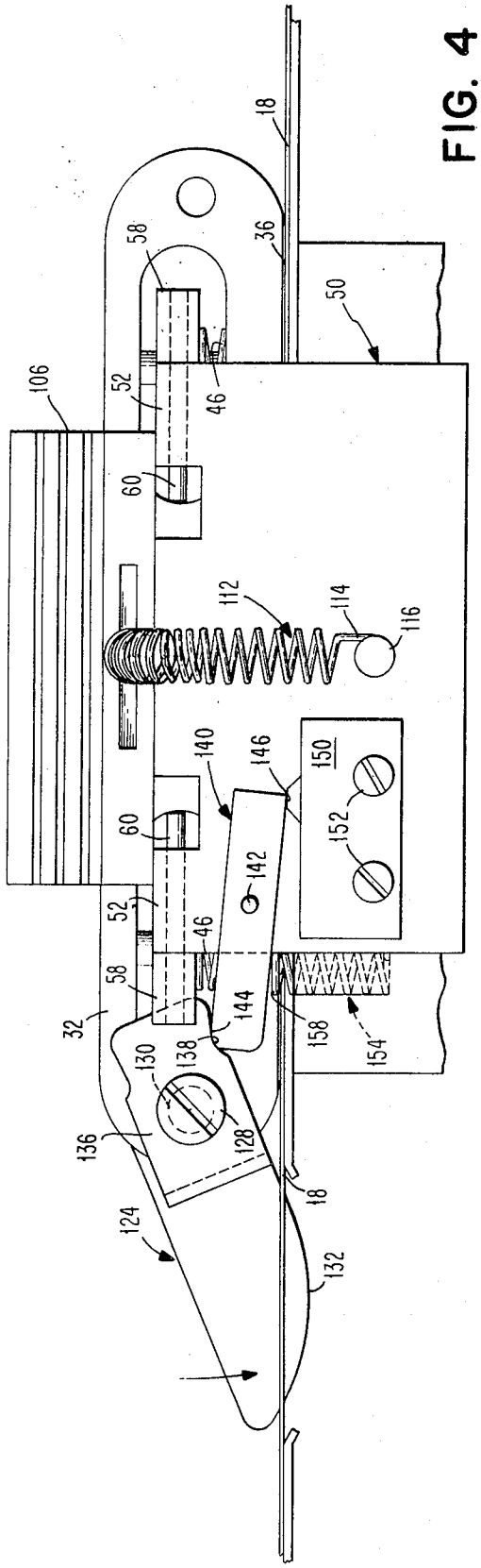
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FIG. 4

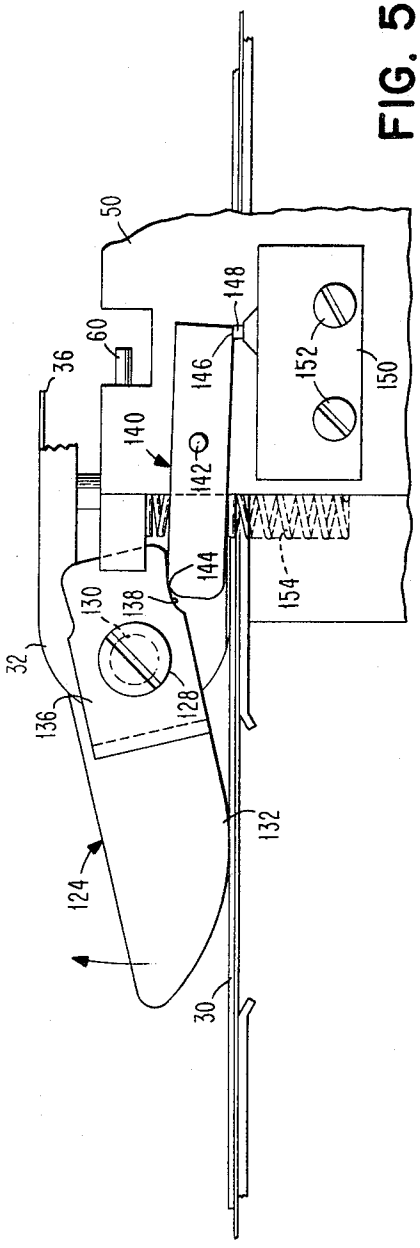
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FIG. 5

FORMS FEEDING TRACTOR JAM DETECTOR THEREFOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed to improved forms feeding tractors, and more particularly to tractors employing moving pins for feeding perforated forms.

2. Description of the Prior Art

A business form constituting either single layer web material or a manifold form of multiple layers normally carries a series of longitudinally spaced perforations, generally along the edges of the form for receiving a similarly positioned, series of movable feed pins to effect positive feeding of the form in the direction of movement of the pins. In particular, forms feeding tractors have been constructed in such a manner as to employ one or more small endless pin support belts positioned within the confines of a larger driven endless belt with the smaller endless belts being provided with a series of longitudinally spaced perforations which receive the projecting ends of headed pins. The headed ends are thus maintained in contact with the underlying fixed metal guide support with the projecting pins further passing through the larger endless drive belt which overlies this. The drive belt may be driven by a powered capstan carrying a series of projecting pins about its periphery which also pass through the perforations of the larger endless belt. In such an arrangement the pins tend to float within the perforations of the small endless belt as well as the larger driven endless belt and in turn pass through the perforations of the form being fed. Such an arrangement allows the individual pins to seek an adjusted position depending upon the alignment of the perforations carried by the small endless belt supporting the pins, the driven endless belt and the form itself. With the form contacting the outer surface of the larger driven endless belt, means are normally provided for pressing the form or at least a portion thereof against the driven belt to insure proper feeding of the same. Suitably hinged guides defining narrow areas of contact on the form being fed have been employed for pressing the edge portions of the form in contact with the driven endless belt. While such guides are satisfactory in most cases, some jamming as a result of variation in thickness of the forms being fed, often occurs. Most forms feed devices badly mutilate the forms holes, creating feeding, registration and stacking problems. Pressure shoes usually are avoided because of their tending to "shingle" multi-part forms and their static generating characteristics. The alternative, a fixed gap between tractor cover and forms table, is obviously a compromise, vulnerable to local variation, restrictive in its thickness limits, and insensitive to the needs of thin forms for support around the feed holes during rapid acceleration.

SUMMARY OF THE INVENTION

The present invention is directed generally to improved forms feeding tractors of this type with the improvement residing in supporting a third endless resilient cover belt carrying similarly spaced longitudinal perforations on the side of the form opposite the supporting means for tractor pins, such that these longitudinally spaced perforations further receive the projecting ends of the tractor pins. By lightly biasing the endless cover belt in contact with the form, greater surface contact is achieved between the cover belt which acts as a guide to facilitate alignment of the form during feeding and continuous precision in tractor feeding.

Preferably, the support for the endless resilient cover belt constitutes an elongated pressure shoe having a longitudinally extending peripheral groove for supporting the cover belt. In turn the pressure shoe floats on a support arm by employing biasing springs thereon, tending to bias the shoe and its cover belt against the surface of the form. The shoe support arm may be pivoted against additional spring biasing means into proper angular position such that the cover belt overlies and is in contact with the surface of the form being fed and locked into proper position.

The invention is further directed to the employment of a forms detecting lever which is pivotably mounted on the floating shoe so as to contact the surface of the form. A pivotable forms detecting lever on the shoe contacts a pivotable lever follower whose opposite end rides on a microswitch actuator pin such that, in the absence of forms, the detecting lever causes the follower to depress the microswitch however, when sensing a form of proper thickness, the end of the form detecting lever presses against the follower to permit extension of the microswitch pin. Upon jamming, the increased thickness of the form raises the spring biased pressure shoe and thus the forms detecting lever carried thereby to again cause depression of the microswitch pin under the pivotable movement of the detecting lever follower.

The low friction grip on the forms by virtue of the form being (clamped) between the two belts which move with the form and minimize friction therewith with its minimized hole mutilation, is characteristic of this invention.

Another point is the suitability of the floating shoe to the self-threading of documents. The shoe rises when a document edge is inserted if the tractor pin fails to find a hole, while the converging belts above and below the form tend to draw the form slowly in until pins and form holes coincide, permitting the shoe to drop down and add pressure onto the document to assist in its feeding.

Finally, with regard to the forms detector lever, it has the ability to detect a cover-open condition and in its intended use as a forms edge detector as an adjunct to the self-threading process, by sensing the incoming edge, a counter may be energized which will count the prescribed number of steps required to attain a precise location for the first line of printing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a schematic side view of the improved forms feeding tractor of the present invention.

FIG. **2** is an end view, partially in section of a portion of the forms feeding tractor shown in FIG. **1**.

FIG. **3** is an exploded perspective view of the forms feeding tractor illustrated in FIGS. **1** and **2**.

FIG. **4** is a side elevational view of a portion of the forms feeding tractor of FIG. **1** in the absence of a form to be fed.

FIG. **5** is a similar elevational view to that of FIG. **4** during feeding of a perforated form.

FIG. **6** is yet another elevational view similar to that of FIGS. **4** and **5** under forms jamming conditions.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The improved forms feeding tractor of the present invention is illustrated schematically in FIG. **1** and consists essentially of a pair, one on each side of a type cartridge **11** which operates generally into the plane of the drawing in conjunction with print hammers represented by the hammer **13**. The longitudinally spaced, fixed metal belt supports **10** are of identical construction generally rectangular in cross sectional configuration, and have rounded ends **12**. An endless pin support belt **14** rides on the outer periphery of the same through which projects, the domed ends of tractor pins **16**. The tractor pins **16** which may be driven by any conventional means, are preferably driven through the medium of a similarly perforated drive belt **18**, which overlies the pin support belt, the drive belt **18** being preferably driven by a drive capstan **20** which in turn carries projecting pins **22** on its periphery which engage the perforations within the drive belt to drive belt **18** as well as the pin support belt **14** for each of the fixed belt support blocks **10**. At the opposite end of the tractor, is provided a free running capstan **26**. As described so far, such an arrangement constitutes one form of a forms feed tractor which is in present use.

The present invention is directed in one aspect, to the employment of one or more full floating pressure shoe assemblies **28** which lie above belt supports **10** and act to lightly clamp

the form 30 between the shoe assemblies and the upper run of drive belt 18. In this respect, each of the full floating pressure shoe assemblies comprise a configured, elongated shoe 32 having rounded ends 34 much in the same manner as belt supports 10. The pressure shoe assemblies are provided with endless Mylar cover belts 36 which in turn carry spaced longitudinal perforations which axially overlie the perforations of pin support belt 14, drive belt 18, and form 30. The projecting ends 42 of the pins 16 are of a configuration and length such that they extend through the thickest form 30 to be fed with their tip ends passing through perforations of the endless cover belt. With the resilient belt 36 formed of Mylar as may be support belt 14 and drive belt 18, the form 30 is pressed in between the belts, preferably under a light bias formed by a series of shoe biasing springs 46, FIG. 2. The tractor drive pins 16, by engaging the holes in the cover belt 36, therefore drives this belt along with the forms sandwiched between the two belts 18 and 36 under light pressure maintaining the form and pins in floating alignment with continuous precision in feeding the same. In the arrangement of the present invention the cover belt 36 moves across the varying surface of the form 30 like a caterpillar track, adjusting to variations in thickness in a continuous manner while providing good control of the forms during transport.

Referring now in particular to FIGS. 2 and 3, the apparatus of the present invention is fixedly supported by a base or block 48, of rectangular configuration. Fixedly coupled to the block 48 are the belt support blocks 10, at spaced longitudinal positions. An L-shaped pivot mount 50 is carried on one side of the fixed block 48, with the vertical portion including two projections 52 at the upper end and on either side thereof, which act as the fixed mounting means for the pivotable pressure shoe assembly support arm 54. In this respect, arm 54 is in the form of the configured plate having a recessed rear edge 56 defining projections 58 which allow pivot pins 60 to pivotally couple the arm 50 to the mounting bar projections 52. The arm 54 is recessed at 62 within its forward end to form projecting portions 64 which extend within elongated slots 66 of rectangular pressure shoe 32 for each shoe assembly 28. Each pressure shoe 32 is drilled vertically at 70 to receive pressure shoe mounting pins 72. Further, the pins which are fixedly carried within bores 70 extend vertically across slots 66. The projecting ends 64 of the pivotable pressure shoe assembly support arms 54 carry holes 74 of a diameter slightly larger than mounting pins 72 such that each shoe assembly 28 may move vertically up and down within holes 74 on the arm projections 64. A shoe biasing spring 46 is concentrically mounted on each pin 72 and captured between the bottom surface of slot 66 and the bottom of the arm projections 64. The pressure shoe 32 carries a longitudinal groove 76 about its full periphery of a width sufficient to receive the cover belt 36 carried thereby. Further, running the complete length of each shoe 32, along the bottom thereof, is an enlarged rectangular slot 78 which allows the projecting ends 42 of the tractor pins 16 to freely move the length of the pressure shoe 32 after the domed ends 42 project through associated holes of the cover belt 36.

In turn, the fixed belt support blocks 10, which are similarly configured, carry a longitudinal slot 80 extending the full periphery of the same which is relatively narrow and receives the stem portions 82 of the tractor pins 16 while, slot portion 84 of larger width extends just beneath the peripheral surface of the belt support block 10 and receives the button portions or headed ends 86 of the tractor pins. The button portions 86 are of a width greater than the holes of pin support belt 14 and pins 16 are thus captured in slots 80 and 84.

To allow removal of jammed forms if there is an occurrence of jamming, it is necessary to pivotably support each pressure shoe assembly in overlying fashion with respect to the form 30 and the underlying drive belt 18. As mentioned previously, the arm 54 supporting each assembly 28 is horizontally pivoted on mounting pins 60, that is, the arm moves about a horizontal pivot axis. The present invention further involves means for locking the pivotable arm in a generally horizontal position such that the pressure shoe assembly overlies the form. In this respect, the L-shaped pivot mount 50 carries a latch plate 88 on the horizontal portion 90 of the same which is coupled to the upper face of the same by screw 92. A projecting lip 94 extends beyond the outer edge 100 of the horizontal portion 90 of the L-shaped pivot mount 50.

Coupled to each arm 54 carrying the pressure shoe assembly 28 is a slidable latch member 106 being captively mounted to the arm 54 between projections 64, guided by slots 65. The pin 108 acts to fix one end 110 of a coil spring 112. The opposite end 114 of the coil spring is held in fixed position to the rear end of the L-shaped pivot mount 50 by a mounting pin 116. Slidable latch 106 is provided with a notch 118, in its rear surface 120 such that, as evidenced in FIG. 2, when the arm 54 is rotated into approximate horizontal position, the inclined surface 159 cams the latch 106 to the rear as it slides across catch 88 dropping into notch 108 by the time the lower end of arm 54 is generally in abutment with the form 30. The latch notch 118 receives the projecting lip 94 of latch plate 88 so as to lock each pressure shoe assembly in overlying position with respect to form 30. Spring 112 biases these elements in latched position. Further of course, the biasing springs 46 of each individual shoe assembly 28 forces the shoe 32 and its cover belt 36 against the upper surface of form 30. If jam occurs, the latch 106 may be released by sliding to allow the arm to swing to the dotted line position shown by arrow 122, allowing access to the jam.

Another aspect of the present invention is directed to the forms detecting lever illustrated generally at 124, FIGS. 4, 5 and 6 which senses the presence of form 30, the lack of the same, or an unusual condition such as a rumpled configuration as occurs during jamming. In this respect, at one end of each pressure shoe 32, a transverse hole 126 receives a threaded screw 128 which in turn, passes through hole 130 of the forms detecting lever blade 132 and an aligned hole 134 of a U-shaped mounting arm 136 which is fixedly coupled to the forms detecting lever 132 by means of an ear 160 engaging hole 161. Thus, the assembly 124 straddles shoe 32 and pivots about screw 128. Knife blade 132 forming a portion of the detecting lever, normally contacts the upper surface of form 30 just behind or in front of the forms feeding tractor. Arm 136 of the forms detecting lever 124 carries an arcuate recess 138 within lower edge, close to the pivot axis defined by screw 128.

The L-shaped pivot mount 50 rotatably carries a forms detecting lever follower 140 which is mounted for pivoting about a horizontal axis at right angles to the longitudinal axis of the moving forms 30 via mounting pin 142, FIG. 3. The follower is generally rectangular in configuration, constituting a narrow plate having its upper edge 144 within the curved notch portion 138. The diametrically opposite lower edge 146 of follower 140 abuts microswitch actuator button or pin 148 projecting upwardly from a microswitch 150 which, in turn, is fixedly coupled to the rear side of the L-shaped pivot mount 50 by a pair of mounting screws 152. Further, a biasing spring 154 is carried within a recess 156 of the fixed base or block 48, and has its upper end 158 abutting the bottom edge of the follower 140, intermediate the pivot pin 142 and its contact edge 144 contacting the detecting lever 124.

In operation, in the absence of a form 30 the knife blade 132 of the detecting lever 124 therefore underlies the plane of the drive belt 18, and lies to one side thereof. In the absence of the form, with the biasing spring 154 pivoting follower 140 clockwise about the axis of mounting pin 142, FIG. 4, as indicated by the arrow causes counterclockwise rotation of the detecting lever 124 and at the same time depresses the microswitch actuator button 148.

However, as soon as a form 30 is moved into proper position and is of proper thickness, the form 30 acts on the edge of knife blade 132 and rotates the same clockwise against the bias of spring 154 causing counterclockwise rotation of the follower 140 and releasing the microswitch actuator button

148, effecting the change of state for the switch and thus an electrical indication of proper form positioning.

The third state for the forms detecting lever is illustrated in FIG. 6. Assuming that the form 30 becomes jammed somewhere in the forms feeding tractor or otherwise, continuous movement of drive belt 18 for instance would tend to cause the portion of the form 30 in the area of the detecting lever 124 to effect an irregular serpentine configuration as illustrated. This causes the form to press upwardly against cover belt 36 raising the shoe 32 with respect to pivotable arm 54 and increasing the gap between drive belt 18 and cover belt 36. The effect of the same is to raise the forms detecting lever 124 until contact edge 144 of follower 140 actually moves out of contact with groove 138 formed in the lower edge of the detecting lever arm 134. The bias of spring 154 will have fully pivoted follower 140 clockwise to the point where the bottom right hand edge 146 of the follower will have fully depressed the button 148 of microswitch 150. Thus, under two conditions, that is, the absence of a form or the presence of a jammed form will cause depression of button 148 and a change of state of microswitch 150 indicative of either two of these extreme conditions. At this time, the machine must be stopped and the jammed form removed by sliding latch member 106 removing notch 118 from projecting lip 94 and allowing the spring 112 to move to its relaxed dotted line position, FIG. 2, along with the pressure shoe assembly 28.

From the above description, it is apparent that the continuous forms feeding tractor of the present invention is applicable for feeding forms either of a single layer or of a manifold assembly relative to a printer or similar machine. As such, it effects feeding by grasping the form without mutilation, readily allows for different thickness of forms, allows for variation both in thickness within a given form and the presence of fasteners or folds, compensates automatically for variations in hole alignment in multipart forms due to the floating nature of the tractor pins and the frictionally gripping endless belts. It is also obvious that due to the large surface contact between the belts on each side of the forms, the forms are retained in optimum position during both rapid starting and stopping of the same and the arrangement assures continuous precision in feeding through non-accumulation of variations. This is achieved visibly by providing pressure on the forms in the critical areas around the individual pin holes without materially affecting either the inertia or the friction in the system. The large footprint of the endless belts on the forms assures maximum grasp with minimum mutilation and the cooperation between belts provides minimum drag on the forms as well as an active throat which funnels the forms into the drive pin area. The full floating pressure shoe not only provides uniform pressure on a wide range of forms thickness and over local irregularities, but provides a basis for jam detection by movement of the same away from the underlying drive belt. Further, the present invention has equal application to paper tape drives as well as conventional forms feeding tractors and pin sheet devices for feeding both endless webs, and sheets.

What is claimed is:

1. In a forms feeding tractor for feeding a thin planar form or the like carrying a series of spaced longitudinal perforations, said tractor including a fixed support defining a longitudinally extending form feed path, a series of tractor pins movable along said path and backed by said support with the free ends of said pins projecting through associated perforations in said form, an endless, resilient cover belt on the side of said form from which said pins project, longitudinally spaced perforations within said cover belt for receiving complementary projecting ends of said tractor pins, and means for moving said pins along said path to drive said belt and said form in unison, the improvement comprising:

an elongated pressure shoe overlying the portion of said cover belt in contact with said form, and being in contact with said cover belt over essentially the full length of said fixed support, and

means biasing said elongated shoe and said cover belt in contact with said form to maintain pressure on said form throughout said longitudinal feed path to thereby prevent bunch-up of the form during feeding and to facilitate alignment of said form in continued precision in feeding of the same.

2. The forms feeding tractor as claimed in claim 1, wherein said fixed support comprises a block having a guide slot within its periphery for receiving said pins and allowing said pins to move about the block periphery, a perforated endless pin support belt surrounding said block with the ends of said tractor pins projecting therethrough and an endless drive belt overlying said pin support belt and moveable therewith and carrying aligned perforations for receiving the projecting ends of said pins which in turn pass through corresponding perforations in said form and said cover belt.

3. The forms feeding tractor as claimed in claim 2, wherein said elongated pressure shoe includes a longitudinal groove extending about the pressure shoe periphery for supporting said endless cover belt thereon, a support arm supporting said pressure shoe and said cover belt in overlying fashion with respect to said form and springs coupled intermediate of said arm and said elongated pressure shoe for biasing said pressure shoe in the direction of said form.

4. The forms feeding tractor as claimed in claim 3 further comprising means for mounting said shoe support arm for pivoting about a horizontal axis extending parallel to the plane of said moving form, and to one side thereof, spring means tending to bias said shoe support arm to an angular position such that said cover belt is out of contact with said forms, and latching means for latching said arm in near horizontal position with said cover belt overlying and in contact with said form.

5. The forms feeding tractor as claimed in claim 4, wherein said mounting means for said shoe support arm comprises a pivot mount fixedly positioned on one side of said block and having a pair of end projections, said shoe support arm comprises an H-shaped plate with outboard projections pin connected to the projections of said pivot mount, said H-shaped plate being further provided with inboard projections received within paired slots formed within said shoe, guide pins fixedly traversing said slots and slidably penetrating said inboard projections, and wherein said springs are coil springs concentrically carried by said guide pins and compressed between the lower face of said slots and the bottom of said arm inboard projections.

6. The forms feeding tractor as claimed in claim 5, wherein said pivot mount is L-shaped in configuration and has a horizontal portion extending inwardly toward the edge of said drive belt, a latching plate fixedly coupled to said horizontal inwardly extending portion of said pivot mount and including a lip extending beyond the lateral edge of said mount and said latching means further comprises a T-shaped latch slidably mounted on said arm, said T-shaped latch including a notch within one end face engageable with the lip of said plate and means for spring biasing said latch toward the position where said notch normally receives said projecting lip.

7. The forms feeding tractor as claimed in claim 1 further comprising a pivotable forms detecting lever pivotably mounted on said pressure shoe and having a portion normally in contact with the surface of said form, a spring biased, detecting lever follower mounted for movement about a fixed pivot axis and having one end in contact with said detecting lever on the side opposite said pivot axis from that in contact with said moving forms, and means for fixedly mounting a microswitch with respect to said follower such that the other end of said follower presses against the microswitch actuator button during the absence of a form or during form jamming but is released therefrom during normal feeding of a proper thickness form by said forms feeding tractor.

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