

June 29, 1954

H. F. WELSH ET AL
STRIP HANDLING MACHINE

2,682,335

Filed Dec. 28, 1949

2 Sheets-Sheet 1

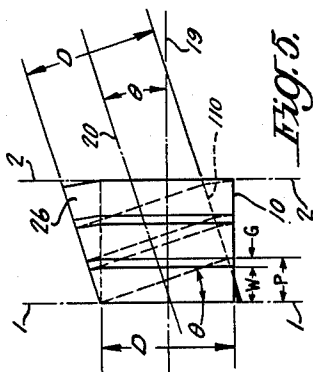


Fig. 5.

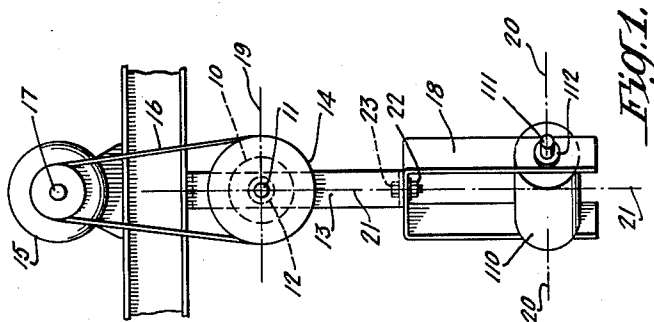


Fig. 1.

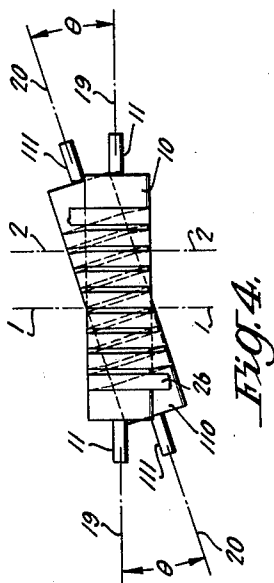


Fig. 4.

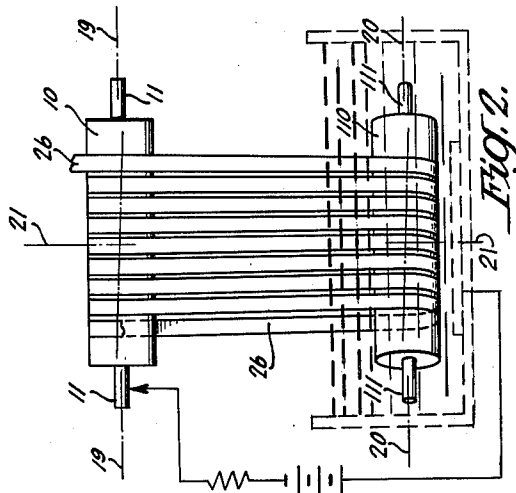


Fig. 2.

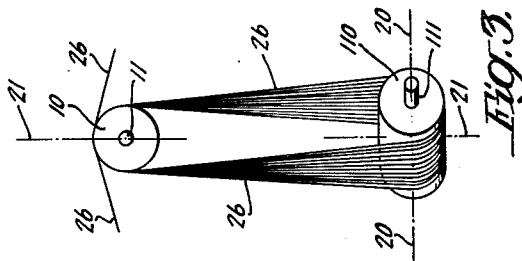


Fig. 3.

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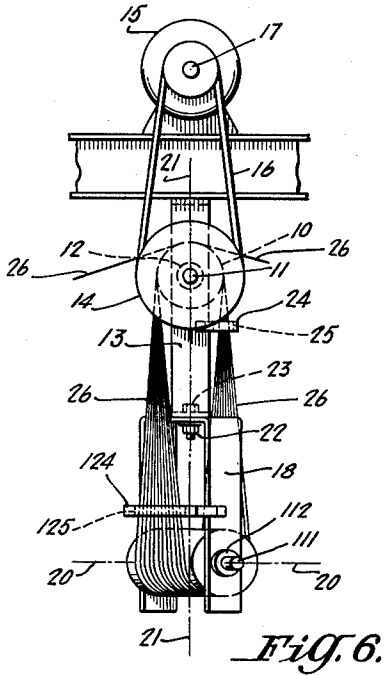


Fig. 6.

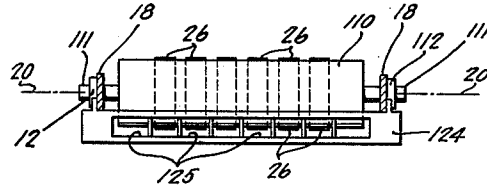


Fig. 8.

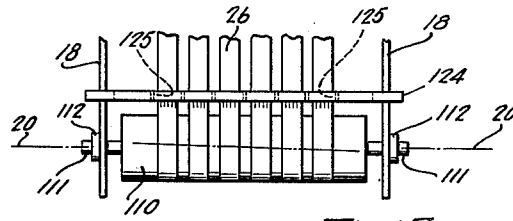


Fig. 7.

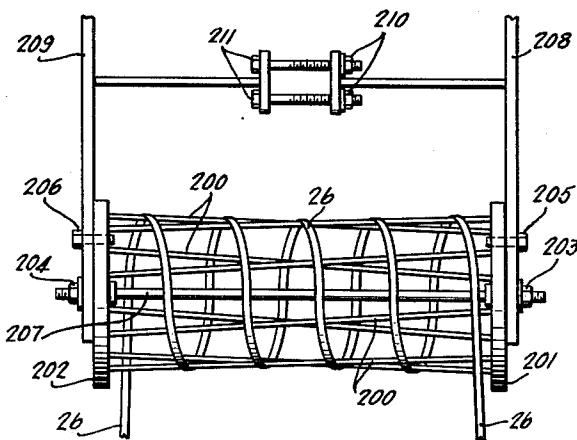


Fig. 9.

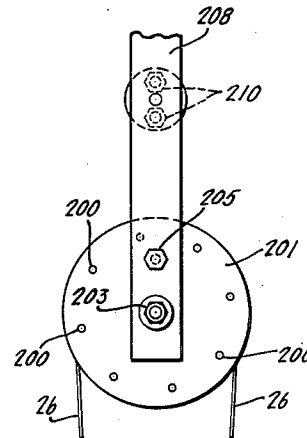


Fig. 10.

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UNITED STATES PATENT OFFICE

2,682,335

STRIP HANDLING MACHINE

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3 Claims. (Cl. 203—280)

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This invention relates generally to a strip or tape handling apparatus which may be used in connection with, but whose utility is not limited to, such processes as electroplating, drying, and photographic development of film strips.

Heretofore strip handling devices have utilized pairs of parallel cylinders in combination with guides such as combs, grooves and slots to direct the strip progressively along the length of the cylinder. If the strip was started on a cylinder or a roller in a direction perpendicular to the axis of the cylinder the strip would overlap upon itself. If the strip was started in a direction not perpendicular to the axis the strip would not overlap, but would tend to progressively traverse the length of the cylinder. That is, as the cylinder revolved the place where the tape was received by the cylinder tended to move to the left or right displacing the strip along the cylinder. Guides as used in the prior art provide a counter force along the edge of the strip to prevent such action. The result is slippage of the strip on the cylinder, vibration or undulation in the strip, instability in the handling of the strip, and extensive damage to the edges of thin strips of material, making it impractical for use in such cases.

In this invention a work piece in strip form is fed through a roller train without the use of complex guides for each wrap about a roller group. The strips do not overlap or traverse the support members; vibrations or undulations are greatly reduced, and there is greater stability in handling of strips. Of great importance is the fact that the invention makes possible the handling of very thin strips of material with negligible distortion.

An object of this invention is to provide a new and improved machine for efficiently handling strips of flexible material.

Another object of this invention is to provide a machine peculiarly adapted to handle very thin strips of material (.001 inch or less) without distortion of or injury to said strip.

Another object of this invention is to provide a machine which may be readily adjusted to handle strips of different widths.

Still another object of this invention is to provide a machine for handling strips of material which is capable of adjustment to accurately maintain a given clearance between adjacent loops of a strip.

A further object of this invention is to provide a machine conveniently and effectively producing an even plating on a strip of material subjected to an electroplating process.

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Yet another object of this invention is to provide a strip handling machine less costly and simpler in construction than any heretofore known.

With the foregoing discussion in mind, this invention itself will be most readily understood from the following detailed description of a representative embodiment thereof, reference for this purpose being had to the accompanying drawings in which:

Figure 1 is an end view of the machine;

Figure 2 is a side view of the cylinders of the machine with a strip of material thereon; and disclosing, by way of example, the use of the invention with conventional electroplating apparatus (shown in dotted lines);

Figure 3 is an end view of Figure 2;

Figure 4 is a top view of Figure 2;

Figure 5 shows an enlarged section between lines 1—1 and 2—2 of Figure 4;

Figure 6 is an end view showing a modified form of the machine;

Figure 7 is a side view of the lower section of Figure 6;

Figure 8 is a top view of Figure 7;

Figure 9 is a side view of a second machine with a strip of material thereon, and

Figure 10 is a right end view of Figure 9.

Like reference numerals designate like parts throughout the several views.

Referring now to the drawings, numeral 10 designates a cylinder or roller having an axially disposed horizontal shaft 11 which is supported for rotation in suitable bearings 12 and end frame 13. It is noted that non-rotatable strip receiving bodies can be utilized if the strip is made to slide over the contacted surfaces of the said bodies. The end of shaft 11 is fitted with a drive wheel 14 which is linked to the drive shaft 17 of an electric motor 15 by means of a drive belt 16. The motor 15 may be reversible and adapted for variable speed operation. It is mounted on the frame 13, which frame is attached to any suitable structure (not shown in drawing). Although the motor drive is desirable, the machine may be operated satisfactorily without it if the strip can bear a tension upon it as it leaves the device.

A cylinder 110 and its shaft 111 are physically similar to 10 and 11, respectively, having equal diameters and lengths. Support is provided by suitable bearings 112 mounted in an inverted U-shaped frame 113. This frame is connected to 13 by a nut and bolt 22 and 23, respectively.

Cylinders 10 and 110 as shown in Figures 1, 2, 3 and 4 are positioned so that their axes 11 and

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111 lie in parallel planes with the axis of one cylinder angularly displaced relative to the axis of the other by the angle θ . By adjustment of the frame 18 about its support point, cylinder 110 may be rotated around a perpendicular line 21 intersecting the axes of the said cylinders at their centers (Figure 4). The said angle may be varied by loosening the nut 22 which allows an angular displacement between frame 13 and frame 18. The angular relationship between 10 and 110 is relative and it does not matter whether 10 or 110 is displaced to vary θ . It is also to be understood that the displacement θ of the cylinders need not be limited to the rotation about an axis such as 21, but may be about any axis which is perpendicular, though not necessarily intersecting both the axes 19 and 20 (Figure 5).

In the operation of the machine, as the cylinder 10 is revolved a strip of material 26 is fed onto the said cylinder from a supply reel (not shown) so that each edge of the strip while it is in contact with the cylinder is in a plane perpendicular to the axis 19. For this reason, as explained above, the strip does not axially traverse the roller and stability is achieved.

The strip 26 after leaving 10 moves to 110 where it passes around 110 in the same manner as described for 10, with the same resulting stability. The strip then again returns to 10 forming a loop.

Upon returning to 10 the strip assumes a position on 10 adjacent to the position taken by the strip as it is first fed onto the cylinder 10. The strip 26 thus continues to pass back and forth about the cylinders 10 and 110 forming a number of loops until it leaves the machine as it entered it, with its edges in a plane perpendicular to the axis of the cylinder it leaves. It may be, thus, observed that because of the symmetrical relationships involved the direction of the strip 26 may be reversed or the strip 26 fed onto either cylinder and may be taken off either cylinder.

It can be noted that the strip 26 in passing from one cylinder to the other is twisted through an angle of θ , and is then twisted back through θ , when it returns. The rate of twist can be increased or decreased by either decreasing or increasing, respectively, the distance between the parallel planes in which the axes 19 and 20 lie.

The distance between the corresponding edges of adjacent loops lying side by side on a cylinder is hereby defined as the pitch of the machine. The pitch of the machine is a function of the diameters of the cylinders as well as θ . In the instant case where the diameters are equal it will be seen by referring to Figure 5, that the pitch is equal to the diameter D of the cylinder times the sine of the angle θ . Furthermore, it appears that the pitch P, is equal to the gap G, plus the width of the strip W. Therefore, by changing θ , any values may be given to G and W, so that the machine can be adjusted to handle different widths of strip with any desired gap between loops of the strip. Although the size of the loops vary along the lengths of the cylinders 19 and 20 the pitch remains sensibly constant.

Referring now to Figures 6, 7 and 8, bars 24 and 124 of rectangular cross-section, are supported at their ends by attachment to the frames 13 and 18, respectively. The bars contain a multiplicity of slots 25 and 125. The distance along the line of slots from an edge of a slot to the corresponding edge of the next adjacent slot is

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equal to the pitch of the machine which has been defined above.

Guides 24 and 124 may be used in connection with the above described machine to provide greater stability when the strips are defective. When strip edges are curved in the plane of the strip it tends to make the strip shift its points of contact on the cylinders. When the guides are used the loops of the strip pass through the slots in each of the guides and damage due to any irregularity in the strip is prevented. Otherwise, as explained above, the guides are not needed.

This machine is generally useful in diverse applications and is especially valuable when used to plate ordinary and very thin strips of material in an electroplating process. Usually when strips are electroplated there is a greater build up of plating along the edges because of the concentration of current density at places of greater curvature. By the use of this machine the strip can be handled so that the gaps between the loops are small (0.02"), approximating a sheet and resulting in the concentration of current density only at the outer edges of the outer loops. If 20 loops are placed side by side 38 sides are protected and 2 sides are exposed. The edge effect is thus reduced to one twentieth ($\frac{1}{20}$) of that on unprotected tape.

Another embodiment of this invention is shown in Figures 9 and 10. A plurality of strip receiving bodies 200 are mounted at a distance from each other with their lengths along direction lines skewed with respect to each other. The said strip receiving bodies 200 are supported at each of their ends by universal mountings in a pair of end plates 201 and 202. If it is desired to have rotatable strip receiving bodies, self-aligning bearings can be provided for the ends of the said bodies.

A shaft 207 which is threaded to receive a nut on each of its ends passes through the centers of the end plates 201 and 202 axially aligning them. The said shaft also passes through the frame sections 208 and 209 to which it is fastened by nuts 203 and 204. The bolts 205 and 206 prevent rotation of end plates 201 and 202 about the shaft 207 and fix the position of the said end plates with respect to the frame section 208 and 209. The skew of the strip receiving bodies 200 with respect to each other is varied by removing one of the said bolts 205 or 206 and respectively rotating with relation to each other one of the said end plates 201 or 202.

The frame sections 208 and 209 are fastened together by a pair of nuts and bolts 210 and 211. The interconnection of the said frame sections allows for change in the axial distance between end plates 201 and 202 due to adjustments in the relative skew of the said strip receiving bodies.

A strip of material 26 is fed into the machine, passes from one strip receiving body 200 to another in a manner similar to that described above, forms a number of loops around the said bodies and is thereafter removed from the machine. The machine need not be provided with rotatable strip receiving bodies when provision is made for the strip to have a sliding contact with the said strip receiving bodies.

The pitch of the machine, as shown previously, is a direct function of the relative skew of said strip receiving bodies. Therefore, the said skew may be varied to adjust the spacing of the loops and also to accommodate for strips of different widths.

It will, of course, be understood that the de-

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scription and drawings herein contained are illustrative merely, and that various modifications and changes may be made in the structure disclosed without departing from the spirit of the invention.

What is claimed is:

1. A strip-handling device comprising a pair of superposed pivotally connected frames, a strip-receiving cylinder rotatably mounted in each frame, one of said frames being adjustable to permit the axes of the cylinders to be relatively adjusted in parallel planes at a skew angle.

2. In a strip-handling apparatus constructed and arranged to receive strips of material of predetermined width, a frame having a plurality of sections, one of said sections being rotatable relatively to another of the sections and having a plurality of guide elements connected thereto, said elements being effective to receive a corresponding plurality of strips of material, a cylindrical member turnably arranged on the rotatable section and receiving strips of material from the guide elements, a second cylindrical member turnably mounted on another of the sections, and other guide elements arranged on the last-mentioned section and effective to receive strips of material from the first-mentioned cylindrical member.

3. In a strip-handling apparatus constructed and arranged to receive and operate on strips of

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material of predetermined width, a frame having a relatively fixed section, a guide assembly fastened to said section, a first strip-receiving member rotatably supported on said fixed section, and operative to receive strips of material from the said guide assembly, a rotatable section arranged on the frame and also having a guide assembly, and a second strip-receiving member turnably arranged on the rotatable section; said second strip-receiving member receiving strips from the last-mentioned guide assembly.

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