June 14, 1949. J. E. SOCKE 2,472,863

APPARATUS FOR PERFORATING METALLIC STRIPS

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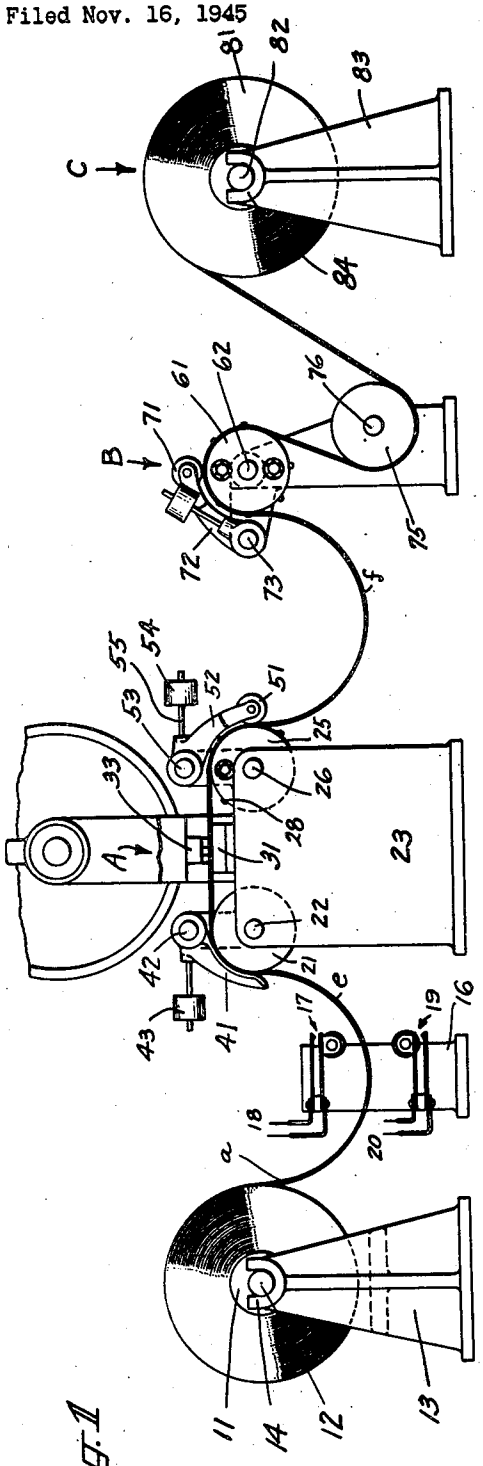


Fig. 1

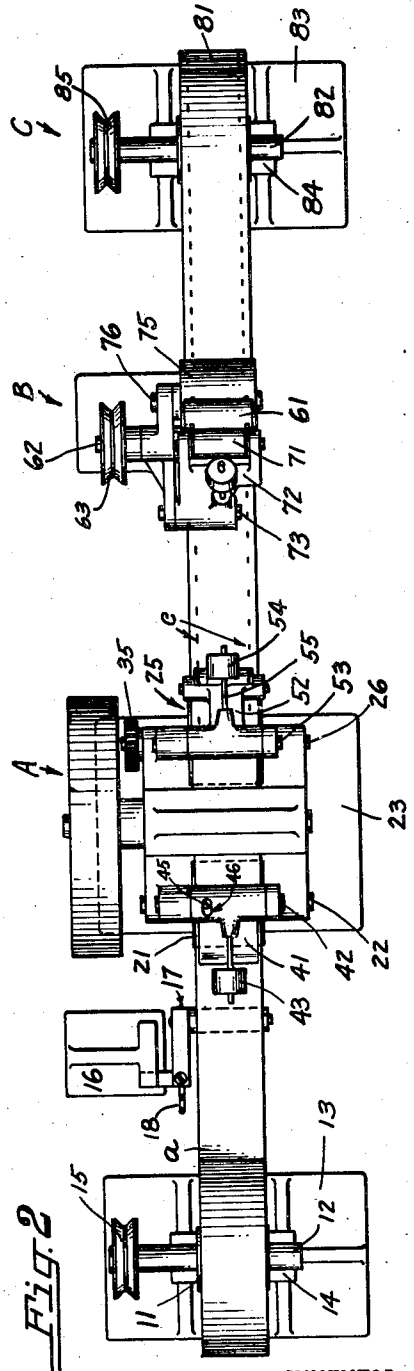


Fig. 2

INVENTOR.
John E. Socke
BY Ivan D. Thornburgh
Charles H. Erne
ATTORNEYS

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Fig. 4

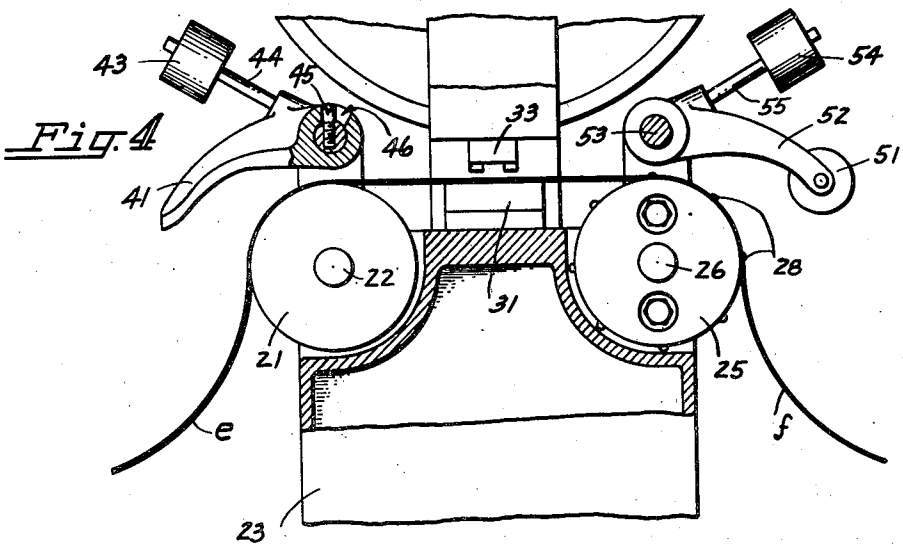


Fig. 3

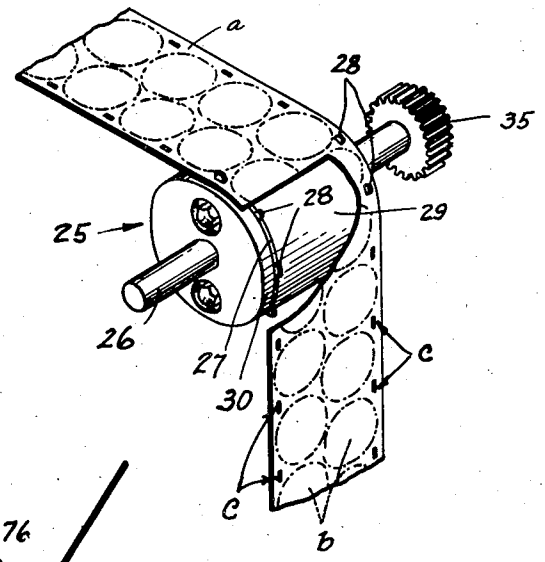
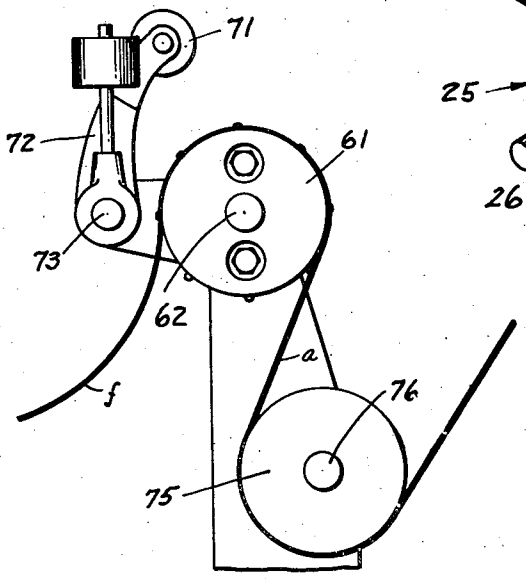


Fig. 5



INVENTOR.
John E. Socke
BY Ivan D. Thornburgh
Charles H. Erne
ATTORNEYS

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APPARATUS FOR PERFORATING METALLIC STRIPS

John E. Socke, Pelham Manor, N. Y., assignor to American Can Company, New York, N. Y., a corporation of New Jersey

Application November 16, 1945, Serial No. 629,130

5 Claims. (Cl. 164—89)

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The present invention relates to the feeding of metallic strips for perforating and the like incident to producing a strip having potential blank spaces arranged in a cutting pattern to provide cooperating feeding perforations and has particular reference to the method of and apparatus for perforating the strip in exact relation to the potential blank spaces in the cutting pattern and for feeding the strip for the perforating operation by engagement in the perforations already cut.

In high speed production for the manufacture of blanks such for example as can ends, it is desirable to utilize a strip of stock containing a plurality of rows of potential blank spaces which provide the individual stock area for the can ends. Usually the most economical use of the strip area when the cutting line is circular, oval, etc., is an arrangement of blank spaces in the well known stagger layout, this constituting a cutting pattern for minimizing the scrap spacing between adjacent cutting outlines.

The present invention contemplates the handling of a strip of material having rows of potential blank spaces arranged in a predetermined pattern so that the feeding of the strip and the holding of the same for the desired treatment of the strip at all times will be carried out in exact relation to the potential blank spaces, the feeding of the strip as well as holding it in a position of rest being accomplished by engagement in feeding perforations which are produced in the strip in a manner to allow for such engagement as the perforations are cut.

An object of the present invention is the provision of a method of and an apparatus for perforating metallic strips having potential blank spaces arranged in rows in a cutting pattern and for feeding the strip under complete control so that individual perforations as cut in the strip are definitely located in exact relationship to the potential blank spaces in the cutting pattern.

Another object of the invention is the provision of a method of perforating a metallic strip of the character described and of handling the strip in a series of steps in such a manner as to allow for unwinding of the strip from one spool or reel, perforating the same and thence rewinding onto another spool or reel.

A further object is the provision of an apparatus for continuously unwinding and rewinding a metallic strip during which time the strip is passed through perforating mechanism and perforations are cut in the strip in rows corresponding to rows of potential blank spaces, the

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cutting of the perforations being carried out intermittently while the unwinding of the strip and the rewinding after perforating are continuous and are carried out without cessation of operations.

Yet another object is the provision of an apparatus of the character described wherein a strip of metallic material may be easily positioned for cutting, such a strip being passed over suitable sprockets the teeth of which engage in the perforations of the strip as cut, together with devices for retaining the strip in accurate position on the sprockets without interference with the operation of the apparatus.

Another object of the invention is the provision of a perforating mechanism having associated feeding devices for handling a strip of metallic material containing potential blank spaces arranged in rows in a cutting pattern, the feeding devices operating to allow for continuous unwinding of the blank strip and continuous rewinding of the perforated strip during the intermittent perforating operation.

Yet another object of the invention is the provision of an apparatus for controlling the feeding of a strip of material into and through a perforating mechanism by means of which the unperforated strip may be continuously unwound from one spool or reel and the perforated strip rewound on another spool or reel while passing through the perforating mechanism whereby loops are formed in the strip to allow for the continuous unwinding and rewinding of the strip and for an intermittent perforating of the strip.

Another object is the provision of a novel sprocket feed device which is so formed as to insure accurate strip feeding without complicated sprocket construction.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description which is of a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a diagrammatic side elevation of a line of machines for carrying out the steps of the present invention and showing machines embodying features of the invention;

Fig. 2 is a diagrammatic plan view of the line of machines shown in Fig. 1;

Fig. 3 is an enlarged perspective view, parts broken away, of a feed sprocket showing the location of the strip on the sprocket during feeding;

Fig. 4 is an enlarged view of a portion of the perforating mechanism with its associated feeding

devices and illustrating the parts in the position assumed in the initial placing of the strip, parts being broken away; and

Fig. 5 is a view similar to Fig. 4 illustrating other feeding parts of the apparatus.

For the purpose of illustrating the present invention there is disclosed in the drawings a strip *a* which is of a width to contain two rows of potential blank spaces *b* (Fig. 3) for the cutting of can ends or similar circular articles from the strip. As the strip *a* is fed through perforating apparatus two rows of perforations *c* are cut adjacent the edges of the strip. Each perforation *c* bears a definite relation to adjoining potential blank spaces *b*.

The perforations in each row are spaced apart the same distance as the distance between the center lines of two adjacent blank spaces *b* in the rows constituting the cutting pattern. Any desired number of potential blank spaces may be utilized in a strip depending upon the size of the can end to be cut therefrom and the number of rows of the can end spaces in a desired width of strip.

The perforations *c* may be cut in the strip in any suitable manner. One way of cutting in connection with a more elaborate cutting pattern is shown in my pending application Serial Number 588,083, filed in the United States Patent Office April 13, 1945, now Patent No. 2,458,538, issued January 11, 1949, where six rows of potential blank spaces are used. The steps of the present invention, however, and the apparatus used are not dependent upon a particular width of strip.

As illustrated in Fig. 1, a suitable blank strip *a* wound in reel form for ease of handling, may be carried upon a spool **11**. This spool is mounted for rotation with a shaft **12** and the shaft and the spool of material are carried in a frame **13**. Open top U-shaped bearings **14** are formed in the frame **13** to permit easy insertion of a shaft containing a full spool or to permit removal of a shaft with an empty spool. This spool of strip material provides the supply of stock to be operated upon.

The strip *a* is unwound from the spool **11** in any suitable way which provides for a substantially uniform lineal travel of the strip. A variable speed motor, for example, may be used for rotating the shaft **12**. A pulley **15** (Fig. 2) mounted on the shaft **12** suggests that such a driving power may be applied to the shaft as by a belt, not shown. An electrical or other control system may be used to regulate the proper speed of the motor. Such control of the rate of rotation of the shaft **12** provides for the desired lineal withdrawal of the strip irrespective of the amount of material on the spool at any particular time.

The strip *a* as it is unwound from the spool **11** preferably hangs down in a loop *e* as shown in Fig. 1. A suitable motor speed control mechanism is adapted to be actuated by certain positions of the loop. To illustrate one such contact device principal parts are shown in Figs. 1 and 2 as being located adjacent the frame **13** and include a support post **16** which is mounted to one side and adjacent an edge of the strip loop *e*.

A normally opened contact switch **17** is carried on the post above the loop *e* and is in electrical connection with wires **18** of an electric circuit connecting with the speedup side of the variable speed motor rotating the shaft **12**. A normally opened contact swtch **19** is carried on the post **16** beneath the loop *e* and is in electrical connection with wires **20** of an electrical circuit connecting with the retard side of the variable speed

motor. Since it is common practice to use variable speed motors and electrical circuit controls for unwinding strip stock in a variety of manufacture, it is believed further more detailed description in this regard is unnecessary.

This control mechanism insures a maintenance of the proper size of loop *e* between the contacts **17** and **19**. For example, when the loop *e* shortens and rises to a point where the strip engages the roller carried on the lower spring contact element of the switch **17** this switch is closed and the resulting control increases the speed of rotation of the shaft **12** through the variable motor. This insures a greater length of the strip being unwound from the spool in a given time. As soon as sufficient material has been drawn off to increase the loop *e* the contact switch **17** is disengaged and the circuit therefore opens allowing the motor to continue at a uniform speed.

In the event that there is an excess in the size of the loop *e* so that the strip engages the movable contact element of the switch **19**, this switch will become closed. The circuit passing to the variable motor and which has to do with retarding its speed thereupon becomes operative and the speed of the motor is reduced and less material is drawn from the spool. This continues until the loop *e* has been shortened sufficiently to disengage the switch **19** whereupon the normal uniform unwinding of the motor continues. This is repeated from time to time during the unwinding of a strip of material from the spool **11**, the result being a proper control of the unwinding of the strip irrespective of the actual amount of strip material on the spool.

On the opposite side from the spool **11**, the loop *e* passes up and over an idler roller **21** mounted upon a horizontal shaft **22** journaled for rotation in a frame **23**. Frame **23** preferably is a part of the perforating mechanism, indicated generally at A. The strip extends in a horizontal position from the upper surface of the idler roller **21** and passes over an intermittently rotatable sprocket unit **25** mounted upon a horizontal shaft **26** journaled in the frame **23**. This sprocket unit effects the feeding of a strip in the perforating mechanism A by drawing the strip the required distance before each perforating operation and by then holding the same in proper position for the cut.

In the preferred form, the sprocket unit **25** (Fig. 3) is composed of two or more thin sprocket members **27** mounted on the shaft **26**. When there are two rows of perforations *c*, as in the present embodiment, there will be two of these sprockets. Each sprocket is formed with sprocket teeth **28** and the sprockets are spaced apart on the shaft **26** the distance desired which will be the distance between adjacent rows of perforations.

A cylindrical spacer drum **29** is mounted on the shaft **26** and is interposed between the sprockets **27** to gauge the distance between sprockets. Drum collars **30** of the same diameter as the spacer drum **29** are also carried on the shaft **26**. These drum collars are mounted outside of the sprockets and clamp the sprockets against the spacer drum **29** to form a compact unit. Longitudinal bolts or other securing means may be passed through the collars, the sprockets and the spacer drum to hold these parts together.

The diameter of the spacer drum **29** and the same corresponding diameters of the collars **30** accurately determine the desired feeding distance of a strip *a* when the sprocket unit **25** rotates the

teeth 28 of the sprockets 27 engaging in the perforations c. This also insures that the strip is always held in exact position during perforating.

By reason of the built-up character of the sprocket unit, it is very easy to insert the proper diameter spacer drum 29 and collars 30 to obtain the desired lineal feeding travel for the strip. The sprockets 27 need be changed only if great variation is required. Since the parts 29 and 30 are merely cylinders the exact diameter desired may be obtained with great accuracy and without any great difficulty.

Thus within certain limits the same size of sprocket 27 may be used for different diameters of the spacer drum 29 and the collars 30 and the same sprockets will function to insure the proper travel of the strip intermittently through the perforating mechanism A irrespective of the exact length of the teeth and pitch diameter of the sprocket. The base diameter of the sprocket is at all times the same or less than the diameter of the spacer drum and the collars. The teeth of the sprockets at the base are of a dimension to fit within the perforations c.

The perforating mechanism A includes a lower perforating die 31 carried in the frame 23 over which the strip *a* passes when moving from the roller 21 onto the feed sprocket unit 25. This is the stationary die part of the perforating mechanism. Directly above the strip and in alignment with the lower die 31 is an upper perforating die 32 which constitutes the movable die part. As shown in the drawings the dies 31, 32 are double so that at each stroke the dies cut out the perforations c in the two rows of the strip *a*. The upper die 32 is mounted upon a cross head 33 which is adapted to be raised and lowered in the usual manner to cause the upper die to engage the strip and force it downwardly over the lower die 31 when the feed sprocket unit 25 is at rest.

The sprocket unit 25 is intermittently rotated in conventional manner so that it stops when the perforating dies 31, 32 are cooperating and moves to advance the strip when the dies are separated. This is accomplished by proper intermittent motion applied, for example, to a gear 35 (Figs. 2 and 3) carried on the shaft 26. Thus it will be observed that the feeding of the strip is accomplished by the sprocket unit 25 and by engagement in the perforations c as they are being cut.

The strip *a* is retained upon the idler roller 21 by a guide shoe 41 (Figs. 1 and 4) which is pivoted on a stationary shaft 42 carried in the frame 23. Shoe 41 may be pulled away from its guiding position, as illustrated in Fig. 4, to permit the initial placing of the strip *a* into the perforating mechanism A. The guide shoe is held in guiding position (Fig. 1) by a weight 43 carried on a rod 44 anchored in the shoe adjacent its pivot 42. A setscrew 45 projected out from the shaft 42 (Fig. 4) extends into a slot 46 cut in the pivotal hub of the shoe. This allows for bringing of the shoe into open position and acts as a stop to maintain a space between the shoe and the roller 21 when the shoe is in the position shown in Fig. 1. This forms a pass for the strip and prevents any bulging or looping during operation of the line.

The strip is held in proper contact with the periphery of the drum parts 29 and 30 of the sprocket unit 25 by means of a grooved roller 51 carried upon the free end of a swing arm 52 mounted for pivotal action on a shaft 53 carried in the frame 23 of the perforating mechanism. The groove of the roller 51 is wide enough and deep enough for clearance of the teeth of the two sprocket parts 27 and the roller holds the strip in close contact with the drum 29 and the collars 30. The teeth 28 of the sprocket engage in the desired number of perforations c in the strip to effect the desired strip movement or to hold the strip stationary for a perforating operation.

The arm 52 is adapted to be swung out of the holding position, as shown in Fig. 4, when the strip is initially inserted in the sprocket unit. A weight 54 is carried on a rod 55 anchored in the arm adjacent its pivot 53 and this normally keeps the grooved roller 51 against the outer surface of the strip.

It will be understood that when an unperforated strip is brought into the line of machinery (Figs. 1 and 2) for the first time that it will be necessary first to cut a number of the perforations c for the double row of the strip to prepare it for feeding. This may be done in any suitable manner it being necessary merely to insure that there is the proper space between adjacent perforations in each row and that all perforations are in proper position relative to the potential blank spaces *b* adjacent. After this preliminary treatment all of the operations in all of the machines including the feeding of the strip thereto, are automatic.

From the perforating machine A, the strip *a* passes into a loop *f* and from thence passes into a timing mechanism B. The loop *f* extends from the sprocket unit 25 in the perforating mechanism to a sprocket unit 61 in the timing mechanism. The sprocket unit 61 is of the same construction as the sprocket unit 25 already described in detail and shown in Fig. 3. However, the unit 61 is continuously rotated instead of being rotated intermittently. The loop *f* allows for the intermittent rotation of the sprocket unit 25 and for the continuous rotation of the sprocket unit 61 as will be obvious.

Sprocket unit 61 is carried on a horizontal shaft 62. The shaft 62 is journaled in the timing mechanism B and is rotated continuously at the proper speed by application of rotative power over a pulley 63 (Fig. 2) carried by the shaft.

In order to hold the strip in proper feeding position on the sprocket unit 61, a grooved roller 71 (Figs. 1 and 5) is carried upon the free end of a swing arm 72 mounted for pivotal movement on a stationary shaft 73 carried in the frame of the timing mechanism B. The grooves of this roller like the grooves in the roller 51 provide for clearance of the teeth of the sprocket unit 61, the roller 71 holding the strip on the sprocket to insure the proper lineal travel of the strip.

The strip A from the sprocket unit 61 passes under a smooth roller 75. This roller may be an idler roller and is carried upon a shaft 76 journaled for free rotation in the frame of the timing mechanism B. Such a roller properly directs the perforated strip to a rewinding mechanism C.

In the rewinding mechanism the strip is wound upon a spool 81 mounted for rotation on a shaft 82 which may be carried in a frame 83. U-shaped bearings 84 are formed in the frame 83 and these form pockets for easy insertion of the support shaft 82 with an empty spool 81 to be filled with the perforated strip and for removal of the filled spool.

The shaft 82 is continuously rotated so that the winding up of the perforated strip goes on without interruption, the lineal travel of the strip being determined by the sprocket unit 61 in the timing mechanism B. The rate of rotation of the shaft 82 and the spool 81 will depend upon the

amount of stock on the spool at any particular time. A suitable friction drive may include a slip-pulley 85 (Fig. 2) mounted on the spool shaft. The application of rotation applied as by a belt to the slip pulley 85 is sufficient at all times to keep the strip taut between the idler roller 75 and the spool for its proper winding. Any excess is taken up by the slip pulley slipping on the shaft, as will be evident.

By means of the loop e, it is possible to unwind the strip before perforating from the spool 11 and to rewind the strip onto the spool 81 after perforating. The time interval required for perforating by means of the dies 31, 32 is taken care of by the interrupted rotation of the sprocket unit 25.

By reason of the simple sprocket construction in the sprocket units 25, 61, any slight adjustment in the distance between adjacent perforations c in a row is made by utilizing a proper diameter of the spacer drum 29 and the drum collars 30. Since these parts are mere cylinders, such adjustment as to the size of diameter is simple as compared with a corresponding adjustment in a sprocket having teeth requiring a change in spacing. This feature together with the accurate holding of the strip a in the sprocket units provides a fully automatic mechanism which makes use of simple steps for operation of such mechanism.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction, and arrangement of parts of the apparatus mentioned herein and in the steps and their order of accomplishment of the process described herein, without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the apparatus and process hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In an apparatus for feeding metallic strips for perforating and the like incident to providing a strip having potential blank spaces arranged in a cutting pattern with cooperating feeding perforations, the combination of perforating dies for punching a row of perforations in a strip in an exact relationship to a row of said potential blank spaces in the strip, a feeding sprocket mounted adjacent said perforating dies for drawing the strip through the dies by engagement in the perforations as they are cut, actuating means for rotating said feed sprocket intermittently to cause the strip as perforated to extend into a varying size loop, a second feed sprocket located on the opposite end of said loop and having engagement in the perforations of the strip, means for constantly rotating said second sprocket at a speed of rotation to maintain the length of said loop within predetermined limits, and devices for holding the strip on said feed sprockets for portions of their peripheries to insure exact operation of each of said sprockets.

2. In an apparatus for perforating metallic strips having potential blank spaces arranged in rows in a cutting pattern so that the perforations bear an exact relationship to the spaces in the pattern, the combination of perforating dies for punching rows of perforations in a strip outside of said potential blank spaces, a sprocket unit for drawing the strip through said perforating dies by engagement in the perforations as they are cut, and means for moving said sprocket unit intermittently to position and to hold the strip in exact relation to said dies to cut said perforations in a predetermined position relative to said potential blank spaces, said sprocket unit comprising drum elements having a predetermined diameter and toothed sprocket discs mounted on the same axis and spaced apart by said drum elements, the diameter of said drum elements determining the distance between adjacent perforations in a row as cut by said perforating dies when said sprocket unit is rotated by said sprocket moving means.

3. In an apparatus for feeding metallic strips for perforating and the like incident to providing strips having potential blank spaces arranged in a cutting pattern with cooperating feeding perforations, the combination of a spool for holding an unperforated strip, means for unwinding the strip from said spool, perforating dies for punching a row of perforations in the strip in exact relationship to a row of said potential blank spaces as the strip is unwound by said unwinding means, a feeding sprocket mounted adjacent said perforating dies for drawing the strip through the dies by engagement in the perforations as they are cut, actuating means for rotating said feed sprocket intermittently to hold said strip for perforating and to pass the strip as perforated into a varying size loop, timing mechanism including a second feed sprocket for drawing on the loop of the strip, and means for constantly rotating said second sprocket to make the said loop smaller when said first feed sprocket is at rest and to increase the length of said loop when said first sprocket is drawing the strip through said perforating dies.

4. In an apparatus for feeding metallic strips for perforating and the like incident to providing strips having potential blank spaces arranged in a cutting pattern with cooperating feeding perforations, the combination of a spool for holding the unperforated strip, means for unwinding the strip from said spool continuously and for passing it into a varying size loop, perforating dies for punching a row of perforations in an exact relationship to a row of said potential blank spaces, a feeding sprocket mounted adjacent said perforating dies for drawing the strip from said loop and through the dies by engagement in the perforations, actuating means for rotating said feed sprocket intermittently to pass the strip into a second varying size loop after it is perforated, timing mechanism including a second feed sprocket located on the opposite end of said second loop, means for continuously rotating said second sprocket, a device for continuously winding the perforated strip from said second sprocket, and devices including pivotally mounted gravity held rollers for keeping said strip in accurate feeding positions on said first and second sprockets by holding the strip against each sprocket for a portion of its periphery.

5. In an apparatus for perforating metallic strips having potential blank spaces arranged in rows in a cutting pattern so that the perforations bear exact relationship to the spaces in the pattern, the combination of perforating dies for punching rows of perforations in a strip outside of said potential blank spaces, a sprocket unit for drawing the strip through said perforating dies by engagement in the perforations as they are cut, and means for moving said sprocket unit intermittently to position and to hold the strip in exact relation to said dies to cut said perforations in a predetermined position relative to said

potential blank spaces, said sprocket unit comprising replaceable cylindrical drum elements each having a predetermined diameter and a predetermined width and toothed sprocket discs mounted on the same axis and spaced apart by said drum elements at a distance equal to the distance between adjacent perforating dies, a said disc being operable with different diameter drum elements within limits, the diameter of said drum elements determining the distance between adjacent perforations in a row as cut by said perforating dies when said sprocket unit is rotated by said sprocket moving means.

JOHN E. SOCKE.

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