Oct. 3, 1933. W. E. WHITNEY ET AL 1,928,714

APPARATUS FOR AFFIXING PINS TO METAL BELTS

Filed Oct. 8, 1929 5 Sheets-Sheet 1

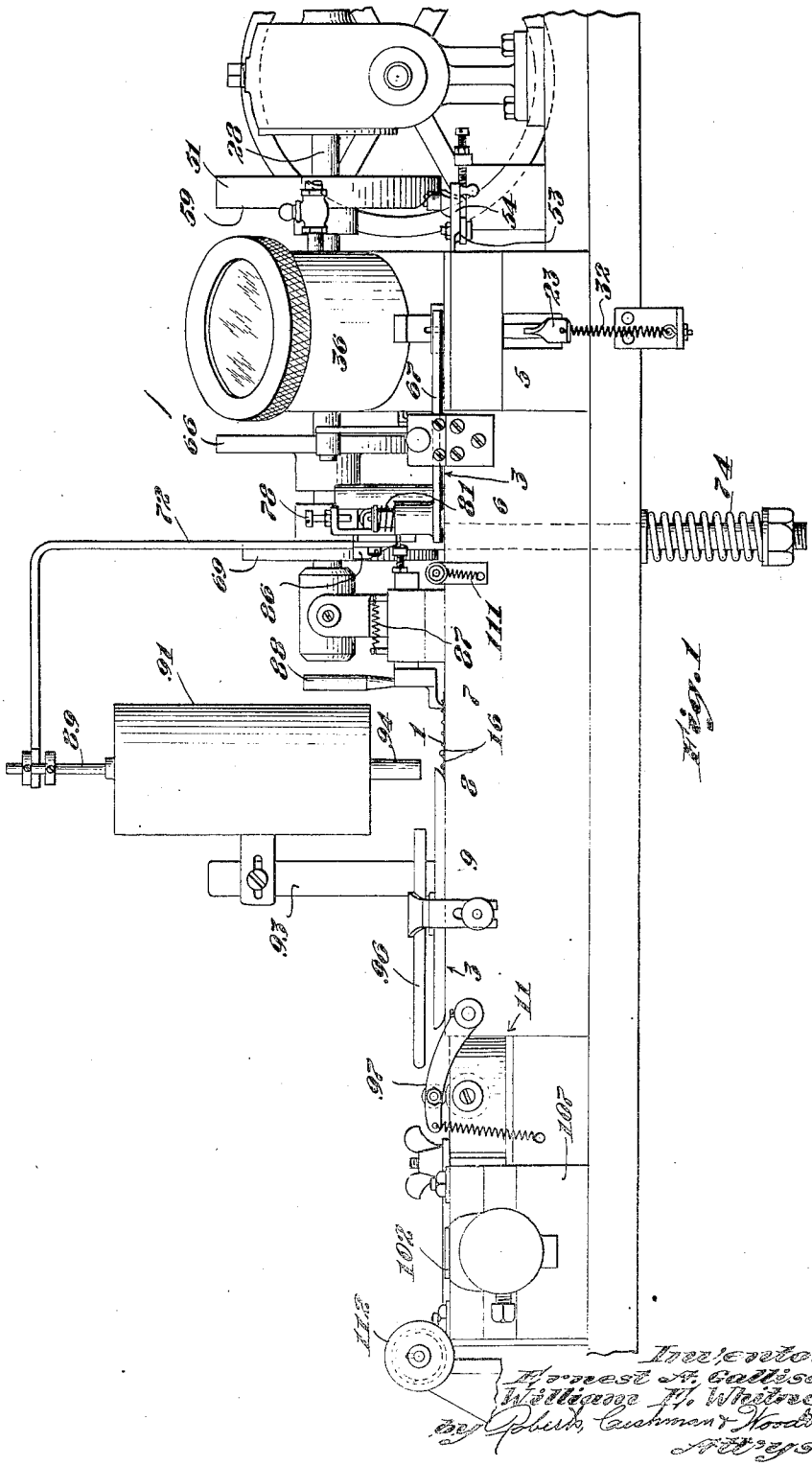


Fig. 1.

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APPARATUS FOR AFFIXING PINS TO METAL BELTS

Filed Oct. 8, 1929 5 Sheets-Sheet 2

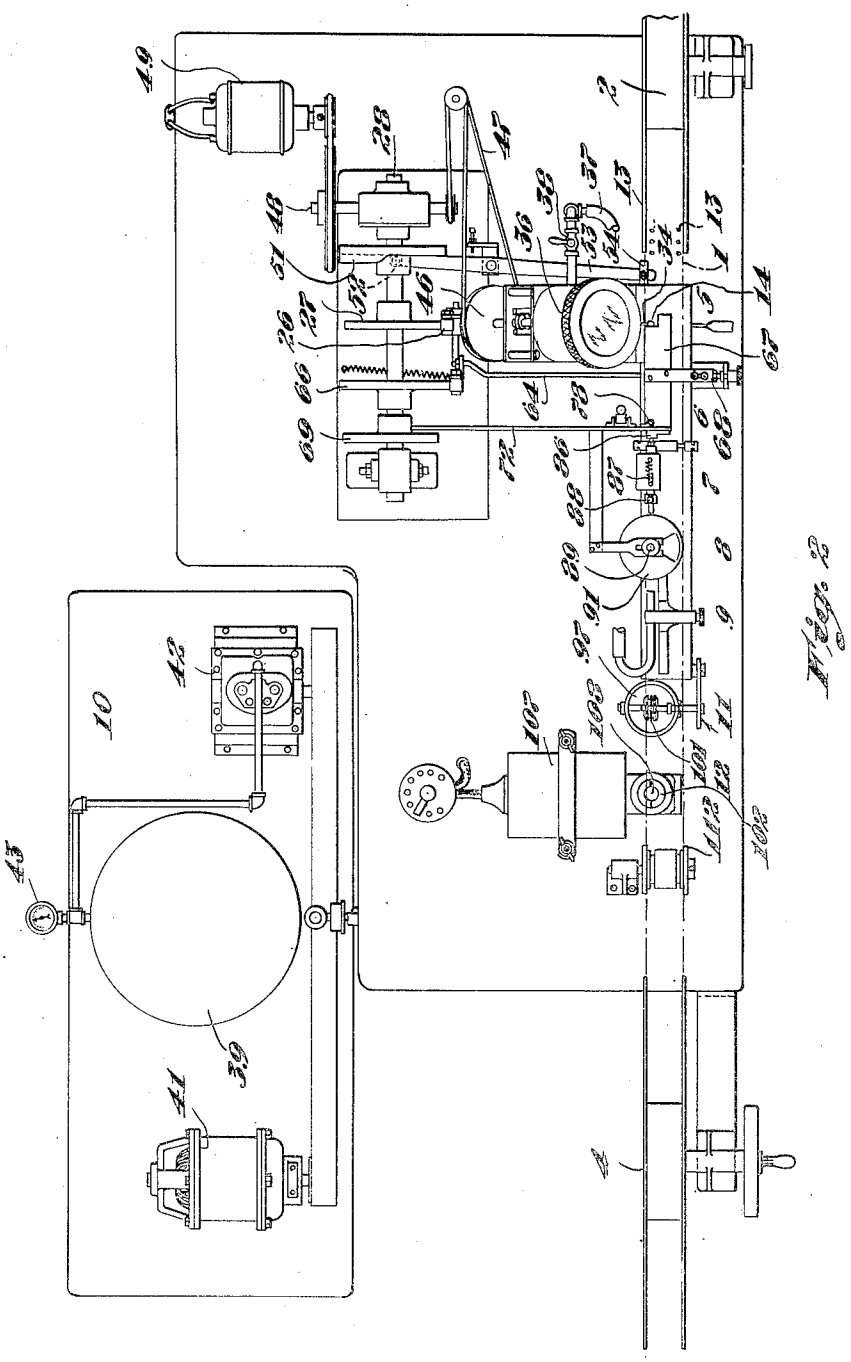


Fig. 2.

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APPARATUS FOR AFFIXING PINS TO METAL BELTS

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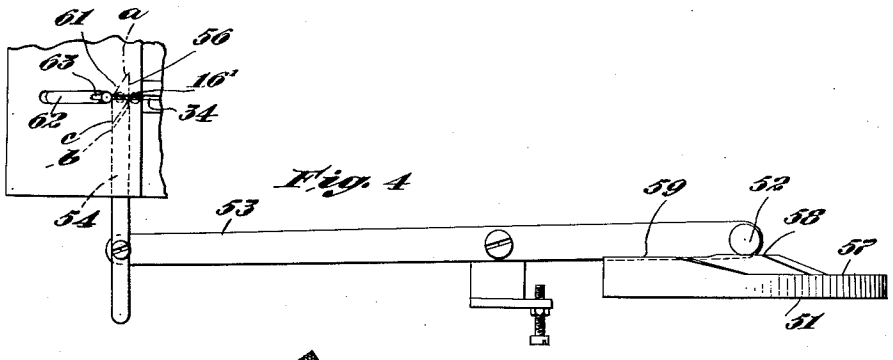


Fig. 4

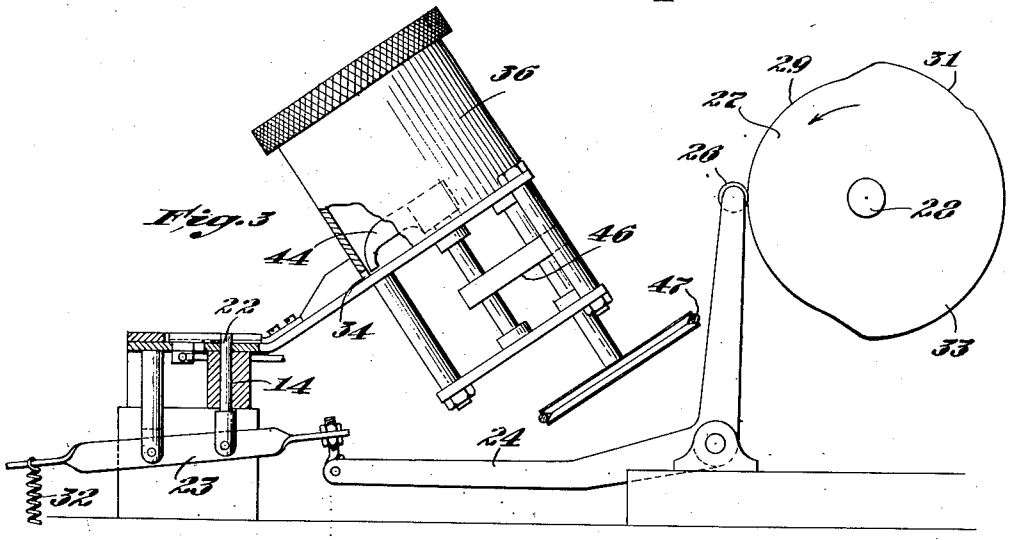


Fig. 3

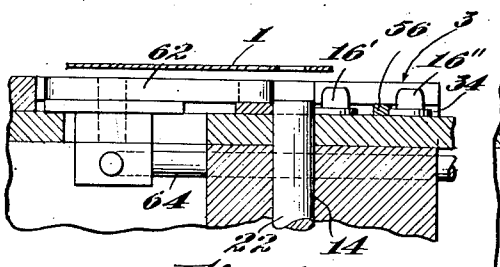


Fig. 5

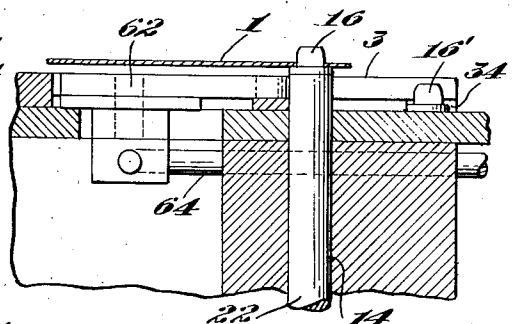


Fig. 7

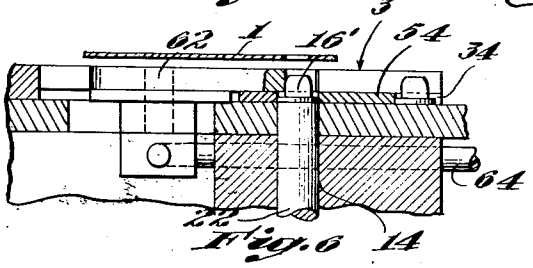


Fig. 6

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APPARATUS FOR AFFIXING PINS TO METAL BELTS

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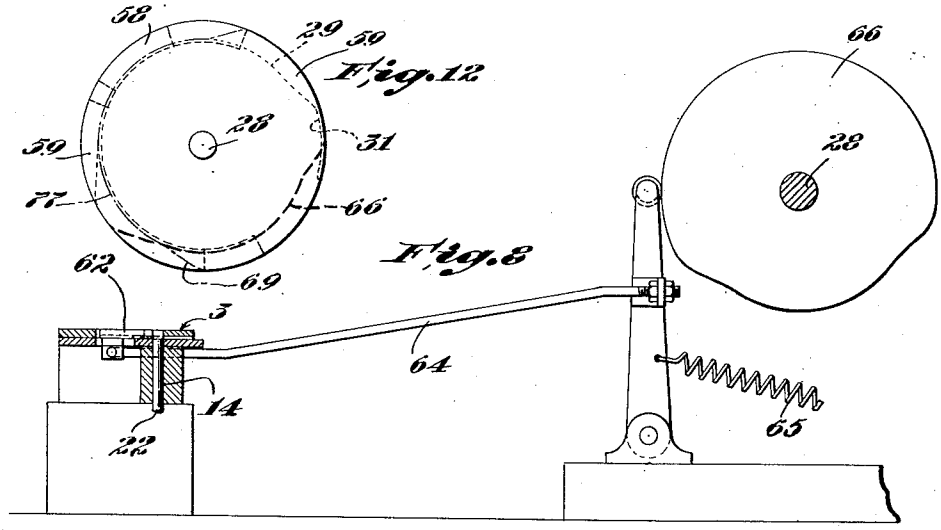


Fig. 12

Fig. 8

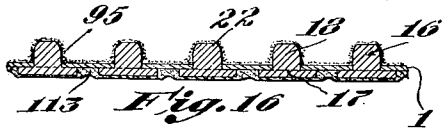


Fig. 16

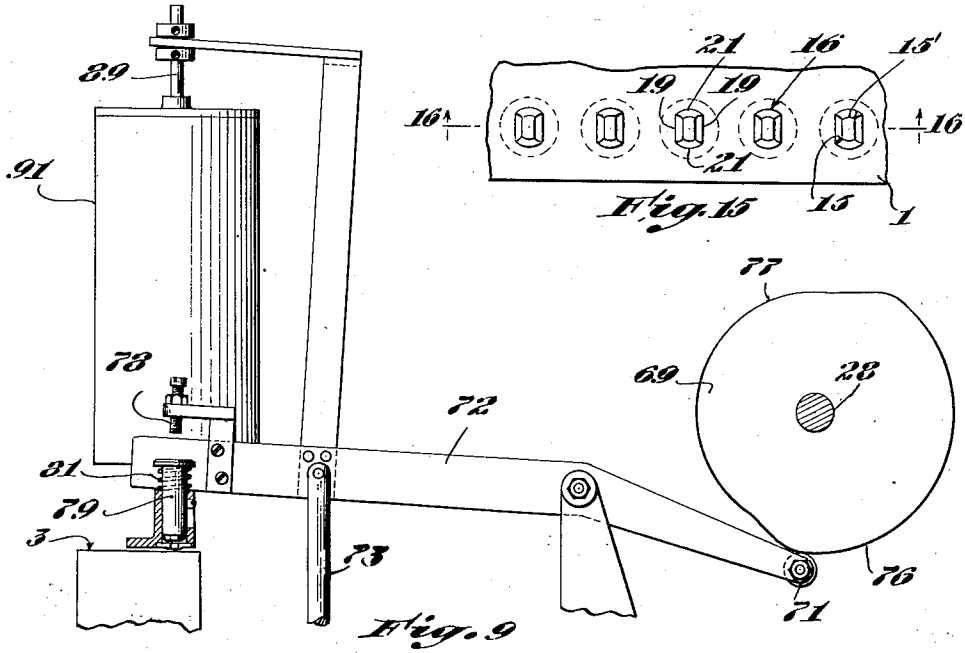


Fig. 15

Fig. 9

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APPARATUS FOR AFFIXING PINS TO METAL BELTS

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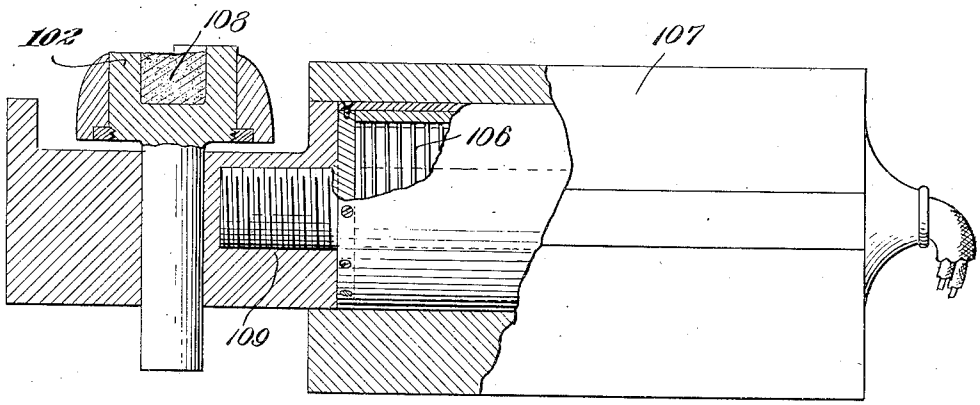


Fig. 14

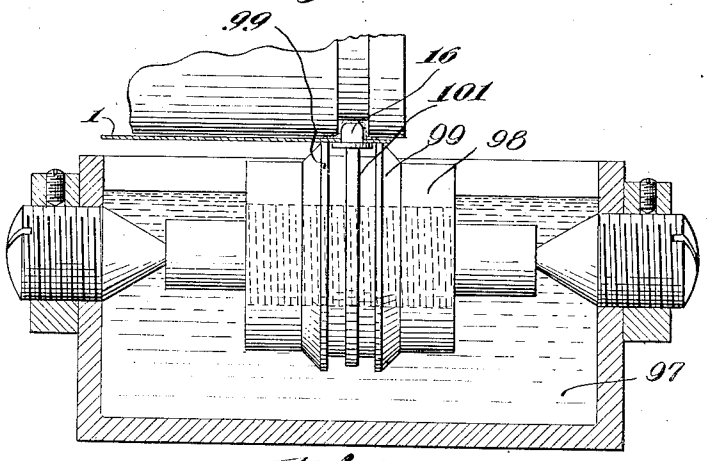


Fig. 13

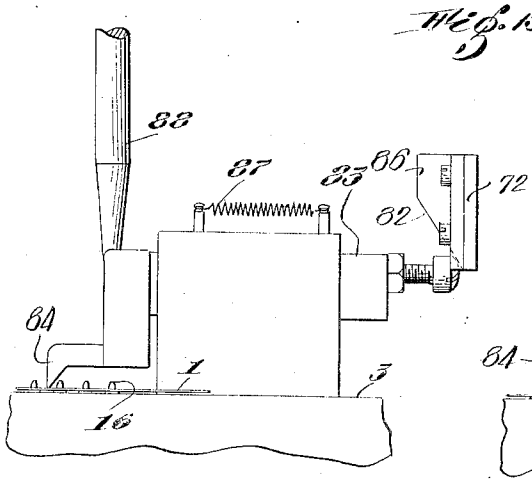


Fig. 10

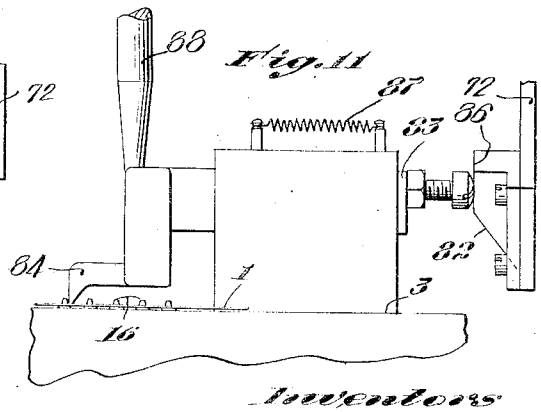


Fig. 11

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UNITED STATES PATENT OFFICE

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APPARATUS FOR AFFIXING PINS TO METAL BELTS

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Application October 8, 1929. Serial No. 398,262

12 Claims. (Cl. 113—59)

This invention relates to a method of and apparatus for positioning and soldering pins in a perforated metal belt or the like.

In the art of making cinematographic films it is now commercial practice to print the same by bringing a dye-wet matrix film into surface contact with a blank film to which the dye image of the matrix is transferred by imbibition. It is necessary to register the matrix film and blank film accurately and hold them firmly in contact during the imbibition step in order to secure accurate transfer and clean cut images without blurring. For this purpose an endless traveling belt is employed having projecting pins thereon which are fixed at accurately spaced intervals along the margins and which engage the sprocket holes in the margins of the matrix film and the blank film and thus hold them in exact registry and in superposed face contact for the required time interval to effect complete and accurate imbibition of the dye by the blank film.

In order to carry out this procedure at a suitable speed, it will be obvious that a relatively long belt must be used. Consequently, the positioning and fixing of a large number of projecting pins is involved which takes it out of the category of hand operations on the ground of economy. Moreover the pins must be accurately spaced and securely held in position throughout the length of the belt without irregularities in the same.

Accordingly an object of this invention is to provide a method of securely positioning and affixing suitable pins to a flexible metal belt and apparatus by which such method may be accomplished automatically. Other objects will appear from the following disclosure.

The method of the invention includes a preliminary preparation of a long flexible metal belt or strip (of approximately the width of the cinema film and preferably made of monel or other non-corrosive metal) which is provided with one or more rows of perforations accurately spaced longitudinally of the belt and corresponding to the usual sprocket holes in cinema films. The perforated belt, as thus obtained, is advanced intermittently in the direction of its length by distances equal to the spacings between the successive perforations, while at each stop a pin having a base and a tapered head is brought into registry and orientation with a perforation in the belt, and then inserted into the perforation; the pin and belt are then firmly seated by a sharp blow, the head of the pin is covered with a protective fluid, the base of the pin and the belt are treated with soldering fluid, and finally with a continuous strip of solder, which may be applied to the base of the pin by passing over a free surface of molten solder.

Apparatus for accomplishing the method in a succession of steps is illustrated by the accompanying drawings, in which:—

Fig. 1 is a front view of the complete apparatus with parts broken away;

Fig. 2 is a plan view of the same with auxiliary apparatus, on a somewhat reduced scale;

Fig. 3 is a side view, partly in section, of the pin-feeding, positioning, and inserting mechanism;

Fig. 4 is a plan view, with parts broken away, of the mechanism shown in Fig. 3;

Fig. 5 is an enlarged cross section with parts broken away, of the pin-feeding, positioning and inserting mechanism shown in Fig. 3, prior to the introduction of a pin into the pin slot;

Fig. 6 is an enlarged cross section similar to Fig. 5 showing the pin in the pin slot; and the pin-positioning device in advanced position;

Fig. 7 is an enlarged cross section as in Fig. 5, showing the pin inserted into a perforation of the belt;

Fig. 8 is a side view and cross section of part of the pin-positioning mechanism as shown in Figs. 3 to 7 and cam control for the same;

Fig. 9 is a side view of a device for seating the pin in the belt, feeding the belt and applying a metal oxide deposit thereon, and a cam for controlling the same;

Fig. 10 is an enlarged front view of the mechanism for feeding the belt, in retracted position;

Fig. 11 is the same as Fig. 10 with the feeding mechanism in advanced position;

Fig. 12 is a composite diagram of the several cams indicated in Figs. 3, 4, 8 and 9;

Fig. 13 is a cross sectional view of a device for applying soldering liquid to the under side of the belt and to the bases of the pins;

Fig. 14 is an enlarged side view and cross section of a solder pot and heater, with parts broken away;

Fig. 15 is an enlarged plan view of a portion of the finished belt; and

Fig. 16 is a cross section of the same on line 16—16 of Fig. 15.

In the operation of the apparatus, as shown generally in Figs. 1 and 2, the belt 1 passes from a reel 2 at the right across the horizontal table 3, and is taken up on reel 4 at the left-hand side of the drawing. The pin feeding and positioning part of the device is indicated at 5, the seating mechanism at 6, the belt-feed at 7, pro-

tective fluid applicator at 8, drier at 9, compressed air apparatus at 10, acid pot at 11, and solder pot at 12.

The perforated belt 1 is already provided with spaced perforations 13 (Fig. 2) usually along both sides of the belt, each perforation has two straight sides 15 at right angles to the margin of the belt and is rounded at the ends 15' (see Figs. 1 and 15).

The end of the belt is drawn from reel 2 and laid upon the table 3, one of the perforations 13 being brought into registry with a round, vertical pin-slot 14 in the table 3 adjacent to the pin feeding mechanism 5 (see Figs. 3 to 7). The pin slot is of a diameter and shape to receive the pin 16 (Figs. 5 to 7 and 16), which has a flat, disc-shaped base 17 and a head 18, which is positioned centrally thereof and has flat sides 19, rounded ends 21, and tapered or rounded top 22. The horizontal cross-section of the pin-head corresponds accurately in size and shape to fit into the perforations 13 in the belt 1.

Slidably mounted in the pin slot 14 is a plunger 22 pivoted to lever 23 which in turn is pivoted to bell crank arm 24 the opposite end of which carries a roller 26 engaging cam 27 on cam shaft 28. When the cam surface 29 engages the roller 26, the plunger 22 is in raised position (the pin being thrust through the belt 1 as shown in Fig. 7). As the cam rotates in the direction of the arrow, face 31 retracts the plunger (against the tension of spring 32) to the position shown in Fig. 5. As the roller rides up onto surface 33, the plunger is still further lowered to the position shown in Fig. 6. As the cam face 29 again engages the roller 26, the plunger is thrust upwardly to the position in Fig. 7.

In sequence with such operations of the plunger 22, a continuous column of pins 16 are fed to the pin slot 14, by means of a feed slot 34 (Fig. 4) which is so shaped as to transfer a column of the pins in upright position from the cylindrical pin feed chamber 36 into the pin slot under the impetus of compressed air introduced through pipe 37 and valve 38 from compressed air tank 39 (Fig. 2) operated by motor 41 and pump 42, to provide a suitable pressure as indicated by a gauge or other suitable indicator 43. The pins 16 in the feed chamber 36 are agitated by an oscillating arm 44 on an eccentric 46 driven as by belt 47 through shaft 48 from motor 49, (Figs. 2 and 3).

The cam shaft 28 is likewise driven from motor 49 by worm gear connection with shaft 48 (not shown) and carries, beside cam 27, a face cam 51 (Figs. 2 and 4) engaging a roller 52 on one end of pivoted arm 53, the opposite end of which carries a V-shaped guide 54 entering the feed slot 34 at right angles, the point 56 of which is in position *a* (Fig. 4) and prevents further movement of pins 16 in the feed slot 34 when the roller 52 engages the lowest face 57. As the roller rides up upon the uppermost face 58 (as shown) the point 56 is retracted to position *b* releasing the next pin 16' in feed slot 34 (Fig. 7). Cams 27 and 51 are so mounted on shaft 28 that this movement occurs while the plunger 22 is in raised position. The roller 52 next engages face 59 and the point 56 is advanced to position *c* (Fig. 5) thus arresting pin 16'' while receiving pin 16' between it and plunger 22. As the roller passes down onto face 57 the guide 54 advances and the slanting edge 61 forces the pin 16' into the pin slot 14 on top of plunger 22, which at this stage has been lowered to the position shown in Fig. 6.

Simultaneously with or before this latter movement a U-shaped member 62 (Figs. 4 to 7) which is slidably mounted in table 3 and has a slot 63 therein adapted to receive the head 18 of the pin 16', is advanced into the pin slot 14 as in Fig. 6, by means of an arm 64 and spring 65, actuated by cam 66 (likewise on shaft 28) as clearly shown in Fig. 8. Hence as the pin 16' is advanced into the pin slot 14, the flat sides 19 are at first guided by the sides of the feed slot 34 and are retained in this position by the U-shaped guide 62 when it enters the round pin slot 14 upon the top of plunger 22. Upon rotation of cam 66 to the position shown in Fig. 8, the U-shaped member is retracted from the pin slot.

The plunger 22 now rises (Figs. 3 and 7) and thrusts the pin 16' into the next perforation 13 of the belt (which has meanwhile been advanced one space by mechanism hereinafter to be described) thus bringing it into the position occupied by the previous pin 16 as shown in Fig. 7.

A plate 67 may be fixed above the belt 1 as by clamp 68 (Fig. 2) to hold the same firmly in position, as the pin 16' is inserted therethrough.

Mechanism for seating the inserted pin and also for advancing the belt 1, is operated by cam 69 (Fig. 9) acting through roller 71 upon lever arm 72, the opposite end of which carries a rod 73 engaging a compression spring 74 (Fig. 1). As the roller 71 rides up on the face 76 the arm is raised against the spring 74, and as it rides down on to the face 77 the arm is brought down suddenly, not only by gravity but by actuation of the spring 74. The end of the arm carries a hammer 78, while a slidable anvil 79 is mounted therebeneath but above the line of inserted pins 16 in the belt 1. The anvil is normally held in raised position by spring 81 and is also shaped, on its under surface, to fit over the head of the pin to strike the edges 15 and 15' of the belt 1 surrounding it, and thus forces them against the base 17 (see Fig. 16).

Lever arm 72 also carries an oblique cam face 82 (Figs. 10 and 11) which, on descending, bears against a spring-pressed horizontal slide 83 having a pawl 84 pivoted thereto. On the down stroke of the cam 82, the slide 83 is thrust to the left and the pawl 24 engages a pin 16 in the belt 1 and advances it by a distance equal to the spacing of the sprocket holes in which the pins are seated. The contacting portion of slide 83 thereafter rides up onto the vertical face 86 of the cam so that the lever arm may continue to descend without advancing the pawl 84 (Fig. 11). As the lever 72 rises, the pawl is retracted to the position shown in Fig. 10, (riding freely over the next pin 16) by actuation of the spring 87 (Fig. 1). The upstanding arm 88 of the pawl permits manual operation of the same, if necessary, to move the belt.

Likewise on lever arm 72 is mounted a vertical rod or plunger 89 (Figs. 1 and 9) passing through a tank 92 (preferably containing an alcohol suspension of zinc oxide) mounted on bracket 93. The end 94 of the plunger passes through the bottom of the tank and carries with it a drop of the liquid from the tank and applies it to the heads of the pins 16, beneath.

To the left of the apparatus thus described (as shown in Fig. 1) is provided a blower consisting of a perforated pipe 96, leading from tank 39 and mounted adjacent to the belt, which directs

a blast of air thereon to evaporate the alcohol from the zinc oxide and leaves a thin but uniform coating 95 of the latter covering the surfaces of the heads of the pins and of the belt (see Fig. 16).

The belt then passes over an acid pot 97 (Fig. 13) containing a suitable soldering fluid which is applied to the bottom of the belt and to the bases of the pins by means of a roller 98 having a pair of flanges 99 contacting the belt 1 on either side of the row of pins 16 and an intermediate rubber roller 101, riding along the bases of the pins.

The belt then passes over the top of an open soldering pot 12, (Fig. 14) the lip 102 of which stands slightly higher than the surface of table 3 and, together with expansion effects due to the heat from the molten solder, flexes the belt 1 upwardly. The pot is heated preferably by a resistance coil 106 surrounded by an insulating jacket 107, the heat being conducted to the solder 108 by means of a metal core 109 (Fig. 14). The belt is wetted by the molten solder and acquires a uniform layer 113; covering both the bottom surface of the belt and the bases of the pins (Fig. 16). From here the belt passes to the take-up reel 4 as above described.

The belt 1 is held firmly to the table 3 as described and also by one or more spring-pressed rollers 111 and guide roller 112.

Thus the perforated belt is advanced intermittently across the table 3, pins 16 are fed adjacent thereto through the pin slot 14, in registry with successive perforations 13 in the belt, oriented in conformity with the perforation by slide 62, inserted therein by plunger 22, and firmly seated in the belt by hammer 79 the heads then coated with a protective layer of zinc oxide suspension which is dried, the bases then being wet with a soldering fluid, and finally coated with a uniform layer of molten solder which quickly solidifies, and the finished belt is reeled up. The zinc oxide powder is readily brushed off and the finished belt is ready for use.

It is to be understood that the apparatus herein disclosed for applying pins successively to a single row of perforations may be duplicated or multiplied, to apply and offer pins to two or more rows of perforations simultaneously. Other modifications and adaptations may be made within the contemplation of the invention and are to be considered as included by the following claims.

We claim:

1. Apparatus for affixing pins to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt intermittently in the direction of said row of perforations by a distance equal to the spacing of the perforations, means for feeding a pin adjacent to said belt, in registry with each successive perforation, means for orienting said pin with respect to said perforation, and means for inserting said pin into the corresponding perforation.

2. Apparatus for affixing pins to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt intermittently in the direction of said row of perforations by a distance equal to the spacing of the perforations, means for successively feeding pins into registry with successive perforations in the belt, means for inserting the pins into the corresponding perforations, and means for seating the belt firmly against each inserted pin.

3. Apparatus for affixing pins to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt intermittently in the direction of said row of perforations by a distance equal to the spacing of the perforations, means for feeding a pin into registry with a perforation in the belt, means for inserting the pin into the corresponding perforation, means for applying a protective liquid upon the head of said pin, means for applying a soldering compound to the base of said pin, and means for applying solder to the bases of the pins.

4. Apparatus for affixing pins to a metal belt having a row of spaced perforations containing pins passing therethrough, comprising means for advancing the belt in the direction of said row of perforations, means for applying a protective liquid to the heads of said pins, means for applying a soldering solution to the bases of said pins, and means for applying solder to the bases of said pins.

5. Apparatus for affixing pins to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt in the direction of said row of perforations by a distance equal to the spacing of the perforations, means for feeding a pin to said belt in registry with each successive perforation, means for orienting said pin with respect to the belt, means for inserting said pin into its corresponding perforation, and means adapted to actuate each of said means in appropriate sequence each with the other.

6. Apparatus for affixing pins to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt in the direction of said row of perforations by a distance equal to the spacing of the perforations, means for feeding a pin to said belt in registry with each successively positioned perforation, means for intermittently checking subsequent pins in said pin feeding means, and means for inserting said pin into the corresponding perforation in the belt.

7. Apparatus for affixing pins to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt in the direction of said row of perforations by a distance equal to the spacing of the perforations, means for feeding a pin to said belt in registry with each successively positioned perforation, means for intermittently checking subsequent pins in said pin feeding means, and means for inserting said pin into the corresponding perforation in the belt, and means adapted to actuate each of said means in appropriate sequence, each to the other.

8. Apparatus for affixing pins to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt in the direction of said row of perforations by a distance equal to the spacing of the perforations, means for feeding a pin to said belt in registry with each successively positioned perforation, means for intermittently checking subsequent pins in said pin feeding means, means for orienting said pin with respect to the perforation, and means adapted to actuate each of said means in appropriate sequence, each to the other.

9. Apparatus for affixing pins having a base and a flat-sided head to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt in the direction of said row of perforations by a distance equal to the spacing of the perforations, a pin slot adjacent to said belt adapted to feed a pin to said belt in registry with said perforation, a feed slot entering said pin slot and adapted to guide a column of pins thereto, a V-shaped guide entering said feed

slot adapted intermittently to release a pin in said column and to advance the same into said pin slot and check succeeding pins in said column, a guide member adapted intermittently to enter said pin slot in advance of the pin to orient the flattened head of said pin with respect to the perforation in the belt, a plunger in the pin slot, adapted to insert the pin into the registered perforation in the belt, and means adapted to actuate each of said means in proper sequence of operations.

10. Apparatus for affixing pins having a base and a flat-sided head to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt in the direction of said row of perforations by a distance equal to the spacing of the perforations, a pin slot adjacent to said belt adapted to feed a pin to said belt in registry with said perforation, a feed slot entering said pin slot and adapted to guide a column of pins thereto, a V-shaped guide entering said feed slot adapted intermittently to release a pin in said column and to advance the same into said pin slot and check succeeding pins in said column, a guide member adapted intermittently to enter said pin slot in advance of the pin to orient the flattened head of said pin with respect to the perforation in the belt, a plunger in the pin slot, adapted to insert the pin into the registered perforation in the belt, means for seating the inserted pin in said belt, and means adapted to actuate each of said means in proper sequence of operations.

11. Apparatus for affixing pins having a base and a flat-sided head to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt in the direction of said row of perforations by a distance equal to the spacing of the perforations, a pin slot adjacent to said belt adapted to feed a pin to said belt in registry with said perforation, a feed slot entering said pin slot and adapted to guide a column of pins thereto, a V-shaped guide entering said feed slot adapted intermittently to release a pin in said column, and to advance the same into said pin slot and check succeeding pins in said column, a guide member adapted intermittently to enter said pin slot in advance of the pin to orient the flattened head of said pin with respect to the perforation in the belt, a plunger in the pin slot, adapted to insert the pin into the registered perforation in the belt, means for applying a protective coating to the upper end of the pin, to the base of the pin, and means adapted to actuate each of said means in proper sequence of operations.

12. Apparatus for affixing pins having a base and a flat-sided head to a metal belt having a row of spaced perforations therein, comprising means for advancing the belt in the direction of said row of perforations by a distance equal to the spacing of the perforations, a pin slot adjacent to said belt adapted to feed a pin to said belt in registry with said perforation, a feed slot entering said pin slot and adapted to guide a column of pins thereto, a V-shaped guide entering said feed slot adapted intermittently to release a pin in said column and to advance the same into said pin slot and check succeeding pins in said column, a guide member adapted intermittently to enter said pin slot in advance of the pin to orient the flattened head of said pin with respect to the perforation in the belt, a plunger in the pin slot, adapted to insert the pin into the registered perforation in the belt, and means adapted to actuate each of said means in proper sequence of operations, means for applying a soldering liquid and means for applying molten solder to the base and periphery of the pin.

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