

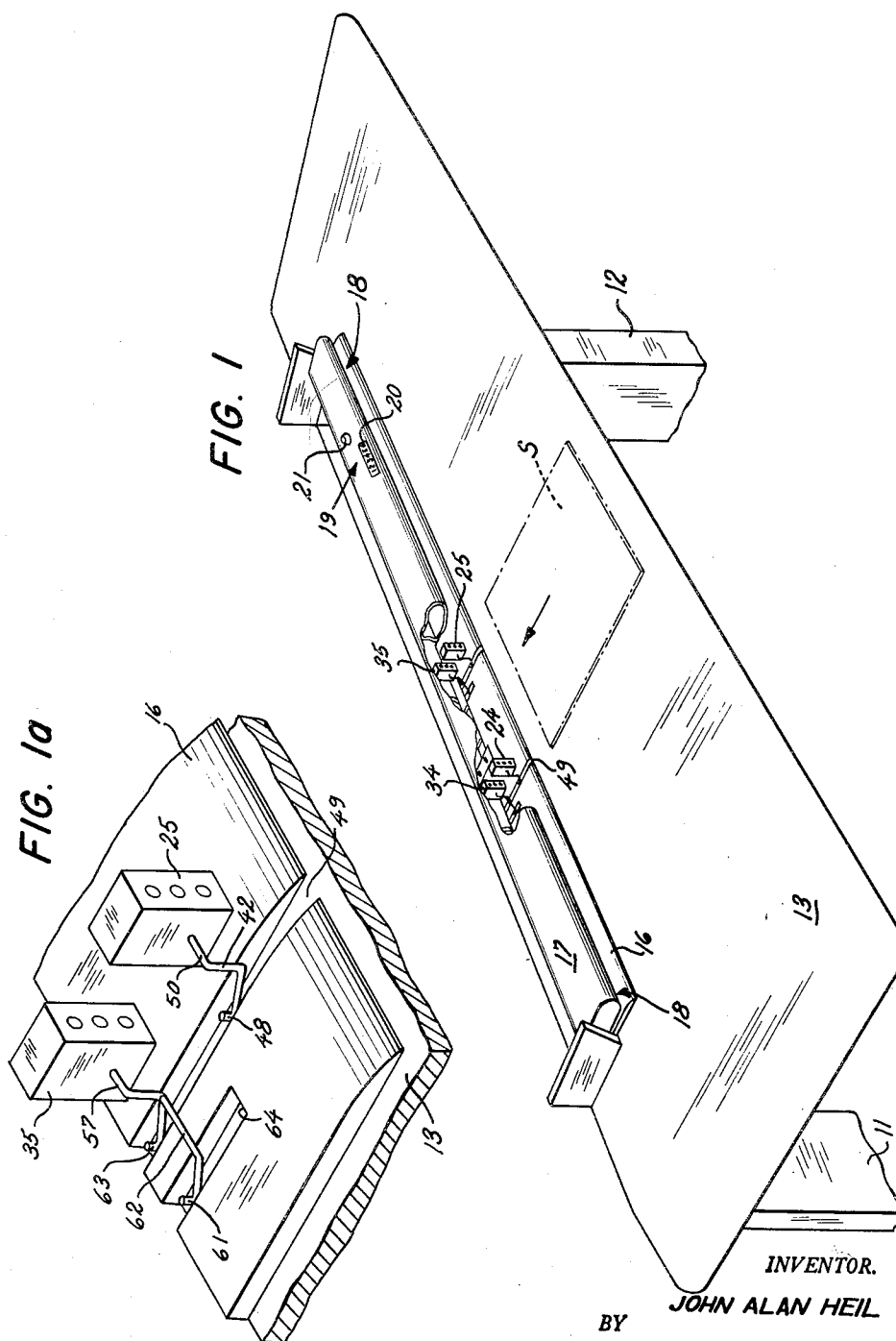
March 13, 1962

J. A. HEIL
SHEET COUNTERS

3,024,985

Filed Feb. 15, 1960

3 Sheets-Sheet 1



INVENTOR.
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March 13, 1962

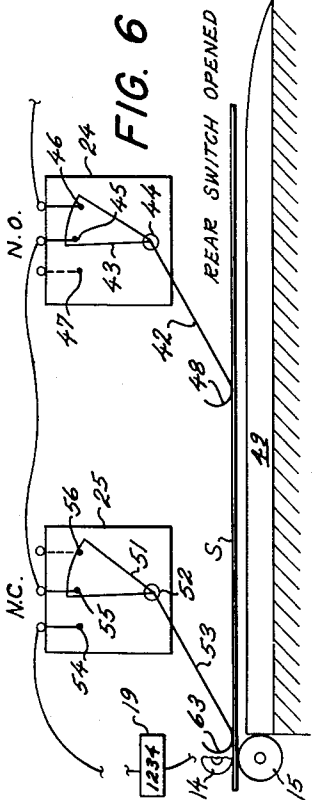
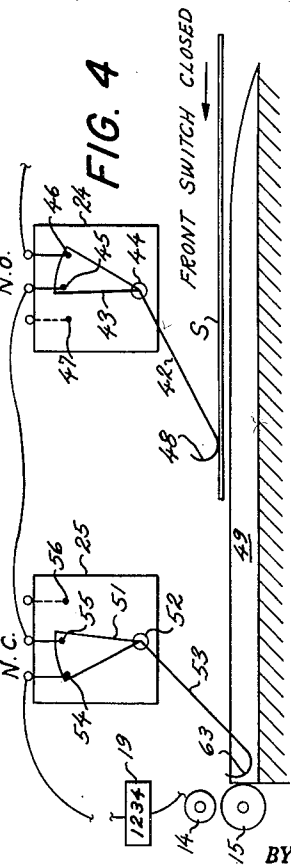
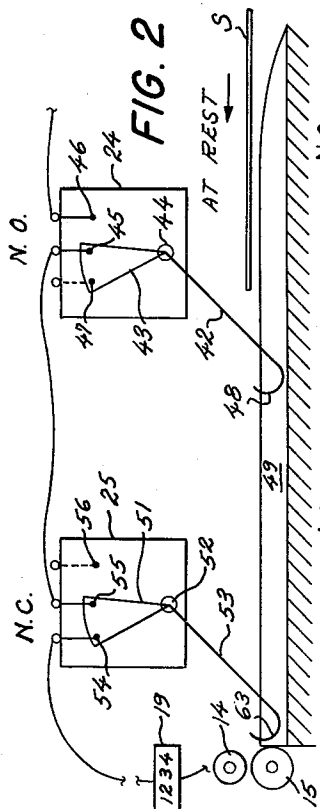
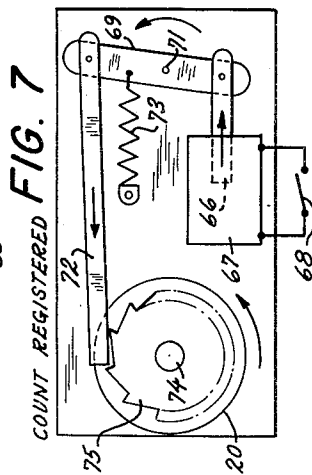
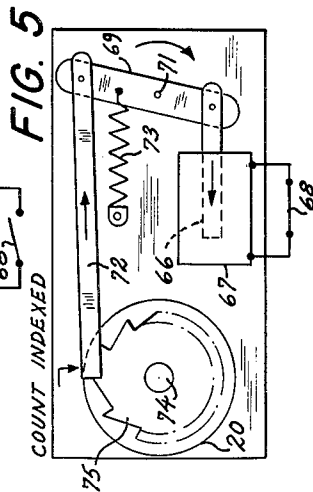
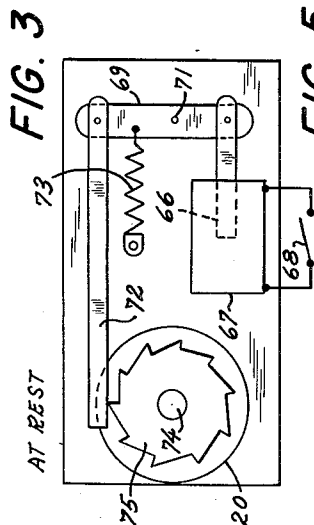
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SHEET COUNTERS

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3 Sheets-Sheet 2



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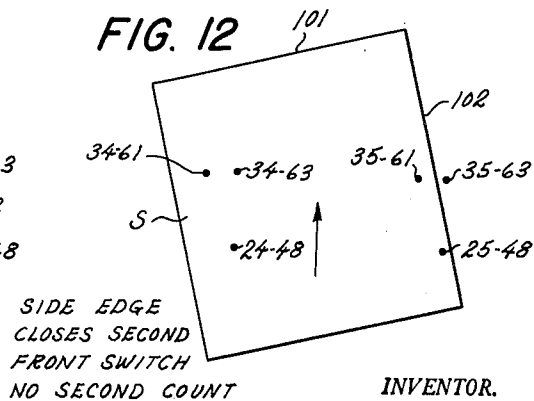
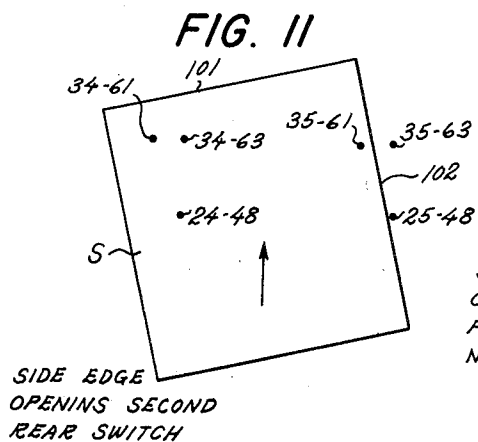
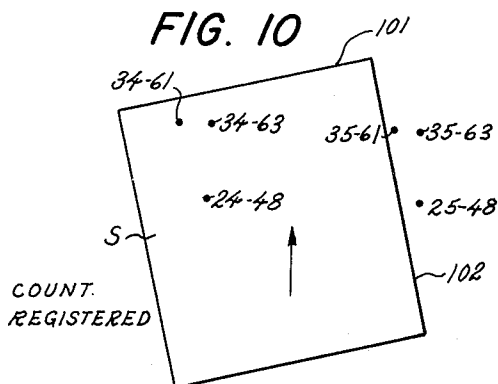
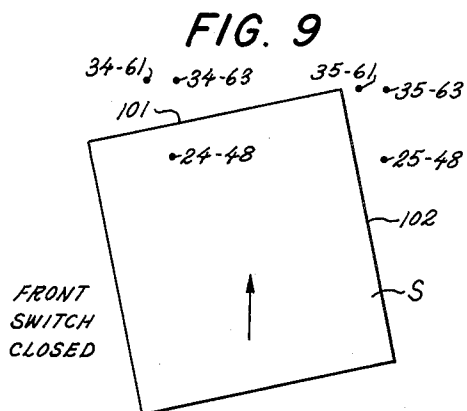
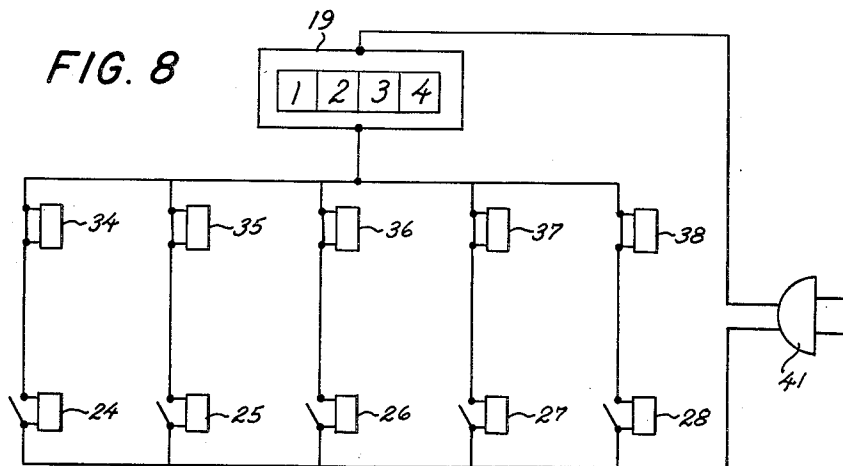
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J. A. HEIL
SHEET COUNTERS

3,024,985

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3 Sheets-Sheet 3



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3,024,985

SHEET COUNTERS

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6 Claims. (Cl. 235-92)

This invention relates to sheet counters, and, more particularly, to sheet counters for accurately counting individual sheets of the same or different widths fed there-through and this irrespective of the location at which the sheet is introduced into the counter.

There is a need for a counter for use in connection with printing, reproduction and other machines, to accurately count sheets of different widths and which counter does not require the feed of the sheets at a definite predetermined position relative to the inlet of the counter. Feed of the sheets at a set, or predetermined position relative to the inlet of the counter, requires the operator to take the time to properly feed the sheets, which reduces the counting speed and increases the expense of the labor required to operate the counter.

It is among the objects of the present invention to provide a counter for accurately counting sheets passed there-through, irrespective of sheet width or length or the location at which the sheet is introduced into the counter.

Other objects and advantages of the present invention will be apparent from the following detailed description thereof.

According to this invention, the counter comprises a plurality of pairs of switches of which one switch of each pair is a normally open switch disposed in a first or front row and the other switch of each pair is a normally closed switch disposed in a second or rear row, all of the normally open switches (N.O.) i.e. the switches in the front row, being connected in parallel, all of the normally closed switches (N.C.) i.e. the switches in the second row, also being connected in parallel, and the respective members of each pair of switches being connected in series with each other and with a counting or registering means. The paired switches are so arranged as to be sequentially actuated by the moving sheets to thereby successively make and break the current flow through the registering means whereby a single count is registered for each make and break sequence to individually record each sheet fed. In other words, before a count is registered, the current flow to the registering means must first be initiated by completing a circuit which affects actuation of the registering means and thereafter the current flow must be interrupted so that the count will be registered.

It will be appreciated that the expressions, front or first, on the one hand, and second or rear, on the other hand, are used in a relative sense to facilitate identifying the parts and the invention is not to be limited to the precise arrangement shown for illustrative purposes. These expressions are used in a sense which has reference to the direction of movement of the sheets through the counter.

In the accompanying drawings, which show for illustrative purposes a preferred embodiment of the present invention, to which, however, the invention is not limited:

FIGURE 1 is a perspective view of the sheet counter, with a part of its housing cut away to show a plurality of the switch pairs; the counter is shown mounted on the frame of a machine, such as a printing machine, which frame is shown fragmentarily;

FIGURE 1a is a fragmentary detailed view of a portion of the sheet counter of FIGURE 1, showing in enlargement one switch pair and its associated mechanism;

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FIGURE 2 is a schematic representation of a pair of switches of the counter in the rest position, i.e. the front switch of the pair is open and the rear switch closed;

FIGURE 3 is a diagrammatic view of the counting or registering mechanism, which will be hereinafter referred to as the register, of the machine in position corresponding to the rest position of the switch pair in FIGURE 2;

FIGURE 4 is a representation of the switch pair, similar to that of FIGURE 2, showing their condition upon movement of a sheet past the front switch and short of the back switch, i.e. both the front and rear switches are closed.

FIGURE 5 is a view of the register, similar to FIGURE 3, but corresponding to the position of the switches shown in FIGURE 4;

FIGURE 6 is a representation similar to FIGURES 2 and 4 showing the position of a pair of switches upon the further movement of the leading edge of the sheet past the rear switch of the pair of switches; i.e. the front switch is closed and the rear switch opened;

FIGURE 7 is a view similar to FIGURES 3 and 5 showing the parts of the register in the position they occupy upon opening of a rear switch;

FIGURE 8 is a circuit diagram of the switches and register; and

FIGURES 9-12 are diagrammatic representations showing the successive positions of a sheet relative to the switches during the sheet movement through the counter with the longitudinal axis of the sheet at an oblique angle to the longitudinal direction of feed through the counter.

Referring first to FIGURE 1 of the drawing 11 and 12 are the supporting members for the table top 13 or other supporting surface of a machine, such as a printing, copying, reproducing or other machine in connection with which the counter is used. Associated with the counter is a pair of feed rolls, 14, 15 (FIGURE 2) positioned to the rear thereof, which rolls effect feed of the sheets once they reach the bite of these rolls when moved thereinto by the operator.

The counter is a self contained unit suitable for use wherever desired. It comprises a base feed plate 16 disposed below a housing 17 defining a throat 18 into which the sheets to be counted are manually fed. Housing 17 has mounted thereon an electrically actuated register 19 provided with a number wheel 20 actuable by a reset knob 21; such registers are well known, and the register per se may be of any conventional type.

Also mounted in housing 17 is a front row of normally open electrical switches, desirably micro switches, 24, 25, 26, 27, 28 (FIG. 8) in spaced relation. The number of such switches may be varied as desired. Laterally adjacent switches of this front row are spaced apart a distance slightly less than the width of the narrowest sheet to be counted; the distance between the end switches of the row and the adjacent end of throat 18 is also slightly less than the width of the narrowest sheet to be counted. Hence, no matter where the sheet is introduced into the throat 18 it must actuate at least one front switch.

Disposed directly in back of switches 24 to 28 inclusive is a normally closed row of switches 34 to 38 inclusive, switch 34 being directly in back of switch 24, i.e. in longitudinal alignment; switch 35 in line with switch 25 and each of the switches 36, 37 and 38 in line respectively with switches 26, 27 and 28. Thus the switches are arranged in switch pairs 24, 34; 25, 35; 26, 36; 27, 37; and 28, 38. The switches 24 to 28 inclusive are connected in parallel with each other as shown in FIGURE 8. The switches 34 to 38 are also connected in parallel with each other. Each switch of a switch pair is connected in series with its member switch of the pair; thus switches 24 and

34 are connected in series; 25 and 35 are connected in series, etc. The switch pairs are connected in series with a power supply 41, such as a 110 volt A.C. source and the register 19.

The normally open switches 24 to 28, inclusive, are biased to return to open position when the lever arm 42 effecting actuation of the switch is not engaged by a sheet. The switches 24 to 28 may be of any well known type, for example, as shown in FIGURES 2, 3 and 4, involving a contact member 43 pivotally mounted at 44 and movable when lever arm 42 is raised to engage contacts 45 and 46 and thus close the switch. When contacts 45 and 47 are engaged as shown in FIGURE 2, the switch 24 is open. Lever arm 42 as best shown in FIGURE 1a, comprises a portion 50 extending laterally (to the left viewing FIGURE 1a) from the switch, and is then inclined downwardly in the same direction as the direction of movement of the sheet and is provided with a hooked end 48 disposed in a longitudinal extending narrow groove 49 in feed plate 16. Thus when a sheet S is fed past a switch, the advancing edge engages the hooked end 48 of the lever arm and moves it from the position shown in FIGURE 2 to that shown in FIGURE 4 thus closing the switch. It will be appreciated that all of the switches 24 to 28 are of the same construction.

The normally closed switches 34 to 38 are all of the same construction and each comprises a contact member 51 pivotally mounted at 52 and actuated by a bifurcated lever arm 53. Contact member 51 is biased to engage contacts 54 and 55 as shown in FIGURE 2 when a sheet does not effect actuation of lever arm 53; in this position the switch is closed. When contact member 51 is moved by actuation of lever arm 53 to engage contacts 55 and 56, the switch is open.

As best shown in FIGURE 1a, lever arm 53 is provided with a lateral portion 57 and a downwardly inclined portion extending in the direction of sheet feed and terminating in a hooked end 63 disposed in groove or aperture 49. A lateral extension 62 about 1/2 inch long is formed on lever arm 53 from which a downwardly inclined portion extends and terminates in a hooked end 61 disposed in groove 64 in feed plate 16. Groove 64 is spaced laterally about 1/2 inch from groove 49. It will be appreciated that each pair of switches has associated therewith spaced grooves or apertures 49, 64 into which extend the hooked ends of the lever arms which effect actuation of the switches.

The structure of the register 19 is shown in FIGURES 3, 5 and 7. It comprises a core 66 of a solenoid 67 in series with both rows of switches, as hereinabove described. In FIGURES 3, 5 and 7, the switch 68 indicates diagrammatically the open or closed status of the circuit to the solenoid as effected by both rows of switches, as hereinafter explained when describing the operation of the counter. Thus in FIGURE 3 the circuit to solenoid 67 is interrupted; in FIGURE 5 it is closed and the solenoid is energized; and in FIGURE 7 the circuit has been interrupted. Core 66 is pivoted to one end of link 69, pivoted at 71; the other end of link 69 is pivoted to pawl 72, spring biased by the coil spring 73. Number wheel 20 is mounted for rotation on shaft 74 which has fixed thereto a ratchet wheel 75.

In the position shown in FIGURE 3 pawl 72 rests on a tooth of the ratchet wheel 75. Upon energization of solenoid 67, core 66 is moved to the left viewing FIGURE 5, tensioning spring 73 and moving pawl 72 so that it engages a tooth of ratchet wheel 75 as shown in FIGURE 5. Thus the pawl 72 is moved into position to register a count but no count is as yet registered. To complete the count, i.e. effect registration thereof, it is necessary to interrupt the circuit which has just been completed. When this takes place, as shown in FIGURE 7, pawl 72 is moved to turn ratchet 75 the unit distance required for one count to be registered, under the influence of spring 73.

In operation, a sheet S is inserted manually into the counter and is fed therethrough by the feed rolls 14, 15. As shown in FIGURES 2 and 3, prior to engagement of the sheet S with the lever arm 42 of one of the switches in the front row, these switches are in their normally open (N.O.) or rest position whereas the switches in the rear row are in their normally closed (N.C.) position. No circuit is therefore completed between the switches and the register 19 and the pawl 72 rests atop one of the teeth of the ratchet wheel 75 under the influence of the coil spring 73.

When the sheet S engages the lever arm 42 of one or more switches 24-28, each lever arm thus actuated moves its contact member 43 into the closed position and closes the switch, as shown in FIGURE 4. With one or more of the switches 24 to 28 thus closed, a circuit is completed from the power supply 41 to the register 19, thereby retracting the solenoid core 66 (see FIGURE 5) which effects actuation of pawl 72 into engagement with a tooth of the ratchet wheel 75. The pawl thus indexes the number wheel, a count however is not registered at this point.

When, as shown in FIGURES 6 and 7, the sheet S in its continued movement trips one or more of the lever arms 53 of the switches in series with the switches in the front row which have been closed, the circuit which has been completed, as described above, is opened by the rotation of the contact member 51 to the switch open position shown in FIGURE 6. When the circuit is thus broken the solenoid 67 is de-energized and the pawl 72 returns under spring tension to its former position, simultaneously turning the ratchet wheel 75 and number wheel 20. A single count is thus registered by each turn of the number wheel; such count is only registered after a complete make and break current sequence, effected by sequential actuation of each of the members of one or more switch pairs.

Since the switches are spaced apart laterally of the feed plate 16 a distance slightly less than the width of the narrowest sheet to be counted, and similarly spaced from the ends of the feed throat 18, the sheets may be introduced into the counter at any location on the feed plate and will still trip at least one pair of switches to give one count for each sheet.

It will be noted the switch arrangement of the present invention prevents a double count for a single sheet, irrespective of its width or length and irrespective of where the sheet is fed into the counter, provided the sheets are fed successively and spaced apart a distance at least equal to the distance between the two rows of switches. As the sheets are fed manually usually by a single operator there is no problem involved in so feeding them successively.

As noted, the first switch tripped in the front row of switches closes the circuit and indexes the number disc by the action of the solenoid 67; however, the subsequent actuation of others of the parallel connected switches of the front row cannot effect a count until the current is interrupted by actuation of the rear bank of switches. Thus, the passage of a very wide sheet through the counting device, tripping all the switches in the front row, will not register a count. Nor will such wide sheet register a count when it trips one or more, but less than all, of the switches in the rear switch row, which switches are in series respectively with the switches which have been closed in the front row, because the circuit is not interrupted until no current can pass through any of these parallel wired switch pairs. Consider, for example, the switch pairs 26, 36; 27, 37; and 28, 38. Assume switches 26, 27 and 28 are closed by a wide sheet fed somewhat askew and switches 37 and 38 opened. Since switch 36 remains closed and there is therefore a current path through switches 26, 36 the current flow to register 19 is not interrupted. A count will not register for any sheet until a complete make and break sequence has been

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achieved, i.e. until opening of all normally closed switches in the rear row of switches in series with those switches in the front row which have been closed by the moving sheet to be counted.

The rear switches are each provided with two hooks 61 and 63 spaced laterally about $\frac{1}{2}$ inch, to prevent a double count (as will be explained hereinafter) when a sheet is fed at a slight angle so that after the leading edge has passed the rear row and the count is completed, the side edge of the portion of the sheet which has yet to pass the front row of switches may encounter and trip another front row switch as its angular extension to the side advances. Such false counting has been precluded by the provision of the bifurcated lever arms on the switches of the rear row as will be evident from FIGURES 9 to 12 inclusive. These figures depict for illustrative purposes, the relative position of a sheet S fed slightly inclined with respect to a pair of switches, say 24, 34 and 25, 35. The dots in these figures represent the position of the lever arm hooks (which effect actuation of the switches) relative to the position of the sheet shown. Thus 24—48 represents the position of lever arm hook 48 of switch 24; 25—48 represents the position of lever arm hook 48 of switch 25. 34—61 represents the position of lever arm hook 61 of switch 34; 34—63 of lever arm hook 63 of switch 34; 35—61 of lever arm hook 61 of switch 35 and 35—63 of lever arm hook 63 of switch 35.

As shown in FIGURES 9—12, when the sheet S is introduced at an angle so that the leading edge 101 closes the front switch 24 by raising lever arm hook 48 (FIGURE 9) and then opens rear switch 34 by raising the lever arm hooks 61 and 63 (FIGURE 10) a make and break sequence occurs and a count is registered. As the side edge 102 thereafter advances it raises the rear lever arm hook 61 of switch 35 (FIGURE 11). Opening of switch 35, however, has no effect on the register 19 because the circuit through switches 25 and 35 is open due to switch 25 being open; switch 25 is a normally open switch. Further movement of the sheet as shown in FIGURE 12 causes the side edge 102 to raise hook 48 of switch 25. This, however, does not energize the circuit to register 19 because switch 35 has previously been opened, as explained above. Hence the make and break switch sequence is not performed by these latter actions of the edge 102, because the initial actuation of the rear switch 35 prevents the latter actuation of the front switch 25 from completing the circuit. Accordingly, by utilizing the bifurcated or double lever arms on the rear switches, one of which is offset laterally sufficiently, say about $\frac{1}{2}$ inch, from the paired front switch lever arm to intercept advancing angular sheet edges, double counting of single sheets disposed at an angle is avoided. Of course, in counters designed for straight line feed, the double or bifurcated lever arms need not be used although it is preferred to use them on all machines as a precautionary measure should a sheet be fed askew inadvertently.

In one embodiment of the counter of the present invention, the rear row of switches is spaced from the front switch row about $1\frac{3}{8}$ inches and the switches in each row are laterally spaced from each other about 8 inches. The end switches of each row are spaced from the ends of inlet throat 18 about eight inches. As noted, the switches of each pair are aligned in the direction of movement of the sheets therethrough. These dimensions are intended to be illustrative and not limiting; the spacing of the switches and the number used may be changed to best accommodate the variations in dimensions of the sheets to be counted.

It will be noted, the present invention provides a counting device capable of accurately counting individual sheets of varying size successively introduced at the same or different locations. The first switch to be tripped of the first row serves to energize the solenoid and anymore switches of this row which might be tripped cannot do more, because the sheet has not yet reached the rear

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row of switches to interrupt the current. Thus the solenoid will index the count and continue to be held so long as one or more front row switches remains closed. A wide sheet could close all switches in the front row. A narrow sheet only one. The result is the same. Nor can the counter register the count even when the sheet trips the first rear row switch if the sheet is wide enough to open more than one front row switch. The count is not registered until all of the rear row switches are opened which are paired with the front row switches which have been closed by movement of the sheet. Thus the counter of this invention gives an accurate count of sheets fed successively therethrough.

Since certain changes may be made in the counter above described and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A sheet counter comprising in combination, a feed plate, a register, a plurality of pairs of switches adjacent said feed plate, one member of each switch pair being a normally open switch and being disposed in a front row and the other member of said pair being a normally closed switch and disposed in a rear row parallel to and spaced from said front row; the switches in each row being connected in parallel with each other and said paired switches being connected in series with each other and with said register.

2. A sheet counter as defined in claim 1, wherein said front row and said rear row of switches are arranged with said paired switches positioned in alignment with one another, each of the switches of said front row having a lever arm actuated by a moving sheet to close said switch and each of the switches of said rear row having a bifurcated lever arm actuated by a moving sheet to open said switch, one of said bifurcations of each rear row switch being positioned out of alignment with the lever arm on the paired switch of said front row.

3. A sheet counter comprising in combination a register, feed means for feeding successive sheets, a plurality of pairs of switches adjacent said feed means, one switch member of each pair being a normally open switch disposed in a first row and the other switch member of each pair being a normally closed switch and disposed in a second row, each of said pairs being connected in parallel and said paired switches being connected in series with one another and with said register, said register comprising a number wheel, solenoid means for actuation of said number wheel, said solenoid means effecting movement of said number wheel after being sequentially energized and de-energized and said solenoid means being energized by an electric circuit completed through the closing of the switches of one or more of said switch pairs and de-energized by the interruption of said circuit through all of said switch pairs which had previously been closed.

4. A sheet counter as defined in claim 4, wherein said first row and said second row of switches are arranged in parallel relationship with said paired switches positioned in alignment with one another, each of the switches of said first row of switches having a lever arm actuated by a sheet fed by said feed means, and each of the switches of said second row of switches having a bifurcated lever arm actuated by a sheet fed past said first row of switches, one of said bifurcations of each bifurcated lever arm being positioned out of alignment with the lever arm on the paired switch member of said front row of switches, said circuit being completed upon actuation of one or more of said first mentioned switch lever arms by movement of a sheet past said first mentioned lever arm or arms and said circuit being interrupted upon sequential actuation of said bifurcated lever arms

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of all of those switches in said second row which are paired with the switch or switches in the first row the lever arm or arms of which had been actuated by said sheet.

5. A sheet counter comprising, in combination, a register, a first row of normally open switches, trip means for each switch in the first row for closing said switch, a second row of normally closed switches, each of which is paired with one of the normally open switches in said first row, trip means for each of the switches in the second row for opening said switch, the switches in each row being connected in parallel with each other and the switches of each pair being connected in series with each other and with said register, said register registering a count after a moving sheet sequentially actuates the trip means of at least one of said normally open switches and the trip means of each of said normally closed switches which are paired with the normally open switches thus closed by movement of the sheet.

6. A sheet counter comprising, in combination, a plu-

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5 rality of pairs of switches and a register, one switch of each pair being a normally open switch disposed in a first row and the other switch of each pair being a normally closed switch disposed in a second row, said first row and said second row of switches being arranged in parallel relationship with said paired switches positioned in alignment with one another, each of the switches of said first row having a lever arm actuated by a moving sheet and each of the switches of said second row having a bifurcated lever arm actuated by a moving sheet, one of the bifurcations being displaced laterally relative to the position of the lever arm on the paired switch in said first row, the switches in each row being connected in parallel with each other and the switches of each pair being connected in series with each other and with said register.

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