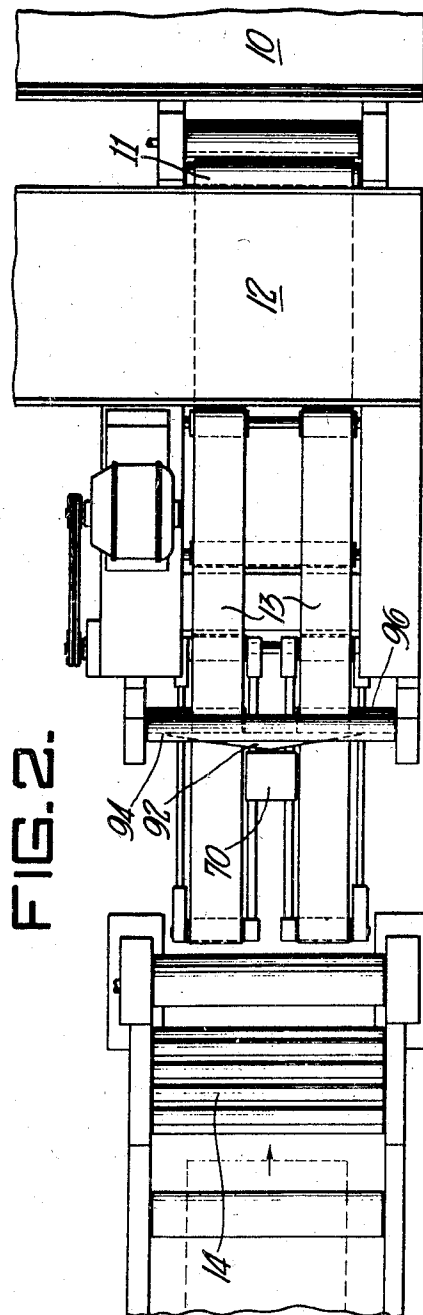
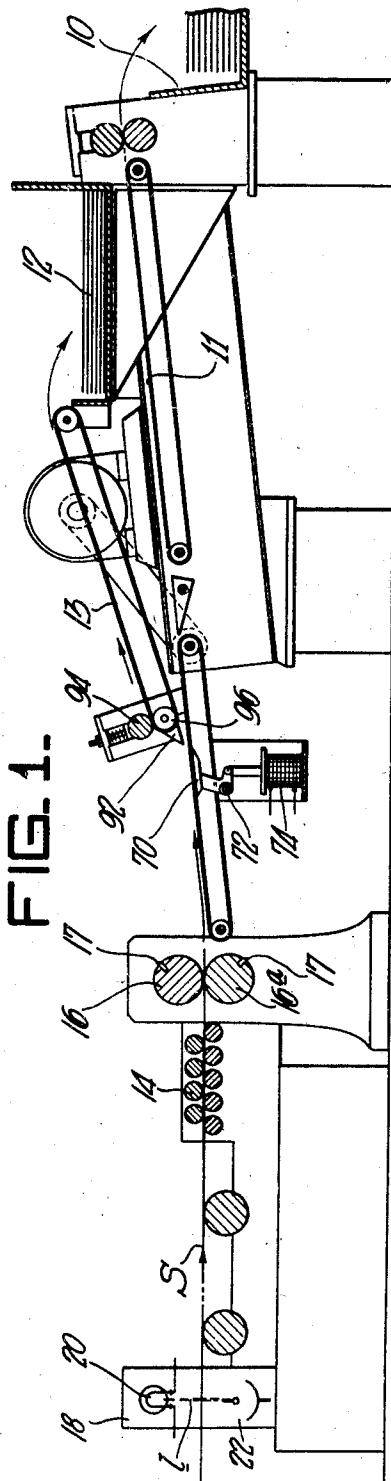


Dec. 30, 1947.

R. L. DOWELL
 APPARATUS FOR SEPARATING DEFECTIVE SHEETS
 AS SHEARED FROM CONTINUOUS STRIP
 Filed Nov. 3, 1943

2,433,685

4 Sheets-Sheet 1



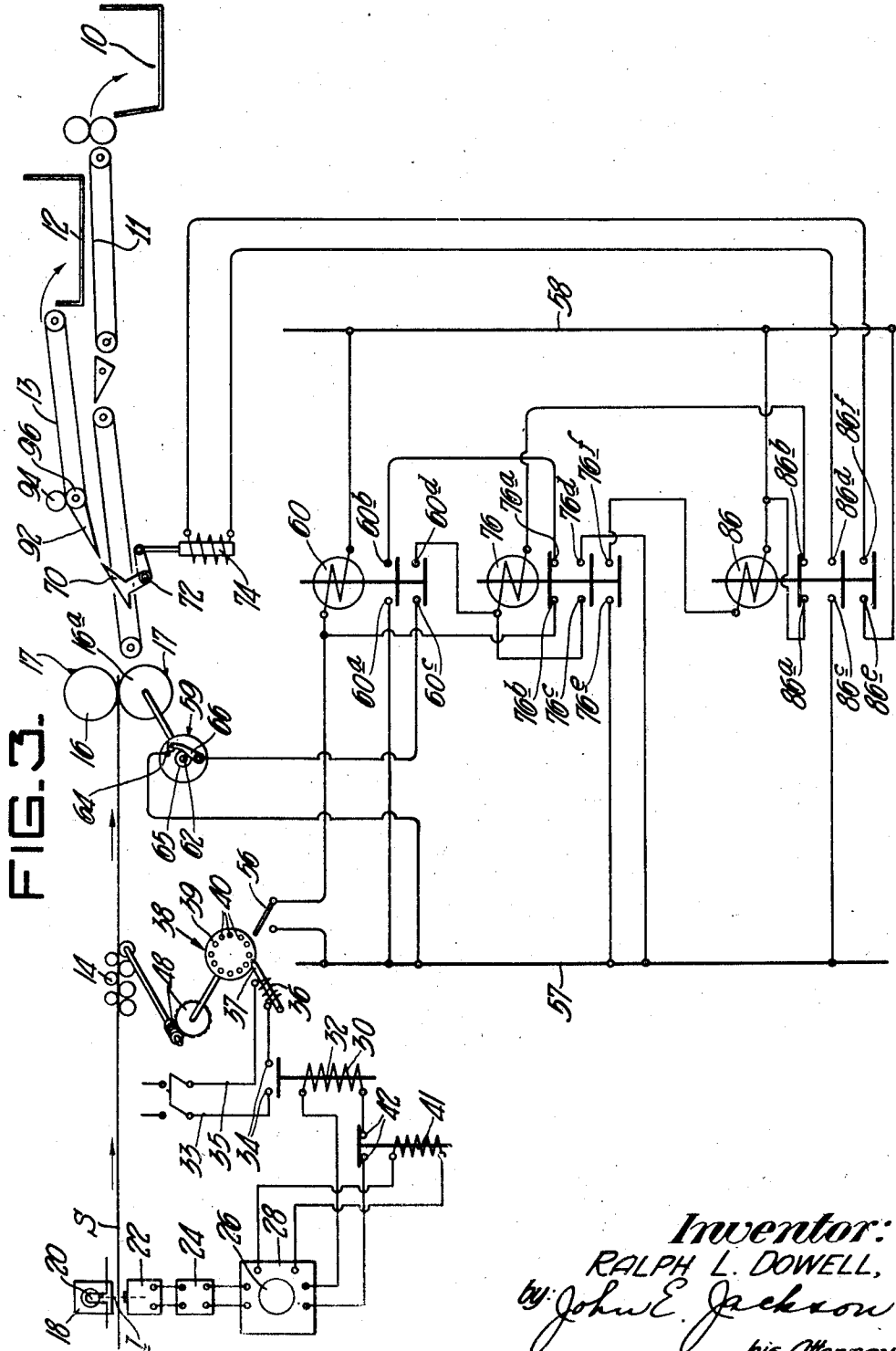
Inventor:
 RALPH L. DOWELL,
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 his Attorney.

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4 Sheets-Sheet 2

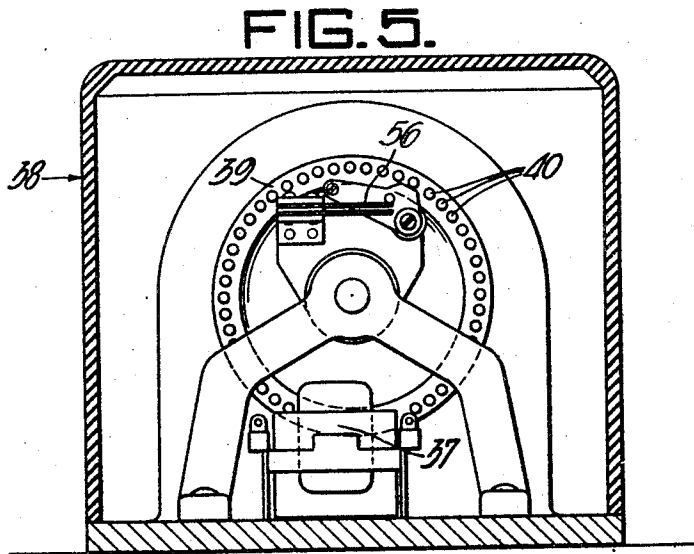
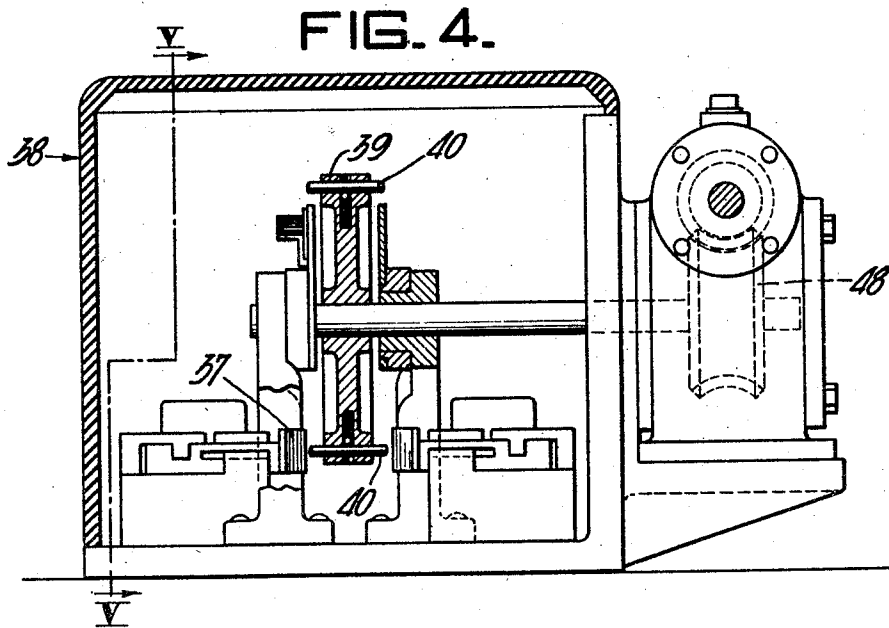


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4 Sheets-Sheet 3



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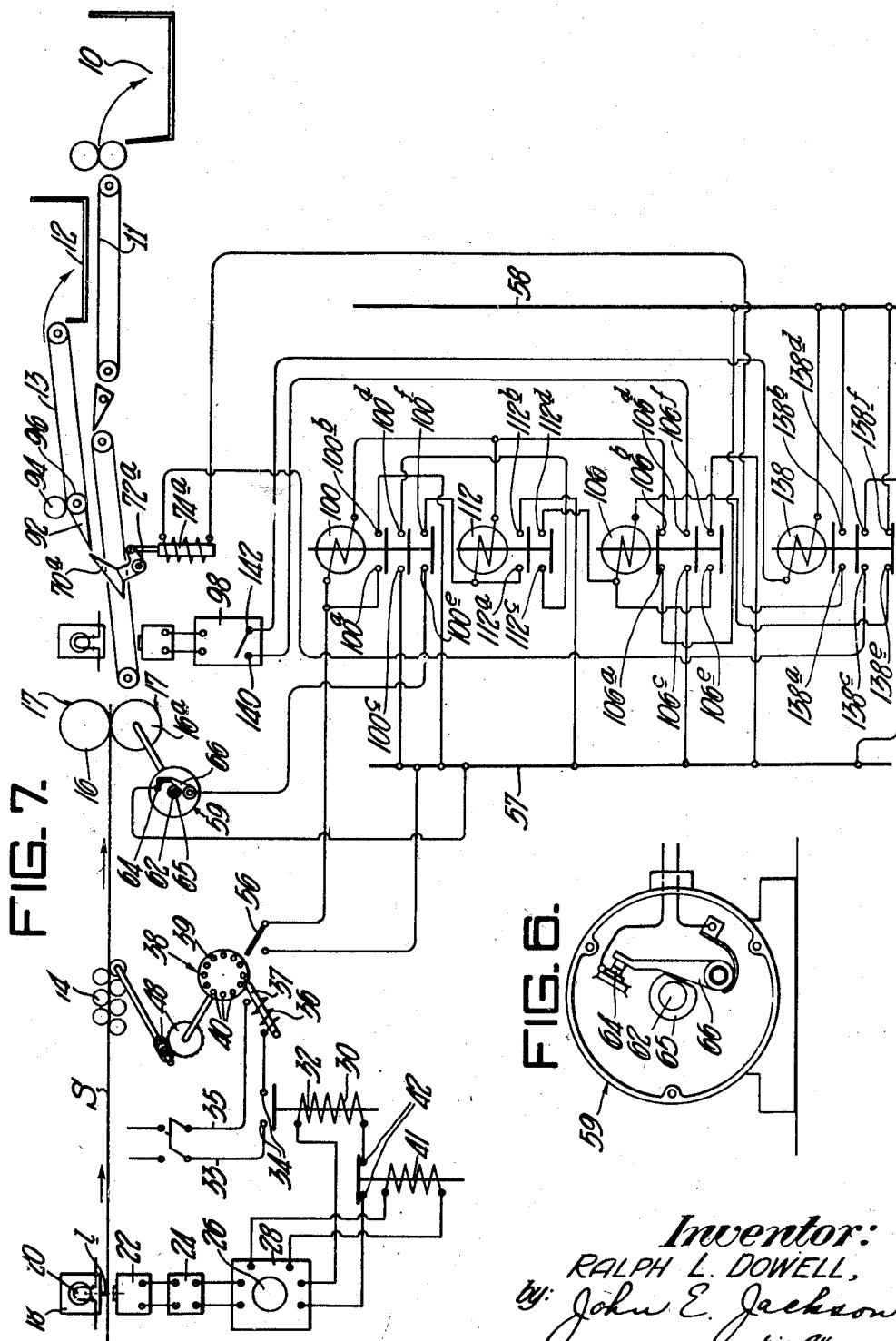
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,433,685

APPARATUS FOR SEPARATING DEFECTIVE SHEETS AS SHEARED FROM CONTINUOUS STRIP

Ralph L. Dowell, Birmingham, Ala., assignor to Tennessee Coal, Iron and Railroad Company, Birmingham, Ala., a corporation of Alabama

Application November 3, 1943, Serial No. 508,850

5 Claims. (Cl. 209—111)

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The present invention relates broadly to metallic sheet classifiers, and more particularly to an improved electrical detector and control for segregating prime metal sheets from defective sheets having pin-holes or like defects therein, and means for conveying the prime sheets to one station and the defective sheets to another station.

More specifically, the invention is directed to a novel combination of coordinated mechanical and electrical instrumentalities, including means for feeding continuous strip, a rotary or flying shear for cutting the strip into sheets of desired predetermined lengths, a sheet classifier comprising one station adapted to receive prime sheets and another station adapted to receive sheets with pin-holes or like defects therein, there being respective conveyors for delivering the sheets to each of said stations, the routing of the sheets being under control of a deflector gate effective in one position to direct them to the conveyor serving the prime sheet station and in another position to the conveyor serving the defective sheet station, said deflector gate being under control of a pin-hole detector which is responsive to light rays adapted to penetrate a pin-hole or similar defect in the strip, the deflector being actuated by a solenoid or equivalent electrically powered element, the operation of the deflector being governed with great precision by novel control instrumentalities constructed and arranged to energize said electrically powered element after a pin-hole or defective portion of the strip has traveled, at a high speed, a predetermined distance beyond said pin-hole detector and reached a definite position with respect to the cutter blade on the shear drum which severs the strip into sheets.

For a more complete understanding of the invention, reference should be made to the following detailed disclosure, the accompanying drawings, and the appended claims.

In the drawings:

Figure 1 is a view partly in side elevation and partly in section, illustrating the principal elements of a classifier and related equipment embodying the present invention.

Figure 2 is a plan view of Figure 1.

Figure 3 is a diagram schematically illustrating the essential elements of the herein claimed invention and showing the coordination between the mechanical and electrical instrumentalities for controlling with great precision the deflecting means which routes sheets to either the prime sheet station or the defective sheet station.

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Figure 4 is a detail view of a timing device.

Figure 5 is a section on line V—V of Figure 4.

Figure 6 is a detail view of a make-and-break contact device driven by the shear.

Figure 7 is a diagram similar to Figure 3, illustrating an alternative embodiment of the invention.

Referring in detail to the drawings, 10 represents a sheet piler herein referred to as a prime sheet station, adapted to receive perfect sheets delivered thereto by a belt conveyor 11, and 12 represents a rack or box adapted to receive defective sheets, delivered thereto by a belt conveyor 13, such as sheets having pin-holes or other defects therein. Metallic sheet stock S in continuous strip form is fed by a roller leveler 14 of conventional construction to a rotary flying shear comprising rotary drums 16—16^a having blades 17 which coast to shear the strip to thus form a plurality of separate sheets of predetermined desired lengths. Prior to the time the strip reaches the shear, it passes a pin-hole detector indicated as a whole at 18. This detector is of conventional form, and comprises a housing containing a plurality of exciter lamps one of which is indicated diagrammatically at 20. These lamps are adapted to pass rays of light 1 through pin-holes or other openings or light-pervious defects in the strip. The light beam penetrating the pin-hole or similar defect acts on a conventional photoelectric cell contained in the housing 22. This generates a current which is amplified by a conventional amplifier 24 which, in turn, acting through a thyatron control element 26 contained in the cabinet 28, energizes the coil 30 of relay 32. Relay 32 closes contacts 34, which complete a circuit across the 60-cycle 220-volt power supply lines 33—35, thus energizing the actuating solenoid 36 of a pinwheel timer 38. This timer includes a rotor 39 carrying a plurality of pins 40 which can be set by solenoid 36 to a position to actuate a switch 56 herein-after referred to.

The length of time for which relay 32 remains energized is under control of a conventional thyatron tuning device including relay 41 whose contacts 42 when opened deenergize coil 30 of relay 32 after the lapse of time necessary to cause solenoid 36 to depress pins 40 of timer 38. Since this relay 41 is a conventional Westinghouse time delay relay of a type well known to those skilled in the art as an electronic timer, it will not be further described or illustrated. It is well suited for controlling very short interval timing. Its operation depends upon the time

interval required to charge a condenser associated with a known type of thyratron tube which causes said tube to become conducting. When the thyratron tube becomes conducting, it energizes the relay 41.

The function of the timer 38 is to measure the linear amount of strip passing a given point per unit of time. For example, the timer can measure the feet of strip passing a given point per minute or for a definite number of revolutions of the roller leveler. The timer is conveniently driven through a suitable gear reduction unit 48, shown in Figure 4, from the roller leveler 14, as shown diagrammatically in Figure 3.

When an impulse from the amplifier of the pin-hole detector 18 energizes coil 30 of relay 32, its contacts 34 close. Thus a circuit through power source 33 is closed across said contacts 34 through the timer actuating solenoid 36. This causes a plunger 37 to move forward and strike one of a circular series of pins 40 carried by the rotor 39 of the timer. The pins are held projected outwardly from one face of the rotor about $\frac{1}{4}$ inch as long as the solenoid 36 remains energized. The rotor eventually turns the projected pin or pins to a position where it or they actuate a switch 56 effective to close a circuit across power supply lines 57 and 58 through a relay 60.

The timer pins described provide a proportional time control delay device, since the fraction of a revolution traversed by the depressed pin until it reaches the switch 56 represents the linear distance from the pin-hole detector 18 to the shear drums 16—16^a, or the elapsed time required for the indicated defect or hole in the strip to reach the shear drums 16—16^a.

The shear drum 16^a drives a contact device shown in detail in Figure 6 and indicated as a whole at 59 in Figure 3. This contact device includes a shaft 62 secured to a shaft extension of the shear drum 16^a. Shaft 62 carries a cam 65, for coaction with a pivotally mounted contact arm 66 movable into and out of engagement with a contact 64. An electrical impulse is passed through the contact 64 and arm 66 once for each revolution and at a definite point in each revolution of the shear drums 16—16^a or for each sheet sheared thereby.

The electrical control instrumentalities above referred to, when coordinated with the sheet feeding means and related electrical and mechanical devices to be presently more fully described, are effective to automatically route prime salable sheets to the prime sheet station 10 and defective sheets such as those having pin-holes therein to the reject station 12. Such routing is under control of a deflector gate 70 pivoted on a shaft 72. A solenoid 74 or equivalent electrically powered device is capable of shifting the deflector gate so that in one position it routes the prime sheets to station 10 and in another position routes defective sheets to station 12.

In operation, assuming that the metal strip is traveling at its normal speed of about 600 to 800 feet per minute and a portion of the strip with a pin-hole defect arrives at the pin-hole detector 18, such hole indication is transmitted as an electric impulse substantially instantaneously to the pin-wheel timer 38. As the portion of the strip with this defect or hole travels toward the shear drums 16—16^a, its movement is accurately measured by the timer 38. When the portion of the strip with a pin-hole or like defect therein reaches the shear drum, the timer contact 56 closes, thus energizing relay 60. Relay 60 then

seals in through its own contacts 60^a—60^b and through normally closed contacts 76^a—76^b of relay 76. Thus the impulse from the timer 38 is transmitted to relay 60. The result of this action is to place the routing of the defective sheet under the precision control of the shear drum contact device 59.

When the shear drums 16—16^a shear the defective sheet, contacts 64—66 of device 59 are closed, thus energizing relay 76, the exciting current flowing through normally closed contacts 86^a—86^b of relay 86. Relay 76 then closes and seals in through its own contacts 76^a—76^b and normally closed contacts 86^a—86^b of relay 86. The closing of relay 76 thus definitely initiates the operation of the deflector gate 70 through energization of solenoid 74 at an exact time, controlled with great precision with respect to the exact time of shearing a particular defective sheet, regardless of whether the pin-hole or defect is located centrally or adjacent one or the other ends of the sheared sheet.

When relay 76 is energized, contacts 76^a and 76^b open, deenergizing relay 60, thus resetting said relay 60 to condition it to handle the next impulse from the timer-actuated contact 56 so as to provide for the precision control of successive defective sheets.

The operation of the deflector gate actuating solenoid 74 is controlled as follows:

Relay 86 is energized and closes immediately upon the closing of contacts 76^a—76^b of relay 76, thus energizing the deflector-actuating solenoid 74 due to closing contacts 86^a—86^b and 86^c—86^d of relay 86. The gate operating solenoid 74 remains energized only for the time interval required to deenergize relay 76 through the normally closed contacts 86^a—86^b, which deenergizes relay 86 upon the opening of contacts 76^a—76^b, thereby restoring the entire electrical control system for a repetition of the hereinabove described cycle.

It is manifest that upon energization of the deflector gate actuating solenoid 74, the deflector gate 70 will be instantly rocked about its pivotal support 72 so as to move the same from the position of Figure 1 to the position of Figure 3, thus directing the defective sheet with the pin-hole therein to the guide apron 92, guiding said defective sheet into the nip of pinch roll 94, which cooperates with the roller 96 over which the defective sheet conveyor 13 is trained. Thus the defective sheet is routed to the conveyor 13 which delivers it to the box 12 herein referred to as the defective sheet station.

In the alternative embodiment of the invention diagrammatically illustrated in Figure 7, I have illustrated a combination of control instrumentalities embodying certain refinements over the combination shown and described in connection with Figures 1 to 6 inclusive. When using the control of Figures 1 to 6 inclusive, it is necessary to precisely adjust the drum contact device 59 in such manner as to set the point in the cycle at which the contacts 64, 66 close with respect to the position occupied by the cutter blades on the shearing drums 16—16^a. To overcome this, in the arrangement of Figure 7 a photoelectric relay 98 is installed to control with precision the actual time at which the gate-operating solenoid 74 will operate with respect to the sheared sheet.

The photoelectric relay 98 is of known conventional form, and is actuated in much the same manner as the pin-hole detector 18 hereinabove described, except that relay 98 is actuated by the

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light beam passing through the space or gap between two adjacent sheared sheets. This relay 98 is located at an exact predetermined distance from the deflector gate 70^a calculated to allow sufficient time to operate the deflector gate promptly upon the arrival of a defective sheet.

Referring in detail to Figure 7, the impulse from the pin-hole detector 18 is handled by the timer in the same manner described in connection with Figure 3. Relay 100 then is closed from pinwheel timer 38 and normally closed contacts 106^a and 106^b of relay 106, and seals in through contacts 100^a and 100^b of relay 100. Relay 112 now closes through contacts 64—66 of the shear driven contact device and normally open contacts 100^c—100^d of relay 100. Then relay 112 seals in through its own contacts 112^a—112^b and normally closed contacts 106^a—106^b of relay 106. Relay 106 now closes through contacts 112^c—112^d of relay 112 and contacts 100^c—100^d of relay 100. Relay 106 seals in through its own contacts 106^c—106^d and normally closed contacts 138^a—138^b of relay 138. After relay 106 closes, relays 100 and 112 are deenergized upon the opening of normally closed contacts 106^a—106^b. This allows the handling of successive sheets as relays 100 and 112 can operate from another impulse while relay 106 remains energized until the defective sheet reaches the photoelectric relay 98. When the defective sheet reaches the photoelectric relay 98, contacts 140—142 close, which closes relay 138 through contacts 106^c—106^d of relay 106 and relay 138 energizes deflector gate solenoid 74^a through contacts 138^a—138^b and 138^c and 138^d.

An important feature of the herein claimed invention which distinguishes over prior art arrangements is that prior devices, to the best of my knowledge and belief, always measure the amount of strip from a photoelectric detector to a deflector gate and operate the gate after the strip travels said measured amount, regardless of whether the hole or similar defect occurs in the middle or at some other point in the sheared sheet. Thus in such prior art devices, when the pin-hole occurs near the leading end of the sheet, the deflector gate is actuated too late in point of time to properly route the defective sheet. Hence in the prior art arrangement, a prime sheet is frequently erroneously directed to the station for rejects, and the defective sheet, which should have been directed to the station for rejects, frequently is conveyed to the station for prime sheets. My improved precision control apparatus herein set forth and claimed prevents such undesirable occurrences.

The advantages of my precision control for sorting defective and prime sheets are made available largely as the result of providing means whereby the circuits controlling the energization of the power device 74 for actuating the deflector gate are controlled jointly by the timing device 38 and the contact device 59 driven in synchronism with the shear drums 16—16^a. In the device of my invention, when the portion of the strip with a pin-hole or like defect therein reaches the shear drums 16—16^a, the position of the blades 17 may be anywhere with respect to the point at which the sheet is sheared. The contacts 64—66 of the shear-driven contact device close only momentarily at a point in the rotation of the shear drums 16—16^a approximately 15° before the knife blades 17 come into registry to shear the sheet. Thus in my improved apparatus, the sheet with the hole therein may be said to be

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definitely selected and its position located with great precision by electrical control instrumentalities whose operations are controlled jointly by the timer 38 and the shear driven contact device 59. The position of the pin-hole or like defect with respect to the shearing point will therefore not affect the distance measured by the timer 38. Otherwise expressed, the electrical control instrumentalities shown and described herein may be said to be constructed and arranged to energize the electrically powered deflector gate at a definite time predetermined with relation to the severing of the strip by the shear. Thus my invention recognizes a bothersome operating problem which has baffled those skilled in the art for some time, and provides a satisfactory and novel solution for the problem.

While the foregoing description and accompanying drawings illustrate preferred embodiments of the invention which an actual reduction to practice has demonstrated to be highly desirable, it is not to be construed that I am limited thereto, since various modifications and substitutions of mechanical and electrical equivalents may be resorted to by those skilled in the art without departure from the scope of the appended claims.

I claim:

1. The combination with means for feeding a continuous strip and a shear for cutting the strip into sheets of desired lengths, said feeding means being in frictional contact with said strip to advance the same of a sheet classifier comprising respective stations adapted to receive prime and defective sheets, respective conveyors for delivering sheets to each of said stations, a deflector effective in one position to route sheets to the conveyor serving the prime sheet station and in another position to route sheets to the conveyor serving the defective sheet station, a pin-hole detector responsive to light penetrating a pin-hole or similar defect in the strip, an electrically powered element for actuating said deflector, and instrumentalities constructed and arranged to energize said electrically powered element at a definite time predetermined with relation to the severing of the strip by said shear, said instrumentalities including a time delay device driven by said feeding means and a contact device driven by said shear.

2. The combination with means for feeding a continuous strip and a shear for cutting the strip into sheets of desired lengths, said feeding means being in frictional contact with said strip to advance the same of a sheet classifier comprising respective stations adapted to receive prime and defective sheets, respective conveyors for delivering sheets to each of said stations, a deflector effective in one position to route sheets to the conveyor serving the prime sheet station and in another position to route sheets to the conveyor serving the defective sheet station, a pin-hole detector responsive to light penetrating a pin-hole or similar defect in the strip, an electrically powered element for actuating said deflector, and electrical control instrumentalities responsive to said pin-hole detector constructed and arranged to energize said electrically powered element at a definite time predetermined with precision in relation to the exact time the strip is severed by said shear, said instrumentalities including a time delay device driven by said feeding means and a contact device driven by said shear.

3. The combination with means for feeding a

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continuous strip and a shear for cutting the strip into sheets of desired lengths, said feeding means being in frictional contact with said strip to advance the same of a sheet classifier comprising respective stations adapted to receive prime and defective sheets, respective conveyors for delivering sheets to each of said stations, a deflector effective in one position to route sheets to the conveyor serving the prime sheet station and in another position to route sheets to the conveyor serving the defective sheet station, means for detecting a perforated defect in the strip, a power means for actuating said deflector, and control instrumentalities responsive to said detecting means constructed and arranged to render said power means effective to actuate said deflector at a definite time predetermined with precision in relation to the exact time said strip is severed by said shear, said instrumentalities including a time delay device driven by said feeding means and a contact device driven by said shear.

4. The combination with means for feeding continuous strip and a shear for cutting the strip into sheets of desired lengths, said feeding means including staggered straightening rolls defining a sinuous path for the strip, said rolls making a non-slip frictional driving contact with the continuous strip of a sheet classifier comprising respective stations adapted to receive prime and defective sheets, respective conveyors for delivering sheets to each of said stations, a deflector effective in one position to route sheets to the conveyor serving the prime sheet station and in another position to route sheets to the conveyor serving the defective sheet station, a pin-hole detector responsive to light penetrating a pin-hole or similar defect in the strip, a timer driven by said rolls at a rate proportional to the strip's travel, means responsive to said detector

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for setting said timer, a contact device driven by said shear, and an electrically powered element controlled jointly by said timer and said contact device for actuating said deflector.

5. The combination with means for feeding a continuous strip and a rotary shear for cutting the strip into sheets of desired lengths, said feeding means including staggered straightening rolls making a non-slip frictional driving contact with the continuous strip of a sheet classifier comprising respective stations adapted to receive prime sheets and defective sheets, respective conveyors for delivering sheets to each of said stations, a deflector effective in one position to route sheets to the conveyor serving the prime sheet station and in another position to route sheets to the conveyor serving the defective sheet station, a pin-hole detector responsive to light penetrating a pin-hole or similar defect in the sheet stock, an electrically powered solenoid operatively connected to and adapted to actuate said deflector, a timer driven by said rolls, a contact device driven by the shear, and electrical control instrumentalities governed jointly by said timer and said contact device for controlling the energization and deenergization of said solenoid.

RALPH L. DOWELL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,883,858	Spiess	Oct. 18, 1932
2,138,645	Rey	Nov. 29, 1938
2,229,638	Chamberlin	Jan. 28, 1941
2,363,577	Dexter	Nov. 28, 1944