June 28, 1938. I. S. BODKIN 2,121,947

MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

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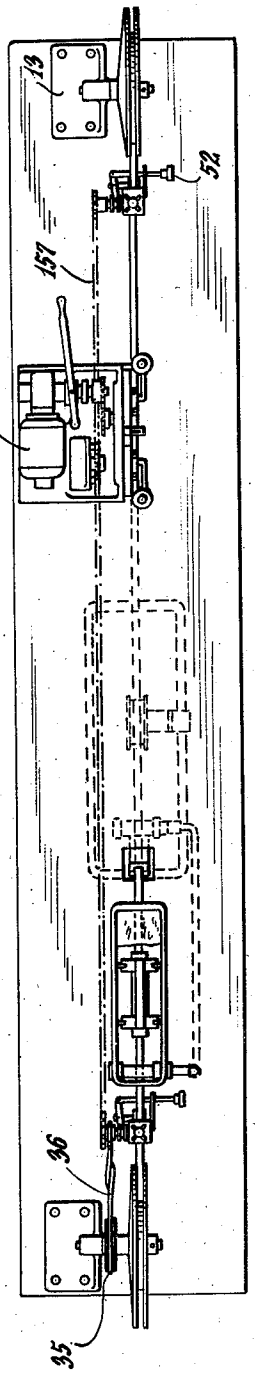


Fig. 1.

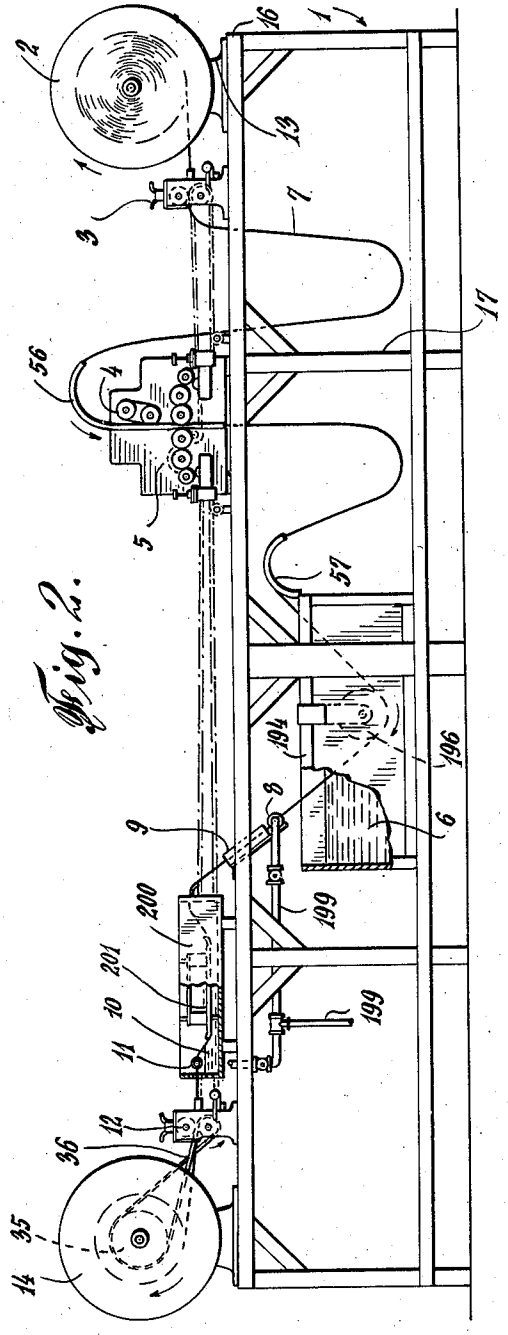


Fig. 2.

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June 28, 1938. I. S. BODKIN 2,121,947

MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

Filed May 12, 1934 8 Sheets-Sheet 2

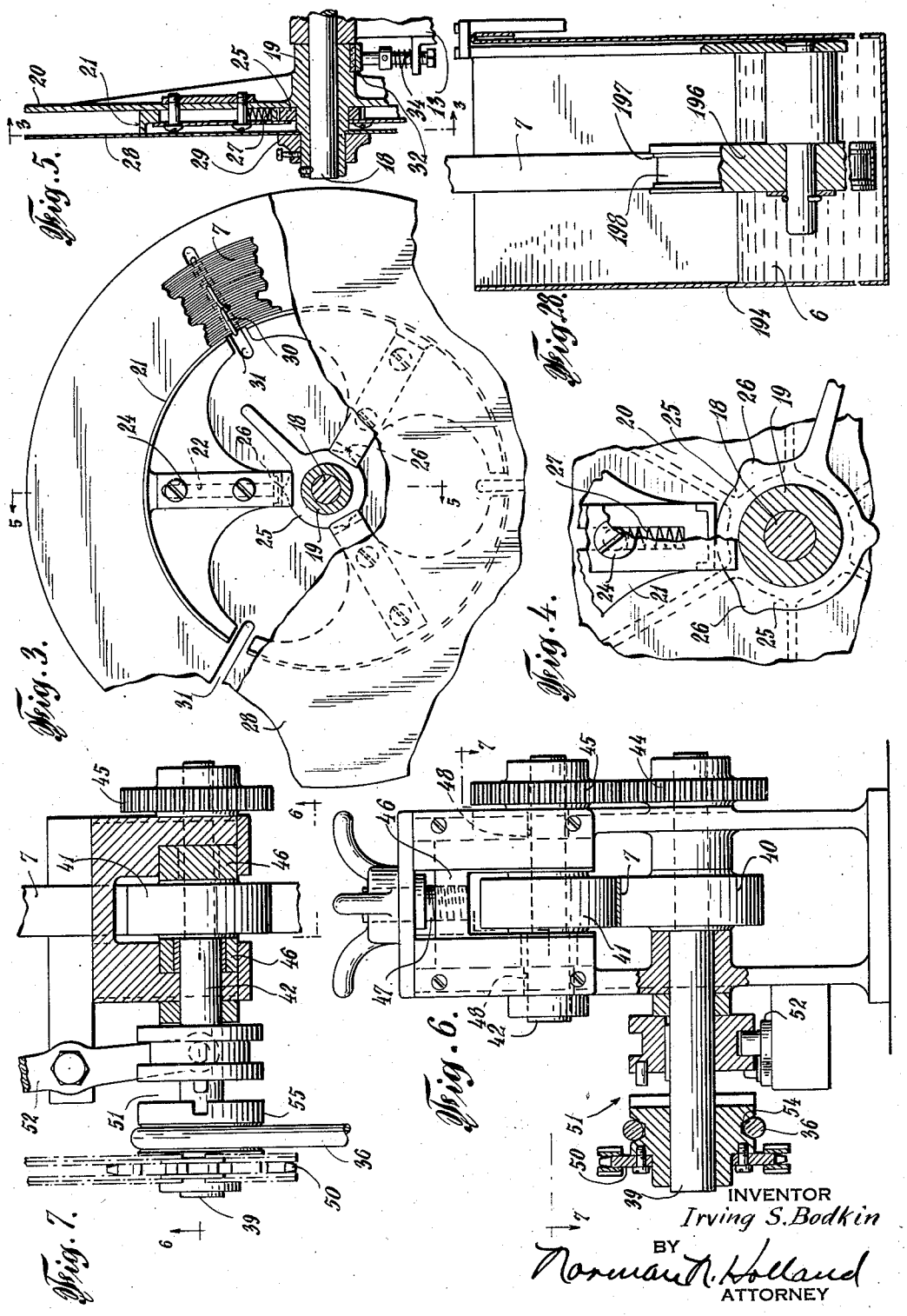


Fig. 5.

Fig. 2B.

Fig. 3.

Fig. 4.

Fig. 7.

Fig. 6.

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MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

Filed May 12, 1934 8 Sheets-Sheet 3

Fig. 8.

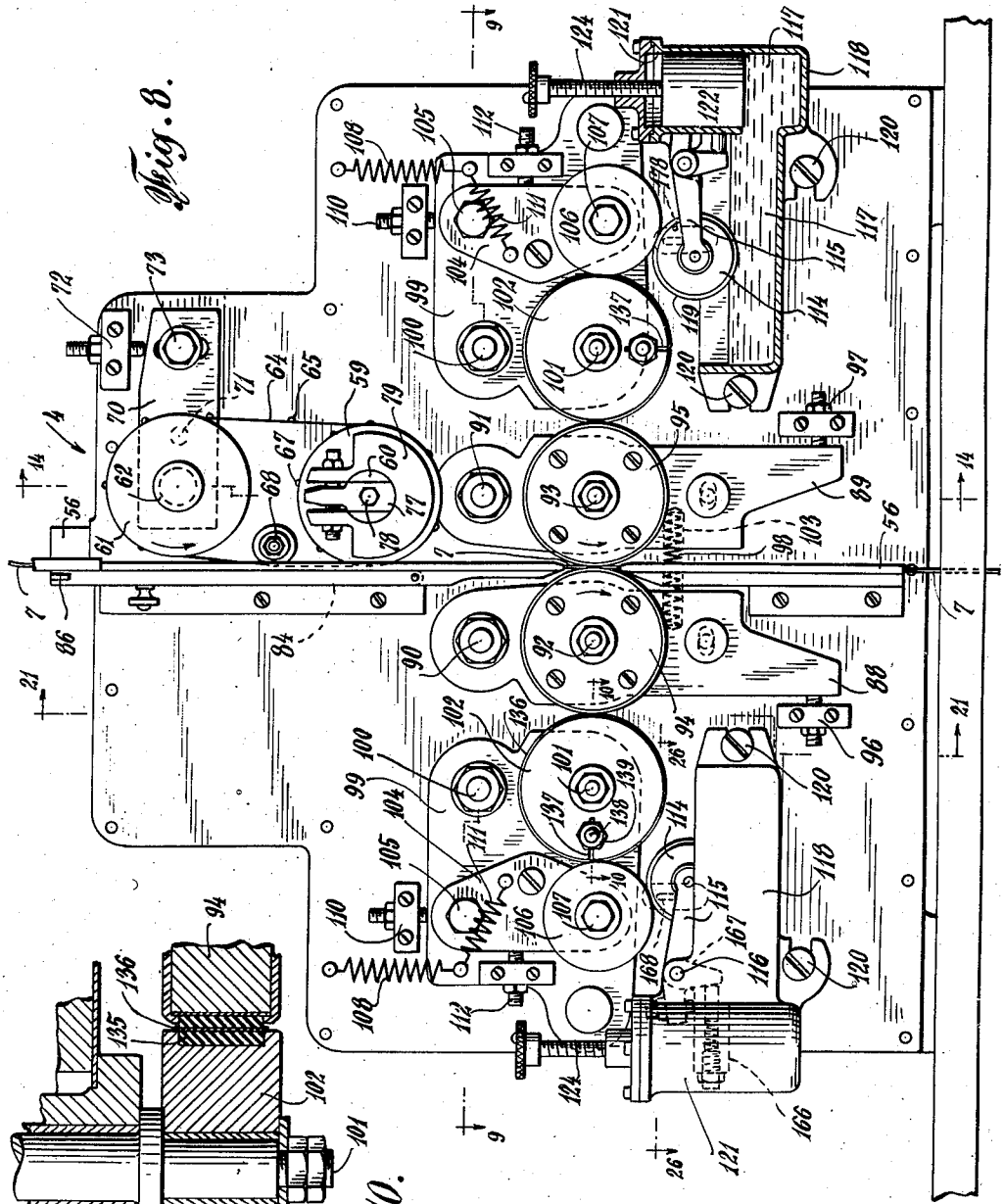


Fig. 10.

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June 28, 1938. I. S. BODKIN 2,121,947

MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

Filed May 12, 1934 8 Sheets-Sheet 4

Fig. 9.

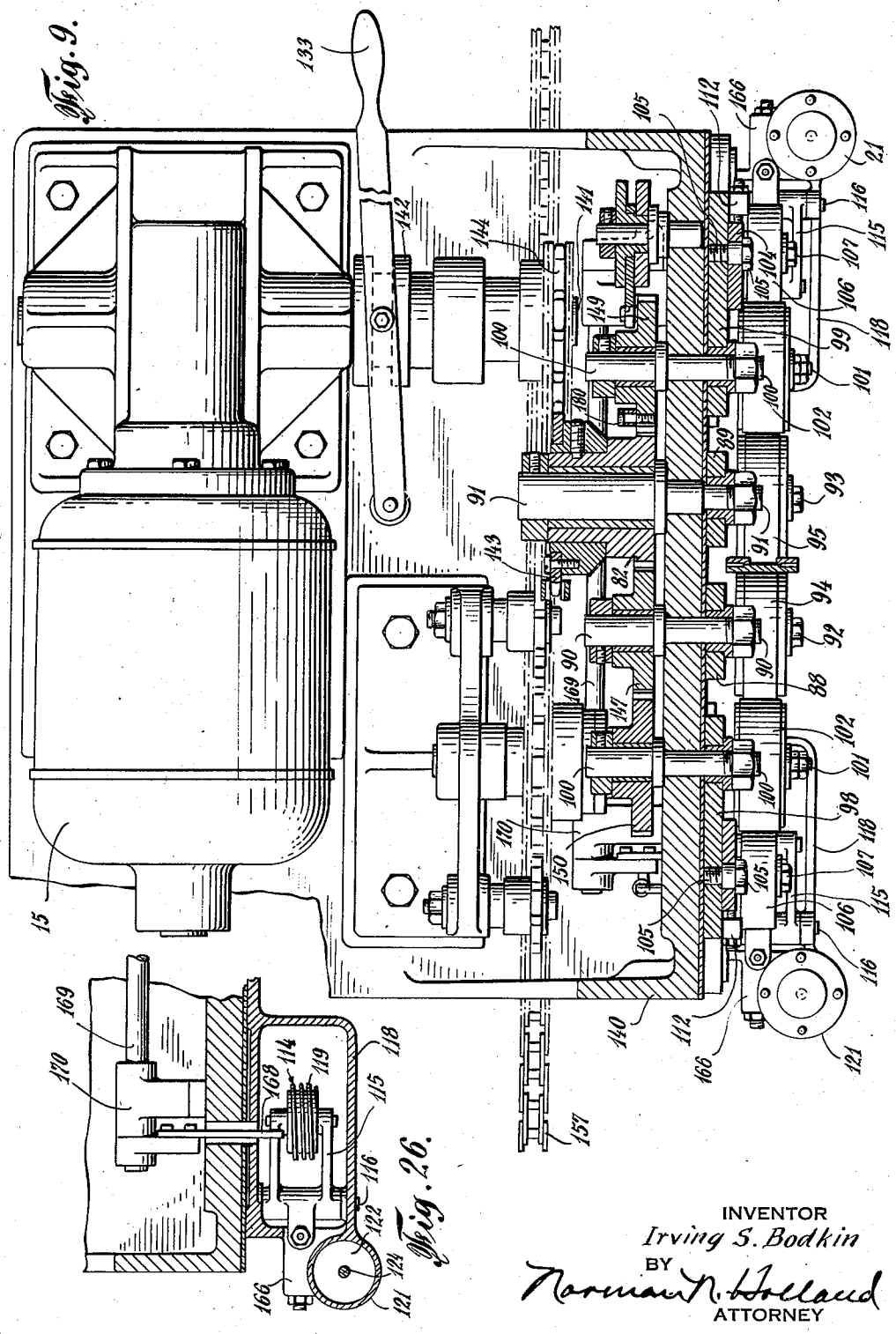


Fig. 26.

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June 28, 1938. I. S. BODKIN 2,121,947

MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

Filed May 12, 1934 8 Sheets-Sheet 5

Fig. 12.

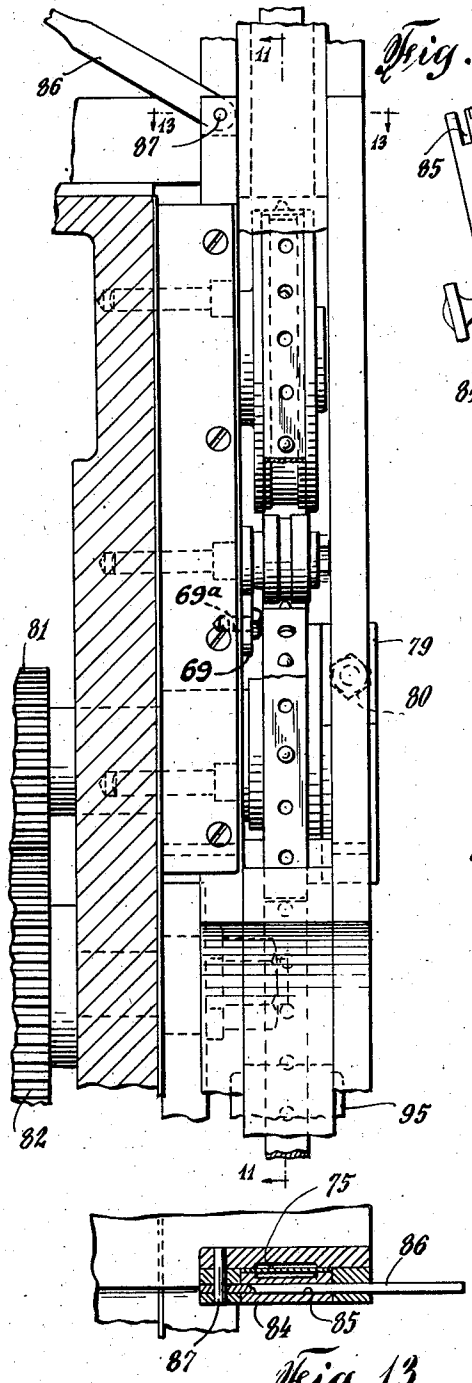
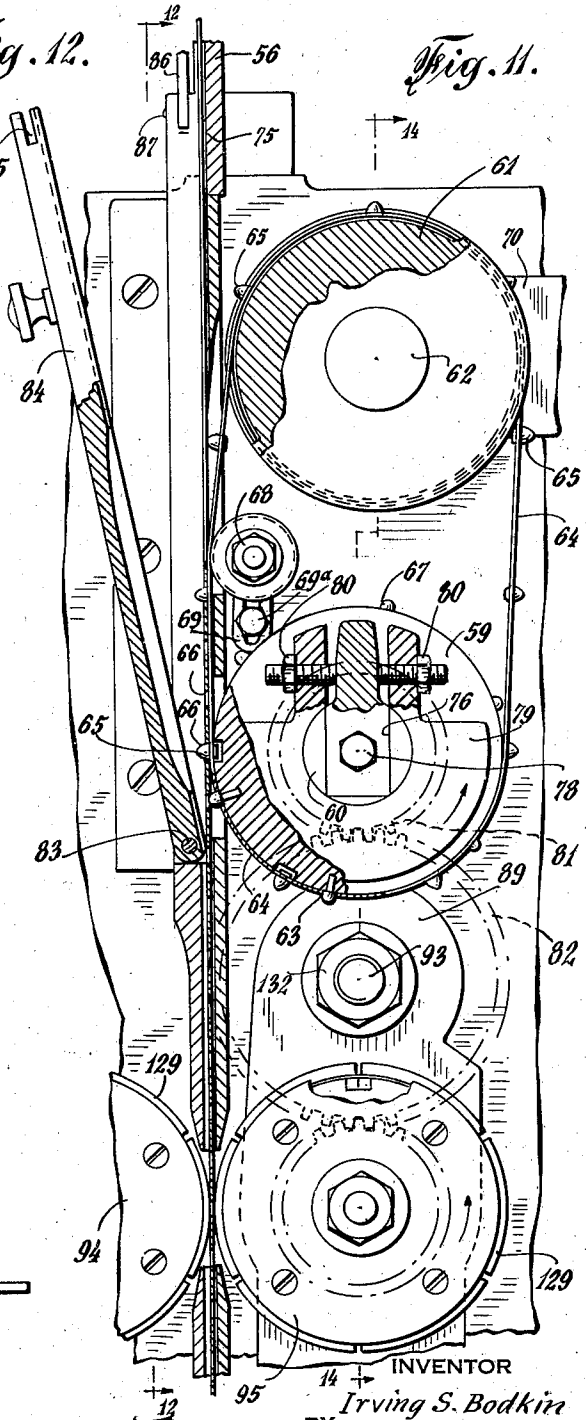


Fig. 13.

Fig. 11.



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June 28, 1938. I. S. BODKIN 2,121,947

MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

Filed May 12, 1934 8 Sheets-Sheet 6

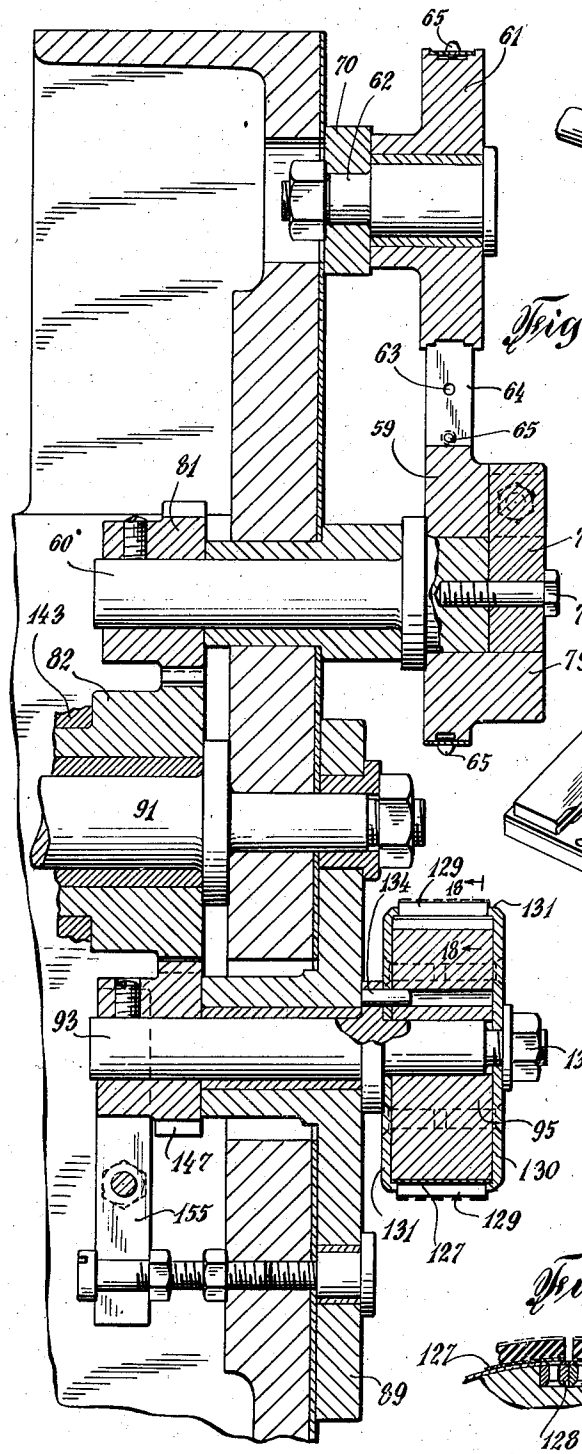


Fig. 14.

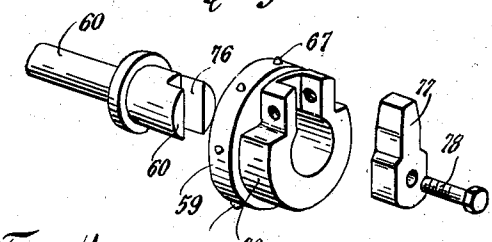


Fig. 15.

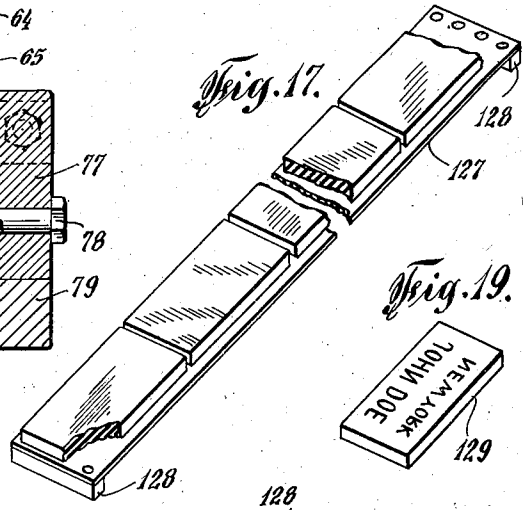


Fig. 17.

Fig. 19.

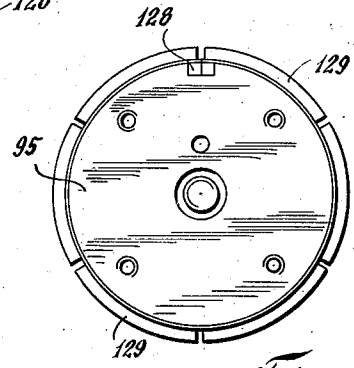


Fig. 16.

Fig. 18.

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June 28, 1938. I. S. BODKIN 2,121,947

MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

Filed May 12, 1934 8 Sheets-Sheet 7

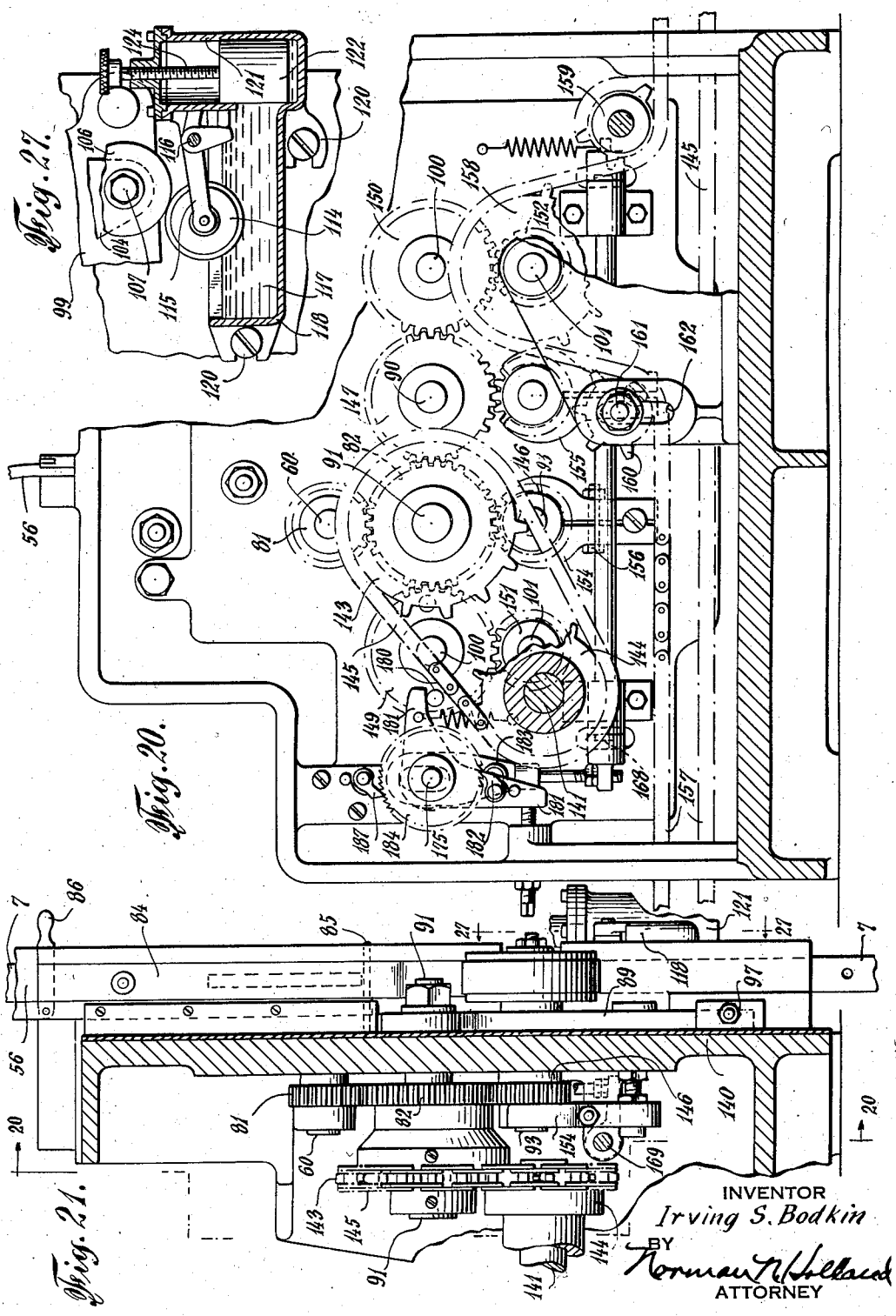


Fig. 21.

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June 28, 1938. I. S. BODKIN 2,121,947

MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

Filed May 12, 1934 8 Sheets-Sheet 8

Fig. 23.

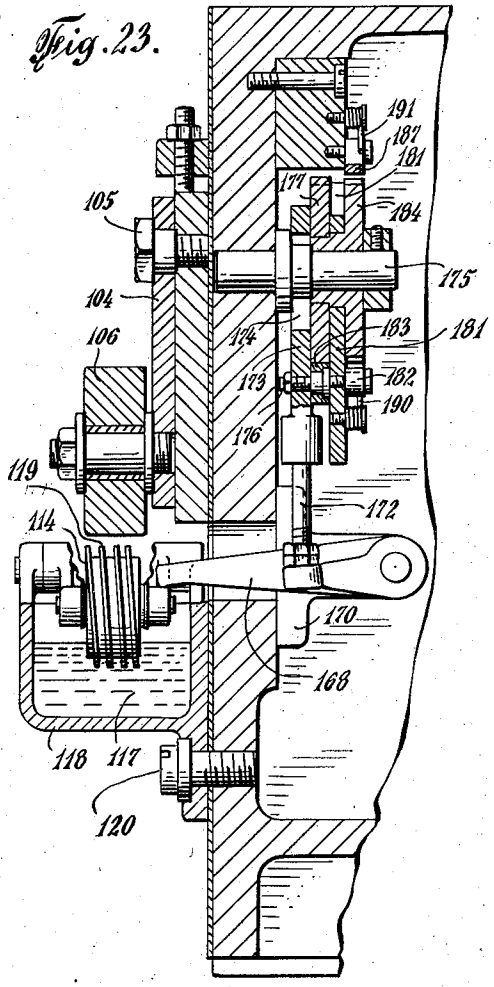


Fig. 25.

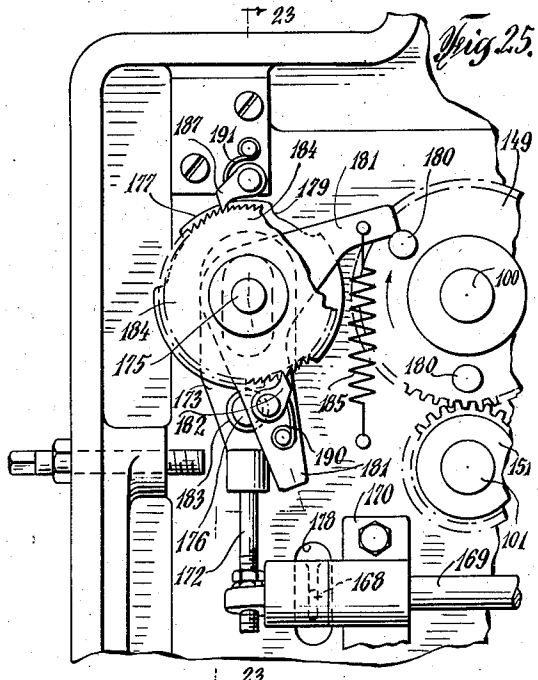
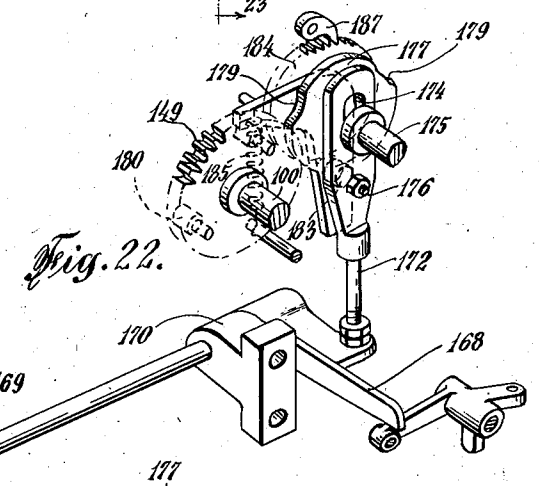


Fig. 22.



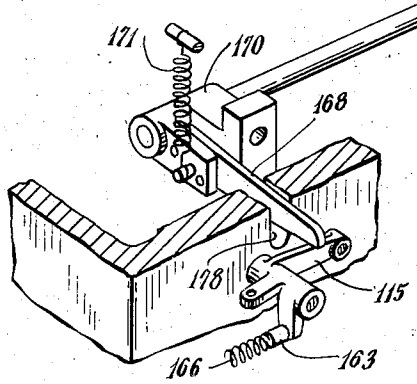
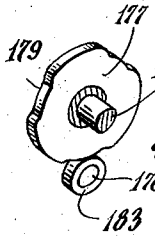


Fig. 24.



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Patented June 28, 1938 2,121,947

UNITED STATES PATENT OFFICE

2,121,947

MACHINE FOR APPLYING LEGENDS TO RAZOR BLADES

Irving S. Bodkin, New York, N. Y., assignor to Conrad Razor Blade Co., Inc., Long Island City, N. Y., a corporation of New York

Application May 12, 1934, Serial No. 725,290

24 Claims. (Cl. 101—220)

The present invention relates to the manufacture of blades for safety razors and more particularly to a mechanism for etching or printing a suitable trade-mark or other legend thereon.

For convenience in manufacture, blades for safety razors are made from a strip of steel having substantially the same width as the finished razor blade. The strip is passed through a series of machines where it is formed with blade apertures, hardened, ground at the edges, and finally cut into finished individual blades which are ready to be inspected, wrapped in packages and sold.

It is customary and desirable to apply directly to the blade a trade-mark or other suitable legend to identify the manufacturer thereof. This is usually done by applying an etching acid to the blade which, when washed off, leaves a permanent mark or legend on the blade. Preferably, this operation is performed after the blade apertures have been formed in the metal strip but before the strip has been cut into individual blades. This is the most convenient time for performing the etching or printing operation, since the handling of individual blades is eliminated; however, there are certain inherent difficulties. In annealing the strip and in other operations after the strip has been laid out into blades by punching apertures or the like, the strip of metal may be stretched slightly, which makes it difficult to obtain proper registry of the etching mechanism with the annealed blades forming the continuous strip. The difference in the length of a single blade may be small and not noticeable but the cumulative difference in a strip is substantial and should be compensated for in the printing operations. It is, therefore, difficult to have the printing mechanism register in all cases with the individual blades, and particularly to keep the legend centralized on each blade, regardless of variations in length. It is necessary to make a clear imprint of the legend at least on one side of the blade and generally on both, which should not be smeared during or after the printing, until the acid has been neutralized or washed off. The edge of the strip should be protected from the acid and from contact with extraneous objects. The film of acid must be thin and uniform to obtain good results without wasting the acid. The present invention aims to provide an inexpensive mechanism which will accomplish these and other results satisfactorily and at a high speed without interrupting the movement of the strip.

An object of the present invention is to provide a printing mechanism for razor blades which will accurately register with each blade regardless of stretching or other irregularities occasioned by previous operations on the strip.

Another object of the invention is to produce a practical mechanism for printing or etching the blades without stopping the strip during its passage through the printing mechanism, that is, permitting a continuous movement as distinguished from an intermittent movement.

Another object of the invention is to provide means for accurately registering the individual blades with the printing mechanism without stopping the movement of the strip.

Another object of the invention is to simplify the mechanism for printing or etching safety razor blades.

Another object of the invention is to increase the speed of etching or printing razor blades and thereby reduce the cost thereof.

Another object of the invention is to reduce to a minimum the number of parts of the machine exposed to the acid.

Another object of the invention is to protect the edge of the strip from acid and the like.

Another object of the invention is to avoid smearing the acid after application thereof and prior to its removal.

Another object of the invention is to provide means for intermittently supplying a thin film of acid to the transfer rollers.

Another object of the invention is to provide means for retaining the level of the acid in the reservoirs substantially constant to obtain a uniformly thin film.

Another object of the invention is to provide a coil holding device adapted to permit rapid mounting and removal of a coil of strip metal.

Other and further objects of the invention will be obvious upon an understanding of the illustrated embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming part of the specification, wherein

Fig. 1 is a top plan view of a preferred embodiment of the invention;

Fig. 2 is a side elevational view of the mechanism shown in Fig. 1;

Fig. 3 is a detailed fragmentary view illustrating a coil of metal mounted on the drum;

Fig. 4 is a detailed fragmentary view illustrating the cam mechanism for collapsing and expanding the drum;

Fig. 5 is a fragmentary sectional view along the line 5—5 of Fig. 3, illustrating details of the drum construction;

Fig. 6 is a sectional view along the line 6—6 of Fig. 7, illustrating the take-up mechanism at the delivery end of the machine;

Fig. 7 is a sectional view along the line 7—7 of Fig. 6, illustrating features of the take-up mechanism at the delivery end of the machine;

Fig. 8 is a side elevational view of the printing mechanism;

Fig. 9 is a sectional view of the printing mechanism taken along the line 9—9 of Fig. 8;

Fig. 10 is a sectional view of a transfer roller, taken along the line 10—10 of Fig. 8;

Fig. 11 is a side elevation, partly in section, of the feed and synchronizing mechanism associated with the printing mechanism, taken along the line 11—11 of Fig. 12;

Fig. 12 is a sectional view, along the line 12—12 of Fig. 11;

Fig. 13 is a detailed sectional view, taken along the line 13—13 of Fig. 12, illustrating the construction of the guideway, the position of the strip of metal therein, and the means affording access to the guideway;

Fig. 14 is a sectional view along the lines 14—14 of Fig. 11;

Fig. 15 is an exploded perspective view illustrating the details of the adjustment mechanism for synchronizing the feed device;

Fig. 16 is an end elevational view of one of the printing rollers;

Fig. 17 is a perspective view of the metal strip to which the printing pads are secured;

Fig. 18 is a detailed sectional view, along the line 18—18 of Fig. 14, illustrating the attachment of the metal strip to the printing roller;

Fig. 19 is a perspective view of one of the printing pads with an illustrative legend thereon;

Fig. 20 is a sectional view, taken along the line 20—20 of Fig. 21, illustrating the driving connections for the printing mechanism;

Fig. 21 is a fragmentary sectional view, taken on the line 21—21 of Fig. 8, illustrating the driving connections for the printing and transfer rollers;

Fig. 22 is a fragmentary perspective view illustrating the mechanism for intermittently applying acid to the transfer rollers;

Fig. 23 is a detailed sectional view, taken along line 23—23 of Fig. 25, illustrating the intermittent mechanism effective upon the acid applying roller;

Fig. 24 is a fragmentary perspective view of the cam for operating the acid applying roller intermittently;

Fig. 25 is a detailed illustration of the means for driving the cam shown in Fig. 24;

Fig. 26 is a sectional view on the line 26—26 of Fig. 8, illustrating the acid applying roller and the acid reservoir;

Fig. 27 is a vertical sectional view of the acid reservoir illustrating the level adjusting member in its lower position; and

Fig. 28 is a sectional view illustrating the construction of the pulley under which the sheet metal strip passes in the neutralizing bath.

Described generally, and referring more particularly to Figs. 1 and 2, the preferred embodiment of the invention comprises a framework 1 for supporting the various mechanisms, a drum 2 for receiving a coil of strip material 7 to be etched, a feed mechanism 3 for delivering the strip material at a constant rate to the synchronizing mechanism 4 of the printing mechanism 5. The strip of material is preferably sheet steel from which safety razor blades can be made and preferably has apertures formed therein, or other recesses dividing the strip into a series of connected blades adapted to be cut or stamped into individual blades in a later operation. The synchronizing mechanism 4 regulates the delivery of the strip to the printing mechanism 5 so that the printing mechanism registers properly with each of the blades of the strip. The printing mechanism applies a suitable acid which etches the legend on the strip while the strip is passing from the printing mechanism to the neutralizing bath 6, where the acid is washed from the strip. The strip 7, on leaving the neutralizing bath, passes a blower 8 and a heater 9 for removing the neutralizing solution and then passes into an oil bath 10, where a film of oil is applied for preventing rust, and past a blower 11. The strip then passes through the take-up rollers 12 onto the drum 14. A suitable driving motor 15 is operatively connected to these several devices to drive all of them in timed relation to each other.

These several mechanisms and their operations will now be described in detail.

The table 1, which is adapted to support the various mechanisms as illustrated more particularly in Figs. 1 and 2, may be made of any suitable material and in various ways. As herein illustrated, it comprises a top 16 and a series of legs 17 suitably braced. On one end of the table, the drum 2 is mounted to receive a coil of strip material which is to be fed to the printing mechanism, and the drum 14 is mounted on the other end of the table adapted to receive and wind into a coil the strip of material after it has been printed or etched.

For convenience, these drums are constructed alike and are shown more particularly in Figs. 3 to 5. A shaft 18 mounted on a bracket 13 extends through a hub 19, integral with the disc member 20. A plurality of arcuate members 21 are slidably mounted on the disc 20 by screws 24 slidably mounted in the slots 22. The position of the arcuate members is controlled by a cam 25 having projections 26 thereon adapted to force the arcuate members outwardly through the intermediation of the springs 27, so that by rotating the cam the arcuate members 21 may be moved radially inwardly to remove a coil of the material 7 or may be moved radially outwardly to be expanded into engagement with the inner periphery of the coil. A second disc 28 is removably mounted on the hub 19 by means of the collar 29, held in position by a screw, so that the coil of material is supported between the two discs 20 and 28 on the arcuate members 21. In this way, the disc 28 may be removed and a coil placed in operative position on the drum quickly. It is usually customary to have a string or wire wrapped about the coil of metal, as shown more particularly at 30 in Fig. 3, and a slot 31 is provided for this purpose. Preferably, a suitable brake 32 is effective through the intermediation of the spring 34 on the hub 19 to provide sufficient tension in the strip of material being removed from the drum to prevent slack between the drum and feed mechanism. The drum on the take-up end

of the machine differs slightly from that described above, in that it has a pulley 35 (Figs. 1 and 2) for a belt 36 so that it may be driven in timed relation with the other mechanisms to create the proper tension in the wrapped coil. Preferably, the belt drive is such that the belt will slip when the tension exceeds a predetermined amount.

The feed mechanism 3 and the take-up mechanism 12 are likewise substantially similar and are shown more particularly in Figs. 6 and 7. The purpose of these mechanisms is to maintain the movement of the strip substantially constant as it is being unwound from one drum and as it is being wound up on the other drum, so that the amount of slack in the strip intermediate the several mechanisms will be substantially the same at all times.

Referring more particularly to Figs. 6 and 7, there is shown a shaft 39 having a roller 40 thereon directly below a roller 41 on shaft 42. A pair of gears 44 and 45 are mounted on the shafts 39 and 42 to drive the rollers 40 and 41 at the same speed. The shaft 42 is mounted in a yoke 46, held in position by a threaded adjusting member 47. Suitable slots 48 in the frame permit slight vertical movement so that any desired pressure may be applied to the strip of material 7 passing between the rollers. The vertical movement of the rollers and of the gear 45 is so slight that it does not affect the drive.

The shaft 39 is operatively connected through a suitable sprocket 50 and clutch 51, operated by a handle 52, to the common drive for the several mechanisms, as will be described hereinafter. The movement of the clutch handle 52 engages the keyed slidable member of the clutch with the jaws of the rotating clutch element.

A suitable groove 54 is provided in the rotating clutch element 55 adapted to receive the belt 36 for driving the take-up drum 14. This groove and belt are omitted in the feed mechanism 3 on the front of the machine; otherwise both the feed and the take-up mechanisms are the same and the above description will serve for both. The clutches 51 are utilized for increasing or decreasing the amount of slack between the respective mechanisms, as desired.

After the strip of material 7 leaves the feed rollers 3, it is allowed to drop down and form a loop or slack portion, as shown in Fig. 2, and then passes into a guideway 56. The guideway 56 passes adjacent the synchronizing mechanism 4 and between the printing rollers of the printing mechanism 5, as shown more particularly in Figs. 2 and 11. After passing the printing rollers, the strip is again allowed to form considerable slack and is passed over a guide 57 into the neutralizing bath. As stated hereinbefore, the strip of material has already been divided into blade portions in a previous operation. In order for these blade portions to register accurately with the printing rollers so that the trade-mark or legend will be centralized with respect to each individual blade forming the continuous strip, it is desirable to have a synchronizing mechanism for maintaining the blade portions of the strip in proper registry with the printing mechanism.

The preferred embodiment of the synchronizing mechanism illustrated herein is shown more particularly in Figs. 2, 8, 11, 12 and 14 and may comprise a pulley or sprocket 59 mounted on a shaft 60, and a second pulley 61 mounted on the stub shaft 62. A suitable belt 64 extends over the pulleys 59 and 61 and has projections 65 adapted to register with the apertures 66 in the strip of material being operated upon. The belt 64 also has apertures 63 therein adapted to register with the projections 67 on the pulleys or sprockets 59 and 61. The lower pulley 59 is preferably mounted adjacent the guideway 56 and sufficiently close thereto so that the projections on the belt 64, passing therethrough, engage the aperture 66 in the strip of material and propel it along the guideway. The upper pulley 61, while mounted adjacent the guideway, is sufficiently removed therefrom so that the projections on the belt as it passes over the pulley do not extend into the guideway. An idling pulley 68 is mounted intermediate the two pulleys 59 and 61 and is adapted to control the portion of the belt which engages the strip of material. The pulley 68 may be adjustably mounted in any suitable manner, for example, it may be mounted on an arm 69 provided with a slot for a bolt 69a adapted to hold the arm in various positions. Preferably, the idling pulley 68 is adjusted so that two of the projections 65 engage apertures in the strip of material. This causes the strip to register with the belt and, at the same time, reduces to a minimum the length of the strip which is in engagement with the projections on the belt. If desired, the pulley 68 may be adjusted so that a larger or smaller number of projections may engage the belt, but the minimum number giving effective results is desired because the distance between the apertures in the strip of material may vary, as pointed out hereinbefore, and hence the greater the number of projections fitting into the apertures of the strip simultaneously, the greater will be the variations that have to be compensated for in both the belt and in the strip. These variations are occasioned by irregularities in the belt and by previous operations on the strip of material.

The stub shaft for the upper pulley 61 is preferably mounted on a plate 70 pivoted to the frame work of the machine at 71 (Fig. 8). The opposite end of the plate has an adjustment screw 72 in engagement therewith for controlling the amount of slack or tension in the belt 64. After the proper adjustment has been made in the belt, a bolt 73 fitting in a slot in the plate 70 is tightened to hold the plate and pulleys in their adjusted position.

The feeding mechanism 4 should be accurately synchronized with the printing rollers 94 and 95 and there is provided for this purpose means for adjusting the angular position of the roller 59 about its drive shaft 60. This adjusting means is shown more particularly in Figs. 8, 11 and 15. The end of the shaft 60 (Fig. 15) is formed with a slot 76 adapted to receive an arm 77, which may be held in position by a bolt 78 to fix the pulley 59 in position on the end of the shaft. The pulley 59 has a substantially U-shaped member 79 thereon adapted to extend about the arm 77. The free ends of the U-shaped member have adjustment screws 80 (Fig. 11) therein adapted to engage the sides of the projecting arm 77. By adjusting the screws 80, the angular position of the U-shaped member 79 and likewise the attached pulley 59 may be adjusted with respect to the shaft 60 so that the pulley 59 and belt 64 thereon may be synchronized with the pads on the printing rollers. By utilizing the set screws 80, minute changes in the adjustment may be made so that the respective blades of the strip 7 register accurately with the pads on the printing rollers. Failure by as much as a small frac-

tion of an inch to have the legend on the blade properly centralized is noticeable because, ordinarily, the margin between the end of the printing and the end of the blade is relatively small. The driving gear 81 on shaft 60 for the synchronizing mechanism is driven directly from the drive gear for the printing roller through the intermediation of the intermeshing gear 82. The strip moves continuously past the synchronizing mechanism to the printing mechanism and is delivered to the printing mechanism at the proper speed to avoid slack or tension therein.

Preferably, the guideway 56 adjacent the synchronizing mechanism is provided with a removable cover 84, as shown more particularly in Figs. 11, 12 and 13, which is hinged by a pin 83 so that it may be opened and closed to permit access to the portion of the strip adjacent the synchronizing mechanism. The cover 84 has a slot 85 at its free end and is adapted to be secured in position by a latch member 86 hinged by a pin 87 and adapted to engage in a slot 85 of the cover when the latch is in closed position.

Preferably, the cross-sectional dimensions of the slot are as shown more particularly in Fig. 13, a channel 75 being provided above and below the strip of material to permit substantial flexing thereof, and to allow the projection 65 on the belt 64 to pass through the apertures in the strip. The space provided by the channels 75 is particularly important after the strip passes the printing rollers, since it prevents any smearing of the acid applied by the printing rollers.

The construction of the printing mechanism can be best understood by reference to Figs. 2 and 8. Various details of the mechanism, as well as the drive therefor, illustrated in other figures, will be referred to after the description of the mechanism in these two figures.

The various parts of the printing mechanism are mounted on a vertical partition or frame 140 (Figs. 8 and 9), the driving gears being on one side of the partition and the acid applying mechanism on the other side. The partition serves as a mounting frame for the various shafts and protects the driving mechanism from the acid. In this manner, a minimum number of parts are exposed to the acid.

As shown more particularly in Fig. 8, a pair of downwardly depending plate members 88 and 89 are pivoted on the frame by means of the shafts 90 and 91 extending through their upper ends. A pair of shafts 92 and 93 extend through the central part of said members 88 and 89 and have the printing rollers 94 and 95 mounted thereon. The strip of material 7, to be printed, passes between the two printing rollers in a continuous movement, with the individual blade portions registering with a series of pads on the printing rollers. The details of the construction of the printing rollers will be described hereinafter. Suitable screw adjustments 96 and 97 are provided to engage the opposite sides of the pivoted members 88 and 89 at the lower ends thereof, and a spring 98 is mounted between said pivoted members in suitable slots 103, as shown. The spring 98 tends to force the two printing rollers away from each other at all times. The screw members of the adjustment devices 96 and 97 are adjusted to force the printing rollers about their pivots 90 and 91 toward each other to apply as much pressure to the strip being printed as desired.

A suitable mechanism is provided for applying an etching acid to the printing rollers and may be the same for each of the printing rollers. For convenience, the mechanism for applying acid to the printing roller 95 will be described and the parts of the similar mechanism for applying acid to the printing roller 94 will be correspondingly numbered to avoid duplicating the description.

A plate 99 is pivoted about a shaft 100 and has mounted thereon a shaft 101 carrying a transfer roller 102. Pivotally mounted also on the member 99 is a plate member 104 pivoted by a bolt 105. A second transfer roller 106 is rotatably mounted on this pivoted plate 104 by a bolt 107. A spring 108 tends to raise the right side of the plate 99 about its pivot to move the transfer roller 102 away from the printing roller 95. An adjustment screw 110 may be adjusted to force the right side of the plate downwardly and to press the transfer roller 102 against the printing roller 95 to obtain any desired pressure. A spring 111 tends to pull the plate 104 about its pivot and to move the transfer roller 106 away from the transfer roller 102. An adjustment screw 112 is adapted to counteract the force of the spring and to press the transfer roller 106 against the transfer roller 102 with any desired pressure. By means of the two adjustments 110 and 112, any desired contacting pressure may be imposed upon the transfer rollers 102 and 106.

A suitable roller 114 mounted on an arm 115 pivoted at 116 is in contact with the acid solution 117 in the reservoir 118 and intermittently contacts with the roller 106. As shown more particularly in Figs. 23 and 26, the roller 114 is provided with a helical thread or ridge 119, the ends of which preferably terminate at the edge of the roller 106. The purpose of providing the roller 114 with ridges is to minimize the amount of acid applied to the roller 106 and to minimize also the thickness of the film and to increase the uniformity thereof as the acid is transferred from one roller to another. The mechanism for periodically raising and lowering the roller 114 to have it contact intermittently with the roller 106 will be described hereinafter.

Any suitable acid reservoir may be provided but, as here illustrated, a metallic reservoir 118, preferably of stainless steel or some other metal which is not subject to corrosion, is mounted on the framework by means of a pair of bolts 120 which may be readily loosened to remove the reservoir for emptying, cleaning or the like. At one side of the reservoir, there is preferably provided a cylindrical chamber 121 having a piston 122 therein (Figs. 8 and 27), which may be raised or lowered by means of the screw 124. The purpose of the piston or cylinder 122 is to raise or lower the level of the acid in the reservoir by displacing part of the acid by the piston. In this way, the level may be maintained constant without continually adding acid to the reservoir.

While any desired construction of printing rollers may be utilized, the preferred embodiment illustrated herein is shown more particularly in Figs. 8, 9, 11, 14, and 16 to 19. The printing rollers 94 and 95 are similarly constructed and a description of one only will be given. Preferably, the printing roller has a groove 126 extending across the peripheral surface thereof and a strip of metal 127 is adapted to be bent about the printing roller with the projections 128 on the end of the strip fitting into the slot 126 so that the metal strip cannot slip with respect to the printing roller. A series of pads 129, as shown more particularly in Figs. 17 and 19, are attached to the strip 127. These pads may be cemented in position or secured to the strip in any other suit-

able manner and are preferably made of rubber. When the strip 127 with the pads thereon is wrapped about the printing roller, with the projections on the end secured in the slot 126, a pair of end plates 130 having a peripheral flange 131 are telescoped over the respective ends of the roller so that the flange fits over the edges of the strip or band 127. Thereafter, the printing roller is placed on the shaft and secured in position by the nut 132 which holds the plates 130 in position. A suitable pin 134 may be utilized to key the printing roller to the shaft.

The construction of the transfer rollers 102 is shown more particularly in Figs. 2, 8 and 10 of the drawings. Preferably, these rollers have a rubber pad 135 secured to the periphery thereof and a strip of fabric 136, for example linen, secured over the pad. While any suitable means may be utilized for achieving this result, preferably the ends of the fabric are passed through the radial slot 137 in the roller 102 and threaded through a slot in the bolt 138. Thereafter, the bolt is rotated to take up the slack in the strip of fabric extending about the transfer roller and to create any desired tension in the strip. By tightening the nut 139 on the bolt, the bolt may then be held in its proper position for maintaining the tension in the band 136.

The drive for the printing mechanism, as well as for the rest of the machine, is shown more particularly in Figs. 1, 8, 9, 14, 20 and 21 and is supported from the acid side of the printing mechanism by a metal partition 140 to minimize the effect of the acid on these parts. Referring more particularly to Fig. 9, a motor 15 drives, through a suitable speed reducing mechanism, a shaft 141 which is connected through a clutch 142 of the conventional type to a sprocket 144. The clutch lever 133 may be utilized for stopping and starting the machine without stopping the motor.

The sprocket 144 is connected by a chain 145 to a sprocket 143 on shaft 91, which serves as a pivot for the plate member 89 (Fig. 8), carrying the printing roller 95. The shaft 91 carries the gear 82, which meshes with a gear 146 (Fig. 20) immediately below it on shaft 93, carrying the printing roller 95. The gear 82 is also connected to drive the other printing roller 94 through gear 147 on shaft 90, which serves as a pivot for the plate 88 and gear 147 on shaft 92, which is keyed to the printing roller. The two printing rollers are, therefore, geared together and rotate at the same speed. It will be noted also that the driving gears for each printing roller are mounted on the shafts 90 and 91 which are the pivots for the plate members 88 and 89. Hence, any adjustment of the printing rollers to or from each other does not affect the drive or the meshing of the gears in any way because the printing rollers and the gears on their shafts are moved about the shafts of the drive gears as pivots. The distance between the centers of the intermeshing gears does not change as a result of the adjustments.

Each of the gears 82 and 147 also mesh with gears 149 and 150 on the shafts 100, the latter being the pivots for the plate members 99 supporting the transfer rollers 102. Mounted directly below the gears 149 and 150 are gears 151 and 152 on shafts 101 for driving the transfer rollers 102, which contact with the printing rollers. The transfer rollers, being geared to the driving gears for the printing rollers, rotate at the same speed as the printing rollers. This prevents wear and also provides a more uniform film of acid.

The transfer rollers 106 are not driven except by contact with the transfer rollers 102. The rollers 106 may be plain metal rollers, preferably of stainless steel.

In order to prevent smearing of the acid being applied to the strip of metal 7 by reason of play in the gears, the printing roller shafts 92 and 93 preferably have suitable braking devices 154 and 155 (Fig. 20) which may be adjusted by means of bolts 156 to prevent backlash or other undesired movements tending to mar the printing.

The synchronizing mechanism is also driven from the gear 82 by the intermeshing gear 81 on shaft 60.

For the purpose of driving the feed and take-up rollers 3 and 12, a chain 157 extends along the entire length of the machine and passes over suitable sprockets 50 on the feed mechanism 3 and take-up mechanism 12. This chain is driven by means of the sprocket wheel 143 through the intermediation of gears 147, 150 and 152, and sprocket wheel 158. Suitable idling and slack adjusting sprocket wheels 159 and 160 are provided to cooperate with the the sprocket wheel 158. The idling sprocket 160 may be adjusted to take up slack by means of the bolt 161 in slot 162.

The mechanism for causing the ridged roller 114 to contact with the transfer roller 106 at intervals is shown more particularly in Figs. 8, 9, 20, and 22 to 25.

As illustrated in dotted lines on the left side of Fig. 8, and as illustrated in full lines in Fig. 22, a spring 166 pressing a pin 163 against the arm 115 tends to retain the ridged roller 114 in its upper position, that is, in contact with the transfer roller 106. The preferred embodiment illustrated herein contemplates moving the ridged roller downwardly periodically in opposition to the spring 166. The mechanism for achieving this result is shown in detail in Figs. 22 and 23. The supporting arms 115 for the ridged rollers are engaged by a pair of arms 168 mounted on the ends of a shaft 169 and extending through slots 178 in the frame so that only the ends thereof are exposed to the acid side of the mechanism. The shaft 169 is mounted in suitable supporting bearings 170 attached to the frame. The arms 168 are normally held in their upper position by a spring 171. One end of the shaft 169 has an arm attached to a vertical rod 172 with a member attached to its upper end and slotted at 174 to fit about a shaft 175. The member 173 has a cam roller 183 secured thereto by a bolt 176 for engaging a cam 177. As the shaft 175 rotates, together with cam 177, the cam moves the rod 172 together with arms 168 and the ridged roller supporting arms 115 downwardly, which moves the rollers 114 out of contact with the transfer rollers 106. As the dwells 179, here shown as three in number, pass the cam roller, the spring 171 on the opposite end of the shaft 169 raises the rod 172 and the arms 168, permitting the spring 166 to raise the ridged rollers 114 into contact with the transfer roller 106.

The cam 177 may be rotated in any suitable manner but, as here illustrated, the gear 149 on shaft 100 has a plurality of projections or rollers 180 thereon adapted to raise an arm 181 having a pawl 182 operatively connected thereto and in engagement with a ratchet wheel 184 (Fig. 25). A spring 185 normally retains the arm 181 in lowered position. The projections 180 raise the arm and turn the ratchet wheel 184 a predetermined amount and a latch 187 holds it in

this position while the spring 185 pulls the arm 181 down in position to be engaged by another projection 180. The speed of the ratchet wheel 184 may be increased or decreased, as desired, by removing or adding the projections 180. The ratchet wheel is operatively connected to the cam 177 to rotate it. The latches 182 and 187 are held in effective position by means of springs 190 and 191.

After the strip of material passes through the printing mechanism, the acid has sufficient time to etch the legend on the metal before the strip passes over the guide 57 into the reservoir 194 containing the neutralizing solution 6 which may, for example, be lime and water. The strip of material passes under a suitable guide roller 196, as shown more particularly in Figs. 2 and 28, which has a channel 197 formed therein to receive the strip and has its central portion recessed at 198 to prevent any possible smearing of any acid which may remain on the strip. The guide 57 at the entrance to the reservoir is likewise channeled to prevent any contact with the central portion of the strip in order to avoid smearing.

As the strip leaves the neutralizing bath, it passes a blower 8 which is connected to pipes 199 leading to a suitable source of compressed air where as much as possible of the liquid on the strip is blown off. The remaining liquid is dried from the strip while it is passing through a heater 9. The heater 9 is preferably an electric heater, although any type of drying device may be utilized. From the electric heater, the strip passes into a reservoir 200 containing a supply of oil 10. In passing through the reservoir, the strip passes under a guide 201 which maintains it immersed on the oil for a substantial distance. Upon leaving the oil reservoir, the strip passes a blower or air stripper 11, which removes excess oil therefrom, and then passes through the take-up mechanism 12 and is delivered to the take-up drum 14 where it is wound into a coil.

In the operation of the machine, a coil of metal in strip form is placed on the drum 2, and the cam 25 is rotated to expand the drum into secure engagement with the inside of the coil. Thereafter, the wire or string 30 is cut or removed and the end of the strip may be threaded through the various mechanisms of the machine. The feed rollers 3, being geared to the main drive of the machine through sprockets 50 deliver the strip at the proper speed and maintain a substantial amount of slack, as shown more particularly in Fig. 2, to permit the printing mechanism 5 to operate without having to overcome any resistance to the movement of the strip. The strip enters the printing mechanism through a guideway 56 which passes adjacent to the synchronizing mechanism 4. The latter comprises the pulleys or sprockets 59 and 61 having a belt 64 thereon. The projections 65 on the belt engage the apertures in the strip of the material 7 and convey the strip along the guideway. By means of the adjusting screws 80, the rotation of the pulley 59 and the movement of the belt 64 may be synchronized with the printing rollers 94 and 95 (Fig. 8) to properly register each blade portion of the strip with a pad on the printing rollers. In this way, the legends on the blades are properly centered. The synchronizing mechanism and the feed rollers being driven from the same source, the feeding mechanism feeds a strip to the printing rollers at the same speed that it is being printed, thereby eliminating any pull on the strip and minimizing any tendency for the printing rollers to smear the legend.

Acid is transferred to the printing rollers from the acid reservoirs 118 by means of the transfer rollers 102, 106 and 114. The transfer rollers 102 are driven through gears operatively connected to the gears rotating the printing rollers and, hence, rotate at the same speed as the printing rollers. The transfer rollers 106 are not driven except by contact with the transfer rollers 102. The roller 114, partially immersed in the acid, is intermittently operated to contact with the transfer roller 106 at intervals.

The printing rollers 94 and 95 are pivoted about the shafts 90 and 91 of their driving gears. In this way, the printing rollers may be adjusted to and from each other without disturbing the driving connection. The transfer rollers 102 are driven in like manner. The operation of the mechanism for driving the printing rollers, the synchronizing feed and the transfer rollers may be most easily understood from Figs. 9 and 20. The motor 15 is operatively connected through shaft 141, clutch 142, sprocket 144, chain 145 and sprocket 143 to shaft 91. Shaft 91 has a gear 82 meshing with the gear of one of the printing rollers and driving the gear of the other printing roller through the intermediate gear 147. The transfer rollers and the synchronizing rollers are also driven by gears operatively connected to the gear 82.

The mechanism for intermittently raising and lowering the ridged roller 114 is shown more particularly in Figs. 22 to 25. This comprises a pawl and ratchet mechanism operatively connected to the gear 149 (Fig. 9) for rotating a cam 177 which lowers the rollers 114 in opposition to spring 166 through the arms 168 and shaft 169, at intervals.

After leaving the printing mechanism, the strip passes over the guide 57 under the roller 196 immersed in the neutralizing bath and past a blower 8 and heater 9 for removing the neutralizing solution to prevent rust. Thereafter, the strip passes through an oil bath 10 and after being subjected to a blower 11 is passed through the take-up rollers 12 onto the drum 14, where it is wound into a coil. The coil, when completely wound, may be removed from the drum by collapsing the arcuate members of the drum by means of the cam 25. Thereafter, the wound coil may be stored or delivered to other machines for additional steps in the manufacture of the blades.

It will be seen that the present device provides a simple mechanism for printing legends on a strip of material adapted to be formed into razor blades, for neutralizing the acid used on the strip, and for applying a preservative oil to prevent rust. These operations are accomplished rapidly on a continuously moving strip. The various operations are performed without stopping the strip, thereby increasing the speed of the operations and minimizing the time required for the printing. Improved results are obtained by utilizing a very thin film of acid spread uniformly over the printing rollers and uniformly applied to the strip without smearing. The thin film, in addition to giving better results, minimizes the amount of acid used and reduces the cost of the printing operation. A minimum number of parts on the machine are exposed to the acid, the remainder being enclosed to prevent rust. All of the parts of the machine are accessible for repairs or adjustment and, pref-

erably, the various parts associated with the printing mechanism and exposed on the acid side thereof are made of stainless steel or some other material which is not likely to rust. The mechanism for conveniently maintaining a constant level of the acid aids in obtaining uniform results. The mechanism for accurately synchronizing the feed rollers with the printing mechanism minimizes any tendency for the printing rollers to smear the acid applied to the strip and insures accurate registry of the legends on each of the blade portions of the strip.

While the present device is described with particular reference to the use of acid as the etching fluid, the device may be used with other printing or etching fluids and the term "acid" is to be understood to include, in a generic sense, any type of etching or printing fluid.

As various changes may be made in the form, construction and arrangement of parts without departing from the spirit and scope of the invention and without sacrificing its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In a device of the class described, the combination of a guideway, a pair of rotatable members mounted adjacent said guideway, a belt on said rotatable members adapted to engage a strip of material and convey it along said guideway, and means for controlling the length of the portion of the belt in engagement with said strip.

2. In a device of the class described, the combination of a guideway for a strip of material adapted to be formed into safety razor blades, a pair of rotatable members, a belt on said members having projections adapted to engage said strip of material, means including a shaft for driving one of said members, and means for adjusting the angular relation of said driven member with reference to the driving shaft.

3. In a device of the class described, the combination of a guideway for a strip of material adapted to be formed into safety razor blades, a rotatable member having projections thereon adapted to engage apertures in said strip of material to control the longitudinal movement thereof, a shaft for said rotatable member, and means for adjusting the angular position of said rotatable member on said shaft, said means comprising a radial extension on said shaft, and adjustable means on said rotatable member for engaging said extension.

4. In a device of the class described, the combination of a guideway for an apertured strip of material adapted to be formed into razor blades for safety razors, a pair of rotatable members, a belt on said members adapted to engage said strip of material, and an idler for controlling the amount of engagement between said belt and said strip.

5. In a device of the class described, the combination of a guideway for an apertured strip of material adapted to be formed into safety razor blades, a pair of rollers adapted to engage opposite sides of said strip, means on said rollers for applying a legend to said strip, a rotatable member having projections associated therewith adapted to engage the apertures of said strip, and means for operatively connecting said rotatable member and said pair of rollers to cause the blade portions of said strip to register accurately with the legend applying portions on said rollers.

6. In a device of the class described, the combination of a printing roller for applying acid to a strip of material adapted to be formed into razor blades, a second roller for applying acid to said printing roller, a shaft for swingingly mounting said printing roller, a shaft for swingingly mounting said second roller, said rollers being driven by gears mounted on the axes of their pivots whereby they may be adjusted toward and away from each other without disturbing their driving connection.

7. In a device of the class described, the combination of a pair of printing rollers adapted to engage the opposite sides of a strip of material adapted to be formed into safety razor blades, gears mounted on the axes of the rollers, driving gears meshing with said first gears, means for pivotally mounting said rollers about the axes of said driving gears whereby said rollers may be adjusted toward and away from each other without interfering with the driving connection.

8. In a device of the class described, the combination of a printing roller adapted to engage the surface of a strip of material adapted to be formed into safety razor blades, a gear mounted on the axis of the roller, a driving gear meshing with said first gear, a series of transfer rollers adapted to cooperate with each other and with said printing roller, a gear mounted on axes common to the axes of one of said transfer rollers, a driving gear meshing with said last mentioned gear, means for pivotally mounting said printing roller and said transfer rollers about the axes of said driving gears whereby said rollers may be adjusted about their pivots without interfering with the driving mechanism.

9. In a device of the class described, the combination of a guideway for a strip of material adapted to be formed into safety razor blades, a pair of printing rollers adapted to engage the opposite surfaces of said strip to apply a legend thereto, transfer rollers adapted to cooperate with said printing rollers to transfer an acid to said printing rollers, a gear mounted on the axis of each of said rollers, driving gears meshing with said first gears, means for pivotally mounting said rollers about the axes of said driving gears, whereby said rollers may be adjusted toward and away from each other without interfering with the driving connection.

10. In a device of the class described, the combination of a guideway for a strip of material adapted to be formed into safety razor blades, a pair of printing rollers adapted to engage the opposite surfaces of said strip to apply a legend thereto, transfer rollers adapted to cooperate with said printing rollers to transfer an acid to said printing rollers, a gear mounted on the axis of each of said rollers, driving gears meshing with said first gears, means for pivotally mounting said rollers about the axes of said driving gears whereby said rollers may be adjusted toward and away from each other without interfering with the driving connection, a pair of reservoirs for acid, and a roller in each of said acid reservoirs adapted to transfer acid from said reservoir to a transfer roller.

11. In a device of the class described, the combination of a feeding mechanism for strip material adapted to be formed into safety razor blades, a printing mechanism for said strip, an accurately synchronized feed mechanism for said printing mechanism, a take-up mechanism for delivering said strip to a storage reel, and a common drive for said feeding mechanism, said syn-

chronizing mechanism, said printing mechanism and said take-up mechanism.

12. In a device of the class described, the combination of a pair of rollers, means on said rollers for printing legends on both sides of a strip of material having apertures therein, a belt for feeding the strip of material to said rollers, said belt having spaced projections thereon adapted to register with the apertures in the strip to position the strip with respect to said printing means, a guideway effective upon the edges of the strip for guiding the strip of material to said rollers and holding said strip in alignment with the projections on said belt, and a second guideway for guiding the strip of material from said rollers after the legends are printed thereon.

13. In a device of the class described, the combination of a frame, a guideway for a strip of material, a rotatable member, a second rotatable member, a belt extending about said rotatable memer for engaging a strip of material in said guideway, a member pivotally mounted on said frame and supporting said second rotatable member at one end thereof, and means at the other end of said pivotally mounted member for changing the position of said pivotally mounted member for regulating the amount of slack in said belt.

14. In a device of the class described, the combination of a pair of rotatable members, a belt on said rotatable members having sprockets thereon adapted to engage a strip of material, a guideway for holding the strip of material in position to be engaged by said sprockets, said guideway having a groove therein to permit said sprocket projections to enter and move along said guideway and an idling pulley for urging said belt toward the groove.

15. In a device of the class described, the combination of a guideway for a strip of material, a pair of rotatable members, one of said members having its outer periphery closer to said guideway than the other of said members, a belt on said members adapted to engage the strip of material and move it along said guideway, and means intermediate said rotatable members for urging the portion of said belt adjacent to the rotatable member which is closer to said guideway toward said guideway.

16. In a device of the class described, the combination of a guideway for a strip of material having apertures therein, a pair of rollers adapted to engage said strip having means thereon for applying a legend to said strip, a belt adjacent to said strip having projections associated therewith adapted to engage the apertures of said strip, a rotatable member for moving said strip having means for preventing slippage between said belt and said rotatable member, means for operatively connecting said rotatable member and said pair of rollers, and means associated with said connecting means for adjusting the relative position of said belt with respect to the legend applying means on said rollers.

17. In a device of the class described, the combination of a guideway for a strip of material adapted to be formed into safety razor blades, a rotatable member, a belt on said member having means adapted to engage said strip, means including a shaft for driving said rotatable member, means for adjusting the angular relation of said driven member with reference to the driving shaft, and legend applying means operatively connected to said driving means.

18. In a device for applying legends to a metallic strip having preformed apertures therein, said strip being adapted to be formed into safety razor blades the combination of a roller, means on said roller for applying a legend on each of the blade portions of said strip, and means adjacent said strip moving in one direction and having projections adapted to extend into said apertures, said projections being spaced and positioned with respect to said strip so that a plurality of projections simultaneously extend into a corresponding number of apertures to accurately register said blade portions with the legend applying means on said roller.

19. In a device of the class described, the combination of a guideway for an apertured strip of material adapted to be formed into safety razor blades, a pair of rollers mounted to engage opposite sides of said strip, a series of pads mounted on the periphery of at least one of said rollers to apply a legend to each blade portion of the strip, a rotatable member having projections adapted to extend into the apertures of said strip for controlling the longitudinal movement of said strip and feeding it to said rollers, and means for operatively connecting said feeding member to said rollers to cause the blade portions of said strips to register accurately with the pads on said roller.

20. In a device of the class described, the combination of a guideway for a strip of material adapted to be formed into safety razor blades having preformed apertures therein, a roller having means for applying a legend to the strip, a rotating belt member having a plurality of projections thereon adapted to engage the apertures of said strip and feed it to said roller, and means for operatively connecting and adjusting the relative circumferential position of said rotating member and said roller to cause the blade portions of the strip to register accurately with the legend applying means on said roller.

21. In a device of the class described, the combination of a guideway for an apertured strip of material adapted to be formed into safety razor blades, a roller at one end of said guideway having means for applying a legend to the strip, a rotating member adjacent said guideway having a plurality of projections thereon adapted to engage the apertures of said strip and feed it to said roller, drive means for said rotating member, and means associated with said drive means for operatively connecting and adjusting the relative position of said rotating member and said roller to cause the blade portions of the strip to register accurately with the legend applying means on said roller.

22. In a device of the class described, the combination of a guideway for a strip of material having recesses therein and adapted to be formed into safety razor blades, a pair of rollers adapted to engage opposite sides of said strip, means on said rollers for applying a legend to said strip, a movable member having projections associated therewith adapted to engage the recesses of said strip, and means for operatively connecting said movable member and said pair of rollers to cause the blade portions of said strip to register accurately with the legend applying portions on said rollers.

23. In a device of the class described, the combination of a pair of printing rollers adapted to engage the opposite sides of a strip of material adapted to be formed into safety razor blades, means adapted to be driven mounted on the axes of the rollers, rotatable driving means in driving connection with said drive means, means for

pivotally mounting said rollers about the axes of said driving means whereby said rollers may be adjusted toward and away from each other without interfering with the driving connection.

24. In a device of the class described, the combination of a guideway for a strip of material adapted to be formed into safety razor blades, a pair of printing rollers adapted to engage the opposite surfaces of said strip to apply a legend thereto, transfer rollers adapted to cooperate with said printing rollers to transfer an acid to said printing rollers, means adapted to be rotated mounted on the axis of each of said rollers, rotating means in driving connection with said rotated means, means for pivotally mounting said rollers about the axes of said rotating means whereby said rollers may be adjusted toward and away from each other without interfering with the driving connection, a pair of reservoirs for acid, and a roller in each of said acid reservoirs adapted to transfer acid from said reservoir to a transfer roller.

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