

[54] **DIGITAL CONTROL DEVICE FOR STRIP METAL FEEDER**

[76] Inventor: **Andrew Raoul**, 672 E.C. Row Avenue, Windsor, 12, Ontario, Canada

[22] Filed: **June 4, 1971**

[21] Appl. No.: **150,046**

[52] U.S. Cl. **318/600, 318/467**

[51] Int. Cl. **G05b 19/26**

[58] Field of Search **318/142, 467, 600**

[56] **References Cited**

UNITED STATES PATENTS

2,727,570	12/1955	Hempel	318/467 X
2,692,361	10/1954	Asbury et al.	318/142
2,767,981	10/1956	Hempel	318/467 X
3,195,385	7/1965	Paterson	318/600 X

Primary Examiner—T. E. Lynch

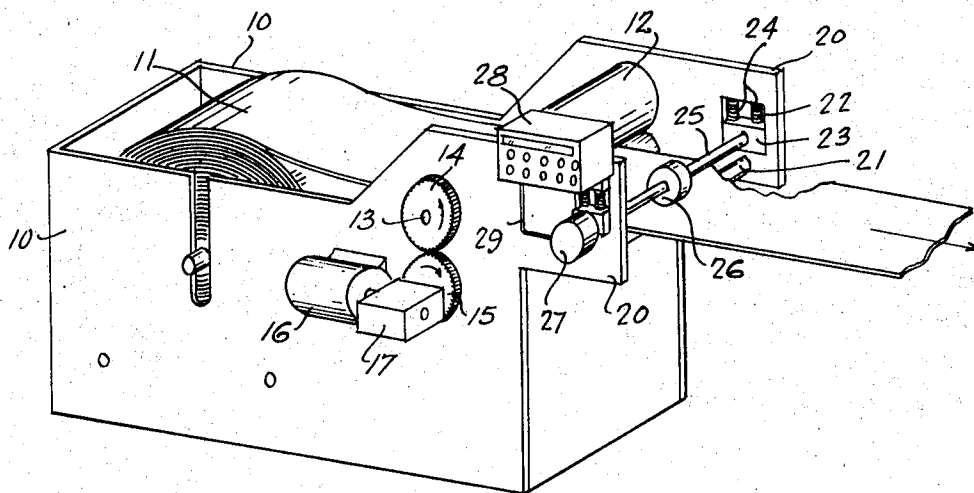
Attorney—Peter Kirby, Charles P. Curphey and Norris M. Eades

[57] **ABSTRACT**

A control device for a strip metal feeder is described which provides a very accurate control of the distance of advancement of the strip metal during an operational cycle. The device comprises

- a. a measuring wheel of known circumference adapted to engage the strip metal whereby rotational movement of the wheel is actuated by movement of the strip metal,
- b. a rotary transducer operatively connected to said wheel for generating electric pulse data proportional to the rotation of the wheel, and
- c. an electronic counter with presets for counting electric pulses received from the transducer and stopping the feeder after a predetermined number of pulses have been received.

14 Claims, 3 Drawing Figures



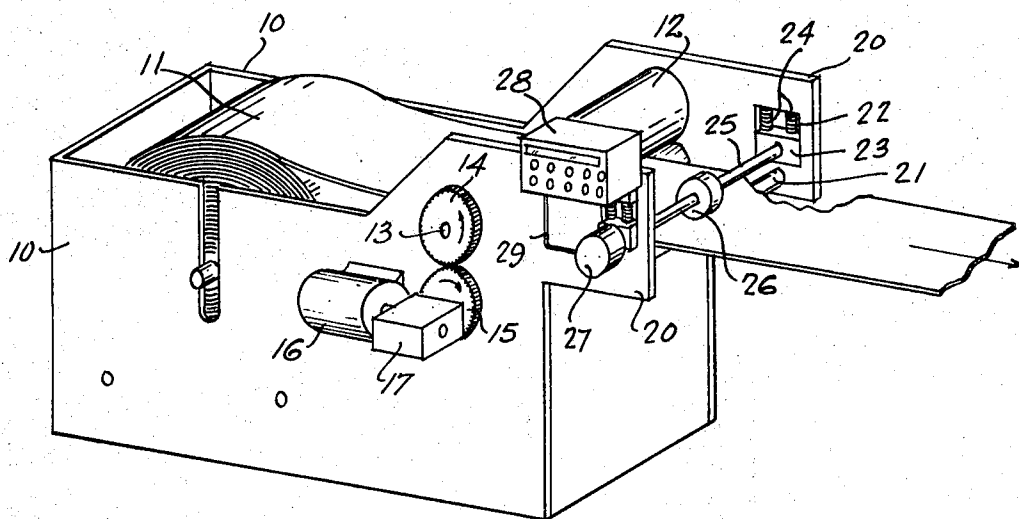


Fig. 1.

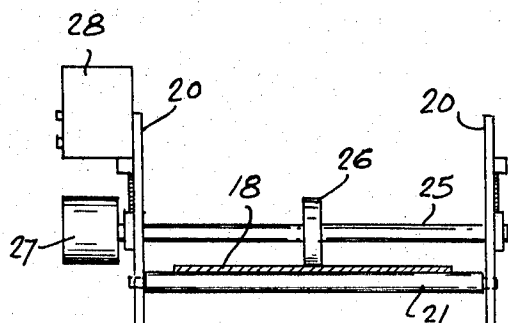


Fig. 2.

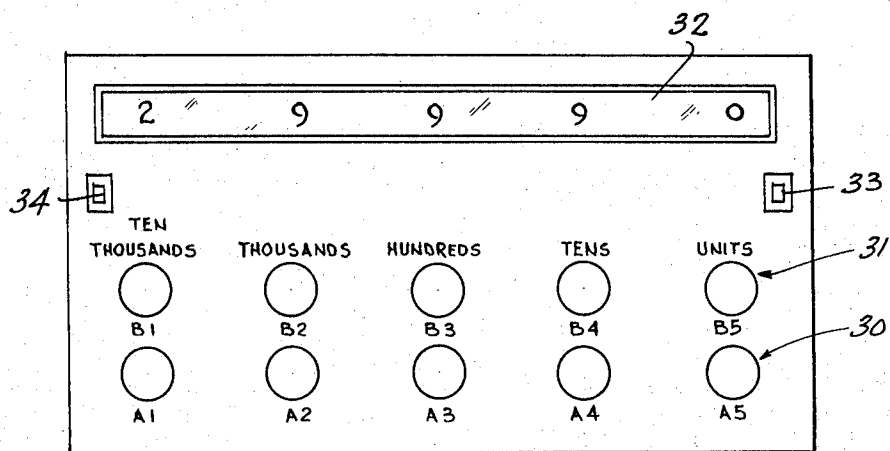


Fig. 3.

DIGITAL CONTROL DEVICE FOR STRIP METAL FEEDER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a control device for strip metal feeders.

2. Description of the Prior Art

The sheet metal processing and stamping industry is a very large one involving extremely expensive pieces of equipment with immense material throughputs. In the metal stamping industry, strip metal, usually steel, from which shapes are to be cut by power presses is usually supplied in tightly wound coils and these coils are supported in cradles for unwinding. Whether the strip metal is merely being cut into pieces by a cutter or fed directly to a power press for shaping into shaped articles, the shaping or cutting operation must be done while the strip metal is stationary and this means that the strip metal being uncoiled must be advanced a predetermined distance, then the cutting and/or shaping takes place, after which the strip is once again advanced a predetermined distance. If the strip does not advance sufficiently far, the piece formed is undersized and becomes a reject. On the other hand, if the strip advances too far, the piece formed may require trimming and this creates more wastage.

In view of the fact that these machines are frequently operated on a 24 hour day basis, it will be readily apparent that wastage caused by poor control of the movement of the strip metal becomes a very expensive item. Even fractions of an inch when considered in terms of a full year of operation become very significant in terms of losses.

It is still a quite common practice to provide an operator with manual controls for stopping and starting a feeder device for advancing an uncoiled metal strip and various mechanical devices have also been developed which are intended to advance a precise amount of strip metal in each cycle. One such device is in the form of pneumatic cylinders with grippers which grip the metal and pull it forward the length of the stroke of the air cylinders. This does provide a reasonably positive action but has the very serious drawback that if there is any slippage between the grippers and the metal, an insufficient amount of the strip metal will have been advanced so that the part formed is rejected.

Another system involves the use of feed rollers driven by a motor with the motor being actuated for a predetermined length of time which is intended to be sufficient to advance the strip metal the desired distance. It must, of course, be appreciated that this strip metal is frequently very heavy so that a certain amount of momentum is generated during the forward advance and this makes it very difficult to stop the forward advance at a very precisely determined location.

There is, therefore, still a great need in the metal processing and stamping industry for a control device which will advance a precise length of strip metal in every cycle.

SUMMARY OF THE INVENTION

The control device of the present invention for a strip metal feeder comprises in combination:

a. a measuring wheel of known circumference adapted to engage the strip metal whereby rotational movement of the wheel is actuated by movement of the strip metal,

b. a rotary transducer operatively connected to said wheel for generating electric pulse data proportional to the rotation of the wheel, and

c. an electronic counter with presets for counting electric pulses received from the transducer and stopping the feeder after a predetermined number of pulses have been received.

The control device of the invention can be used with any type of strip metal feeder including the roller types driven by AC or DC motors as well as those powered by air or hydraulic cylinders. It is, however, particularly effective when used in combination with a strip metal feeder powered by a DC motor.

DESCRIPTION OF PREFERRED EMBODIMENTS

The measuring wheel will normally be a relatively narrow one, e.g., about 1½ inches wide, and is mounted on an axle transverse to the direction of travel of the strip metal. The axle is mounted in supports which can be held in pivotally mounted arms or mounted directly in sidewalls of the feeder positioned on each side of the strip metal. Since rotational movement of the wheel is actuated by movement of the strip metal, it is important that the measuring wheel assembly be either weighted or spring-loaded so as to provide at all times a positive engagement between the surface of the wheel and the strip metal. For instance, a loading of 40 pounds on the wheel provides a very positive contact on the metal. It is advantageous to provide an idler roller adjacent the measuring wheel for supporting the strip metal so that the idler roller and measuring wheel are pressing the strip metal therebetween. It is also advantageous to provide the peripheral surface of the measuring wheel with a gripping face to further decrease any tendency of slippage between the wheel and the strip metal.

The axle of the measuring wheel is directly connected to a rotary transducer for generating electric pulse data proportional to the rotation of the wheel. A photo-electric transducer is particularly desirable since it can provide a very large number of electric pulses per rotation.

The electronic counter with presets is of known design and this counter receives the electric pulses from the transducer. Such an electronic counter typically has a series of preset controls whereby a relay is activated after a predetermined number of electric pulses have been received.

It is particularly desirable to use a counter having two series of preset controls and two output relays. With this arrangement, one series of preset controls can be adjusted to activate one relay at a predetermined count and the second series of preset controls adjusted to actuate the second relay at another predetermined count.

The relay or relays of the electronic counter are operatively connected to the drive means for the feeder and particularly when two series of preset controls and relays are used, the first set of controls and relay can be arranged to cause a slowing down of the feeder after a predetermined number of counts and the second series of presets and relay arranged to cut off the feeder drive completely at a second predetermined count.

In order to better explain the operation of the system, we will now consider a particular embodiment of the invention utilizing a measuring wheel having a circumference of 10.000 inches. In other words, with each revolution of the measuring wheel, the strip metal will have advanced a distance of 10.000 inches. By utilizing such a wheel together with a rotary transducer which produces 10,000 impulses per revolution it will be seen that each pulse produced by the transducer will be equivalent to a strip metal advancement of 0.001 inch.

The electronic counter can then be provided with two series of preset controls, each series having an individual control for units, tens, hundreds, thousands, and ten thousands. In other words the counter can be adjusted for a strip metal advancement of anywhere between 0.001 inch and 99.999 inches.

The electronic counter has a pair of output relays which are connected to the controls of a DC motor which drives the strip metal feeder. If the machine is to advance precisely 30.00 inches of strip metal, then the second series of preset controls will be set at 30.000 while the first series of preset controls are set at, for instance, 29.900. With this arrangement, when the metal strip feeder motor is turned on both the field and the armature windings of the motor will receive full voltage resulting in high acceleration up to the desired speed. The maximum speed will continue until the counter reads 29.900 at which time the first relay is activated and a resistor is put in the armature windings control. The reduced current in the armature causes the motor to quickly decelerate to a preset slow speed. The slow speed carries the strip forward the remaining 0.1 inch until the counter reads 30.000 at which time the second relay is activated causing a complete cut-off of current to the DC motor. This programmed slow-down provides the very unique and important advantage of being able to advance the strip metal at a maximum desired speed for a substantial portion of its travel, then slowing the advance down and continuing the advance for a short distance at a greatly reduced speed. This makes it possible to stop the advancement precisely within a few thousandths of an inch and thus eliminate wastage.

The electronic counter also serves as a control center for the machine acting on the strip metal, e.g., a metal cutter or press. Thus, when the second relay of the electronic counter is activated, this also serves as the signal to activate the subsequent machine. It will be evident from this arrangement that the subsequent machine cannot operate unless a sufficient amount of strip metal has been supplied.

For full automatic operation, the electronic counter will normally include an automatic reset. The cutter or press on completing its cycle trips a limit switch which actuates the counter reset whereby the counter resets to zero reading and is ready to count the advancement of the next length of strip metal.

It is also advantageous to utilize an electronic counter which gives an instantaneous visual readout, e.g., by means of a Nixie tube display. This is very useful to an operator since it can be arranged to record any overrun of material. In other words, if the slowdown control is adjusted too close to the cut-off point, there may be an overrun and this will be recorded on the readout. The operator will then be in a position to immediately know the precise amount of the overrun in

every cycle. Because of this instantaneous information on overrun, it becomes a very simple matter for the operator to make minor adjustments in the slowdown location such that the strip metal will stop at precisely the desired location as will be indicated on the readout.

Certain preferred embodiments of the invention are illustrated in the attached drawings in which:

FIG. 1 is a perspective view showing the device of the invention in use with a strip metal feeder;

FIG. 2 is an end elevation of the device; and

FIG. 3 is an elevation of the control panel.

A typical feeder device which is illustrated in FIG. 1 and has a pair of heavy steel plate sidewalls 10 forming a cradle for supporting a reel of strip metal 11. Mounted between these sidewalls are a pair of feed rollers 12 between which the strip metal 11a is pressed and advanced by rotation of the rollers. These feed rollers are mounted on axles 13 and driven by a DC motor 16 via reduction gear box 17 and pinions 15 mounted on the axles. Vertical pressure is applied to the feed rollers in the usual manner, e.g., by pneumatic cylinders.

The sidewalls 10 have end projections 20 and these are provided to support the control device of the invention. A freely turning roller 21 is mounted between sidewall projections 20 directly beneath the strip metal 18. Above this roller, cutouts 22 are provided in side projections 20 and within these cutouts are mounted vertically movable pillow blocks 23. These pillow blocks are spring biased in a downward direction by means of springs 24.

An axle 25 is mounted in these pillow blocks and this axle supports a measuring wheel 26 which engages the top face of the strip metal 11a. Onto one end of axle 25 is mounted a photo-electric rotary transducer 27 for generating electric pulse data proportional to the rotation of the measuring wheel 26. There is a direct connection between the axle 25 and the transducer 27 so that the transducer will always directly respond to any rotational movement of axle 25 and measuring wheel 26. As an example of a suitable transducer there may be mentioned a Dynapar Type 80 Rotopulser Transducer.

An electronic counter 28 is mounted at a convenient location on one side extension 20 where it will be readily accessible to an operator. This electronic counter can be of known type such as that produced by the Eagle Company of Toronto, Ontario and is connected to the transducer 27 by way of connection 29.

The electronic counter as illustrated has two series of preset control buttons 30 and 31. Each control button has ten calibrations so that each can be preset between 0 and 9. Each series of preset knobs 30 and 31 is arranged to activate a separate relay in the counter. As shown in FIG. 3, each series of preset buttons includes five separate buttons arranged for measuring units, tens, hundreds, thousands and ten thousands of electric pulses received from the transducer.

The counter 28 also includes a Nixie tube display 32 which gives a direct reading of the number of pulses that have been counted by the counter at an instance.

As well as having an automatic reset mechanism, the counter 28 may also include a manual reset button 33 as well as the usual off-on switch 34.

This electronic counter has a typical terminal board with connections for the first and second relay outputs,

signal input, external reset, etc. The outputs from the first and second relays are connected to the current controls for the DC motor 16 of the feeder and the details of such connections are not shown since they will be readily apparent to anyone skilled in the art and form no part of the invention. One of the relay outputs is also connected to the drive mechanism for the subsequent machine such as cutter or press which is to act upon the strip metal 11a. The cutter or press also can include a limit switch which is actuated by the machine on completing its cycle and this limit switch is operatively connected to the external reset terminal of the counter so that when the subsequent machine completes its cycle the counter 28 resets to a zero reading.

I claim:

1. A device for automatically feeding predetermined lengths of strip metal to a metal processing machine, comprising:

- a. a pair of feed rollers for engaging therebetween and advancing strip metal,
- b. motor drive means for said feed rollers,
- c. a measuring wheel adapted to engage the strip metal being advanced whereby rotational movement of the wheel is actuated by movement of the strip metal,
- d. a rotary photoelectric transducer mechanically linked to said measuring wheel for generating pulse data proportional to the rotation of the wheel, and an electronic counter for counting electric pulses received from the transducer and controlling the drive motor, said counter having at least two output relays controlled by at least two

series of preset controls, said relays being connected to power supplies to said motor drive whereby the motor initially receives a greater power supply to drive the rollers at a high speed, after the strip metal has advanced a predetermined distance the first relay is activated to cause a decrease in the power supplied to the motor thereby causing the motor to decelerate to a predetermined slower speed and after the strip metal has advanced at least a second preset distance at slow speed a further relay is activated causing a complete cut-off of power to the motor.

2. A device according to claim 1 wherein a support roller is positioned beneath the measuring wheel for holding the strip metal in firm contact with the wheel.

3. A device according to claim 1 wherein the measuring wheel is spring biased against the strip metal.

4. A device according to claim 1 wherein the measuring wheel is fixed to a freely rotatable axle which is also connected to the transducer.

5. A device according to claim 4 wherein the transducer is a photoelectric transducer.

6. A device according to claim 4 wherein the electronic counter has two series of preset controls, each of said two presets activating a separate output relay.

7. A device according to claim 6 wherein the two relays are connected to the controls of a DC motor which drives the strip metal feeder, whereby when the motor is first turned on both the field and armature windings of the motor will r0

14. A device according to claim 13 calibrated to automatically advance lengths of strip metal between 0.001 inch and 99.999 inches.

* * * * *

35

40

45

50

55

60

65