

April 27, 1954

C. E. EMMER

2,676,360

METHOD FOR MAKING PLASTIC BINDERS

Filed Dec. 21, 1949

4 Sheets-Sheet 1

Fig. 6

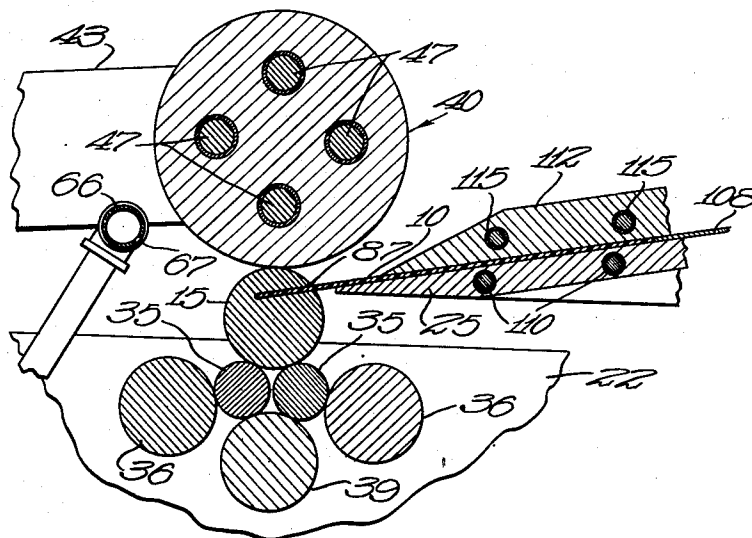


Fig. 1

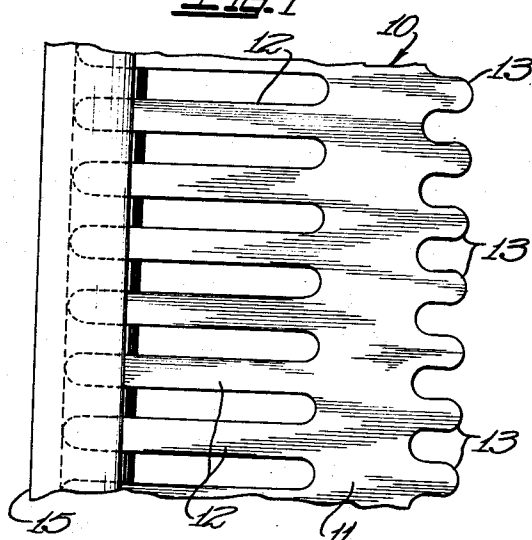
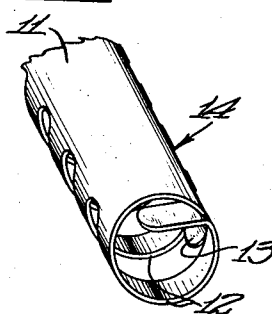


Fig. 2



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The Sign of Charles Emmer
by Attys.

April 27, 1954

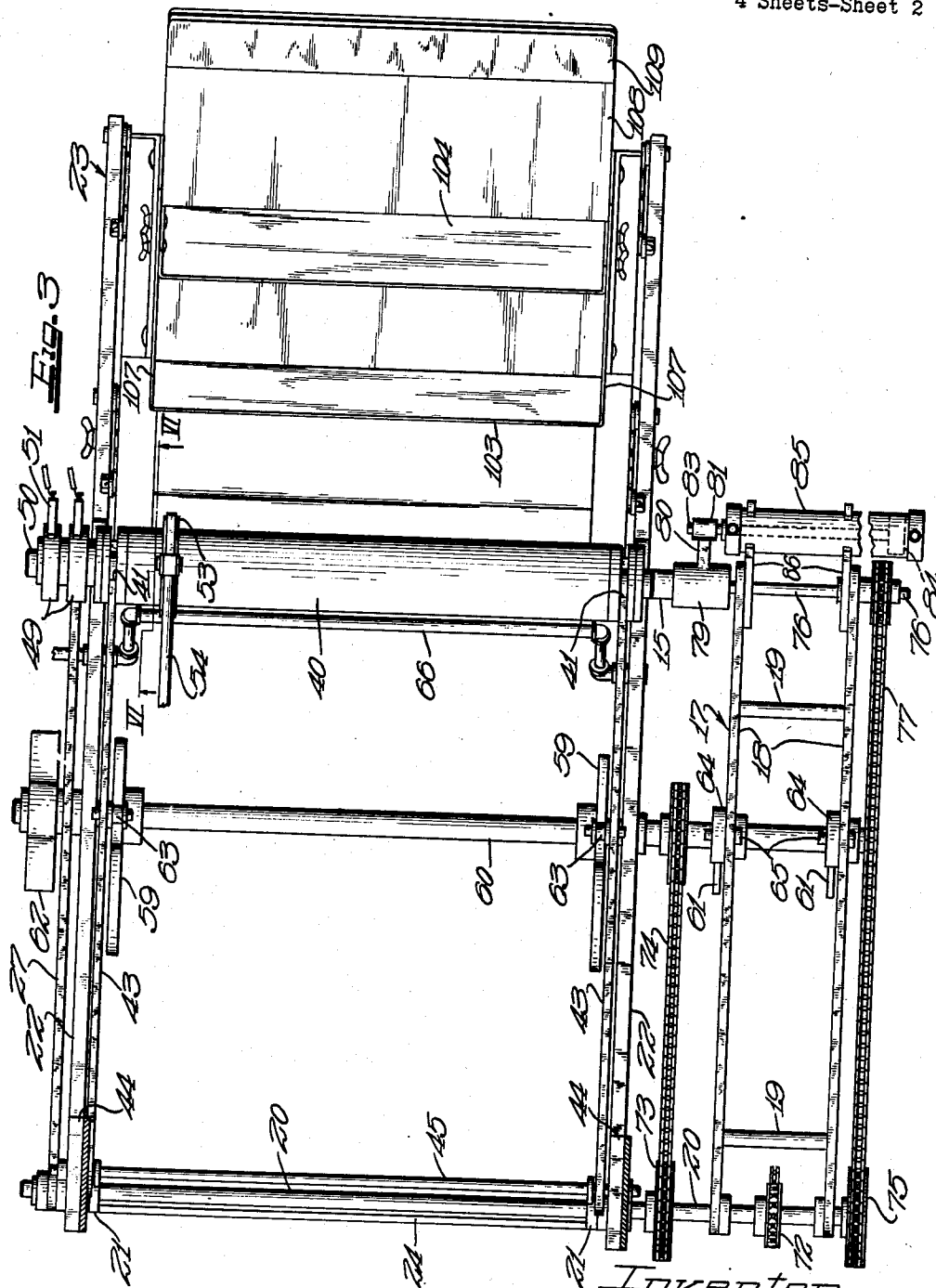
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4 Sheets-Sheet 2



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64 The Firm of Charles Smith Attys.

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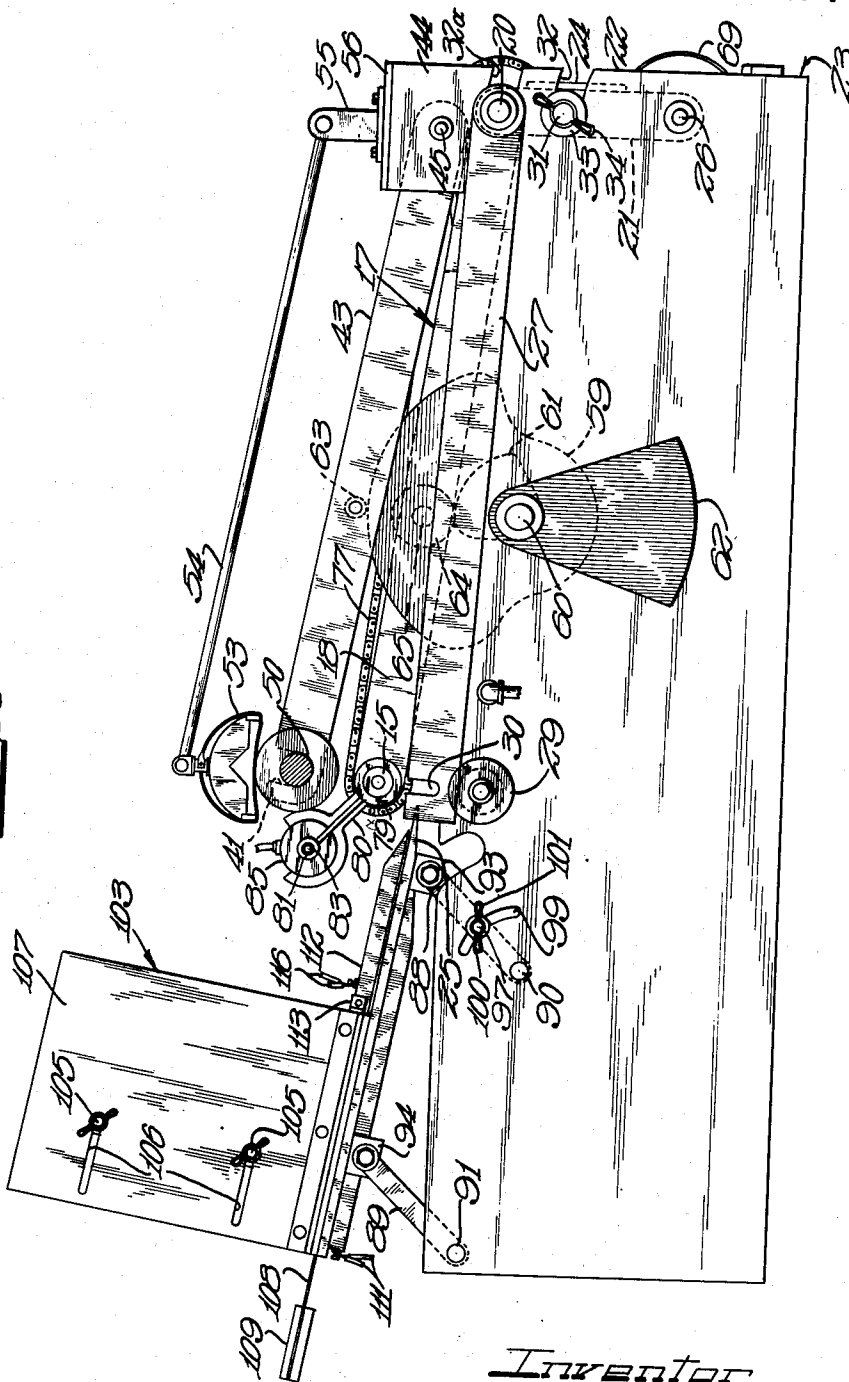
2,676,360

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4 Sheets-Sheet 4

Fig. 5



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UNITED STATES PATENT OFFICE

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METHOD FOR MAKING PLASTIC BINDERS

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Application December 21, 1949, Serial No. 134,158

1 Claim. (Cl. 18—56)

1

This invention relates to a method for making plastic binders and has as its principal object to provide such a method and apparatus arranged to produce binding elements, from thermo-plastic materials, free from defects and spoilage in a more efficient and expeditious manner than formerly, with little attention from the operator.

Another object of my invention is to provide a new and improved process for making plastic binding elements from blanks of thermo-plastic materials by pre-heating the blanks and then curling and softening the blanks by heat to the required form, and setting the formed blanks by cooling.

A further object of my invention is to provide a new and improved process for making plastic binding elements or the like from thermo-plastic materials in a more facile and positive manner than formerly by pre-heating the blanks and then curling the pre-heated blanks to a substantially circular form, and at the same time rolling the blanks and softening them during the rolling operation by heat, and then setting the blanks by cooling.

A still further object of my invention is to provide a new and improved process for making plastic binders from comb-like blanks of thermo-plastic material by pre-heating a plastic blank and then gripping the leading edge thereof and feeding it in a rotational direction and at the same time softening the blank and engaging the outer periphery thereof with a rolling action, to curl the blank to the required form, and then cooling the blank to set to the required form.

These and other objects of my invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

Figure 1 is an enlarged fragmentary plan view of a comb-like blank, showing the leading edges of the teeth of the blank in engagement with a forming mandrel;

Figure 2 is a fragmentary view of a completed binding element;

Figure 3 is a plan view of one form of apparatus constructed in accordance with my invention with certain parts thereof broken away and certain other parts shown in section;

Figure 4 is a view in side elevation of the apparatus shown in Figure 3 showing the operative parts thereof in a forming position;

Figure 5 is a view in side elevation of the apparatus shown in Figure 3, but looking at the opposite side thereof from Figure 4 and showing the parts in position to strip the blank from its forming mandrel; and

Figure 6 is an enlarged fragmentary detailed transverse sectional view taken substantially along the line VI—VI of Figure 3.

On the drawings:

2

Figure 1 shows a fragment of a comb-like blank 10, which may be made from a sheet of thermo-plastic material such as the vinyl chlorides or vinyl acetates, known to the trade as "Vinylite," or cellulose acetates, butyrates and ethyl-cellulose. It may also be made of various other vinyl resins and from nylon compoundings, as well as any other suitable materials desired. The blank 10 is herein shown as having a backbone portion 11 having a plurality of spaced relatively long teeth 12—12 extending therefrom in one direction, and short teeth 13—13 extending therefrom in an opposite direction and herein shown as being arranged alternately of the teeth 12—12 so as to extend in the spaces between the teeth 12—12, when the blank has been curled to the form of a complete binding element 14, as shown in Fig. 2.

A forming mandrel 15 is shown in Figs. 3 and 5 as being rotatably journaled on a vertically movable frame structure 17 consisting of two parallel spaced arms 18—18, connected together by cross members 19, 19 and transversely pivoted adjacent their rear ends on the overhanging end of a transverse shaft 20, journaled on the upper ends of parallel spaced links 21, 21. The links 21, 21 are pivoted at their lower ends to the insides of side walls 22—22 of the frame 23 of the machine on a transverse shaft 26. The links 21, 21 are connected intermediate their ends by cross bar 24 to form a solid link extending across the rear of the machine. An arm 27 is pivotally mounted at its rear end on the shaft 20, on the outside of the side wall 22, and extends forwardly therefrom and is supported adjacent its forward end on a flanged support 29, herein shown as being secured to the outside of a side wall 22 and as projecting outwardly therefrom (see Figure 5). The arm 27 has an upwardly opening slot 30 adapted to receive the opposite end of the mandrel 15 from the frame structure 17, and to form a guide means therefor during the forming and curling operation. The links 21, 21 serve to adjust the position of the mandrel 15 with respect to the discharge end of a feeding plate 25, and support rollers 35, 35 therefor, and are held in position by means of a threaded rod 31 connected across said links and slidably guided in the side walls 22—22 of the frame 23 in arcuate slots 32, 32. The shaft 20 is guided in similar slots 32a—32a. Washers 33—33 on the outer ends of said rods about the outsides of side walls 22—22 and are held in engagement therewith by means of wing nuts 34—34, to lock the arms 21—21 in position.

During the curling or forming operation the mandrel 15 is rotatably supported on the two spaced transversely extending support rollers 35—35 (see Figure 6). Said rollers are suitably journaled adjacent their opposite ends in the side walls 22—22, for free rotation with respect

thereto and are backed up at their outer sides so as to avoid the tendency of said rolls to spread when supporting the mandrel 15, by parallel spaced backing rolls 36—36 extending transversely of the frame 23 and suitably journaled in opposite side walls thereof. The rolls 35—35 are held from downward deflection by means of a transversely extending roll 39, suitably journaled in opposite side walls of the frame 23, and having its axis extending between the axes of the rolls 35, 35 and forming a rotatable support therefor.

A heating roll 40 is rotatably mounted at its opposite ends so its full weight may rest on the mandrel 15 during the forming or curling operation in upwardly opening slots 41—41 formed in the free ends of parallel spaced arms 43—43. The arms 43—43 are pivotally mounted adjacent their opposite ends on upright extensions 44—44 of the side walls 22—22 on a transverse shaft 45. The heating roll 40 is adapted to be supported on the forming mandrel 15 during the forming and curling operation and to have rolling engagement with the top sides of the plastic blank 10 and heat and roll the blank into engagement with the outer periphery of the forming mandrel 15. The heating roll 40 thus serves both as a softening or heating roll and as a forming roll, to form the blank to the form of the mandrel 15, when soft. Said heating roll may be of any well known form, and is preferably made from metal, such as iron, steel or brass and has a plurality of heating elements 47—47 extending therethrough (see Figure 6). The heating elements 47—47 are diagrammatically shown in Figure 6 as being electric heating elements and are not shown or described in detail herein, since they may be of several well known forms.

Current is herein shown as being conducted to the heating elements 47—47 by means of two spaced collector rings 49—49 mounted on a shaft 50 extending outwardly from said heating roll and concentric with the center thereof. The collector rings 49—49 may be engaged by brushes 51—51, arranged to supply current thereto, and may be suitably insulated from each other and be suitably connected to the heating elements 47—47, to conduct electric current thereto.

The temperature of the heating roll 40 may be controlled by a temperature-sensitive device 53, slidably engaging the top surface of said heating roll, and pivotally mounted on and depending from a longitudinally extending vertically movable arm 54. The arm 54 is shown as being pivoted at its rear end to an upright support 55, extending upwardly from a transverse plate 56, mounted on the upright extensions 44—44 of the side walls 22—22. The temperature-sensitive device may be suitably connected to electric control means (not shown) having connection with brushes 51—51 and collector rings 49—49, to stop the flow of current to the heating elements 47—47, when the temperature of the roll 40 becomes too high, and to supply current to said heating elements and maintain the temperature of said roll at a predetermined constant temperature, which may be capable of being set for the various forms and thicknesses of plastic material used to make the binding elements. The temperature sensitive device 53 and the control connections therefrom to the heating elements 47—47, may be of any well known form and are no part of my present invention so are not herein shown or described in detail.

A power operated means is provided to first pivot the arms 43—43 upwardly and raise the heating roll 40 out of engagement with the mandrel 15 and then raise the mandrel 15 out of engagement with the support rolls 35—35 to permit the formed binding element to be stripped from the free end thereof.

The means for elevating the heating roll 40 and the mandrel 15 in a predetermined sequence, is herein shown as including two spaced cams 59—59 mounted on transverse shaft 60, inwardly of the side walls 22—22 of the frame 21, and two spaced cams 61—61 mounted on said transverse shaft on the outer side of the side wall 22, which in Figure 3 is the left hand side wall. The shaft 60 is suitably journaled in the side walls 22—22, and projects beyond opposite sides of said side walls, and has a counterweight 62, on its right hand outer end. The counterweight 62 is arranged to aid lifting of the heating roll 40 and mandrel 15, and to hold said heating roll and mandrel 15 in elevated positions. The cams 59—59 on the transverse shaft 60 are engageable with rollers 63—63 mounted on and extending inwardly of the arms 43—43, to elevate said arms upon rotation of said cams, and to permit them to move downwardly and allow the heating roll 40 to come into engagement with the forming mandrel 15. The cams 61—61 on the transverse shaft 60 are out of phase with respect to the cams 59—59 and are engageable with cam followers or rollers 64—64 journaled on the sides of the arms 13—13 of the frame structure 17, adjacent the side wall 22 of the frame 23 on stub shafts 65—65.

It may be seen from Figures 4 and 5, that as the shaft 60 is rotating in a direction which in Figure 4 is shown as being a clockwise direction, the cams 59—59 engaging the followers 63—63 will move into position to elevate the arms 59—59 and the heating roller 40 at a relatively rapid initial rate, and then hold said arms and heating roller in an elevated position until the formed blank has been cooled and stripped from its mandrel, and then allow said heating roll to drop into engagement with said mandrel for the next forming operation. This will quickly remove the heating roller 40 from the formed blank on the mandrel 15 as soon as the blank has been formed thereon, and will prevent over-heating or injury to the blank. After the heating roller 40 has been fully elevated, the cams 61—61 will then raise the frame structure 17 and the mandrel 15 out of engagement with the support rolls 35—35 and the upwardly opening slot 30, and will hold said mandrel in position for cooling the formed blank and the stripping of the formed blank therefrom.

The formed blank may be cooled when the heating roll 40 is lifted therefrom, by contact with the air and with the support rolls 35—35. In order to facilitate the cooling operation, however, I herein show a pipe 66 spaced from and extending along the mandrel 15 and having a plurality of orifices 67—67 opening therefrom and directed to discharge blasts of cold air on the rotating blank (see Figure 4).

A motor 69 is herein shown as being mounted on a support bracket 70 projecting from the left hand side wall 22, to rotatably drive the cams 59—59 and 61—61 and also to rotatably drive the forming mandrel 15. The motor 69 may be an electric motor of any well known form, preferably of the type having a speed reducer

5

built therein so as to have a relative slow output speed. The motor 69 has a drive shaft 71 the axis of which is coaxial with the shaft 22. The shaft 71 is connected to drive the transverse shaft 20, journaled in the side walls 22—22 and in the frame structure 17, by means of a chain and sprocket drive 72. A sprocket 72 is keyed to the shaft 20 drives the transverse shaft 60 through a chain and sprocket drive 74. Another sprocket 75 is shown as being keyed on the outer end of shaft 20 and serves to drive a shaft 76 and the mandrel 15 through a chain and sprocket drive 77. The shaft 76 projects from the mandrel 15 and is journaled in the frame structure 17, and also forms a support for said mandrel, supporting said mandrel in overhanging relation with respect to said frame structure. Tension is maintained on the chain and sprocket drive 74 in all positions of adjustment of the shaft 20 with respect to the shaft 60, by a tension idler 78. The reduction from the motor 69 to the shafts 60 and 76 may be such that the heating roll 40 will remain in engagement with the blank 10 on the mandrel 15 for one complete revolution thereof plus the initial travel of said mandrel necessary to bring the blank into the nip between the roll 40 and mandrel 15 and the amount of over lap of the short teeth 13, or until the blank 10 has been fully curled on the mandrel 15, and will then almost instantaneously move away from said mandrel out of engagement with the formed blank. Where, however, larger binding elements may be formed from blanks of greater cross-section, the speed reduction may be such, or may be capable of being changed to take care of the thicker blank so that the roller 40 will remain in engagement with the blank during two or more revolutions of the blank, plus the distances of any overlap of the blank. Various forms of change speed gearing may be used to effect this, which are not herein shown or described since they are no part of my present invention.

A stripping sleeve 79 is mounted on the mandrel 15 for slidable movement therealong, to strip the cooled and formed binding element from the open end thereof when the mandrel 15 has been raised above the support rolls 35—35 into the position shown in Figure 5. The stripping sleeve 79, as herein shown, has an arm 80 extending therefrom having a boss 81 at its outer end, to which is secured a piston rod 83. The piston rod 83 extends from a piston 84 movable within a cylinder 85. The cylinder 85 is herein shown as being of a double acting type of air cylinder sufficiently long to move the sleeve 79 along the entire length of the mandrel 15. The cylinder 85 is supported on bracket members 86—86 projecting from the free ends of the arms 18—18 of the frame structure 17 (Figure 3).

The means for feeding each plastic blank to the mandrel 15 includes the inclined feeding plate 25 having a discharge end in alignment with a blank receiving slot 87 extending along the mandrel 15 from one end thereof to the other, and opening to opposite ends thereof (see Figure 6). The feeding plate 25 is adjustably supported on the side walls 22—22 of the frame 23 on two pairs of laterally spaced links 88—88 and 89—89, pivotally supported at their lower ends on transverse shafts 90 and 91 respectively, mounted in and extending across opposite side walls 22—22. The upper ends of the links 88—88 and 89—89 are pivotally connected to lugs 93—93 and 94—94 respectively, depending from the feeding plate 25. A threaded rod 97 moveable in arcuate slots

6

99—99 formed in opposite side walls 22—22 of the frame 23 extends through the two links 88—88 and is herein shown as having wing nuts 100—100 threaded on opposite ends thereof, to afford a means for holding the feeding plate 25 in the proper relationship with respect to the blank receiving slot 87 for the various diameters of mandrels which may be used to form the various binding elements desired.

A feed box 103 is mounted on and extends upwardly from the receiving end of the feeding plate 25, and is adapted to receive a stack of plastic blanks 10—10, placed therein with the teeth 12 facing the mandrel 15. The feed box 103, as herein shown, has an adjustably moveable rear wall forming a back up plate 104. Said back up plate is mounted on bolts 105—105 having wing nuts threaded on the outer ends thereof, and slidably guided in vertically spaced longitudinal slots 106—106, formed in side walls 107—107 of said feed box. The back up plate 104 is adapted to abut the rear faces of the blanks 10—10 to hold them in line within the feed box 103 and is adjustable to adapt said feed box to the various sizes of blanks that may be used.

The means for ejecting the blanks 10 from the bottom of the feed box 103, one at a time is herein shown as being a pusher plate 108 slidably guided in the bottom of said feed box and having a hand grip 109 at its rear end. The pusher plate 108 is thus withdrawn behind the back up plate 104 to allow a blank 10 to drop the bottom of the feed plate 105, and then is moved forwardly to slidably move the blank 10 downwardly along said feed plate and move the teeth 12 of said blank into engagement with the blank receiving slot 87 formed in the mandrel 15.

While I have herein shown a manually operable pusher plate to strip the bottom blank 10 from the feed box 103 it may readily be understood that this plate may be power driven and synchronized with rotation of the mandrel 15 so as to automatically strip the blanks from the bottom of the pile, one at a time, and feed them to the mandrel 15. If necessary or desired the pile of blanks within the feed box 103 may be weighted by a suitable weight (not shown) engaging the top blank of the pile. Such a weighting means may be particularly advantageous where light weight blanks are being fed to the forming mandrel 15, to be made into binding elements.

The feeding plate 25 is diagrammatically shown in Figure 6 as having a plurality of heating elements 110—110 mounted therein, beneath the top surface thereof, said heating elements may be connected to a source of electric power by electrical conducts 111—111. The heating elements 110—110 may be of any well known form and are provided to heat the feed plate 25 sufficiently to preheat the individual blanks as they are fed therealong into engagement with the blank receiving slot 87 of the mandrel 15, to condition the blank to readily follow said mandrel before coming into engagement with the heating roll 40. The preheated temperature of the blank, however, should not be sufficient to soften the blank, and may vary for varying thicknesses of the blanks. The temperature of the preheated blanks may also be controlled by a suitable thermostatically operated temperature control means controlling the heat given off by the heating elements 110—110. Said control means is not herein shown or described since it forms no part of my present invention.

A preheating shoe 112 for the top side of the

blank 10 is herein shown as being transversely pivoted to laterally spaced ears 112—113 extending forwardly from the feed box 103, adjacent its lower end. The preheating shoe 112 extends forwardly of the feed box 103 to a position adjacent the discharge end of the feed plate 25, and is adapted to rest on the top surfaces of the blanks 10 as they are fed along said feed plate into engagement with the blank receiving slot 87. The preheating shoe 112 is diagrammatically shown in Figure 6 as having transversely extending heating elements 115—115 mounted therein and connected to a suitable source of electric power through conductors 116—116. The temperature of the preheating shoe 112 may likewise be controlled by a suitable thermostatically operated control means, to uniformly heat both sides of the blanks, and to take care of varying thicknesses or blanks and to prevent softening of the blanks during preheating. The shoe 112 being free to move vertically about its axis of connection to the lugs 113—113, may thus follow each blank as it is turned upwardly by the mandrel 15 into the nip between the heating roll 40 and said mandrel.

In carrying out the process of my invention the individual blanks 10—10 may first be formed by a cutting or blanking operation. The formed blanks may then be loaded in the feed box 103 with their teeth facing the mandrel 15, and if desired or necessary may be weighted. They may then be ejected from said box one at a time by the pusher plate 103 into engagement with the slot 87 of the mandrel 15. During this feeding or ejecting operation each blank is preheated to a temperature to make it readily pliable and below the softening temperature thereof, by means of the heating elements 110—110 and 115—115. When the leading end of the blank is in full engagement with the slot 87 of the mandrel 15, said mandrel may be rotatably driven in a direction, which in Figure 6 is a counterclockwise direction. This will turn or move the blank 10 upwardly into engagement with the nip between said mandrel and the heating roll 40, it being understood that said heating roll is brought up to the required temperature prior to the forming operation by the heating elements 47—47 and is maintained at this temperature during the entire forming operation, which temperature should be sufficient to soften the particular blank being formed, but should not be high enough to harm the blank. The mandrel 15 will then continue to rotate and turn the blank in the nip between said mandrel and the heating roll 40 until it has rotated one revolution plus the initial distance to the nip between said mandrel and heating roll and the overlap of the teeth 13, or more than one revolution where the thickness of the blank demands additional heat to cause it to acquire the desired form. After the blank has been softened to acquire the form of the mandrel 15, the cam followers 63—63, will raise the heating roll 40 out of engagement with the formed blank. An air blast may then be directed on the rotating formed blank, to cool it. When the arms 43, 43 have been raised to their extreme elevated positions, the cams 61—61 rotating with the cams 59—59 will elevate the frame structure 17 about the axis of the shaft 20 and lift the mandrel 15 out of engagement with the upwardly opening slot 33 formed in the arm 27. The mandrel 15 may continue to rotate during the lifting operation and the air blast from the pipe 66 may continue to play on the rotating blank, to cool it. When the

heating roll 40 and mandrel 15 have reached the upper limits of their vertical travel the blank 10 will have acquired its set. The blank may then be stripped from the free end of the mandrel 15 in the form of a completed binding element, by the admission of air to the head end of the cylinder 85 effecting movement of the stripping sleeve 79 along said mandrel towards the free end thereof. The motor 69 and the shaft 60 continuing to rotate, and the cams 59 and 61 rotating therewith, the mandrel 15 will then move downwardly into engagement with the supporting rolls 35—35, and the heating roll 40 will then move into engagement with the top surface of said mandrel. The motor 69 may then be stopped with the slot 87 in alignment with the feeding plate 25, for the insertion of a new blank therein.

It may be seen from the foregoing that a simple novel and improved process has been provided for forming plastic binding elements from comb-like blanks of thermo-plastic material, which contemplates feeding a thoroughly preheated plastic blank into a blank receiving or gripping slot provided in the forming mandrel 15, rotating said mandrel while supported on the freely rotating supporting rolls 35—35, and held into engagement therewith by the free turning heating roller 40, and bringing the plastic blank into engagement with and drawing it through the nip between said mandrel and heating roll, and compelling the plastic blank, by raising the heat thereof to a softening temperature upon progressive contact with said heating roll, to wrap itself around said mandrel, so that after one or more complete revolutions, said plastic blank will have become sufficiently soft to acquire the required shape. It further contemplates cooling the formed blank after completion of the forming cycle and in stripping the completed and cooled binding element from the free end of the forming mandrel.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

In a method of forming a curled binding element from a comb-like plastic blank, the steps of feeding the blank over a pre-heat plate to guide the leading ends of the teeth thereof into a slotted mandrel, the temperature of the blank being maintained below the softening temperature of the plastic material thereof during the feeding operation, rotating the mandrel about a fixed axis while pressing the blank against the mandrel with a heated roller to raise the temperature of the blank above the softening temperature thereof, removing the heated roller from engagement with the blank, then further rotating the mandrel with a cold blast of air directed against the blank, and then stripping the formed element from the mandrel.

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