



Aug. 11, 1959

W. F. FUNNELL

2,898,995

DEMAND SHEAR WITH MEANS TO ALTERNATELY BRAKE  
AND ACCELERATE A CONTINUOUSLY MOVING WEB

Filed March 29, 1954

2 Sheets-Sheet 2

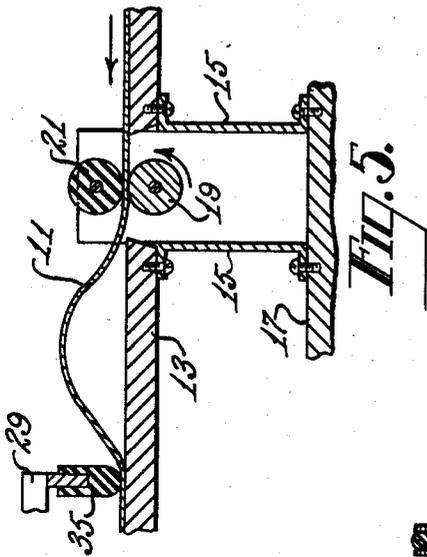


FIG. 5.

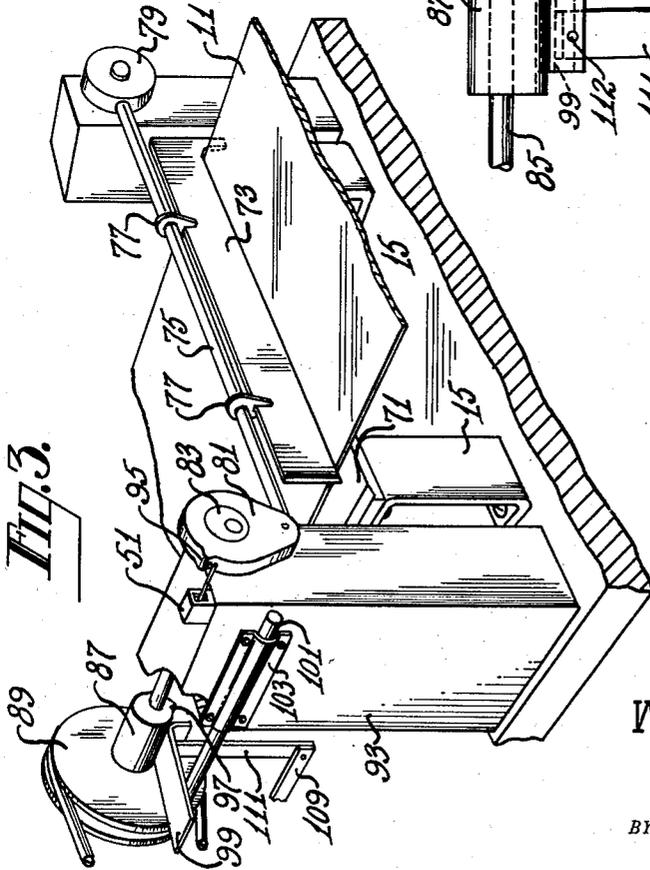


FIG. 3.

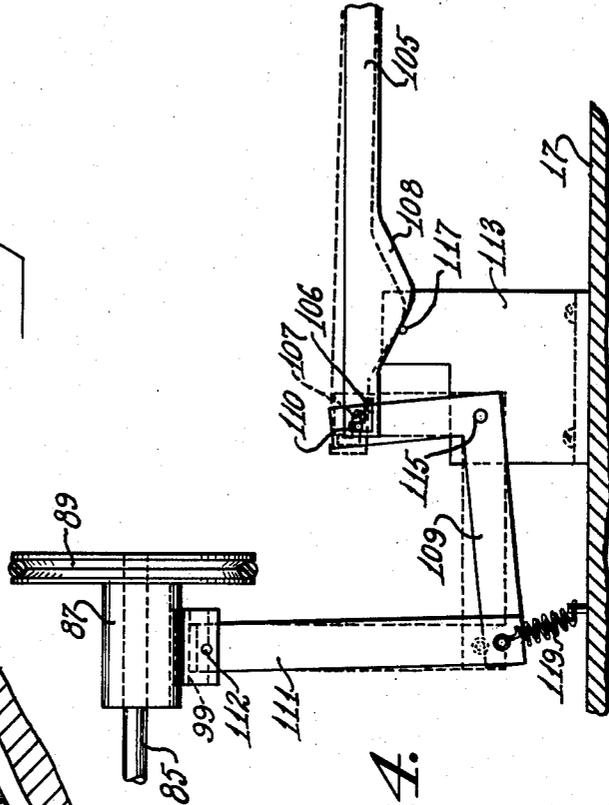


FIG. 4.

INVENTOR  
WILLIAM F. FUNNELL

BY *Morris Kavan*

ATTORNEY

1

2,898,995

**DEMAND SHEAR WITH MEANS TO ALTER-  
NATELY BRAKE AND ACCELERATE A  
CONTINUOUSLY MOVING WEB**

William F. Funnell, Haddonfield, N.J., assignor to Radio Corporation of America, a corporation of Delaware

Application March 29, 1954, Serial No. 419,517

The terminal fifteen years of the term of the patent to be granted has been disclaimed

2 Claims. (Cl. 164—42)

This invention relates to apparatus for cutting a continuously moving web into varying lengths, and, more particularly, to a high speed shear which is responsive to indicating marks on a sheet or web of paper, for example.

This invention is particularly applicable to cutting long strips of paper on which information has been printed in groups of varying sizes, and in which the size of the sheets of various information is not uniform. It is particularly applicable to this use because in the printing of the information on the continuous strip or web indexing marks may also be printed at a given point in relation to an information group which will determine where the strip is to be severed.

In known apparatus of this type, complicated clutching and braking mechanisms have been provided for stopping the movement of the web during the shearing operation through the stoppage of the drive rollers. Such systems, being relatively complicated, are expensive, are subject to excessive wear and require delicate adjustment. Further, in known apparatus of this type, and primarily in apparatus designed to cut a web into pieces of uniform length, complicated compensating mechanisms, such as an electrical phase correction system, are provided to correct for errors in the amount of web travel in relation to the shearing cycle.

An object of this invention, therefore, is to provide a novel shearing apparatus in which the web driving mechanism operates continuously during the shearing operation.

Another object of this invention is to provide a novel apparatus for cutting a continuous web into pieces of uniform or irregular size in response to indicating marks on said web.

A further object of this invention is to provide a novel shearing apparatus for a continuous web with printed information in which misalignment of the printed material in relation to the cutting cycle is precluded.

A still further object of this invention is to provide a novel apparatus for cutting a continuous web into pieces of regular or irregular size in which no synchronizing mechanism is required between the drive rollers for the web and the drive mechanism for the cutters.

In accordance with the present invention, apparatus which accomplishes the above enumerated objects comprises, generally, a pair of drive rollers which drive the web continuously at a constant speed; a shearing mechanism comprising a fixed and a movable blade in which the movable blade is driven by a constant speed source through a one-revolution clutch mechanism; a roller and a brake bar which are mounted for alternative engagement with the web and including means for biasing the roller against the web; an electromagnetic device associated with the above mentioned roller and brake bar mechanism for rotating the brake bar into engagement with the web to stop the web motion; a sensing mechanism for actuating the electromagnetic device in response

2

to indicia printed on the web; and linkage associated with the braking mechanism for actuating the clutch mechanism.

5 The novel features of the present invention, as well as additional objects and advantages thereof, will be understood more fully from the following detailed description when read in connection with the accompanying drawings in which:

10 Figure 1 is a plan view of a shearing apparatus in accordance with the present invention;

Figure 2 is a view in side elevation of the apparatus of Figure 1 in which part of the supporting structure is broken away and which includes a schematic diagram of a control circuit;

15 Figure 3 is a perspective view of the shearing mechanism of the apparatus of Figure 1 including a portion of the actuating means therefor;

Figure 4 is a partial view of the linkage associated with the shearing mechanism of Figure 3; and

20 Figure 5 is a partial side elevation of the apparatus of Figure 1 illustrating the disposition of the web when the braking bar is engaged therewith.

25 Referring in more detail to Figures 1 and 2 of the accompanying drawings, which illustrate a complete shearing apparatus according to the present invention, a web 11 is shown supported by a table 13. The table 13 is in turn supported on a base member 17 by means of support brackets 15. A pair of rollers 19 and 21, employed for feeding the web through the shearing apparatus, are supported by members 23 and 25. The lower roller 19 is the drive roller and is preferably constructed of metal. The upper roller 21 is an idler or follower and is preferably constructed of rubber or other resilient material. The roller 19 is driven by constant speed power source shown as an electric motor 27.

30 In general, the cycle of events of the shearing apparatus occurs as follows: As the web moves from right to left over the table 13, due to the action of the feed rollers 19 and 21, a sensing device "sees" the indicating marks which are printed on the web and produces a corresponding electrical pulse signal. A brake bar, actuated in response to this electrical pulse, moves against the web to stop the motion of the web at the shear. The shear mechanism consists of a stationary blade and a movable blade, the latter being coupled to a single revolution clutch mechanism. The clutch mechanism is actuated through a mechanical pulse mechanism by the brake bar when it engages the web. At the completion of the shearing cycle, the brake bar is caused to be released from engagement with the web and an accelerating mechanism takes up the slack in the web created by the brake bar.

35 The braking mechanism comprises a bracket 29 which is pivotally mounted over the web 11 by means of support members 31 and 33. The bracket 29 carries a brake bar 35 on one side of its pivotal axis and a roller 37 oppositely thereof. The brake bar 35 and the roller 37 are mounted for alternative engagement with the web 11. The bracket 29 is biased, by means not shown, so that the roller 37 is normally urged into engagement with the web. An arm 39 is attached to the bracket 29 at its pivotal axis 30 and extends in two directions therefrom. The plunger 43 of a solenoid 41 is attached to one extension of the arm 39. When the solenoid 41 is energized, the plunger 43 causes the arm 39 to rotate the bracket 29 about its pivotal axis 30 in a clockwise direction to bring the brake bar 35 into engagement with the web. This stops the travel of the web on the left side of the brake bar 35. However, since the feed rollers are driven continuously, the web will tend to buckle and pile up between the brake bar and the feed roller. This condition is illustrated in Figure 5.

A circuit for energizing the solenoid 41 comprises a source of direct current electrical energy shown at battery 47, the winding 45 of the solenoid 41, conductor 49, microswitch 51, conductor 53, thyatron 55, and conductor 57 all connected in series. A sensing device, indicated generally at 59, senses the indicating marks as they pass beneath the device and produces signals corresponding thereto for firing the thyatron 55 and thereby energizing the solenoid circuit. The sensing device 59 comprises a light source, such as a lamp 61, an optical system made up of lenses 63 and 65 and a photoelectric device 67. Light from the source 61 is reflected from the web 11 to the photoelectric device 67 by means of the optical system, and the pulse resulting from the interruption of reflected light by an indicating mark is transmitted from the photoelectric device to an amplifier 69 by means of a conductor 68. The amplified pulse is then fed to the grid of the thyatron 55 to fire the thyatron.

The shearing mechanism is comprised of a stationary cutting blade 71 and a movable cutting blade 73. This mechanism is illustrated in detail in Figure 3. The movable blade 73 is mounted on a supporting rod 75 by means of brackets 77. The blade 73 is biased for engagement with the stationary blade 71 by means not shown. The rod 75 is pivoted at one end by means of a bearing 79 and its other end is attached to the housing 81 of eccentric 83. Eccentric 83 is coupled by means of shaft 85 to the driven element of a one revolution spring clutch 87. One revolution spring clutches are well known in the art. Several examples of such clutches, any of which are suitable for use in the present apparatus, are described in each of the following patents: Russel, 2,298,970, Marihart, 2,475,432, and Goetz, 2,600,636. The driving element of the spring clutch 87, not shown in the drawing, is coupled to a pulley 89 which is driven by a constant speed power source shown as an electric motor 91.

The microswitch 51 of the solenoid energizing circuit is mounted on a member 93 which is a support for the shear operating mechanism. This switch is normally in the closed contact position. The eccentric housing 81 has a projection 95 on one edge surface thereof. When shearing mechanism is at rest, the housing 81 is in its uppermost position as indicated in Figure 3. When the shear is actuated, the eccentric 83 is rotated in a clockwise direction for one revolution and hence the eccentric housing 81 traces a corresponding oscillatory motion. As the eccentric rotates, the housing causes the blade 73 to move downward and sever the web. As the housing 81 is returning to its uppermost position, nearing the completion of the shearing cycle, the projection 95 trips the switch arm of microswitch 51 causing the switch contacts to break momentarily. This results in the de-energization of the solenoid circuit.

The cylindrical housing of the one revolution spring clutch 87 is provided with a longitudinal shoulder 97. A pawl 99 is pivotally mounted on support member 93 by means of shaft 101 and bracket 103. This pawl is biased against the housing 87 by means to be described subsequently. A mechanical pulse mechanism is provided for momentarily withdrawing the pawl 99 from engagement with the shoulder 97 for each shearing cycle. This pulse mechanism is illustrated in Figures 2 and 4.

Referring to Figure 2 the pulse mechanism comprises the lower extension of the arm 39, trip arm 105, bell crank 109 and link 111. When the arm 39 is rotated by solenoid 41 about the axis 30 to engage the brake bar 35 with the web 11, the lower extension of arm 39 causes the trip arm 105 to move to the left. The trip arm 105 is provided with an L-shaped slot 106 for engagement with a pin 110 which is mounted on one arm of bell crank 109. The bell crank 109 is mounted on support member 113 by means of a rivet 115. The support member 113 also carries a pin 117 which is engaged by a projection 108 of the trip arm 105. As the arm 105

moves toward the left, the shoulder 107, formed by the L slot 106, pushes against the pin 110 causing the bell crank 109 to rotate in a counterclockwise direction about its pivot point 115. This motion of the bell crank causes the link 111 to be pulled downward. The link 111, being connected to the pawl 99 by means of pin 112, draws it away from the clutch housing 87, permitting the clutch housing to revolve. A compression spring 119 is mounted between one arm of the bell crank 109 and the base member 17. This spring opposes the rotation of the bell crank and hence resists the action of the pulse mechanism to withdraw the pawl 99 from engagement with the shoulder 97 of the clutch housing 87. This is the pawl biasing means heretofore mentioned. As the trip arm 105 moves to the left, the left hand end of the arm is caused to rise due to the action of the pin 117 on the trip arm projection 108. This action is illustrated by the solid lines of Figure 4. As the motion of the trip arm 105 to the left continues, the shoulder 107 is raised above the pin 110, permitting the pin 110 to slide into the right hand portion of the slot 106. This action permits the bell crank 109, and consequently the pawl 99, to return to its normal position due to the action of the bias spring 119. This action is illustrated by the dotted lines of Figures 4. Hence, the return of the pawl 99 to its normal, biased condition is independent of the return of the trip arm 105 to its normal starting position. When the solenoid 41 is de-energized, the arm 39 will cause the brake bar to be disengaged from the web and will cause the trip arm 105 to return to its normal position.

In order to take up the slack of excess web material which has accumulated between the brake bar 35 and the feed rollers 19 and 21, an accelerating roller 123 is provided for cooperative engagement with the roller 37. This roller 123 is preferably constructed of metal and is driven by a constant speed source shown as a motor 129. This accelerating mechanism is set to move the web at a faster rate than the feed rollers 19 and 21 so as to absorb the slack ahead of the feed rollers. The roller 37 is preferably constructed of rubber or other resilient material and its length should be shorter than the width of the web material so that the rollers 37 and 123 will not directly contact each other when the web material is between them. When the accumulated slack is absorbed by the accelerating mechanism, the accelerating roller 123 will be attempting to drive the web faster than the feed rollers will permit. Hence, the accelerating roller will slip against the under surface of the web until such time as its accelerating action is again required.

A cycle of events of the shearing apparatus will now be outlined in greater detail. The web is fed at constant speed over the table 13 by means of the rollers 19 and 21 and this feeding means is independent of the operation of the shearing apparatus. As the web passes beneath the sensing device 59, an indicating mark thereon interrupts the light reflected from the source 61 to the photoelectric device 67. This results in an electrical pulse signal which is transmitted through the amplifier 69 to the grid of the thyatron 55. Since the microswitch 51 is normally closed, the energizing circuit for the solenoid 41 is complete except for the open circuit at the thyatron. Hence, when the thyatron is fired, this circuit becomes energized and the solenoid 41 will actuate the brake bar 35 into engagement with the web 11 to stop the motion of the web on the left side of the brake bar. At the same time that the brake mechanism is actuated, the mechanical pulse mechanism momentarily withdraws the pawl 99 from engagement with the shoulder 97 of the clutch housing 87. This permits the shearing mechanism to be driven through one cycle by its drive motor 91. As this shearing cycle is nearing completion, the projection 95 of the eccentric housing 81 trips the switch arm of microswitch 51 to momentarily open the solenoid energizing circuit. When this occurs, the thyatron 55 ceases to conduct and the

solenoid circuit becomes de-energized and will remain so until the thyatron is again fired in response to the passing of a subsequent indicating mark beneath the sensing mechanism. When the solenoid 41 is de-energized, the brake bar 35 is released from the contact web 11 and the roller 37 is urged into engagement with the web 11 by the bracket biasing means. The pressure of the roller 37 on the web is opposed by the accelerating roller 123 which now acts to accelerate the web fed through the shear until the accumulated slack in the web has been taken up. This cycle of events will be repeated each time an indicating mark passes beneath the sensing mechanism.

This cycle of events can be made to occur at a very rapid rate. Apparatus constructed according to the present invention has transversely cut a web of paper into strips having a dimension longitudinally of the web direction of considerably less than one inch.

The apparatus has been described as having three separate power sources of constant speed. It will be apparent, however, that a single source of power could be provided to drive two or more of the parts of the apparatus requiring a driving source.

What is claimed is:

1. Apparatus for shearing a web into lengths which are determined by indicating marks printed on said web, said apparatus comprising rollers for continuously feeding said web which are coupled to a constant speed power source, a shear having opposing shearing blades, one stationary and one movable, an eccentric mechanism for operating said movable blade, a constant speed power source, a one revolution spring clutch coupled to said eccentric mechanism and driven by said constant speed power source, a braking mechanism positioned between said feed rollers and said shear for stopping the motion of said web at said shear, said braking mechanism comprising a bracket pivotally mounted over said web and carrying a brake bar and a roller for alternative engagement with said web, normally deenergized electromagnetic means coupled to said bracket for actuating said brake bar into engagement with said web in response to energization thereof, an energizing circuit for said electromagnetic means including, in series, a normally closed switch, a normally deenergized thyatron, and a photoelectric device for sensing said indicating marks and for producing electrical signals corresponding thereto, means for transmitting said signals to said thyatron, a mechanical linkage connected between said spring clutch and said braking mechanism for engaging said spring clutch in response to the actuation of said braking mechanism, means on said eccentric mechanism for opening said switch to thereby deenergize said thyatron and said electromagnetic means to thereby effect disengagement of said brake bar

from said web and effect engagement of said bracket mounted roller with said web, and an accelerating roller acting in cooperation with said bracket mounted roller to accelerate said web when said brake bar is released from engagement with said web.

2. In high speed apparatus for shearing a continuous web into sheets of varying size in response to indicating marks printed on said web, continuous feed means for said web comprising drive rollers coupled to a constant speed power source, an intermittently operable shear having opposing shearing blades at least one of which is movable, an eccentric mechanism for driving said one movable blade of said shear, a spring clutch having a rotatable cylindrical housing coupled to said eccentric mechanism, said cylindrical housing being provided with a longitudinal shoulder, a constant speed power source for urging continuous rotation of said clutch housing, a pivotally mounted pawl biased against said spring clutch housing and engaging said shoulder to prevent rotation of said housing, a braking mechanism located ahead of said shear for stopping the motion of said web at said shear, said braking mechanism comprising a bracket pivotally mounted over said web and carrying a brake bar and a roller for alternative engagement with said web, said bracket being biased for engagement of said roller with said web, a solenoid coupled to said pivotally mounted bracket for rotating said bracket to bring said brake bar into engagement with said web, a mechanical pulse mechanism associated with said braking mechanism for momentarily disengaging said pawl member from said clutch housing, a series energizing circuit comprising said solenoid, a thyatron, and normally closed circuit breaking means, a photoelectric device for sensing said web indicating marks and for providing corresponding electrical signals to fire said thyatron, a switch associated with said eccentric mechanism adapted to be actuated upon completion of a shearing cycle, said switch comprising said energizing circuit breaking means, and an accelerating roller opposing said bracket mounted roller for accelerating the web to take up slack between said web drive rollers and said braking mechanism when said brake bar is released from engagement with said web.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

1,873,057	Smith	Aug 23, 1932
1,951,844	Rose	Mar. 20, 1934
2,077,439	Schmitt	Apr. 20, 1937
2,475,432	Marihart	July 5, 1949
2,623,590	Johnson et al.	Dec. 30, 1952
2,674,308	Knobel	Apr. 6, 1954