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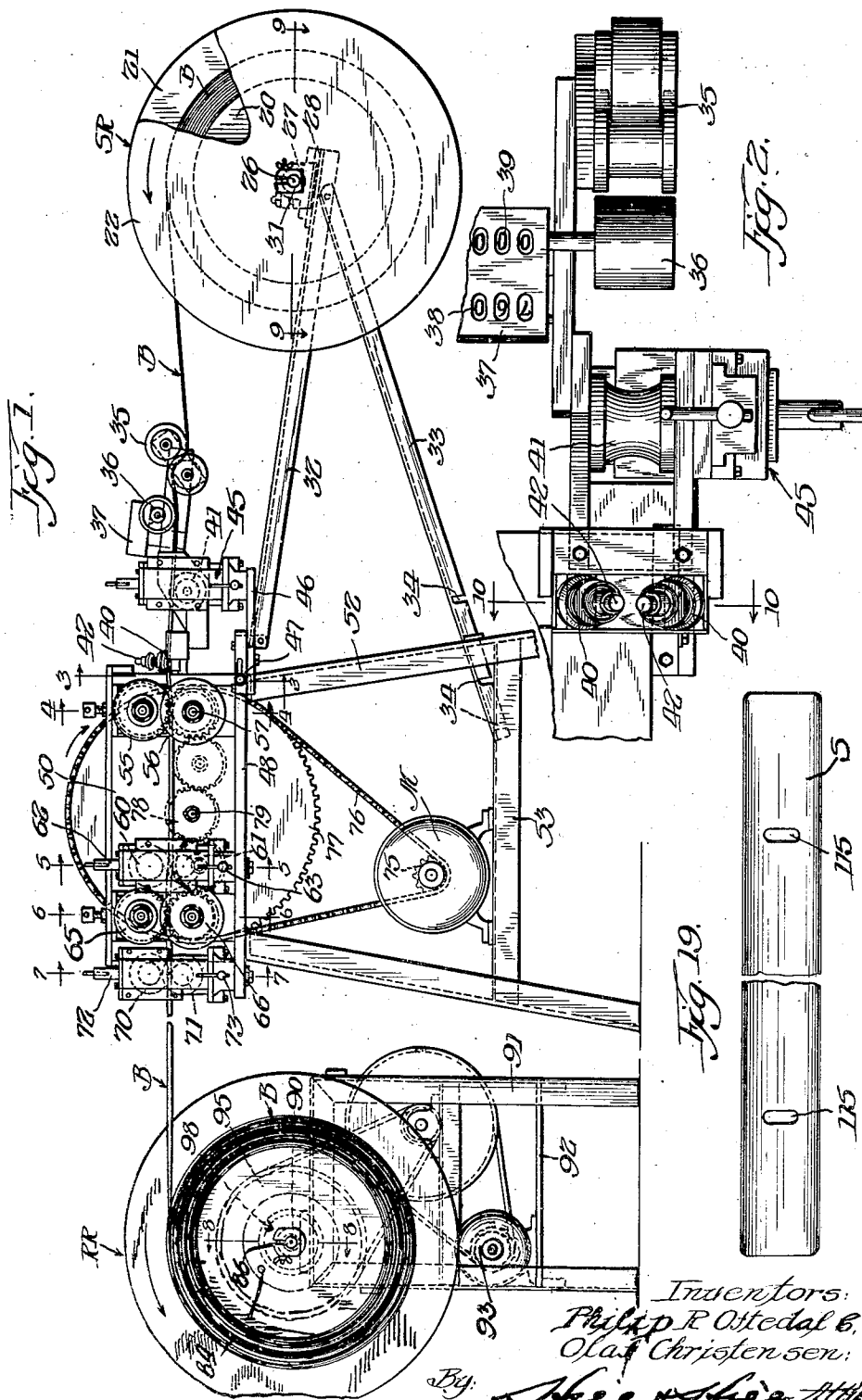
P. R. OFTEDAL ET AL

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METHOD AND MEANS FOR FORMING WINDOW BLIND SLAT STOCK

Filed April 20, 1942

4 Sheets-Sheet 1



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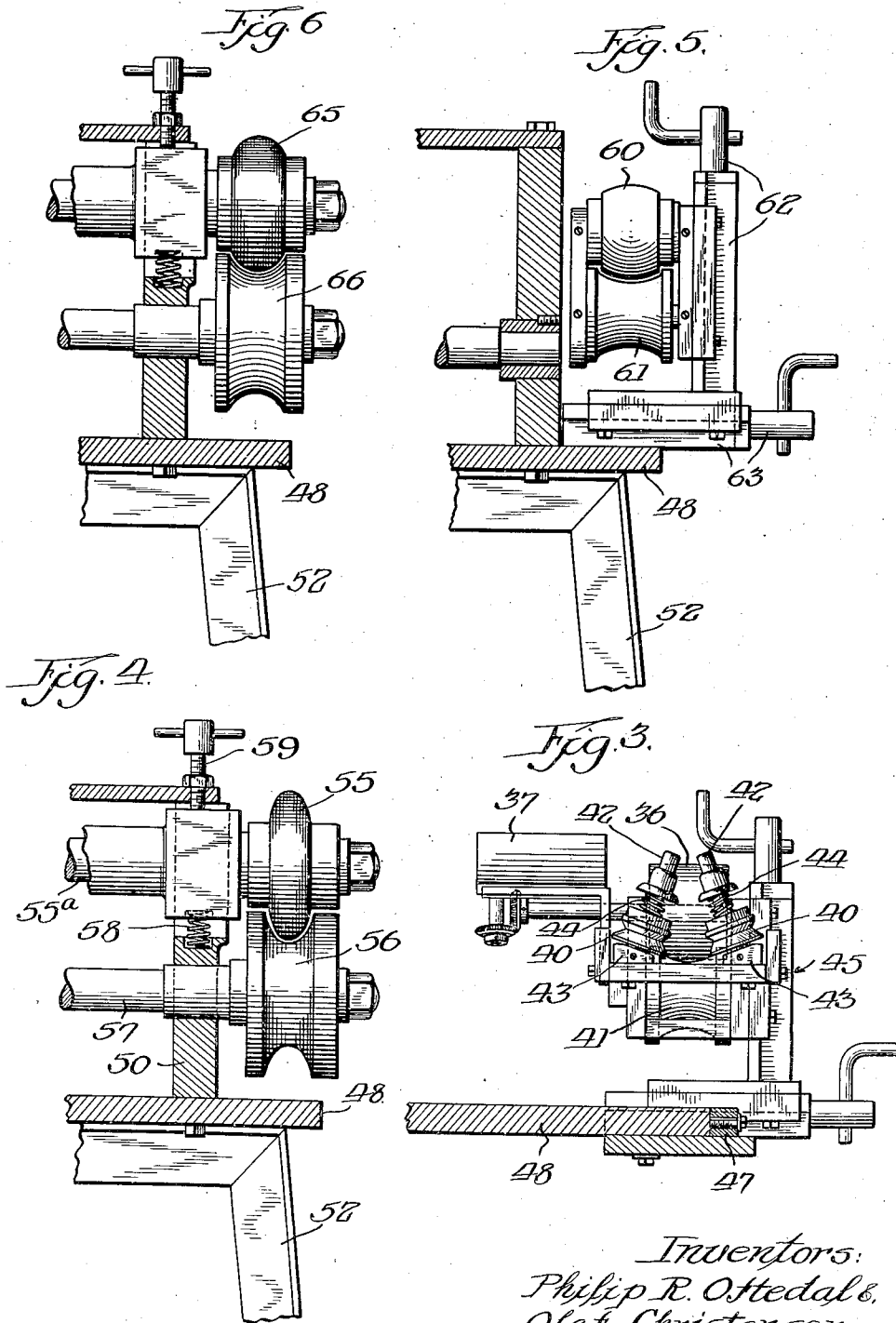
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METHOD AND MEANS FOR FORMING WINDOW BLIND SLAT STOCK

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4 Sheets-Sheet 2



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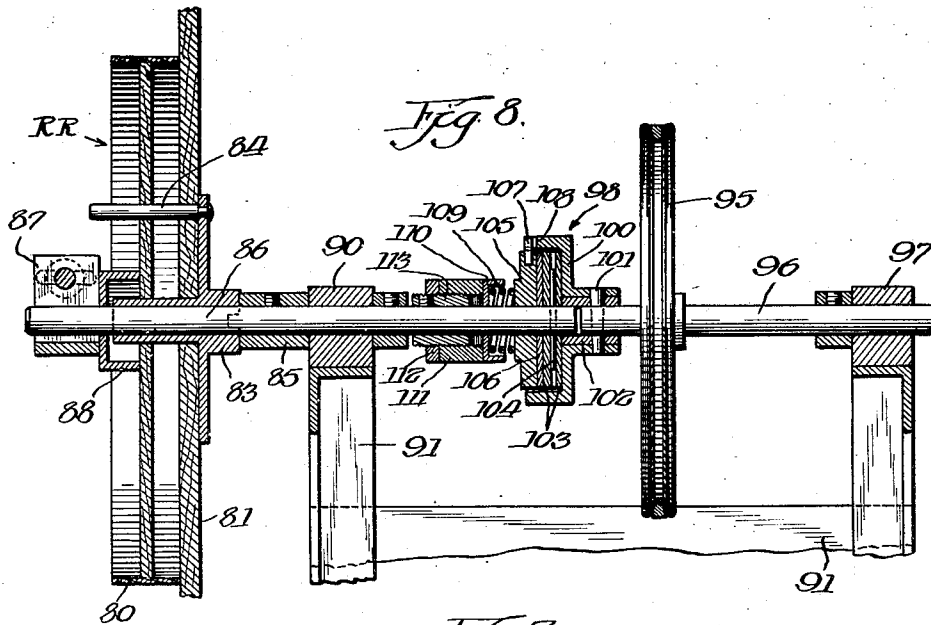
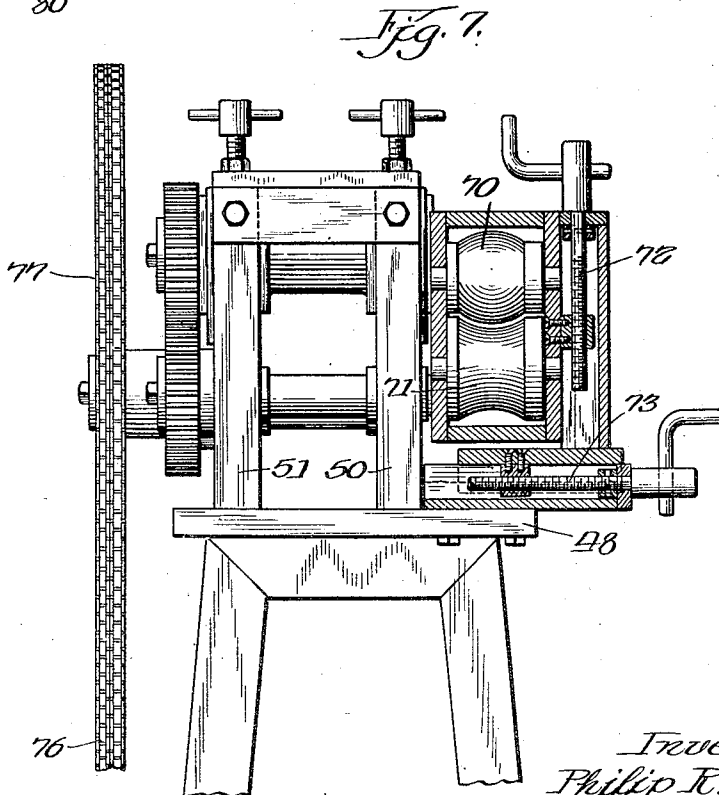
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METHOD AND MEANS FOR FORMING WINDOW BLIND SLAT STOCK

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4 Sheets-Sheet 3



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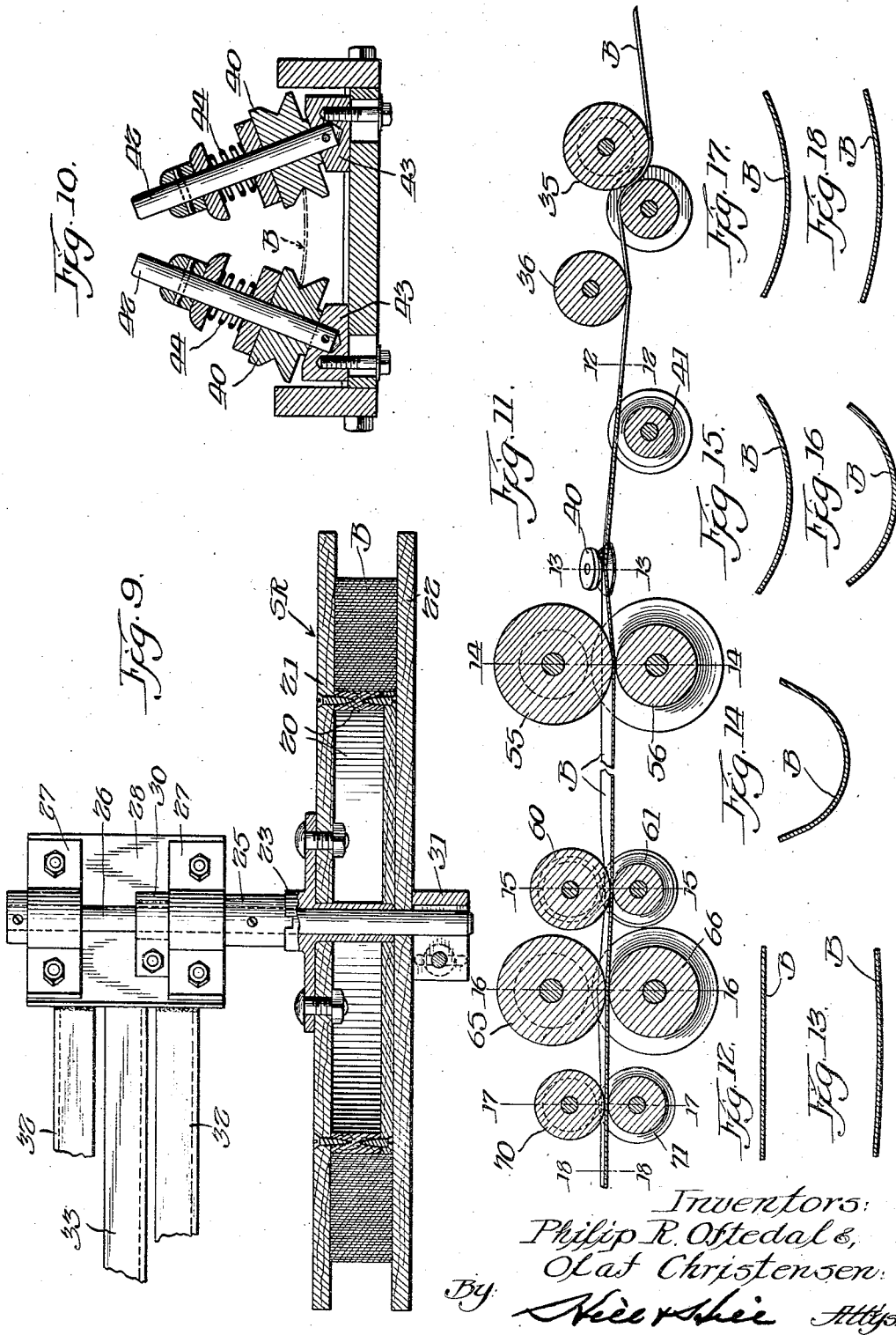
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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

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METHOD AND MEANS FOR FORMING
WINDOW BLIND SLAT STOCKPhilip R. Oftedal and Olaf Christensen, Chicago,
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Application April 20, 1942, Serial No. 439,714

7 Claims. (Cl. 153—54)

The present invention is directed to the method and means for working continuous flat metal slat material for window blinds into a dished band so as to provide the band with a predetermined, appropriate and desired transverse concavity along its entire length and in such a manner and to the extent that the band may be wound into suitable rolls for future sale and delivery or for subsequent use in general.

The machine of this invention is adapted to so shape the band to permit the use of relatively thin steel thereby reducing the cost of production by saving metal and correspondingly creating a window blind that will be comparatively light in weight and composed of metal slats of the design and nature herein contemplated.

The purpose of adding concavity to the slat band is to induce structural stiffness and structural rigidity to the same thereby permitting the use of such relatively thin metal in the formation of the slats as hereinbefore referred to. The only manner in which the rigidity can be developed is by resorting to the use of heavier gauge metal, which is undesirable, or else by changing the shape of the metal in a manner best determined by experiment and also which will prove most practical in the production of the continuous slat band. The latter method is the one proposed and utilized herein and the machine for accomplishing the results sought by deforming the flat metal slat band forms the device of this invention.

With the machine herein portrayed, the band formed thereby is rolled upon reels which may accommodate any continuous length of band that may be desired within practical limits and the reels of bands may be stored until used at which time they can be suitably cut into slats and slotted as to comply with and to be sold in accordance with the specifications at hand. Furthermore, various colors of band material are made available and by processing and winding the separate colored bands upon individual and separate storage reels, the particular reel to be cut into slats can be chosen according to the color called for in the order presenting the specifications.

One of the principal objects, therefore, of the present invention is to provide a method and means for deforming a substantially continuous flat metal band along the length thereof to impart substantially controlled internal stresses to the band and winding the resultant band upon a reel so as to be easily and readily stored and whereby upon the subsequent unwinding of said

band from the reel, the band will again assume an arcuate or crowned shape due to the latent internal stresses which have been imparted to the physical structure of the band.

Another object of the present invention is to provide successive mechanisms which will form and reform the band, respectively, to so produce a reversal of stresses in the physical structure of the band by successively tensioning or stretching the metal adjacent the convex surface of the band and inversely by successively compressing the metal adjacent the concave surface of the band whereby a definite set is imposed upon the metal band. In this manner the band will have the latent characteristics of readily assuming the arcuate or crowned shape along its length at any subsequent time that the band shall be unwound from its storage reel.

Another object of this invention is the ability of the machine to counteract and correct the camber that may be present in the rolled band stock while running the same through the machine.

A further object of the present invention is to produce the band of the arcuate shape as hereinbefore referred to at substantially high speeds and comparably with a minimum amount of effort.

All other objects and advantages shall hereinafter be expressed in the following detailed description of a preferred embodiment of the invention as best illustrated and disclosed in accompanying drawings.

In the drawings:

Fig. 1 is a side elevational view of the machine and its associated mechanisms.

Fig. 2 is a plan view of the primary band guiding and straightening mechanism.

Fig. 3 is a transverse sectional view taken substantially along the line 3—3 in Fig. 1.

Fig. 4 is a vertical section taken along the line 4—4 in Fig. 1 illustrating the primary forming rolls.

Fig. 5 is a vertical sectional view taken substantially along the line 5—5 in Fig. 1, illustrating the primary reforming rolls.

Fig. 6 is another vertical section taken substantially in the plane of the line 6—6 in Fig. 1 to illustrate the secondary forming rolls.

Fig. 7 is a transverse section of the entire width of the machine taken along the line 7—7 of Fig. 1, part of which view is in elevation, this view illustrating the secondary reforming rolls.

Fig. 8 is a sectional view taken along the line 8—8 of Fig. 1 illustrating the slippage compen-

sating mechanism associated with the rewinding reel.

Fig. 9 is a horizontal section taken along the line 9—9 in Fig. 1 to show the mounting of the stock reel for feeding the flat band into the machine.

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 2 to show the mounting of the notched wheels utilized in positioning the band perfectly horizontally prior to the first forming operation.

Fig. 11 is a diagrammatic sectional view showing the path of the band through the machine.

Figs. 12 to 18, respectively, are sectional views of the band as taken along the points indicated in Fig. 11, and

Fig. 19 is a face view of a completed slat which has been cut from the stock that has been unrolled from the storage reel, said slat being slotted to provide route holes.

Referring to the drawings, Figs. 1 and 9 best illustrate the stock reel SR which is provided with a relatively large core 20 secured to the flange 21 of the reel, while the front face plate of the reel 22 acts to removably hold the band upon the core of the reel when in the position shown in Fig. 9. The reel is provided with the notched hub 23 having removable cooperative driving engagement with lugs of the collar 25 which is secured to the shaft 26 forming the reel spindle. Shaft 26 is journaled in bearings 27 supported upon a bracket 28, and a suitable friction brake 30 is supported upon the bracket 28 and engages the shaft 26 to guard against over-running of the band B of the stock reel as said band is being fed into the machine. Any suitable form of clamp 31 is employed to hold the reel SR in cooperative engagement with the collar 25, the clamp also holding the face plate 22 against the core 20, thereby eliminating lateral play of the band B as the latter is being unwound from the reel.

It is to be noted in Fig. 1 that the bracket 28 supporting the stock reel SR is adjustably carried with respect to the machine by means of the relatively movable supporting arms 32 and 33, the latter arm being notched as at 34 to hook onto any suitable part of the machine proper as provided for this purpose. With the adjustment noted, the elevation of the stock reel can be varied to suit or moved into a position best determined through experiment to insure a smooth running of the band at high speed into the machine.

As the band B is drawn from the stock reel it passes through a pair of straightening rollers 35 which also tend to give it a reverse curl to compensate for the natural tendency of the band to curl in the direction in which it is wound upon the reel SR. The band then passes under a roller 36 associated with a register 37 which automatically records the lineal feet passing into the machine. In Fig. 2 the register 37 shows two footage indicator readings 38 and 39, the former of which is a totalizer while the latter can be reset to provide means for checking the individual runs made.

In Figs. 1 and 2 the band now passes from the aforesaid described mechanisms into a pair of V-grooved wheels or leveling rolls 40—40 which are provided to stabilize and place the band in a perfect horizontal position which will be disposed as nearly as possible at right angles to the primary forming rolls. In utilizing V-grooved wheels or rolls only the edges of the band stock

are contacted in guiding the band. This guards against marring, scratching or chipping of the enamel whenever coated bands are used.

Immediately prior to the band's entry between the leveling rollers 40—40, the band is contacted by a roller 41 which is mounted for vertical and horizontal adjustment, this roller being utilized as idler means to counteract any whip or vibration of the band that may occur prior to its entry between the leveling rolls 40—40. It should be noted that the roller 41 is made of concave construction so as to not counteract any tendency that the band may have to assume an arcuate shape prior to its entry into the rolls 40—40. Obviously, when the band is being fed flatly over the roller 41 the edges of the band will merely ride on the high spots of the roller and between the flanges thereof so that the free movement of the band is in no way hampered.

Referring to Figs. 1, 2 and 10, the leveling rolls or wheels 40—40 are carried by the spindles 42—42 secured to the adjustable blocks 43—43, the wheels 40—40 being normally held against the blocks 43—43 by the spring units 44—44. With this arrangement, the band may be fed through either entirely flat or slightly bowed as shown in dotted lines in Fig. 10, depending upon the lateral adjustment of the blocks 43—43. By suitably adjusting blocks 43—43, therefore, a more or less degree of concavity can be imparted to the band prior to entering the primary forming rolls which acts to ease the way into the rolls to insure smooth entry of the band at relatively high speeds.

In Figs. 1 and 2 it should be noted that the foregoing units described, namely the leveling wheels or rolls 40—40, roller 41, register mechanism 37, and the straightening rolls 35 are all mounted and carried so as to be connected with the vertical and horizontal adjusting unit 45. Also, the latter unit is carried upon the base plate 46 which in turn is adjustably connected for movement along the length of the band as at 47 to the table 48 supporting the forming mechanism. By so mounting the units described, the rolls 40—40, idler 41, etc., constitute primary band guiding means which may be adjusted vertically or transversely horizontally of the machine and also in the direction of the band to dispose the leveling rollers or wheels 40—40 closer or farther away from the primary forming rolls.

The primary and secondary forming and reforming rolls are all rotatably supported by the spaced uprights 50 and 51, see Fig. 7, which are suitably mounted upon the table 48, the latter being supported on a suitable leg structure 52 carrying a sub-platform 53 with the drive motor M for the rolling mechanisms being supported upon the latter platform.

In Fig. 4 the primary forming rolls are best illustrated and comprise the rolls 55 and 56 shaped and coacting as shown, with the roll 56 being mounted on a rotatable shaft 57, while the roll 55 has its shaft 55a spring supported at 58 to allow vertical adjustment by means of the screw 59 in any suitable manner. The same spring adjustment means is duplicated at the other end of shaft 55a. With the adjustment noted it is much easier to control the deep arching of the band which is accomplished by the rolls 55 and 56, such control being necessary since the band thickness varies from one stock reel to another. In this connection it should be noted that variations in the thickness of the band are encountered by reason of the manufac-

ture of the steel band itself and taken compositely with the variation encountered in the enameling of the band, a variation of several thousandths of an inch will result.

After the band leaves the primary forming rolls it passes between the reforming rolls 60 and 61 best illustrated in Fig. 5, such rolls being carried as a unit for vertical adjustment at 62 and horizontal adjustment at 63 both relative to the table 48. Although not provided, it is conceivable to mount the rolls 60 and 61 for movement relative to each other in the same manner as the rolls 55 and 56 in Fig. 4. By means of the rolls 60 and 61 some of the arch is taken out of the band and by the proper aligning adjustment of the rolls 60 and 61 the band is correctly positioned with respect to the secondary forming rolls as well as providing a means for correcting any minor variance in the band as the same comes from the primary forming rolls 55 and 56. The rolls 60 and 61 also provide secondary guiding means.

The secondary forming rolls 65 and 66 are best illustrated in Fig. 6 and it is to be noted that they are mounted in the same manner as are the primary forming rolls 55 and 56 in Fig. 4. These rolls impress the band with another relatively deep arcuate or arched shape transversely to the width of the band and so affect the internal physical structure of the band as to produce a substantially permanent set in the metal which will counteract any tendency for the band to subsequently straighten out into its original shape.

The band subsequently passes from the secondary forming rolls to the rolls 70 and 71 illustrated in Fig. 7, which act to reform the band into the shape which has been predetermined and desired in the use of metal slats for window blinds of the Venetian blind type or others of a like nature. The rolls 70 and 71 of the secondary reforming rolls are carried to be adjustable vertically by means of the screw 72 and horizontally by means of the screw 73, suitably mounted on a base plate supported upon the table 48. The more detailed disclosure of the adjustments of the rolls 70 and 71 vertically and horizontally relative to the table 48 will help to illustrate the other adjustable mountings hereinbefore referred to inasmuch as the construction is the same, namely the adjusting means shown at 45 in Figs. 2 and 3 and at 62 and 63 in Fig. 5.

Any suitable driving mechanism may be employed to drive the various rolls described in forming the arcuate band so long as the rolls are synchronized to have their peripheral speeds uniform and substantially the same as the speed of the band moving between the respective rolls. As shown in Fig. 1, the present machine incorporates the use of a motor M preferably of variable speed type driving a sprocket 75 for transmitting the drive by means of the chain 76 to a large sprocket 77 to reduce the normal driving speed of the gear 78 carried upon the shaft 79. From the common gear 78 the drive is transmitted through suitable idlers shown in Fig. 1 to the primary and secondary forming rolls, each pair of which is connected by gears for driving the respective rolls in each of the sets.

From the foregoing it is noted that the forming rolls act to pull the band off of the stock reel and to pass it through the machine also shaping and reshaping the band while all of the other

rolls contact the band and merely act as idlers to be driven by band whereupon the desired result is finally obtained.

The band B now leaves the machine in a pre-determined arcuate shape and passes to the rewind reel RR which is constructed and driven in the manner best illustrated in Figs. 1 and 8. The rewind reel RR is the storage reel and similarly to the stock reel it is provided with a large core 80 shown in position against the back plate or flange 81 as in Fig. 8. The back plate 81 is connected with the notched hub 82 by means of a pin 84 which extends through both the back plate and also through the reel core 80 to drive the same together, the notched hub 82 being connected with the lugs on a spacer or collar 85 secured to shaft 86 in any desirable manner. A clamp 87 is utilized in securing the reel core in place by means of the cupped spacer 88 which holds the reel core against the face plate 81 and in engagement with the pin 84 in the manner illustrated. Shaft 86 is journaled in the bearing 90 mounted upon the frame 91, the latter carrying another sub-platform 92 adapted for supporting a driving motor 93 as shown in Fig. 1. The drive from the motor is transmitted through a series of pulleys and belts to reduce the speed of the rewind reel, the drive to the reel terminating in the pulley 95 as illustrated in Fig. 8. Pulley 95 is mounted on and secured to shaft 96 which has one end thereof journaled in the bearing 97 also supported upon the frame 91, the other end of shaft 96 being suitably supported and connected through a slip clutch 98 with the reel and its driving shaft 86.

The provision of the slip clutch 98 between the shafts 86 and 96 has been devised as a means to compensate for the change in the peripheral speed of the band B as the latter is being rewound upon the reel RR as the band comes out of the forming mechanism. In order that the band B shall be tightly wound upon the rewind reel, the speed of the latter must at all times be greater than the lineal speed of the band and at all times greater to such an extent as to produce a certain amount of tension in the band B which will wind the band absolutely flatly upon the pickup means such as the reel 80. It is obvious that any loosely wound band of the type herein produced would attempt to assume the arcuate shape given thereto and necessarily interfere with the proper rewinding thereof for future storage.

The amount of tension produced in the band can be varied by regulating the speed of the motor 93 to provide a final adjustment to counteract, if necessary, any residual camber that might be present in the band.

The clutch herein utilized is shown in Figs. 1 and 8 and has a cupped housing 100, keyed by means of the pin 101 to shaft 96 and includes a suitable axial bushing 102 for the ends of the shafts 86 and 96.

A disc 103 is secured to shaft 86 by a pin 104 and the disc is nested within the open end of the cupped housing 100. A second disc 105 is loosely carried upon shaft 86 and a friction plate 106 of suitable material such as brake lining is interposed between the discs 103 and 105. A pin 107 secured to the periphery of disc 105 engages a notch 108 in the rim of the cupped housing 100 whereby the disc 105 is driven along with the housing 100 from shaft 96.

A compression spring 109 is adjustably urged

against the disc 105 to maintain frictional driving contact between the two discs through the agency of the friction plate 106. The spring 109 is held in position by the retainer 110 abutting the threaded collar 111 and its lock nut 112, the latter two both being screwed upon the threaded sleeve 113 secured to shaft 86.

With this arrangement the drive is from the motor 93 through the pulleys and belts to pulley 95, shaft 96 and through the slip clutch 98 to shaft 86 and to the rewind reel RR. The motor is or can be so regulated to be synchronized with the lineal band speed of the machine so that the peripheral speed of the reel 80 is just sufficiently greater as to produce the desired tension necessary to obtain a flat tight wind of the band upon the core of the reel. As the wound band diameter increases on the reel, the tension will increase but all differences in speed between shafts 86 and 96 will be compensated through the slip clutch 98 which will allow greater speed of shaft 96 thereby overrunning the angular speed of shaft 86 and the reel thereon.

After the number of the desired feet of band have been coiled upon the reel RR the latter may be removed from the shaft 86 and stored until such time as needed. Assuming that the roll stored is of a certain color called for by an order and assuming a four foot width of blind is requested with a ten foot length, the necessary number of feet can be unreeled from this stored coil to provide the requisite number of slats such as shown in Fig. 19 and indicated in its entirety by the reference numeral S. Each individual slat may then be slotted as at 115 to provide the route holes necessary for the operation of the blind.

Figures 12 and 18, inclusive, taken together with Fig. 11 will serve to diagrammatically express substantially what happens to the band B as the latter is pulled through the machine by the primary and secondary rolls. In this connection Fig. 10 should also be referred to since these rolls 40 do play an important part and constituent part of the primary band guiding mechanism. Each of the rolls 40—40 is for all normal operation held against the blocks 43 but in case that the band coming off of the stock reel should be badly nicked or kinked at one edge or the other, the rolls can be forced to move along their respective spindles 42 to accommodate the band. Also, by tilting the spindles as shown in Fig. 10 the band will at all times be urged in a direction to accommodate itself to the primary forming rolls in the nature of a preforming or rather preshaping operation to facilitate running the band through at high speed.

With the machine described, it is also contemplated to use various widths of band as well as bands of different thickness which can be taken care of by means of the adjustments provided where needed. In addition, all of the adjustable features incorporated in the machine are also for correcting the possible camber which is usually present in band stock of the character employed. This camber correction follows through the machine and can be best counteracted and eliminated as much as possible by experience up to and including the final tension imposed upon the band as it passes from the final rolls of the machine onto the rewind reel. As a means of detecting any residual camber in the band stock, the rewind reel can be placed at some distance from the rolling unit to permit a person skilled in this work to sight along the band.

It is of course contemplated that structural

changes and refinements may be resorted to in the production of the machine herein described and disclosed. Obviously, the description and disclosure are herein both presented by way of explanation of a preferred form of embodiment of the present invention and that the ultimate construction of the latter shall only be governed and determined by the breadth and scope of the appended claims.

What we claim as new and desire to secure by Letters Patent is:

1. The method of producing a roll of finished window blind stock or the like consisting of forming a flat metal band into a substantially deeply arched band in a direction transversely to the length thereof, reforming said arched band to lessen the degree of arch therein, then again forming said band into a deeper arch and again reforming the same to lessen the degree of arch to a finished product substantially as used in window blinds, and flat winding said band upon a reel for future availability whereupon said band will again assume the degree of arch last impressed thereon as said band is unwound from the reel.

2. The method of producing a roll of arcuate finished slat stock from a flat enameled band adapted to be unwound from a supply reel comprising substantially straightening the band to counteract the recoil tendency thereof, positioning and guiding the band prior to forming with its free edges disposed in the same plane, and then forming by successively depressing the central portion of said band and moving the free edges thereof toward each other in a plane disposed substantially at right angles to the axis of depression, and thereafter raising the central portion of said band to move the free edges thereof apart in a plane substantially at right angles to axis of raising, respectively, to impart a predetermined finished arcuate shape to the band in a direction transverse to the length thereof, and then winding the finished band flatly and tightly upon a storage reel wherefrom the band will again assume its arcuate shape upon the unwinding of said band from said storage reel.

3. A machine for producing a roll of arcuate shaped finished window blind slat stock from a flat band, comprising a primary band guiding mechanism, primary forming rolls for producing a deep arcuate transverse set into the band and along the length thereof, reforming rolls for relieving said deep set in said band, secondary forming rolls for again inducing a relatively deep arcuate set into the band and along the length thereof, second reforming rolls for relieving said deep arcuate set, and means for winding said final arcuately shaped band flatly under tension upon a storage reel.

4. A machine for producing arcuate shaped finished window blind slat stock from a flat band, comprising a primary band guiding mechanism, primary forming rolls for producing a deep arcuate set into the band and along the length thereof, secondary forming rolls for imparting a different degree of arcuate set into the band, band guiding mechanism shiftable vertically, lengthwise and transversely of the machine, interposed in advance of the primary and secondary forming rolls, and reforming rolls disposed beyond the secondary forming rolls to provide a final and predetermined degree of arcuate finished set along the continuous length of band.

5. A band forming machine, comprising a supporting unit, an idler reel carried on said unit and adjustable with respect to said unit, primary

band guiding means connected with said unit and adjustable in three directions with respect to said supporting unit, plural pairs of complementary shaped primary and secondary band forming rolls mounted for rotation upon said supporting unit to form the band arcuately transversely thereof, adjustable means connected with certain of the aforesaid rolls, coacting reforming rolls co-operating with the aforesaid forming rolls to reduce the arcuate set in said band, and carrier mechanisms adjustably connected with said supporting unit for rotatably holding the reforming rolls and for adjusting the latter vertically and transversely of said supporting unit.

6. An arcuate band forming machine, comprising a stock reel of flat band, a plurality of pairs of band forming rolls, band guiding means disposed between said stock reel and some of said forming rolls, reforming rolls disposed between certain of said forming rolls, final shaping mechanism, drive means connected with certain of said forming rolls to draw the band stock off of the stock reel and through said machine at a predetermined rate, and cylindrical rewind reel means having driving mechanism for turning said reel at a greater peripheral speed than the lineal speed of said band and including slip clutch means interposed between said rewind reel and said

driving mechanism to only allow the reel to rotate with a peripheral speed equal to the lineal speed of said band and to thereby flatly rewind said arcuate band upon said cylindrical rewind reel means.

7. A window blind slat stock forming machine comprising in combination pairs of primary and secondary forming rolls having complementary shaped peripheries, a pair of peripherally grooved guide rolls for guiding a flat band between the primary forming rolls, pairs of primary and secondary reforming rolls having complementary shaped peripheries, the primary reforming rolls being interposed between the primary and secondary forming rolls, and the secondary reforming rolls being the last of the series, power driven shafts upon which the primary and secondary forming rolls are mounted, the axis of one shaft of each pair of said last mentioned rolls being fixed and the primary and secondary reforming rolls being shiftable vertically and transversely of the machine, power driven gears on the shafts having fixed axis and idler gears meshing with said power driven gears and the gears on the shafts with the fixed axis.

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