

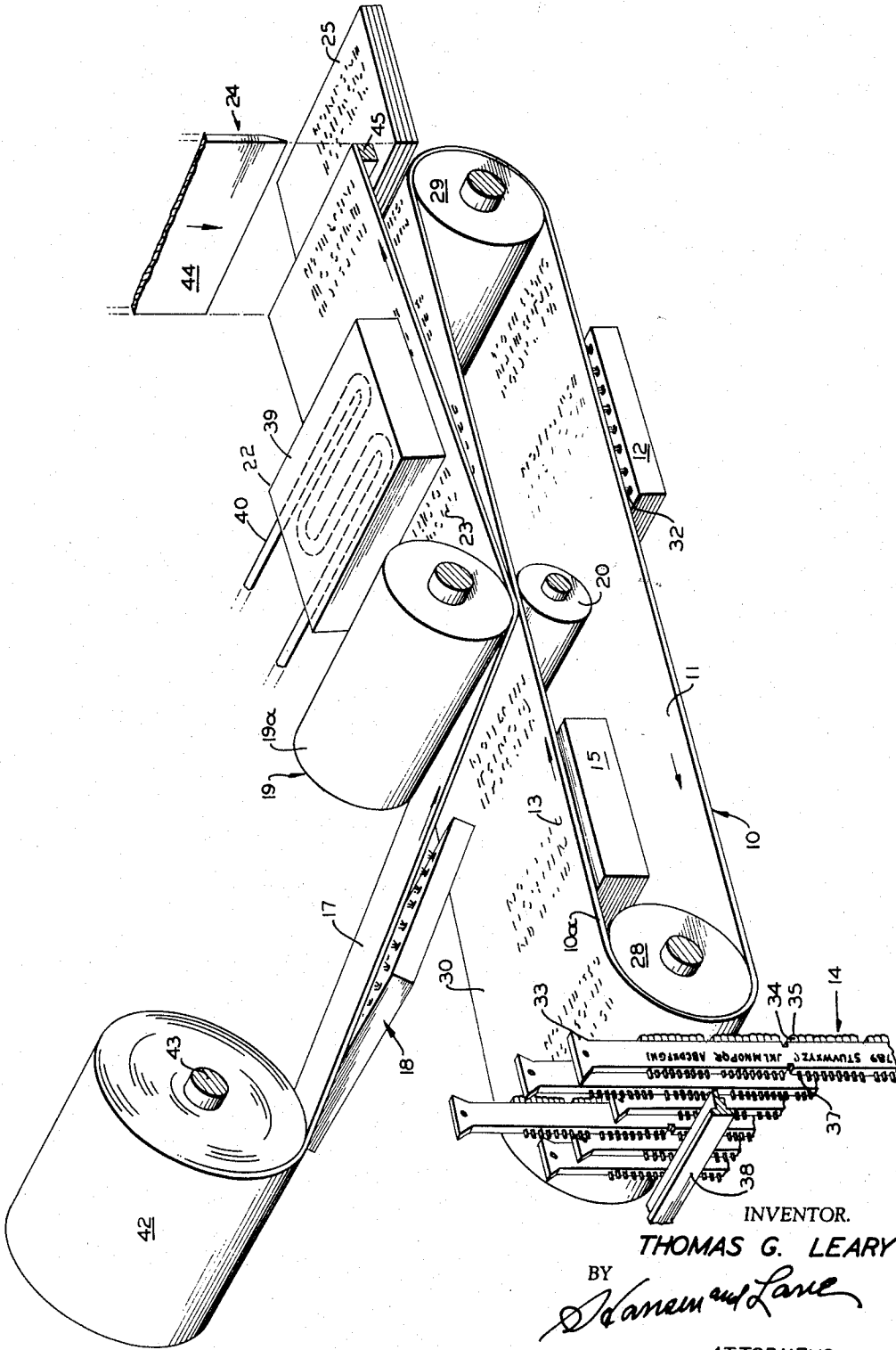
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MACHINE FOR EMBOSsing THERMO-PLASTIC WORKPIECE

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MACHINE FOR EMBOSSING THERMOPLASTIC WORKPIECE

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The present invention relates to embossing, and pertains more particularly to a machine for embossing characters on a heat-softened, thermo-plastic workpiece.

Many printing and other operations require the use of a piece of sheet material having a plurality of type-like or other characters embossed thereon. For example, in making address cards for use in a mail-addressing machine, or credit cards for use by credit customers of retail mercantile firms, oil companies and others it is common practice to use a small plate or card of suitable sheet material having a customer's name and other pertinent data embossed thereon.

In the past, it has been customary to perform such embossing by stamping or printing from set type. This has been a relatively slow and expensive operation, and one not readily adaptable to automatic control as by means of punched cards.

This invention contemplates the use of an embossing medium of material which, when heated to a predetermined temperature will receive character indentations impressed in a surface thereof, when cooled will retain these impressions for use as an embossing die, and when re-heated will smoothen out to restore the indented surface to its original conformation, thereby erasing the impressions therefrom, the reheating also preparing the medium for receiving new character impressions therein.

The invention also provides for easily and quickly embossing selected characters on a sheet of heat-softened thermo-plastic material by the re-use, in succeeding cycles, of a single embossing medium as a die.

Another object of the invention is to provide improved means for embossing characters on a heat-softened thermo-plastic workpiece.

A further object is to employ an embossing medium made of material having a "plastic memory."

For the purpose of the present specification and claims, material having a "plastic memory" is defined as a material capable, when heated, of receiving impressions indented in a surface thereof, of retaining such impressions when the medium is promptly cooled after being indented so as to be usable as a die for embossing a relatively softer member, and of restoring itself to its original conformation when reheated to a predetermined temperature, thereby to remove such impressions therefrom.

The foregoing, and other objects and advantages of the invention, will be apparent from the following description and the accompanying drawing, wherein the drawing is a somewhat diagrammatic, perspective view of a machine embodying the invention, and also illustrates successive steps of the method involved in the invention, portions of the machine being broken away.

Briefly, the illustrated embodiment of the invention comprises a flexible belt 10 of material having a "plastic memory." The belt 10 is exposed on its lower run 11 to a heater 12, which heats the belt to a predetermined temperature to heat-soften the belt sufficiently to receive indented character impressions 13 from type means 14.

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These character impressions 13 are temporarily affixed in the belt 10 by promptly cooling the latter below a predetermined temperature as it passes over a cooler 15.

A strip or workpiece 17 of thermo-plastic sheet material, heat-softened by its passage over a second heater 18, is pressed onto the belt 10 by presser rolls 19 and 20, which deform the heat softened material of the strip 17 into the die-like character impressions 13 in the belt 10, thereby embossing these characters on the strip 17.

The embossed strip 17 then is cooled, as by passing it beneath a cooler 22 which sets the character embossments 23 thereon. Cutter means 24 then shears the strip 17 into individual plates or cards 25.

After completing the aforementioned embossing operation, the embossing belt 10 again passes over the heater 12, where it is reheated to a predetermined temperature to allow the belt material to exercise its "plastic memory" function and thus to restore its indented outer surface portion 10a to its original form. This removes the impressions 13 therefrom and prepares the belt for another cycle by receiving a new set of character impressions as it again passes beneath the type means 14.

Referring to the drawings in detail, the belt 10, or at least its outer surface portion 10a, is of suitable thermo-plastic material of the type having a "plastic memory," such as, for example, a polymer of methyl methacrylate bearing the trade name "Lucite." The specific material is not essential to the invention, which may be practiced using as an embossing medium any suitable "plastic memory" type of material.

The belt 10 is trained around a pair of end rollers 28 and 29, and is driven by conventional drive means, not shown, in the direction of the arrows on the lower and upper runs 11 and 30 thereof.

The heater 12, mounted beneath the lower run 11 of the belt 10, may be energized in any suitable manner, for example, by the use of electrical resistance elements 32. The heater 12 is designed to heat the lower belt run 11 to a temperature, which when the belt passes beneath the type means 14, permits the belt to receive indented character impressions 13 therein when struck by the type means 14.

The illustrated type means 14 comprises a plurality of type bars 33 of a well known kind. These type bars are mounted in slightly outwardly spaced relation, and substantially tangent to, the belt 10 as it passes around the end roller 28. Each type bar 33 has a plurality of usual outwardly biased type-bearing plungers 34 slidably mounted transversely thereof, with the type face 35 of each directed toward the belt 10, and an impact head 37 of each extending from the opposite or lefthand edge of the type bar as shown in Fig. 1.

The type bars 33 are actuated endwise thereof by conventional means, not shown, to position a selected type plunger 34 of each in a position of radial alignment with the belt end roller 28, and directly inwardly of a striker bar 38. The striker bar 38 is spaced outwardly from the impact heads 37 and parallel to the axis of rotation of the end roller 28.

The striker bar 38 is driven inwardly against the impact heads 37 aligned therewith at selected intervals by a usual impulse generator, not shown, thereby to drive selected type plungers 34 into indenting engagement with the heat-softened belt 10. Since the structure and operation of such type bars are well known to those familiar with the art of punch card printing mechanisms, and since such details form no part of the claimed invention, they will not be described in detail herein.

Obviously, it is desirable to have the type means 14 and belt 10 retained against relative lateral movement at the moment of impact of the type with the belt. This

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can be accomplished in a well known manner, either by arresting the movement of the belt 10, or by moving the type means 14 synchronously with the belt at such moment of impact.

After passing the type means 14, the belt 10, with the character impressions 13 indented therein, passes over the cooler 15, which may be, for example, similar to the upper cooler 22, which has an aluminum block 39 encasing a coil 40 through which refrigerated brine is passed. The cooler 15 rapidly cools the belt 10 to a temperature below that at which it is capable of exercising its "plastic memory" function, and thus retains the character impressions 13 die-like in the belt.

The strip or workpiece 17, of thermo-plastic sheet material, preferably is of a material which is firm at temperatures to which the embossed workpiece is to be exposed in use, for example, below 150° F., and which softens to permit easy embossing at a predetermined temperature thereabove. Such materials are well known and their details form no part of the present invention. A supply of the strip material may be supported in the form of a roll 42 on a mandrel 43 for feeding angularly downwardly and between the presser rolls 19 and 20.

The strip 17 is heated to an easily embossable condition ahead of the presser rolls 19 and 20 by the heater 18, which may be similar to the heater 12. The strip 17 then is pressed into the die-like impressions 13 in the outer surface portion 10a of the belt 10 between the presser rolls 19 and 20. The upper presser roll 19 has a resiliently deformable peripheral layer 19a of suitable material, such as soft rubber, which forces the heat-softened material of the strip 17 into the die-like character impressions 13, which, at this point, are affixed in the chilled belt 10.

After passing between the presser rolls 19 and 20 the embossed strip 17 inclines angularly upwardly away from the upper run 30 of the belt 10, and passes beneath the cooler 22, which cools the thermo-plastic material of the embossed strip 17 below its setting temperature, and thereby causes it to retain the characters 23 embossed thereon. The workpiece strip 17 then may be severed into individual plates or cards 25 by the cutting means 24, which comprises an upper, movable shearing blade 44 acting on a lower, fixed shearing blade 45.

The belt 10, after passing between the presser rolls 19 and 20, passes around the right hand end roller 29, and the lower belt run 11, moving in the direction of the arrow thereon, again passes over the lower heater 12, which re-heats the belt to a temperature which permits it to exercise its "plastic memory" function and return to its original form, thereby removing the character impressions 13 therefrom.

This re-heating of the lower belt run 11 also prepares the belt for its next cycle beginning with the indenting of new character impressions therein by the type means 14 as the belt 10 again passes therebeneath.

In common practice the illustrated type means 14 is capable of actuation from punched cards at speeds sufficient to form the character impressions 13 at a rate of more than one short line per second. It is obvious, therefore, that by means of the present mechanism an extremely high rate of production is possible.

Although the invention is shown as employing type bars 33 of a specific, well known kind, it is obvious that other means may be provided for producing indented character impressions in a "plastic memory" type of embossing medium, and that numerous alternate arrangements of other parts of the invention also will occur as routine changes to designers and others working with the invention.

While I have illustrated and described a preferred embodiment of the present invention, it will be understood however, that various changes and modifications may be made in the details thereof without departing

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from the scope of the invention as set forth in the appended claims.

Having thus described the invention, what I claim as new and desire to protect by Letters Patent is defined in the following claims.

I claim:

1. An embossing mechanism comprising a belt of thermo-plastic material having a "plastic memory," a strip of thermo-plastic material adjacent said belt, a pair of presser rolls pressing the strip and belt therebetween into compressive, superposed relation with each other, the belt and strip being driven to pass at the same speed between the presser rolls, heating means acting on the belt ahead of the presser rolls in the direction of belt travel for heating the belt to impressionable condition, type-like means mounted between the belt heating means and the presser rolls for impressing character indentations into an impressionable surface of the belt, cooling means acting on the belt between the character impressing means and the presser rolls for cooling the belt below a temperature at which the "plastic memory" of the belt will function for retaining the character impressions in the belt, heating means acting on the strip ahead of the presser rolls in the direction of strip travel for heat-softening the strip to embossable condition, whereby the softened strip material is pressed by the rolls into the character impressions in the belt to emboss such characters on the strip, cooling means acting on the strip beyond the presser rolls in the direction of strip travel to set the embossed characters on the strip, and heating means acting on the belt beyond the presser rolls in the direction of belt travel for re-heating the belt to a temperature which causes the "plastic memory" of the belt to function, thereby restoring the indented surface of the belt to its former conformation to remove the character indentations therefrom.

2. An embossing mechanism comprising a belt of thermo-plastic material having a "plastic memory," a strip of moldable material adjacent said belt, means for pressing adjacent portions of the belt and strip firmly together in superposed relation, the belt and strip being driven to pass beneath the presser means, heating means acting on the belt ahead of the presser means in the direction of belt travel for heating the belt to impressionable condition, type-like means mounted between the heating means and the presser means for impressing character indentations into an impressionable surface of the belt, cooling means acting on the belt between the character impressing means and the presser means for promptly cooling the belt below a temperature at which the "plastic memory" of the belt will function for retaining the character impressions die-like in the belt, whereby the moldable strip material is pressed by the presser means into the die-like character impressions in the belt to emboss such characters on the strip, and heating means acting on the belt beyond the presser means in the direction of belt travel for heating the belt to a temperature which causes the "plastic memory" of the belt to function, thereby restoring the indented surface of the belt to its former conformation to remove the character impressions therefrom.

3. An embossing mechanism comprising a belt of thermo-plastic material having a "plastic memory," a moldable workpiece positioned closely adjacent a portion of said belt, means for pressing the belt and workpiece firmly together in superposed relation, the belt being driven to travel lengthwise thereof, heating means acting on the belt ahead of the workpiece in the direction of belt travel for heating the belt to impressionable condition, type-like means mounted between the heating means and the workpiece for impressing character indentations into an impressionable surface of the belt, cooling means acting on the belt between the character impressing means and the workpiece for cooling the belt below a temperature at which the "plastic memory" of

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the belt will function for retaining the character impressions die-like in the belt, presser means mounted adjacent the belt for pressing a moldable workpiece into the die-like character impressions in the belt to emboss such characters on the workpiece, and heating means acting on the belt beyond the workpiece in the direction of belt travel for heating the belt to a temperature which causes the "plastic memory" of the belt to function, thereby restoring the indented surface of the belt to its former conformation to remove the character impressions therefrom.

4. In a mechanism for embossing moldable material, an endless belt of material having a "plastic memory" trained to travel circumferentially thereof along a path, drive means operatively connected to drive the belt along said path in recurring cycles, a heater mounted adjacent a portion of the belt's cyclical path for heating the portion of the belt opposite said heater to impressionable condition in which condition the belt is free to exercise its "plastic memory," type-like means mounted beyond the heater in the direction of belt travel for indenting character impressions in the impressionable belt, cooling means mounted beyond the type-like means in the direction of belt travel for setting the character impressions in the belt for use of the latter as an embossing die, said heater being mounted ahead of the type-like means in the direction of belt travel a sufficient distance to allow the belt to exercise its "plastic memory" and thereby to remove the character impressions therefrom.

5. In a mechanism for embossing moldable material, an endless belt of material having a "plastic memory" trained around a pair of end rollers to travel circumferentially in one direction and in recurring cycles, a heater mounted adjacent the belt's cyclical path in advance of one end roller in the direction of belt travel for heating the belt to an impressionable condition, in which condition the belt is free to exercise its "plastic memory," type-like means mounted adjacent the belt as it passes around said one roller for indenting character impressions in the belt, cooling means mounted beyond said one roller in the direction of belt travel for setting the character impressions in the belt for use of the latter as an embossing die, and presser means mounted opposite said belt beyond said cooling means for pressing a moldable workpiece onto a portion of the belt having the die-like character impressions therein for embossing such characters on the workpiece, said heater being mounted ahead of the type-like means in the direction of belt travel a sufficient distance to allow the belt to exercise its "plastic memory" and thereby to remove the character impressions therefrom.

6. In a mechanism for embossing moldable material, a belt of material having a "plastic memory" trained to travel lengthwise along a path, a heater mounted adjacent the belt's path for heating the belt to impressionable condition, printing means mounted adjacent the belt's path and beyond the heater in the direction of belt travel for indenting character impressions in the belt, cooling means mounted adjacent the belt's path beyond the printing means in the direction of belt travel for cooling the belt below a temperature at which it can exercise its

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"plastic memory" and thereby setting the character impressions in the belt for use of the latter as an embossing die, and means mounted adjacent the belt's path beyond the cooling means in the direction of belt travel for re-heating the belt to a temperature sufficient to cause the belt to exercise its "plastic memory" and thereby to remove the character impressions therefrom.

7. In a mechanism for embossing a moldable workpiece, a belt of thermo-plastic material of the type having a "plastic memory" driven to travel lengthwise along a path, means for heating the belt to impressionable condition in a zone thereof along its path, means for indenting character impressions in the thus heated belt, means for cooling the belt in a zone beyond the character indenting means to a temperature below that at which the belt will exercise its "plastic memory" function and thus will retain the character impressions die-like therein, means for pressing a moldable workpiece onto the thus cooled, indented belt to force moldable workpiece material into the character impressions in the belt and thereby emboss the characters on the workpiece, and means for re-heating the belt beyond its zone of pressure engagement with the workpiece in the direction of belt travel to a temperature which causes the "plastic memory" of the belt to function, thereby removing the character impressions from the belt.

8. An arrangement according to claim 7 wherein the belt is an endless belt trained around a pair of end rollers and the character indenting means acts on the belt as it passes around one end roller.

9. An embossing mechanism for rapidly embossing a plurality of moldable plastic work pieces with selected characters comprising a die member having a normally smooth surface of plastic material of the type having a "plastic memory," means for moving said die member along a predetermined path, a heater for heating the die member to impressionable condition at a fixed zone along said path, in which condition the plastic material of the die member will exercise its "plastic memory" and remove any prior impressions therefrom, type-like means mounted adjacent said path and beyond the heater for successively impressing selected characters into the smooth, heated, plastic surface of the die member, cooling means acting on the die member beyond the type-like means for promptly cooling the plastic material thereof and thereby retaining character impressions made in the die member by the type-like means, and means mounted adjacent said path beyond the cooling means for pressing a moldable plastic work piece onto the cooled die member for embossing on the work piece characters impressed into the die member.

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