

PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

A Machine for the Production of a Sliding Clasp Fastener

I TADAO YOSHIDA of 339, 2-chome, Suwadacho, Ichikawa-shi, Chiba-ken, Japan, a Japanese citizen, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a machine for enamelling the inter-engaged teeth of the stringers from which a sliding clasp fastener is formed.

The clasp and teeth of conventional sliding clasp fasteners are usually made from a relatively expensive copper alloy and it is difficult to colour this alloy to match or contrast with the colour of the tape on which the teeth are mounted. Any colouring which has been carried out has usually been by gilding or by an electrolytic process whereby only metallic colourings can be obtained. In addition colouring by either of these processes usually entails boiling in a chemical solvent prior to applying an acid coloured coating.

For this reason it has hitherto been necessary to carry out any colouring, at least of the teeth, before attaching the teeth to a fabric tape.

The present invention provides a machine for enamelling the inter-engaged teeth of a pair of sliding clasp fastener stringers (i.e. tapes on which teeth have been mounted) which comprises a guide means adapted to receive the stringers, means for adjusting the tension of the stringers, a container for enamel, an enamelling wheel provided with a peripheral groove adapted to receive the teeth and so disposed above the container that a portion of the wheel is always within the container, an agitator mounted in the container, a scraper knife adjustably mounted with its blade bearing on the peri-

phery of the enamelling wheel, an enamelling roller mounted on an axis parallel to the axis of the enamelling wheel, means for conveying the stringers away from the enamelling wheel, means for vertically conveying the stringers through a baking chamber provided with infra-red lamps, means for adjusting the position of the lamps with respect to the stringers and means for withdrawing the enamelled stringers from the machine.

If required different colours can be used for different surfaces or different parts of the same surface of the teeth.

The present invention is further illustrated by the accompanying drawings in which:

Figure 1 is a front elevation of the machine according to the invention (with the exception of the baking and drying device);

Figure 2 is a sectional side elevation along the line (A)-(A) of Figure 1;

Figure 3 is the front view showing the main power transmitting mechanism;

Figure 4 is a sectional side elevation along the line (B)-(B) of Figure 3;

Figure 5 is an under plan view of the mechanism for the transmission of power to the enamelling device, and the means for conveying the stringers;

Figure 6 is a sectional side elevation along the line (C)-(C) of Figure 5.

Figure 7 is a front view of the enamelling device;

Figure 8 is a sectional side elevation along the line (D)-(D) of Figure 7;

Figure 9 is a cross-section along the line (E)-(E) of Figure 8;

Figure 10 is a front view of the tank showing the lower enamelling roller and the enamel agitator;

Figure 11 is a side elevational of the view shown in Figure 10;

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Figure 12 is an under plan view of the mechanism for horizontally conveying the stringers.

Figure 13 is a front view of the tension roller and associated driving means;

Figure 14 is a side elevation of Figure 13;

Figure 15 is a side elevation of the mechanism for adjusting the position of the infra-red lamps; and

Figure 16 is the front view of the right side of Figure 15.

The drawings will now be described in four parts, the description in each part relating to a stage in the process carried out by the machine.

1. Mechanism for transmitting power to various parts of the machine:

Power from a motor 1 is transmitted by means of pulleys 2, 3 through a shaft 4, worm 5 and a worm wheel 6 to a shaft 7 to which is attached a bevel gear 8 which cooperates with a bevel gear 9, whereby power is transmitted to shaft 10 which carries a bevel gear 11 which cooperates with bevel gear 12 to rotate a shaft 13, by means of which a pair of interlocked stringers are moved horizontally. The shaft which is supported by a bracket 14 carries a bevel gear 15 which cooperates with a bevel gear 16 whereby the shaft 17 is rotated. The bevel gear 16 cooperates with a bevel gear 18 and transmits rotary motion to a shaft 19 whereby the stringers are moved vertically. The shaft 17 is supported by a bracket 20 near its centre and is connected to a pulley 25 and carries a bevel gear 22. The shaft 17 is supported at the end opposite the bevel gear 16 by a bracket 21. The bevel gear 22, by way of a bevel gear 23 rotates a shaft 24, which shaft, together with the shaft 19 moves the stringers accurately and smoothly along a vertical path. The pulley 25 transmits power to a pulley 26, shaft 27, bevel gears, 28, 29, shaft 30, universal joints 31, 32, shaft 33, universal joints 34, 35 and a shaft 36 whereby an enamelling wheel 45 is driven.

2. Enamelling Device:

An interlocked pair of stringers (i.e. the tooth-carrying tapes from which sliding clasp fasteners are subsequently made) runs between a lower guide plate 41 and an upper guide plate 42, the opposing surfaces of which guide plates each have a groove designed to receive the inter-engaged teeth of the stringers. The guide plate 42 is provided with a spring 43 whereby the plate 42 is held against the plate 41 so that the teeth will not jump out of the grooves. After passing through the guide plates, the interlocked stringers run between a lower enamelling wheel 45 and an upper enamelling roller 51 mounted on axes parallel to one another. The enamelling wheel 45 is driven by the shaft 36 and the

upper enamelling roller 51 is driven by a gear 44 on the shaft 36 by way of a gear 49 and a shaft 50. The lower portion of the enamelling wheel 45 is immersed in enamel in container 68. As the wheel 45 rotates enamel clings to the sides and around the periphery of the wheel. The wheel 45 is provided with a shallow peripheral groove so designed that only the teeth of the stringers fit into it. A scraper knife 46 is mounted to bear against the periphery of the enamelling wheel so that when the enamelling wheel 45 passes the scraper knife, the enamel adhering to the sides of the wheel is removed and the enamel in the groove of the wheel is reduced to an even layer of predetermined thickness. The thickness of the layer can easily be adjusted by altering the position of the scraper knife with bolt 47 and spring 48. The teeth pass quickly through the groove in the upper and lower guide plates and pass between the lower enamelling wheel 45 and upper enamelling roller 51, and are pressed into the groove in the enamelling wheel 45 by the enamelling roller 51. The enamelling roller 51 is permanently pressed downward by a spring 54 acting through a lever 52 pivoted at 53. The tension of the spring is readily adjustable by a bolt 55 so that the position of the roller relative to the wheel is adjustable to enable the enamelling to be carried out under the best conditions. The stringers, after passing between the enamelling wheel 45 and the enamelling roller 51, are conveyed away from it by rollers 60 and 63, which rollers are mounted on axes parallel to the axis of the enamelling wheel and which have peripheral grooves for receiving the teeth, the grooves in the lower roller 60 being deep enough to ensure that the enamelled surface of the teeth does not come in contact with the bottom of the groove. In this way only the cloth tapes of the stringers will be held between the rollers 60 and 63. The rollers 60, 63 are driven by a gear 56 mounted on a shaft 57 in turn connected to the gear 44 mounted on the shaft 36, the gear 56 engaging with a gear 58 mounted on a shaft 59 and engaging with a gear 61 mounted on a shaft 62. The pressure on the tapes of the stringers which are held between the rollers 60, 63 can readily be adjusted by spring 66, which is attached to one end of a lever 64 on which is mounted the roller shaft 62, and a shaft 65, by means of a bolt 67. An agitator 69 having several blades 70 is arranged within the enamel container 68 whereby the enamel is prevented from becoming solid. The agitator is frictionally driven by the enamelling wheel and is provided with a bearing 71 at each end and a spring 72 extending through to a guide 73 which spring holds the agitator against the enamelling wheel 45.



105 groove

3. Mechanism for conveying the stringers:

After undergoing prior treatment, for example polishing with a wire brush and sand paper, removal of grease and washing, the stringers are sent to the enamelling section through a guide 37 adapted to receive the teeth and wheels 39, 40 and when passing through the guide and wheel 39, the stringers are orientated and by a vertical movement of bracket 38, which supports the wheel 39, the tension in the stringers can readily be adjusted, and after one side of the stringers have been enamelled, the stringers pass from the rollers 60, 63 over wheel 74 which has its axis at right angles to the axis of the enamelling wheel and wheel 75 which has its axis parallel to the axis of the enamelling wheel and then passes over a series of horizontally arranged rollers 79 coaxially mounted on a shaft 78 which is supported by brackets 76 77 and round a series of horizontally arranged rollers 82 parallel but staggered with respect to rollers 79 which rollers 82 are coaxially mounted on the shaft 13 which is driven by bevel gears 11, 12. The shaft 13 is mounted in brackets 80, 81. The stringers first then pass under the roller 79 at the very end of the shaft 78 then over the second one of the rollers 79 and then to the second roller 82 and so on, during which process, the stringers are carried horizontally and the volatile constituent of the enamel on the teeth evaporates. Thus, after passing round the last roller 82 and round a take-off wheel 83 with its axis parallel to and above the axis of the rollers 82 the stringers are sent to the baking and drying chamber, in which they are carried over two parallel staggered coaxial sets of rollers 86, 87 and 90, 91 the axes of which are at right angles to those of the rollers 81, 81 and move gradually upwards during which process the enamel coated on the stringers is well baked and dried. The rollers 87 are driven by the shaft 24 which in turn is driven by a bevel gear 84 which engages with a bevel gear 85, while rollers 91 are driven by bevel gear 89 which engages with a bevel gear 88 mounted on the shaft 19. The enamel on the teeth thus baked the stringers are passed from the machine by way of the uppermost of the rollers 90 by passing over the wheels 92, 93 and between the roller 96 and wheel 97. During this stage of the process, in order to prevent stringers from getting entangled on the roller 96, a guide 101 is provided. The roller 96 and the wheel 97 are each provided with a peripheral groove for receiving the teeth of the stringers so that only the tapes held between the roller and the wheel. The roller 96 is driven by the bevel gear 95 which engages with a bevel gear 94 mounted on a shaft 24, while the wheel 97 is held against the roller 96 by the downward pull

of a spring 100 attached to one end of a bracket 98 supporting the wheel 97 with shaft 99 as a pivot. The enamelled stringers are passed from the machine by way of a guide (not shown).

4. Baking and drying device:

The stringers with the teeth, enamelled on one side while passing through the enamelling device are carried horizontally into the baking chamber by a wheel taking several minutes to reach to the baking chamber so that the volatiles of the enamel are substantially removed. The stringers while proceeding gradually upward through the chamber, are baked and dried by infra-red ray lamps 102 which give direct radiant heat and also indirect radiant heat from a reflecting plate and in this way the stringers are baked and dried by the time they reach the top of the chamber. The position of the lamps can be adjusted by revolution of a handle 105 mounted on a shaft 104 at the upper part of the baking chamber, said shaft 104 having a pinion 106 and a rack 107 fixed to a lamp-frame-supporting arm 108 which can be moved inward and outward, which movement moves the lamps fixed on frame 113 and enables quick and steady adjustment of the lamp position. Roller 110 which rotates on shaft 109 and roller 112 which rotates on shaft 111 allows easy forward and backward movement of the lamp-supporting frame.

As the machine according to the invention is automatic no technical skill is necessary for its operation and because the enamelling and baking of the teeth are performed by the one machine not only is there a saving in time and labour but also a saving in the amount of enamel used since only the teeth are enamelled and no enamel is wasted on the tape.

WHAT I CLAIM IS:

1. A machine for enamelling the inter-engaged teeth of a pair of sliding clasp fastener stringers (i.e. tapes on which teeth have been mounted) which comprises a guide means adapted to receive the stringers, means for adjusting the tension of the stringers, a container for enamel, an enamelling wheel provided with a peripheral groove adapted to receive the teeth and so disposed above the container that a portion of the wheel is always within the container, an agitator mounted in the container, a scraper knife adjustably mounted with its blade bearing on the periphery of the enamelling wheel, an enamelling roller mounted on an axis parallel to the axis of the enamelling wheel, means for conveying the stringers away from the enamelling wheel, means for vertically conveying the stringers through a baking chamber provided with infra-red lamps, means for adjusting the position of the lamps with respect to the stringers and

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means for withdrawing the enamelled stringers from the machine.

2. A machine as claimed in claim 1 wherein the guide means, comprises upper and lower guide plates each provided with a groove to accommodate the teeth of the stringers running therebetween.

3. A machine as claimed in claim 1 or 2 wherein the means for conveying the fastener away from the enamelling wheel comprises a pair of rollers, which rollers are mounted on axes parallel to that of the enamelling wheel each roller being provided with a peripheral groove adapted to receive the teeth, the groove in the lower roller being deep enough to ensure that the enamelled surfaces of the teeth do not touch the bottom of the groove, a wheel having its axis at right angles to the axis of the enamelling wheel, a second wheel having its axis parallel to that of the enamelling wheel and two parallel staggered sets of horizontally arranged rollers, the rollers of each set being coaxially mounted, whereby the chain is conveyed horizontally.

4. A machine as claimed in claim 3, wherein the means of vertically conveying the chain through the baking chamber comprise a take off wheel with its axis parallel to the axes of and arranged above the two sets of horizontal rollers and two parallel staggered sets of vertically disposed rollers the axes of which are at right angles to the axes of the horizontal rollers the rollers of each set being coaxially mounted, whereby the stringers are conveyed vertically.

5. A machine as claimed in any of

claims 1 to 4, wherein the means for withdrawing the enamelled stringers from the machine comprises a roller provided with a peripheral groove adapted to receive the teeth, a wheel also provided with a groove adapted to receive the teeth, which wheel is held against the roller by a spring, and a guide from which the stringers pass out of the machine.

6. A machine as claimed in any of claims 1 to 5, wherein the guide means comprise an upper and a lower guide plate the opposing surfaces of which are provided with grooves adapted to receive the teeth and a spring holding the guide plates together.

7. A machine as claimed in any of claims 1 to 6 wherein the enamelling roller is adjustable with regard to its position in relation to the enamelling wheel by a spring loaded lever through which the axis of the enamelling roller passes, which lever is adjustable by means of a spring loaded bolt.

8. A machine as claimed in any of claims 1 to 7, wherein the agitator within the enamel container is frictionally driven by the enamelling wheel.

9. A machine for enamelling the teeth of a pair of stringers substantially as described with reference to the accompanying drawings.

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