

Aug. 26, 1958

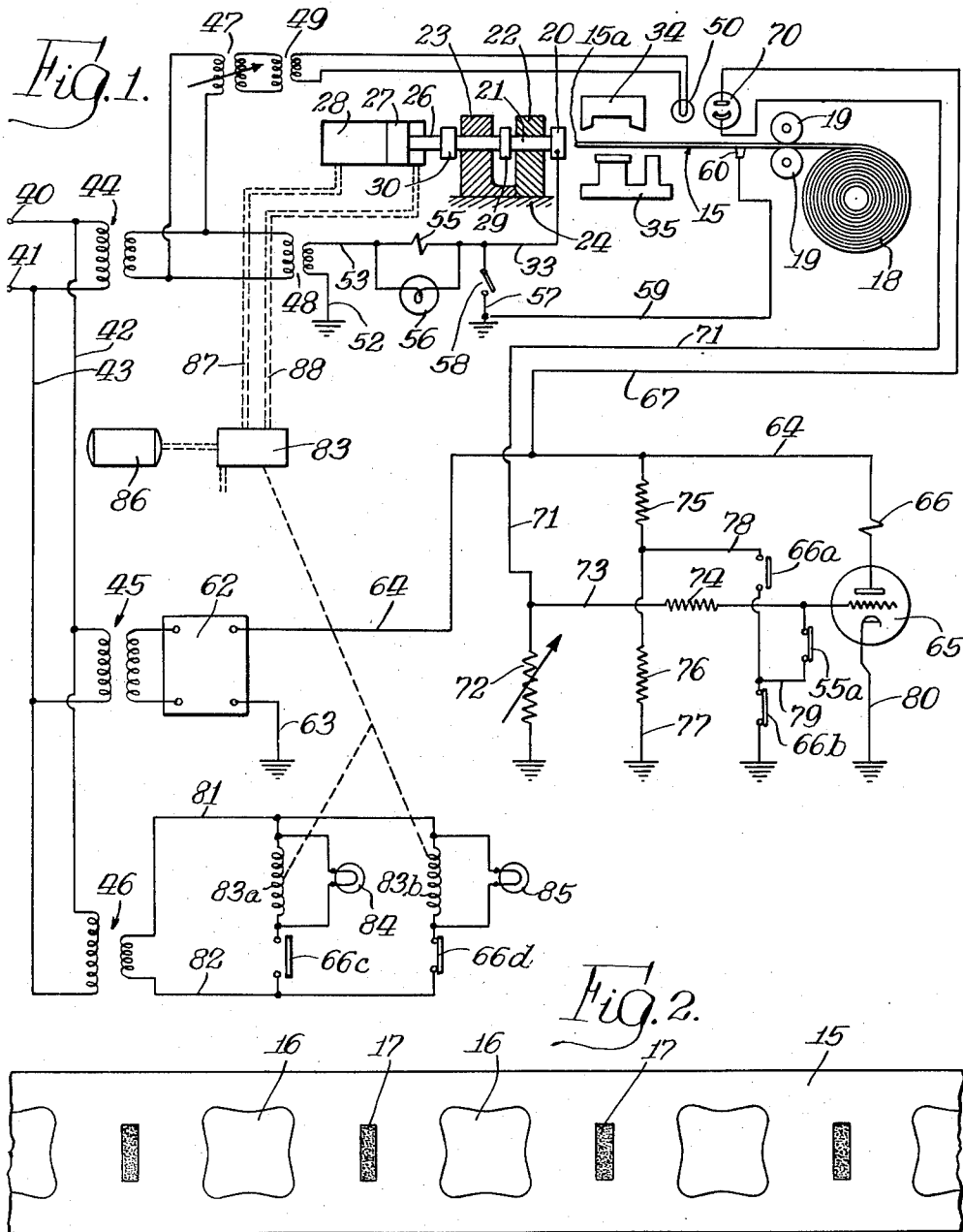
C. J. MICHELET ET AL

2,849,066

INDEXING DEVICE FOR METAL STRIP

Filed Dec. 19, 1955

3 Sheets-Sheet 1



Inventors:-
 Charles J. Michelet
 Jack E. Caveney
 Milton D. Robinson
 By Smith, Olson, Baird & Miller,
 Attys

Aug. 26, 1958

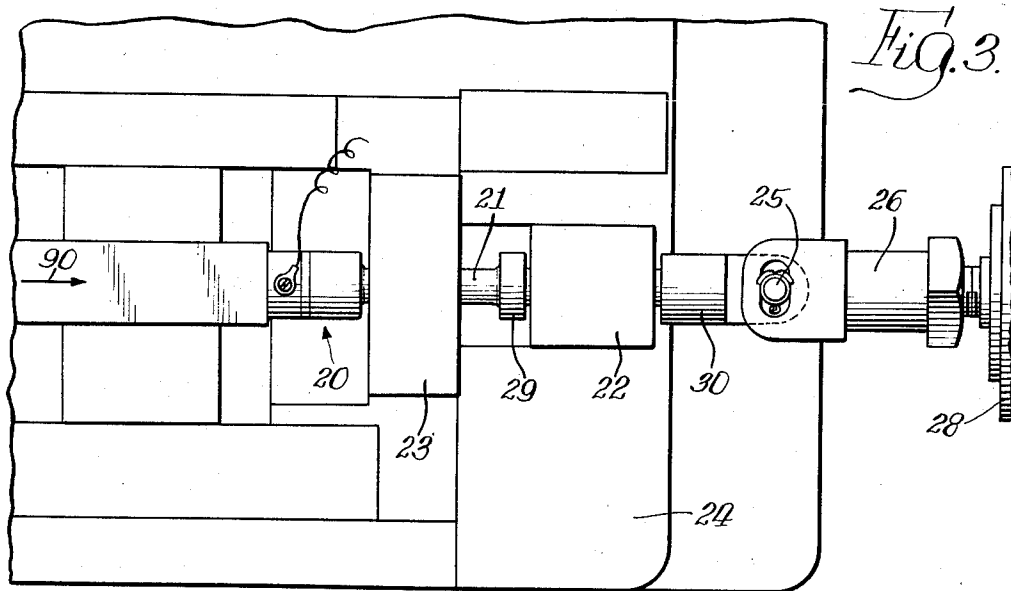
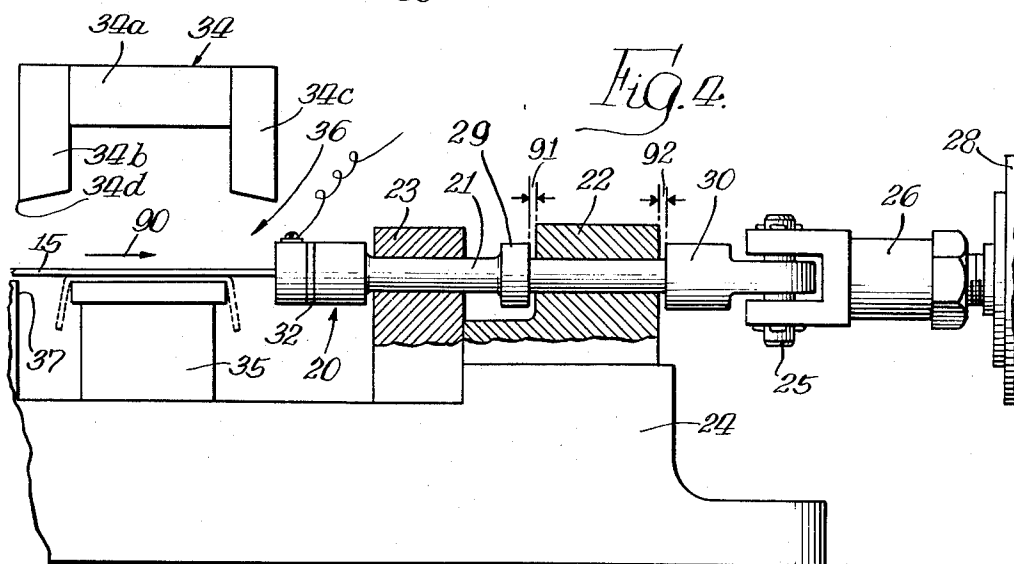
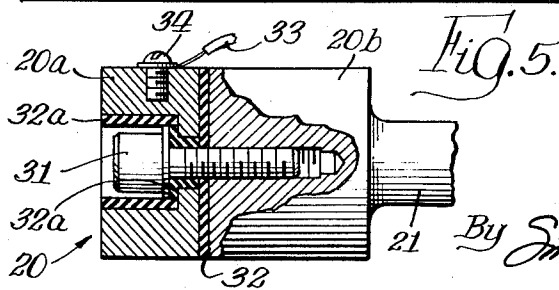
C. J. MICHELET ET AL

2,849,066

INDEXING DEVICE FOR METAL STRIP

Filed Dec. 19, 1955

3 Sheets-Sheet 2



Inventors:-
Charles J. Michelet,
Jack E. Caveney,
Milton D. Robinson,
By *Smith, Olson, Baird & Miller,*
Attys.

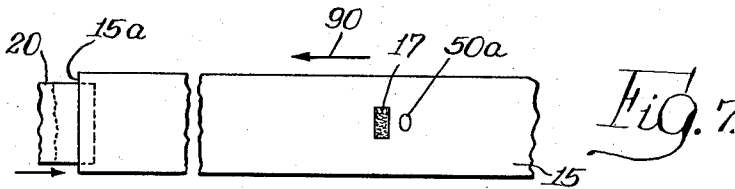
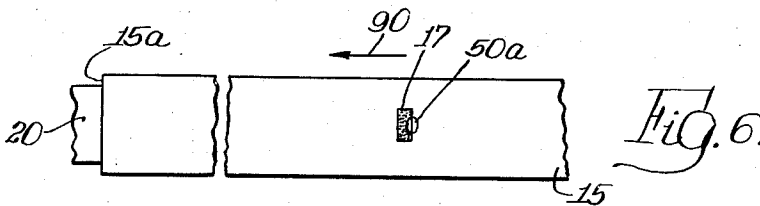
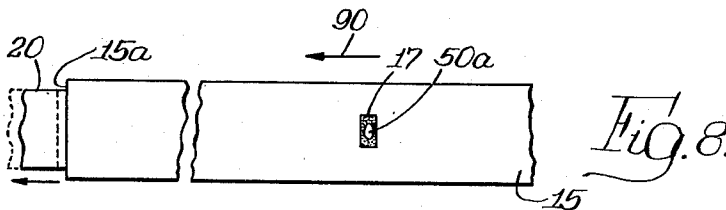
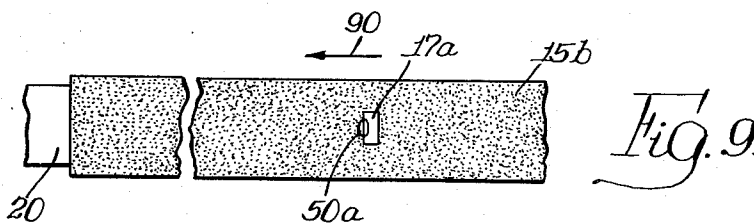
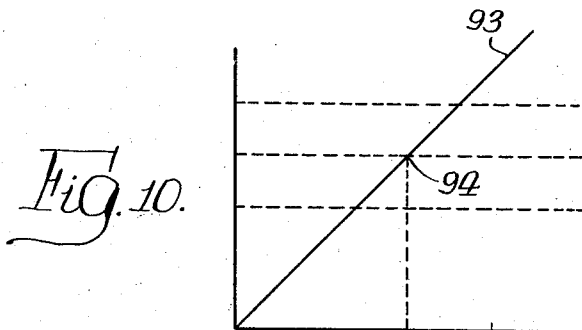
Aug. 26, 1958

C. J. MICHELET ET AL
INDEXING DEVICE FOR METAL STRIP

2,849,066

Filed Dec. 19, 1955

3 Sheets-Sheet 3



Inventors:-
Charles J. Michelet
Jack E. Caveney
Milton D. Robinson,
By *Smith, Alex, Baird & Miller*
Attys.

2,849,066

INDEXING DEVICE FOR METAL STRIP

Charles J. Michelet, Wilmette, and Jack E. Caveney, Chicago, Ill., and Milton D. Robinson, Gary, Ind., assignors to Acme Steel Company, Chicago, Ill., a corporation of Illinois

Application December 19, 1955, Serial No. 553,935

19 Claims. (Cl. 164-48)

This invention relates to improvements in indexing devices for metal strips and its purpose is to provide novel means for correcting the intermittent movements of a metal strip in a stamping and forming machine or the like in order to insure the cutting and forming of equal lengths on which designs or patterns appear in identical locations.

The stamping and forming of blanks cut from a continuous metal strip having endwise movement may be accomplished without difficulty when index marks are provided by cutting or deforming the metal of the strip at equally spaced points, thus forming physical deformations which may be engaged by parts of the apparatus to insure the proper spacing of its operations on the strip. However, when the long metal strip does not carry any physical deformations which may be used for indexing purposes, the cutting of the blank to produce a succession of identical products presents a substantial problem, particularly when the strip carries a series of painted or printed designs or patterns which are to appear in the same locations on the cut blanks.

The principal object of the present invention is to overcome the above-mentioned difficulty by providing apparatus which makes use of the patterns on the metal strip or of spaced index marks, printed thereon as visual indicators of proper indexing, in the operation of measuring the successive lengths of the metal strip which are to be cut therefrom. A further object is to correct the feeding movements of the strip feeding apparatus to maintain a proper indexing of the blanks when the indexing is indicated only by marks on the strip which contrast in color with the body of the strip. Another object is to provide indexing apparatus which is responsive to changes in light intensity originating in a beam of light impinging on the strip in the region of an index mark for causing the actuation of index correction mechanism. Still another object of the invention is to provide indexing mechanism having means for correcting the feeding movements of the strip and comprising means for giving a visual indication to the operator whether the correction about to be made is for a longer or a shorter length of the strip and whether the correction is actually being made by the apparatus. Another object is to provide an indexing system for a moving metal strip comprising an electric control circuit including an adjustable stop adapted to be engaged by the end of the moving strip to regulate the adjustment of the apparatus of the system which may be necessary to correct any inaccuracy in the amount of the feeding movement. A further object is to provide an indexing system adapted to correct inaccuracies in the increments of movement of the metal strip and responsive only to index marks intentionally placed on the strip. Other objects relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying

drawings in which one embodiment is illustrated. In the drawings,

Figure 1 shows a diagrammatic view of the indexing system of the present invention including the electric circuit and the principal parts of the apparatus;

Fig. 2 shows a top plan view of a portion of a metal strip with spaced patterns and index marks imprinted thereon;

Fig. 3 shows a top plan view of a portion of a punch press with parts of the mechanism which is embodied in the indexing system of the present invention;

Fig. 4 shows a partial side elevation of, and partial vertical section through, the apparatus shown in Fig. 3;

Fig. 5 shows an enlarged side elevation of, and partial vertical section through, the movable stop, included in the circuit shown in Fig. 1, which is engaged by the end of the moving strip and which is adjusted automatically to fix the proper location for the end of the strip;

Fig. 6 shows a top plan view of a portion of the metal strip as it moves through the indexing apparatus, illustrating the relation of a dark index mark on a lighter strip to the spot defined by the impinging light beam when the segment of the strip bearing this index mark is properly positioned;

Fig. 7 is a plan view similar to that of Fig. 6 showing the relative positions of the index mark and the light beam when the metal strip has moved too far before engaging the movable stop, thus requiring an extension of the stop to locate the strip properly for the cutting operation;

Fig. 8 is a plan view similar to those of Figs. 6 and 7, showing the relative positions of the index mark and the light beam when the metal strip has not moved far enough before engaging the movable stop, thus requiring a retraction of the stop to locate the strip properly for the cutting operation;

Fig. 9 is a plan view similar to that of Fig. 6, showing the operating relation of the light beam to a light colored index mark on a relatively dark strip; and

Fig. 10 is a chart showing the setting of the photoelectric relay embodied in the circuit shown in Fig. 1 in order to locate the operating point for various light intensities.

As shown in Fig. 2, the metal strip 15 which is to be indexed carries a series of equally spaced imprinted patterns 16 and also a series of equally spaced index marks 17, each of which is located midway between two of the patterns 16. The patterns and the index marks may be painted, lithographed or otherwise applied to the strip. It is essential only that the index marks be either darker than the background area of the strip, as in Fig. 2, or lighter than that background, as shown in Fig. 9, so that when the mark and the strip are exposed to the same light intensity, the index marks reflect either more or less light than the background area of the strip.

The metal strip 15 is withdrawn from a coil 13 by power driven rollers 19 and is moved endwise in a horizontal direction until its extremity 15a engages a stop 20 which is fixed on a rod 21 slidably mounted in bearings formed in stationary blocks 22 and 23 fixed on a frame 24. The rod 21 is connected at the end opposite the stop 20 by a pin 25 to a piston rod 26 adapted to be actuated by a piston 27 in an air cylinder 28.

The rod 21 carries two fixed collars 29 and 30, located on opposite sides of the block 22, which are adapted to abut against this block to limit the movement in opposite directions of the stop 20. When either collar engages the block 22, a strip feed correction which either extends or retracts the feed by changing the position of the stop 20 is terminated, as hereinafter more fully described.

The stop 20 comprises a metal ring 20a secured to a

cylindrical portion 20b which is secured by a stud 31 to or formed integrally with the rod 21, as shown in Fig. 5. The ring 20a is insulated from the part 20b by an insulating disk 32 and the ring is recessed to receive the head of the stud which is insulated from the ring by the parts 32a. To establish an electrical connection with the rings 20a, a conductor 33 is attached to the ring by a screw 34.

As the metal strip is fed toward the stop 20 by the feed rolls 19, it passes between the forming dies 34 and 35 of a punch press 36 which may vary greatly in construction depending upon the type of cutting and forming operations to be performed. In the embodiment illustrated, the upper die 34 comprises a cross member 34a attached at its ends to two vertical members 34b and 34c having inclined end faces converging toward each other which are adapted to engage the metal strip to press it downwardly over the lower die 35 which is in the form of an anvil mounted on the frame 24. The member 34b has a cutting edge 34d which is adapted to cooperate with a stationary cutting die 37 carried by the frame beneath the path of the strip so that, as the upper die 34 descends, the strip is cut off to form a section of the desired length bearing a centrally located pattern 16. It is assumed that the upper die 34 is connected to the usual power operated ram of a punch press. As the descent of the die 34 continues the ends of the cut-off section are bent downwardly over the die 35, as shown in Fig. 4, to form a staple, fastener or other U-shaped member bearing a pattern on its top wall.

In Fig. 1 there are shown the electrical connections of the operating circuit and some of the principal parts of the apparatus which are controlled by this circuit. As there shown, the terminals 40 and 41 are adapted to be connected to the supply line of a 110 volt alternating current circuit and these terminals are connected by conductors 42 and 43 to the primary windings of three transformers 44, 45 and 46 by which different parts of the control system are operated.

One transformer 44 has its secondary winding connected in parallel to the primary winding of a variable transformer 47 and to the primary winding of another transformer 48. The secondary winding of the transformer 47 is connected to the primary winding of another transformer 49 which has its secondary winding connected to the terminals of a low voltage lamp 50 mounted in proximity to the oncoming strip 15 in advance of the dies 34 and 35. It is this lamp 50 which casts a beam of light onto the moving strip to actuate the control system in accordance with the relation of the light beam to an index mark on the strip. The secondary winding of the transformer 48 has one terminal connected to ground by a conductor 52 and it has its other terminal connected by a conductor 53 to a relay solenoid 55 which has its other terminal connected to the ring 20a of the stop 20. A lamp 56 is connected in parallel with the relay solenoid 55. The conductor 33 is adapted to be connected to ground by a conductor 57 having connected therein a normally open manual switch 58. From this ground connection a conductor 59 leads to a brush 60 by which a connection is made with the under side of the metal strip 15.

The secondary winding of the transformer 45 is connected to the terminals of a rectifier 62 which has one of its direct current output terminals connected to ground by a conductor 63 while its other output terminal is connected by a conductor 64 to the plate circuit of a triode power amplifier 65. The conductor 64 has connected therein in advance of the amplifier a relay solenoid 66. The conductor 64 is also connected through a conductor 67 to one terminal of a photo-electric cell 70 which is located in proximity to the lamp 50. The other terminal of the photo-electric cell 70 is connected by a conductor 71 to one terminal of a variable resistor 72 which has its other terminal connected to ground. The conductor

71 is also connected by a conductor 73 through a resistor 74 to the grid of the triode tube 65.

At a point between the rectifier 62 and the relay solenoid 66, the conductor 64 is connected to ground through two resistors 75 and 76 connected in series by a conductor 77. At a point between the resistors 75 and 76, the conductor 77 is connected to a conductor 78 which leads to the ground through two switches 66a and 66b connected in series and arranged to be operated by the relay solenoid 66. A conductor 79 is connected to the conductor 78 between the switches 66a and 66b and leads to the conductor 73, at a point between the resistor 74 and the triode tube, through a switch 55a adapted to be operated by the relay solenoid 55. A conductor 80 leads from the cathode of the triode tube 65 to the ground.

The secondary winding of the transformer 46 is connected to conductors 81 and 82 between which two solenoids 83a and 83b are connected in parallel. These solenoids are in series with switches 66c and 66d, respectively, which are operated by the relay solenoid 66 as hereinafter described. Two lamps 84 and 85 are connected in parallel with the solenoids 83a and 83b, respectively, and, as indicated by dotted lines, these solenoids operate plungers in a solenoid valve 83 which controls the passage of compressed air from a pressure source 86 through conduits 87 and 88 to and from the opposite ends of the cylinder 28 by which the stop 20 is actuated.

The switch 55a operated by the relay solenoid 55 and the switches 66a, 66b, 66c and 66d, which are operated by the relay solenoid 66, are spring actuated in one direction, that is, they are either normally open or normally closed, as hereinafter described, and they are actuated to their other positions by the solenoid 66. The switches 66a and 66c are always open when the switches 66b and 66d are closed and are always closed when the switches 66b and 66d are open.

In the operation of the system described above, the continuously running feed rolls 19 frictionally engage the strip 15 and feed it into the punch press until the end 15a of the strip strikes the stop 20 whereupon the movement of the strip is arrested and the feed wheels slip on the surfaces of the stationary strip. After the dies 34 and 35 have cut and formed a section of the strip, the feed wheels again operate to feed the strip until the newly formed end 15a engages the stop. This operation is repeated as long as the apparatus is in operation with corrections of the position of the stop 20 from time to time, in response to the action of the photo-electric cell 70, in order to bring about an identity of the severed strip sections and the positions of the patterns carried thereby.

The actuation of the correcting mechanism for properly positioning the stop 20 is controlled by the relative positions of an index mark 17 in relation to the bright spot 50a caused by a light beam from the lamp 50 impinging on the surface of the strip, as illustrated in Figs. 6, 7, and 8. In Fig. 6, the dark index mark 17 on the strip 15, which is moving in the direction of the arrow 90, is shown overlapping substantially one-half of the light spot 50a produced by the light beam when it has engaged the stop 20, so that only a moderate amount of light is reflected to the adjacent photo-electric cell 70. This represents the normal operating region. When the index mark is more to the left of this region, more light is reflected to the photo-electric cell 70 to cause a stop extension and when it is to the right of this region, less light is reflected to cause the stop to retract. If the light beam is coincident with the edge of the index mark as shown, due to the delay caused by the inherent slight sluggishness of the operating parts, the stop will remain where it is at the time.

In Fig. 7, there is shown a condition where the strip 15, moving in the direction of the arrow 90, has moved the index mark 17 beyond the light spot 50a before being arrested by the stop 20, so that if the strip were

5

cut with the stop in this position, it would be too long. Since the light spot 50a is then entirely upon the light colored strip, the photo-electric cell then operates the corrective mechanism and thereby extends the stop, at which point the stop 20 remains stationary in the position shown by dotted lines in Fig. 7, to permit the proper section of the strip to be severed by the punch.

In Fig. 8, there is illustrated the condition where the strip 15 is arrested by the stop 20 with the light spot 50a lying entirely within the borders of the dark index mark 17 so that the light reflected to the photo-electric cell is substantially less than that reflected in the normal operating condition shown in Fig. 6, so that the photo-electric cell 70 is effective to actuate the corrective mechanism as hereinafter described to retract the stop 20, as shown by dotted lines in Fig. 8, thereby moving the index mark 17 toward the position shown in Fig. 6 in relation to the position of the light spot.

It is apparent, therefore, that the necessity for a correction of the position of the stop 20 is dependent upon the intensity of the light beam reflected to the photo-electric cell 70 as compared with the operating condition shown in Fig. 6 where one-half of the light spot is on the dark index mark. If the entire indicated correction is not obtained by a single movement of the stop 20, this stop will remain extended or retracted until as many cycles of the apparatus have been performed as are necessary to restore the stop fully to the proper indexed position. In order to maintain the corrective apparatus under proper control, it is necessary that each corrective movement of the stop be less than the width of the index mark 17 so that the light spot does not cross over the index mark to the side opposite to that shown in Fig. 7 and thereby cause a non-corrective movement of the stop. This condition is insured by the fact that the total of the spaces 91 and 92 between the block 22 and the collars 29 and 30, as shown in Fig. 4, is less than the width of the index mark 17.

In Fig. 9 there is shown the proper operating relation of the index mark and the light beam when the metal strip 15b is dark in color while the index mark is comparatively light. The index mark is overlapped by substantially one-half of the light spot 50a.

Referring now to the operation of the electrical system during the feeding movement of the metal strip, with particular reference to Fig. 1, the solenoid 55 remains deenergized until the end 15a of the metal strip engages the stop 20, whereupon a circuit is completed from the ground through the secondary winding of the transformer 48, the conductor 53, solenoid 55, conductor 33, stop ring 20a, metal strip 15, brush 60 and conductor 59 back to the ground. When the relay solenoid 55 is energized, its switch 55a, which is normally closed, is opened.

At this time, the relay solenoid 66 may or may not be energized depending upon whether the triode tube 65 is conducting and this depends upon whether or not the grid of the tube 65 is supplied with a sufficiently positive voltage. If there is sufficient current passing through the photo-electric cell 70, then its resistance is small and a small voltage drop occurs across it. This means that the conductor 73 is more positive than it would be when the resistance of the photo-electric cell 70 is greater, since the total plate circuit voltage is equal to the sum of the voltages across the resistor 72 and the photo-electric cell 70. If there is only a small current passing through the photo-electric cell 70, then its resistance is large and a large voltage drop occurs across it. This means that the conductor 73 is less positive than it would be when the resistance of the photo-electric cell is less at a time when a larger current passes through it. The conductor 73 is in the grid circuit of the triode tube 65 and, therefore, the grid voltage is the same as that applied to the conductor 73.

Whether the tube 65 is or is not conducting, determines whether the relay solenoid 66 is or is not energized

6

which, in turn, determines whether the switches 66a, 66b, 66c and 66d are opened or closed. The effect of closing or opening the switches 66c and 66d is either to cause the extension or retraction of the stop 20 as one or the other of the solenoids 83a or 83b is energized to operate the solenoid valve 84 and actuate the piston 27 one way or the other. The effect of closing or opening switches 66a and 66b is not significant until after the strip end 15a breaks electrical contact with the stop end 20a which deenergizes the relay solenoid 55 to cause the switch 55a to be closed again. At that time, when switch 55a is closed, the triode tube 65 will remain in a conducting or non-conducting condition depending upon whether switch 66a or 66b is closed. If the tube is conducting, then the switch 66a will be closed because the relay solenoid 66 will be energized. If not, then the switch 66b will be closed because the relay solenoid 66 will be deenergized. Therefore, the switch 55a, in series with either switch 66a or 66b, keeps the triode tube 65 and the relay solenoid 66 in the conditions they are at the instant preceding when the strip end 15a breaks electrical contact with the stop end 20a. Thus, the closing of the switch 55a places control of the conduction of the triode tube 65 on the switch 55a at a time when its conduction is not controlled by the photo-electric cell. The only time the photo-electric cell controls its conduction is when the strip end 15a is contacting the stop end 20a.

By way of example, the switches as shown in Fig. 1 are in their positions occurring when the triode tube 65 is in a non-conducting state. The switch 66b is closed and in series with the closed switch 55a to keep the grid of the tube 65 grounded. The switch 66a is open as well as switch 66c. The switch 66d is closed, which keeps solenoid 83b energized which in turn keeps the solenoid valve 84 in a position to keep the stop 20 retracted. The stop remains retracted until the solenoid 83a, instead of solenoid 83b, energizes to extend the stop. This occurs when the tube 65 subsequently conducts as a result of greater light intensity being reflected from the light 50 to the photo-electric cell 70 to increase the current flow through the cell and cause a sufficiently positive voltage to be applied to the grid of the triode tube 65. This energizes the relay solenoid 66 which causes the switches 66b and 66d to open and the switches 66a and 66c to close. The switch 66a maintains a positive voltage on the grid of the tube 65 after switch 55a closes while switch 66c causes the solenoid 83a to be energized which, in turn, causes the stop 20 to be extended.

It is important to note that the change from a conducting to a non-conducting state or vice versa of the tube 65 can only occur at a time when the strip end 15a is in electrical contact with the stop 20 since that is the only time that switch 55a is open. When switch 55a is closed, it keeps the tube conducting or non-conducting until it is opened. By the same token, the change of position of the stop occurs only while the switch 55a is open at a time when the strip is in a stationary position. Such an arrangement prevents the ordinary pattern on the strip not used for indexing from causing a stop change of position while the strip is in motion.

An important feature of the invention is the monitoring phase which is made available by the provision of the lights 56, 85 and 86 which make it possible for the operator to observe readily the performance of certain parts of the apparatus. The light 56 indicates when the stop has been engaged by the metal strip to energize the relay solenoid 55 and close the switch 55a. The actuation of the light 85 by the closing of the switch 66c indicates that the compressed air cylinder 28 is functioning to extend the stop 20. Similarly, the lighting of the lamp 84 when the switch 66d is closed indicates that the solenoid 83b has been actuated to cause compressed air to be admitted to the cylinder 28 to retract the stop 20.

In order to permit a preliminary adjustment of the apparatus to cause the index marks to appear successively

at or in proximity to the light spot produced by the light beam, the set-up switch 58 is provided closing the circuit of the relay solenoid 55 independently of the metal strip, thereby keeping the switch 55a open. The photo-electric cell 70 can thus be maintained in control of the triode tube 65 while the metal strip is adjusted to locate an index mark in proper position with respect to the light beam. For any setting of the photo-electric cell 70 the light intensity of the beam from the light 50 may be at the critical point by regulating the adjustable transformer 47. The adjustment for the operating level of the photo-electric cell 70 is made by operating the variable resistor 72 to vary the voltage applied to the grid of the tube 65.

The preliminary adjustment of the apparatus to locate the index mark and the light beam at the desired operating point may be facilitated by reference to the chart of Fig. 10 in which the abscissae represent the photo-electric relay operating level settings and the ordinates represent reflected light intensity. The curve 93 shows a straight line variation of the two factors which are plotted and the operating point is shown at 94 for a particular light intensity level and its corresponding photo-electric relay operating level.

One form of apparatus for use in the practice of the present invention has been shown and described by way of illustration, but it will be understood that the invention may be constructed in various other forms which come within the scope of the appended claims.

We claim:

1. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks, of means for moving said strip endwise, means for stopping said strip, and means responsive to the position of one of said index marks for adjusting the position of that mark by moving said stopping means when the strip is stopped.

2. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks, of means for moving said strip endwise, means for stopping said strip, and means responsive to the position of one of said index marks for adjusting the position of that mark by moving said stopping means when the strip is stopped, and means actuated after said mark has been adjusted for cutting said strip.

3. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for stopping said strip, means for casting a beam of light on a spot on said strip, and means actuated by the relation of said spot to one of said marks when said strip is stopped for adjusting said stop and thereby regulating the position of that mark.

4. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for stopping said strip, means for casting a beam of light on a spot on said strip, and means actuated by the relation of said spot to one of said marks when said strip is stopped for adjusting the position of said stopping means and thereby regulating the position of said last named mark.

5. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for stopping said strip, means controlled by said contrast of color for adjusting said stopping means to position the strip, and

means for cutting the strip after said stopping means has been adjusted.

6. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks, of means for moving said strip endwise, means adapted to engage the end of said strip to stop the strip, and means responsive to the position of an index mark adjacent said strip end for adjusting the position of said stopping means.

7. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks, of means for moving said strip endwise, means adapted to engage the end of said strip to stop the strip, means responsive to the position of an index mark adjacent said strip end for adjusting the position of said stopping means, and means for limiting the movement of said stopping means in response to said last named means.

8. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for stopping said strip, means for casting a beam of light on a spot on said strip, and means including a photo-electric cell responsive to light reflected from said spot for moving said stopping means and thereby adjusting the position of one of said index marks.

9. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for casting a beam of light on a spot on said strip, means adapted to engage the end of said strip to stop the movement of said strip, and means including a photo-electric cell responsive to light reflected from said spot for adjusting the position of said stopping means.

10. The combination in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for casting a beam of light on a spot on said strip, means adapted to engage the end of said strip to stop the movement of said strip, an electric control circuit having a branch which is closed through said strip when said strip engages said stopping means, and means actuated by said circuit for adjusting the position of said stopping means.

11. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for casting a beam of light on a spot on said strip, means adapted to engage the end of said strip to stop the movement of said strip, an electric control circuit having a branch which is closed when said strip engages said stopping means, and means including a photo-electric cell responsive to light reflected from said spot for adjusting the position of said stopping means and thereby adjusting the position of said strip.

12. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for casting a beam of light on a spot on said strip, means adapted to engage the end of said strip to stop the movement of said strip, an electric control circuit having a branch which is closed when said strip engages said stopping means, and means including a photo-electric cell responsive to light reflected from said spot and an amplifier responsive to voltages set up by said cell for adjusting the position of said stopping means.

13. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for casting a beam of light on a spot on said strip, means adapted to engage the end of said strip to stop the movement of said strip, an electric control circuit having a branch which is closed when said strip engages said stopping means, and means actuated by said circuit for adjusting the position of said stopping means in either direction longitudinally of said strip.

14. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks, of means for moving said strip endwise, a stop for engaging the end of said strip to arrest the movement thereof, fluid pressure operated means for moving said stop in either direction longitudinally of said strip, and an electric control circuit including means responsive to the position of an index mark on said strip for actuating said fluid pressure operated means to move said stop to determine the position of said end of said strip.

15. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks, of means for moving said strip endwise, means for directing a beam of light in a spot on said strip, a stop for engaging the end of said strip to arrest the movement thereof, fluid pressure operated means for moving said stop in either direction longitudinally of said strip, and an electric control circuit including a photo-electric cell responsive to the relative positions of said spot and one of said index marks for actuating said fluid pressure means to move said stop to determine the position of said end of said strip.

16. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks, of means for moving said strip endwise, a stop for engaging the end of said strip to arrest the movement thereof, fluid pressure operated means for moving said stop in either direction longitudinally of said strip, an electric control circuit including means responsive to the position of an index mark on said strip for actuating said fluid pressure operated means to move said stop to determine the position of said end of said strip, and means for limit-

ing the total movement of said stop to an amount less than the width of an index mark.

17. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for stopping said strip, means for casting a beam of light on a spot on said strip, means actuated by the relation of said spot to one of said marks when said strip is stopped for adjusting the position of said stopping means to change the position of said strip, and light indicator means for visually showing in which direction the stopping means has been adjusted.

18. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks having a color contrasting with that of said strip, of means for moving said strip endwise, means for stopping said strip, means for casting a beam of light on a spot on said strip, means actuated by the relation of said spot to one of said marks when said strip is stopped for adjusting the position of said stopping means to change the position of said strip, light indicator means for visually showing in which direction the stopping means has been adjusted, and another light indicator means for visually showing whether or not the strip has contacted said stopping means.

19. The combination in an indexing device for positioning in a strip cutting machine successive segments of a moving metal strip bearing equally spaced index marks, of continuously operating means frictionally engaging said strip for moving it endwise, and means adapted to engage the end of said strip to stop it.

References Cited in the file of this patent

UNITED STATES PATENTS

1,474,748	White	Nov. 20, 1923
1,900,252	Morgan	Mar. 7, 1933
1,984,657	Rosenthal	Dec. 18, 1934
2,188,871	Broekhuysen	Jan. 30, 1940
2,231,735	Pittaluga	Feb. 11, 1941
2,555,069	Verney	May 29, 1951
2,562,702	David	July 31, 1951
2,578,960	Alger	Dec. 18, 1951
2,667,020	Broekhuysen	Jan. 26, 1954