

[54] **NO-COUNTER SORTER-STACKER**

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[51] Int. Cl. **B65h 29/60**

[58] Field of Search 271/64, 57, 173; 270/58

[56] **References Cited**

UNITED STATES PATENTS

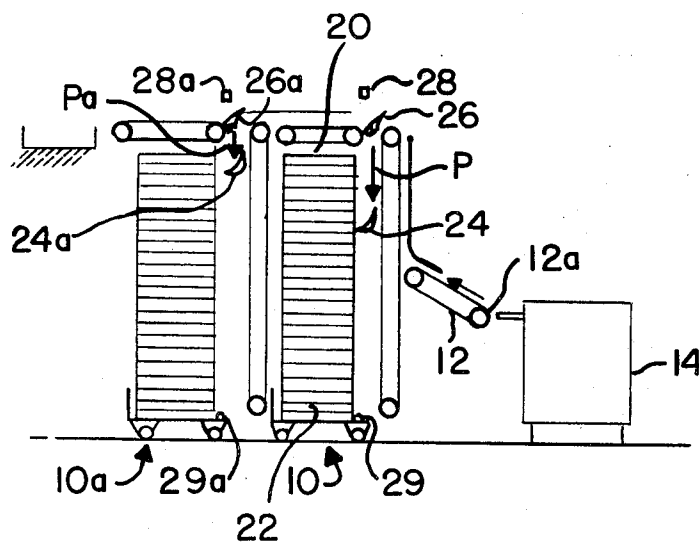
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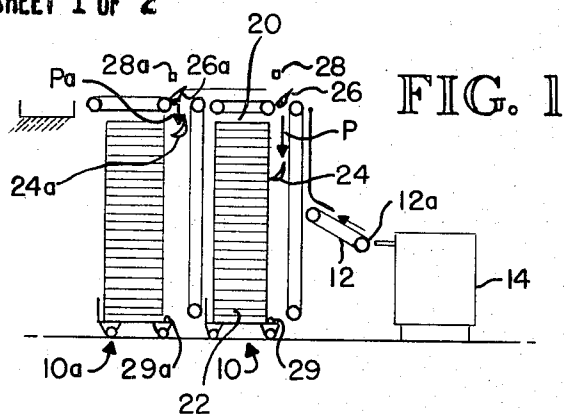
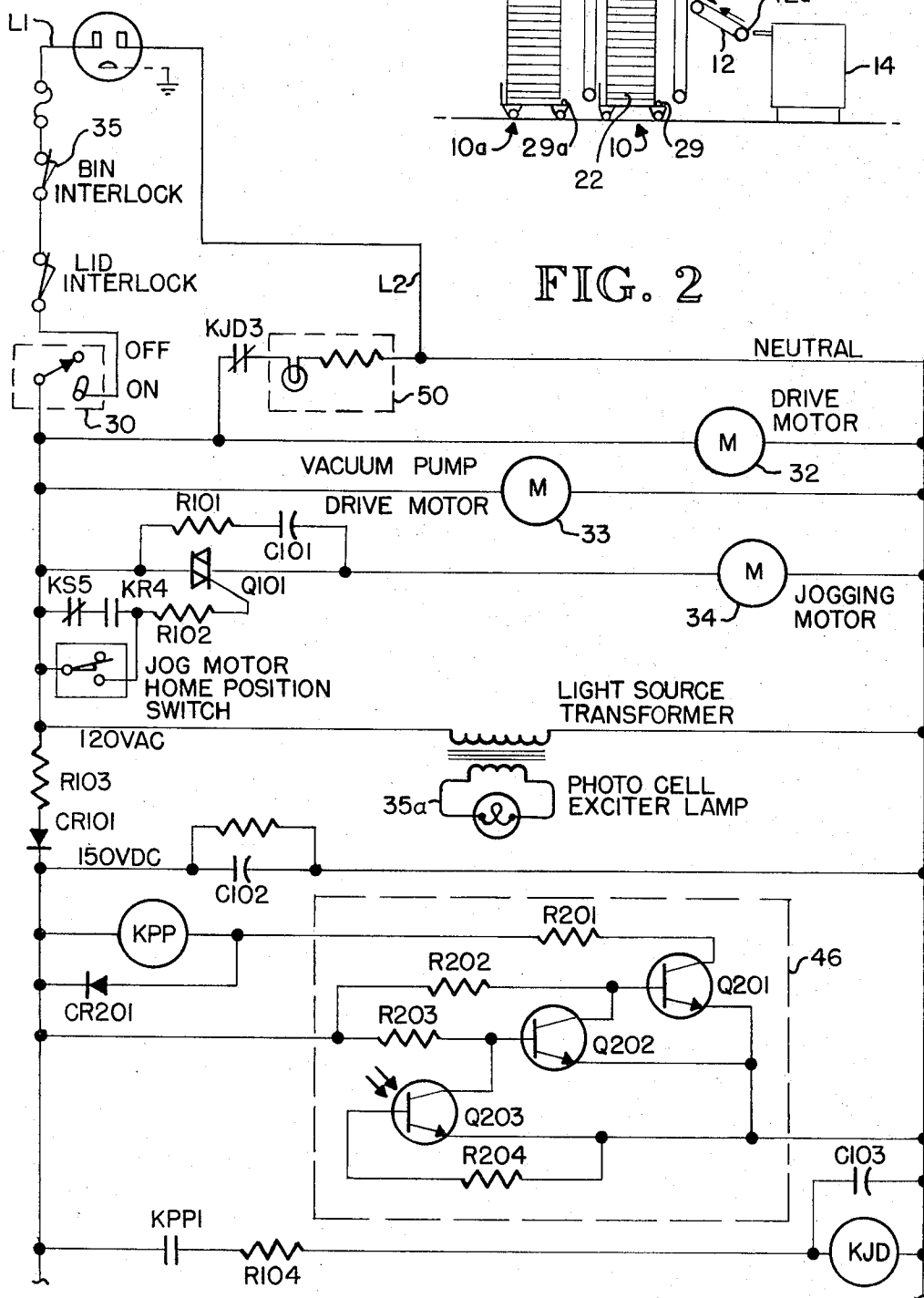
[57] **ABSTRACT**

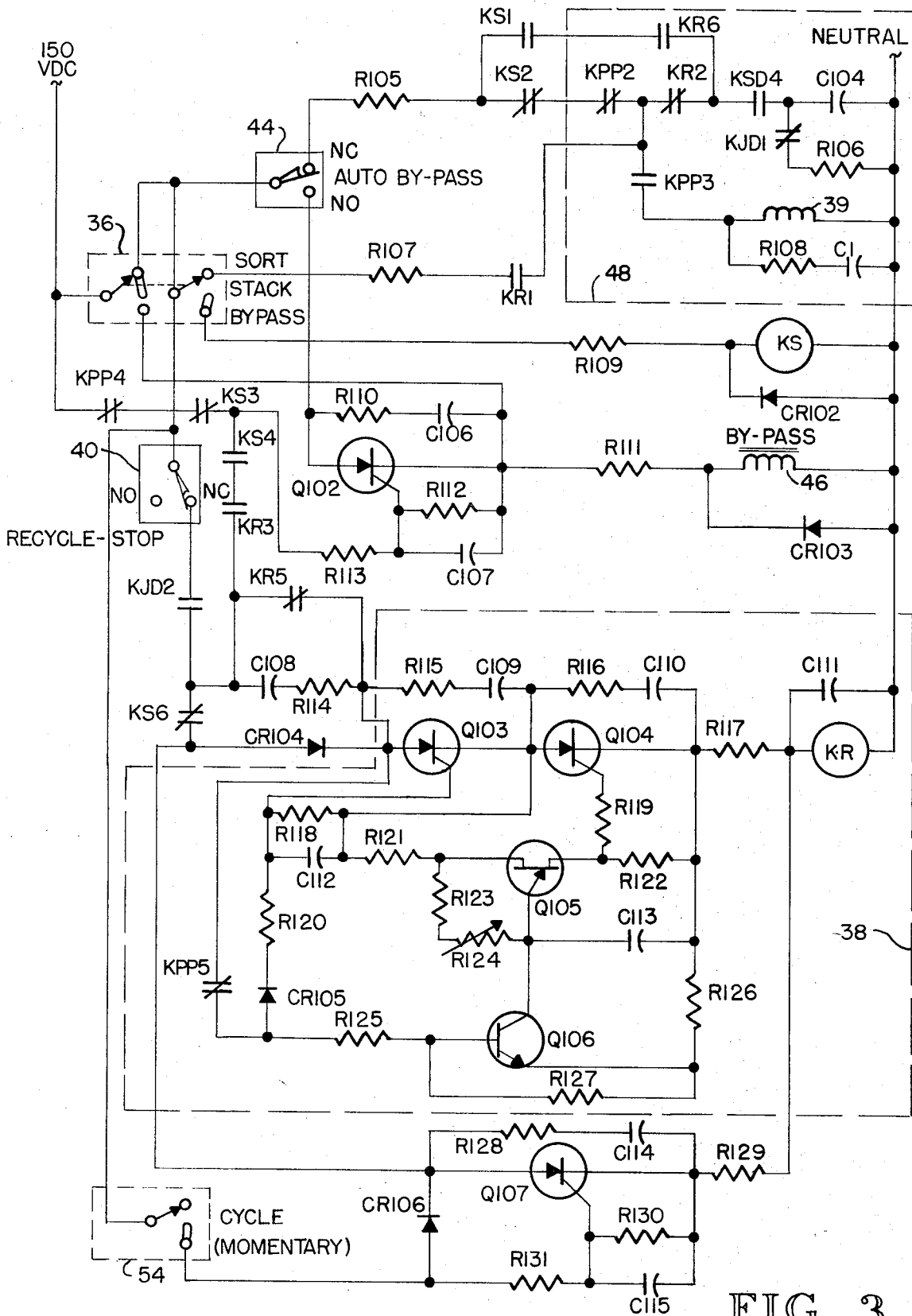
A sheet distributor receives sheets of paper from a printer or other type of paper supply and distributes the sheets into various stations. There is no electrical or mechanical interconnection between the sheet distributor controls and the paper supply with the insertion of sheets into the various stations being determined solely by the time interval between successive sheets passed from the supply. The control is operable to place successive sheets into one station or distribute the sheets individually into successive stations.

4 Claims, 3 Drawing Figures



SHEET 1 OF 2





NO-COUNTER SORTER-STACKER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to sheet distributing apparatus for the type that sorts or collates sheets into various stations.

2. Description of the Prior Art

The controls for sheet distributing apparatus heretofore known requires some form of mechanical or electrical interconnection with the printing apparatus or other paper supply in order to sense the completion of a run of a particular sheet of paper so that the control can begin distribution into the next station or column of stations. For example, the well-known Xerox Co. machine, model 360, employs a sheet counter to terminate further sorting of copies when the desired number of copies have been made and fed from the machine. The sorter commonly used with the model 360 copier has a control electrically interconnected with the counter on the copier to recycle the collator upon completion of the count set on the copier.

Obviously the necessity for an electronic or mechanical interconnection with the copying apparatus requires that the electronic or mechanical components of the sheet distributing apparatus be made compatible with those of the copying apparatus. Frequently, however, a sheet distributing apparatus made for copying apparatus of one well-known manufacturer will not be compatible with the copying apparatus of another manufacturer.

While the electronic or mechanical components of the various copying apparatuses may vary, most all of them have a predictable rate of delivery of successive sheets of paper.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a sheet distributing apparatus which does not require a mechanical or electrical interconnection with a sheet supplying apparatus, such as a printer or copier, and thus is usable with a large variety of differing types of sheet supplying apparatuses.

It is another object of this invention to provide a sheet distributing apparatus that is controlled in response to the detection of the absence of a sheet from the supplying apparatus for some predetermined interval of time.

It is another object of this invention to provide a sheet distributing apparatus which inserts sheets into various stations and which maintains the insertion at any particular station when the machine is shut-down due to a temporary interruption caused by the jamming of a sheet or the like.

It is still another object of this invention to provide a sheet distributing apparatus which is inexpensive to manufacture and which is compatible for use with most any type of office copier or printer.

Basically, the invention employs means for receiving from a supply sheets of paper spaced in some predetermined time interval and distributing the sheets into an initial and subsequent stations, and control means for actuating the receiving and distributing means to direct the insertion of a sheet into another station upon the detection of the absence of a sheet from said sheet supply for a pre-determined second time in-

terval greater than the first time interval. In one operative mode the successive sheets are inserted into a single station to form a stack and upon the detection of the second time interval the insertion of the next successive sheets is directed into a second station. In another operative mode, the successive sheets are inserted individually into successive stations and the sheet insertion mechanism is recycled to said initial station upon the detection of said second time interval.

As is apparent, the apparatus has the unique advantage of being operable when placed adjacent the discharge of conventional printing or copying apparatus with the normal time interval spacing between the sheets delivered to the distributing apparatus alone controlling the selection of the proper station for receiving the sheets. The supply can be of the type which feeds successive sheets at some reasonably constant time interval or the sheets can even be fed by hand. The second time interval is generally equivalent to the time interval between the normal spacing of two and one-third sheets, however, longer or shorter time intervals can be employed depending upon the timing cycles of the sheet supply.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic side elevation of a typical sheet supply and of a sheet distributing apparatus embodying the principles of the invention.

FIGS. 2 and 3 illustrate a circuit schematic embodying the principles of the invention and used with the apparatus of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The sheet distributing apparatus of this invention is best shown in FIG. 1 and includes a vertical column of stations or trays 10 to which one or more additional columns, for example 10a, may be placed in tandem. Alternatively the columns can be shifted laterally as in prior art sheet distribution apparatus. Sheets are delivered to the distributing apparatus by a sheet feeding means 12 that is adjustably mounted for positioning its inlet 12a adjacent the discharge of one of a variety of well known copying or printing apparatus or other sheet supply 14. The mechanical details of the sheet supply, the sheet feeding means and the distributing apparatus, are well known. For example, the sheet supply can be a Xerox Co. copier, model 360. The distributing apparatus can be of the type shown in U.S. Pat. Nos. 3,561,753 and 3,414,254. The sheet feeding means 12 can be any type of sheet conveyor which can deliver a high number of sheets at a fast rate of speed. Thus for the purposes of this description only a few mechanical details of the distributing apparatus will be described.

As best shown in FIG. 1 the paper is carried from the sheet delivery means 12 along a path P past the entrances to the various stations 10, there being an initial station or home station 20 and a terminal station 22 with a plurality of successive stations inbetween. The sheets are deflected out of the path P into the various stations by a movable deflector 24, that traverses vertically past the various stations. A set of by-pass fingers 26 are operable to divert the sheets from path P to a path Pa into the next row of stations 10a in which an identical movable deflector 24a inserts the sheets into the various stations 10a. A photo cell 28 intercepts a

lightbeam from a bulb 29 and functions as a switch to detect the passage of a sheet into a station. A similar photocell and light 28a and 29a are provided in the second column of stations. As is well understood with this type of apparatus, sheets from supply 14 are directed initially to station 10 along path P and are deflected successively into the various stations starting with the initial 20. In one operative mode, after a sheet has been passed into the terminal station 22, the bypass fingers 26 are lowered to deflect the incoming sheets along path Pa and thus into the stations 10a.

While the paper insertion mechanism is described in its preferred form as a movable deflector, it should be understood that the invention in its broadest form is equally applicable to other types of paper insertion mechanisms such as those employing movable stations, swingable paper insertion conveyors, stations having individual deflectors at each station, etc. Several features of the invention, however, are especially unique when employed with the movable deflector type of paper insertion mechanism as shown in U.S. Pat. No. 3,561,753.

With reference to the circuit diagram of FIGS. 2 and 3, the unique control means embodying the principles of the invention will now be described. Power for the machine is from conventional 120 volt AC lines L1 and L2. Power switch 30 is activated applying current to a drive motor 32 and vacuum pump drive motor 33. A bin interlock switch 35, which cuts off all power to the machine when a row of stations is shifted away from the deflector 24 for clearing a jammed sheet of paper or the like, is closed in the normal operating position.

Light from a photocell exciter lamp 35 strikes a photocell Q203 to energizing relay coil KPP through transistor Q201. Normally open contacts KPP1 are closed charging capacitor C103 and energizing relay coil KJD.

SORT MODE

As best shown in FIG. 3 when the sort-stack switch 36 is positioned in the sort mode a sheet of paper enters the distributing apparatus and is deflected out of the path P by the deflector 24 into the initial station 20. The sheet breaks the light beam to the photocell, Q203, and relay coil KPP is de-energized. Normally closed contacts KPP2 become closed to charge index capacitor C104 to 150 volts. Simultaneously, a recycle-start timer circuit 38 is energized by the normally closed contacts KPP5 applying current to the gate of SCR Q103. Transistor Q106 is turned on by the normally closed contacts KPP5 to remove any charge that may be on a capacitor C113 from previously distributed sheets, resetting the recycle start timer to a zero starting point.

As the sheet of paper is successfully inserted into a station the light beam is restored to the photocell Q203 and relay KPP is re-energized. Fully charged index capacitor C104 is discharged through normally open contacts KPP3 through a clutch solenoid 39. This pulses the clutch solenoid which causes the paper insertion deflector 24 to move to the next station. Transistor Q106 is turned off by the opening of normally closed contacts KPP5 causing the recycle start timing capacitor C113 to start to charge. As sheets of paper continue to be fed through the deflector 24 into the stations, the above sequence of steps continues.

The recycle-start-timer circuit 38 operates to be reset to a zero starting point with each sheet that enters the station so long as the flow of sheets is reasonably steady and has a predictable time interval spacing between successive sheets. When the flow of sheets is stopped for a period of time, in the case of the preferred embodiment a second interval equivalent to approximately two and one-third times the time interval between the spaced sheets in a normal flow, it is most often the result of the completion of a run of sheets and thus it is time to recycle the deflector 24 back to the initial station 20. Thus when the paper feed from the supply is terminated and the second time interval expires, the paper insertion mechanism 24 is thus ready to be recycled to its initial position. Relay KPP is no longer being de-energized so the recycle-start-timer circuit 38 will time out and transistor Q105 will apply a pulse to the gate of silicon controlled rectifier (SCR) Q104. Relay coil KR is energized through SCR's Q104, Q103, and the recycle stop switch 40. The clutch solenoid 39 is energized through normally open contacts KPP3 and KR1 causing the deflector 24 to start moving toward the home position at initial station 20. Power is applied to the gate of triac Q101 through normally open contacts KR4 and the jogging motor 34 is energized to jog and straighten the paper in the stations. When the deflector 24 is within one station of the initial station 20, the recycle-stop switch 40 is opened, removing the holding circuit for relay KR. Contacts KR1 are opened removing power to the clutch 39 and the paper deflector will stop at the initial station 20. Contacts KR4 are opened to stop the jogging motor by removing power from the gate of triac Q101. The distributing apparatus is now ready for the distribution of the next run of sheets.

During a longer run of sheets which exceeds the number of stations 10 in the first column, the deflector 24 will reach the terminal station 22 and move the auto by-pass switch 44 to the lower contact. This action removes power from the index circuit 48 preventing further movement of deflector 24. As the next sheet of paper breaks the light beam and relay KPP is de-energized, power is applied to the gate of Q102 through normally closed contacts KPP4 and KS3. This energizes the by-pass solenoid 46 through Q102 and the normally opened contacts of the auto bypass switch 44 lowering the fingers 26 so that all succeeding sheets of paper will be by-passed over the top of the first row of stations 10 into the next row of stations 10a. So long as sheets continue to pass the light beam between light 29 and photocell 28 the recycle-start-timer circuit will continue to be reset to a zero starting point and the deflector 24 remains at the lowest station 22.

PAPER JAM

As thus far described, the control satisfies the desired delivery of sheets to the desired stations with all mechanisms operating normally. Occasionally, however, a sheet of paper may become jammed between the deflector 24 and one of the stations 10. The light beam will remain broken when this occurs and KPP will remain de-energized. Contacts KPP1 remain open so that capacitor C103 will discharge through relay coil KJD and after a period of time, relay coil KJD will become de-energized. It should be noted that the contacts KPP1 are normally open for only a short period of time when paper is entering a station. During this short pe-

riod of time capacitor C103 discharges through relay coil KJD to keep the coil from de-energizing. When the paper has fully entered the station, and contacts KPP1 become closed, power is again applied to relay coil KJD and the capacitor C103 is charged back to its full potential. Thus in normal operation relay coil KJD is always energized. When relay coil KJD4 becomes de-energized due to a jam, contacts KJD1 will open, removing power from capacitor C104 and contacts KJD1 will close, discharging capacitor C104 through resistor R106. This action disables the index circuit 48 preventing further advancement of the deflector 24. Contacts KJD2 open, removing power from the recycle-start-timer circuit 38 to completely disable the timer. Contacts KJD3 close, lighting the jam indicator lamp 50 to show the operator that a jam exists. During this period, the paper may continue to be fed into the distributing apparatus until the operator stops the paper supply. In normal operation, this presents no problem since an operator generally attends a business office-type copier to which this invention is applicable. The operator then manually moves the tray or stations 10 back from the deflector 24 to remove the jammed sheet, opening the bin interlock switch 35, and thus removing power from the machine. After the jammed sheet is removed, the bin is moved toward the deflector closing the interlock switch 35 and power is again applied to the machine. The apparatus is now ready to accept paper again starting with the same station at which the sheet was being inserted when the jam occurred. In this manner, no station is skipped due to a jam in the operation. If desired, means can be provided for coupling the jam detection circuit to the paper supply controls to halt the flow of paper or to the by-pass solenoid 46 to by-pass paper over the stations 10 during the period a jam occurs.

STACK MODE

Switch 36 is moved to the stack position energizing relay coil KS. Contacts KS1 close and KS2 open, allowing relay KR to take control of the index circuit 48, with its contacts KR6, KR2. Contacts KR3 provide control of the by-pass solenoid circuit 46. A sheet of paper enters the distributing apparatus and is deflected out of the path P by the deflector 24 and starts into the initial station 20. This breaks the light beam to the photocell and relay KPP becomes de-energized. The recycle-start-timer circuit 38 is energized by normally closed contacts KPP5 applying current to the gate of Q103. Q106 is turned on to remove any charge that may be on capacitor C113 from previous sheets, resetting the recycle-start-timer to a zero starting point. After a sheet of paper successfully enters the station, the light beam is restored and relay KPP is energized. Q106 becomes turned off by the contacts KPP5 allowing the recycle-start-timing capacitor C113 to start charging. Sheets continue to be fed to the same station, with all the sheets being stacked at that station.

Now assuming the run of that sheet has been completed, the incoming paper feed is halted and the paper insertion deflector 24 is ready to be moved to the next station. Since relay coil KPP is no longer being de-energized, the recycle-start-timer times out and uni-junction transistor Q105 applies a pulse to the gate of Q104. Relay coil KR is energized through Q104, Q103, contacts KR5, and the recycle-stop switch 40. Index capacitor C104 is charged to 150 volts through the nor-

mally open contacts KR6. When the normally closed contacts KR5 are opened, the coil KR will continue to be energized through capacitor C108 and resistor R114. As soon as the capacitor C108 is charged, current will stop and relay coil KR will become de-energized. Relay coil KR is thus energized and de-energized within about 1 second. The fully charged index capacitor C104 is discharged through the clutch solenoid 39 by the normally closed contacts KR2. This pulses the clutch solenoid, causing the deflector 24 to move to the next station. The apparatus is now ready for the next run of sheets to be stacked into the next station.

When the deflector 24 reaches the terminal station 22, the auto by-pass switch 44 is actuated. This action removes power from the index circuit 48 preventing further movement of deflector 24. When the last station is filled and the paper feed stops, the recycle-start-timer times out, power is applied to the gate Q102 through the normally open contacts KS4 and KS3. This energizes the by-pass solenoid 46 through Q102 and the normally open contacts of the auto by-pass switch 44. All succeeding sheets of paper will be by-passed over the top of first row of stations into a collecting tray or into the second set of stations 10a.

The deflector 24 is returned to the initial station 20 by moving the sort-stack-bypass switch 36 to the sort position. Next the cycle switch 54 is closed, momentarily applying power to the gate of Q107 and relay coil KR is energized. When the deflector reaches the initial station 20, the recycle stop switch 40 will open its normally closed contacts and relay coil KR will become de-energized.

It is possible to stack paper in any one of the stations desired. This is accomplished by operating the cycle switch 54 on and off until the deflector 24 has reached the desired station. When the cycle switch is closed, power is applied to the gate of Q107 to energize coil KR. The index capacitor C104 is charged to 150 volts through the normally open contacts of KR6. When the cycle switch is released the current path for KR through the cycle switch is open and KR will become de-energized. Capacitor C104 is discharged through the clutch solenoid causing the deflector to move to the next station.

BY-PASS MODE

When the sort-stack-bypass switch 36 is in the bypass position, the bypass solenoid 46 is operated directly. The index and the recycle-start-timer circuits 48 and 38 have no power applied to them and are therefore disabled. All paper will be by-passed over the top of the first row of stations 10 into a tray or into the second row of stations 10a. The second row of stations 10a has duplicate circuitry and the relay coils KPP, KJD, and the jam indicator lamp 50 are still operational for the first row of stations. If a jam occurs at the top of the row of stations 10, the jam indicator lamp will light as previously described.

While the preferred embodiment of the invention has been illustrated and described, it should be understood that variations will be apparent to one skilled in the art without departing from the principles of the invention. Accordingly it is to be understood that the invention is not limited to the embodiment illustrated but rather is to be limited only by a liberal interpretation of the claims appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a sorting-stacking apparatus having a plurality of successive stations for receiving sheets of paper or the like and sheet distributing means including a sheet deflector movable along said stations for inserting the sheets into said stations and adapted to receive the sheets from a supply capable of feeding a flow of sheets along a path to the distributing means with a time spacing between each successive sheet being at a predetermined generally uniform first time interval, the improvement comprising:

control means for said sheet deflector for directing the insertion of the sheets into predetermined stations, said control means including means operative during said flow of sheets for detecting a second time interval after passage of a sheet greater than said first time interval and in response to said detection directing the insertion of the next sheet into a different station;

said control means including means for directing the insertion of all of a run of sheets into one station for stacking a plurality of sheets into said station before inserting a sheet into a subsequent station; and stack control means responsive to said means for detecting said second time interval for directing the insertion of the sheets after said second time interval into the next successive station;

said control means including means for directing the insertion of individual sheets into successive sta-

tions starting with an initial station and sort control means responsive to said means for detecting said second time interval for directing the insertion of the next sheet after said second time interval into said initial station;

and manually operable switch means for selectively actuating said stack or sort control means.

2. The apparatus of claim 1 including jam control means for detecting the presence of a stationary sheet in said path, said jam control means including means for disabling said control means to halt sheet delivery prior to said control means sensing said second time interval so that upon restoration of said sheet delivery the next sheet is inserted into the same station as when sheet delivery was halted.

3. The apparatus of claim 1 said control means including means for detecting the passage of a first sheet of the regularly spaced flow of sheets and in response thereto energizing said second time interval detecting means.

4. The apparatus of claim 3, said means for detecting the passage of a first sheet including a timer circuit, a light source, means for detecting a light beam from said light source, circuit completion means responsive to a sheet blocking said light beam for sending a signal, means responsive to said signal for recycling said timer circuit, and said means for detecting the passage of said first sheet including switch means responsive to said signal for initially energizing said timer circuit.

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