

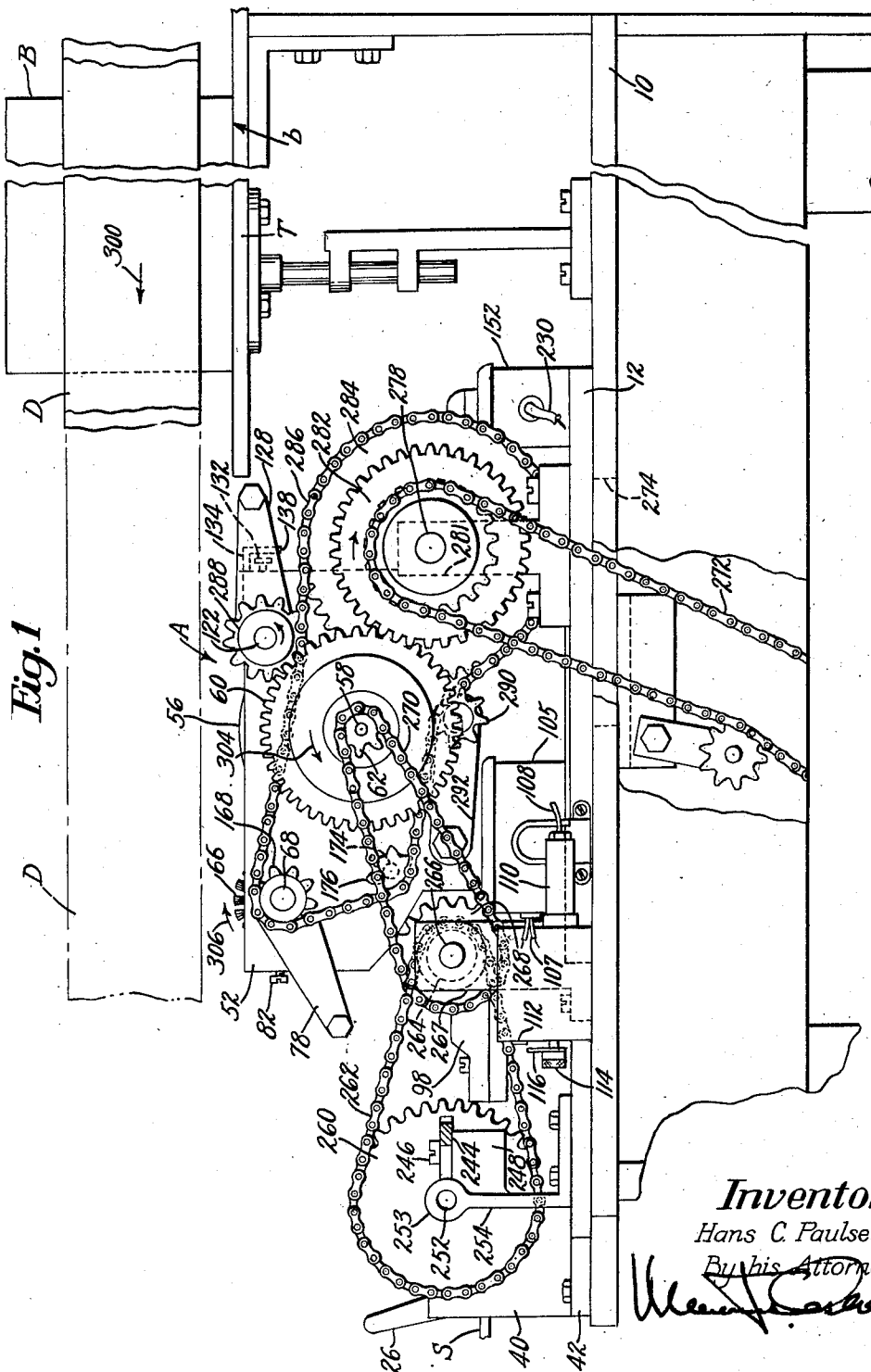
Feb. 25, 1958

H. C. PAULSEN
"GLUING-OFF" MACHINES FOR BOOKS USING
HEAT-SOFTENABLE CEMENT IN ROD FORM

2,824,541

Filed Aug. 4, 1954

5 Sheets-Sheet 1



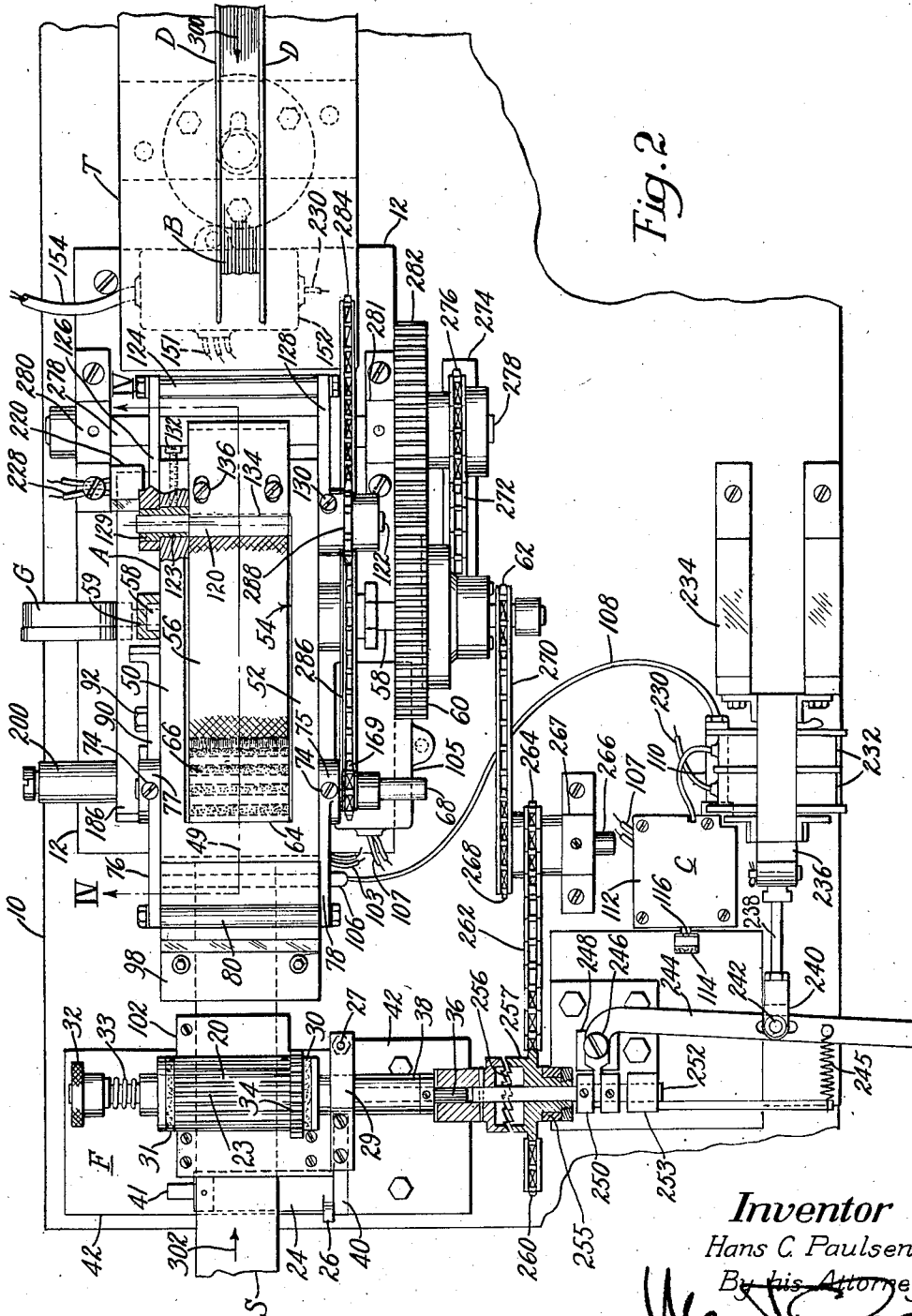
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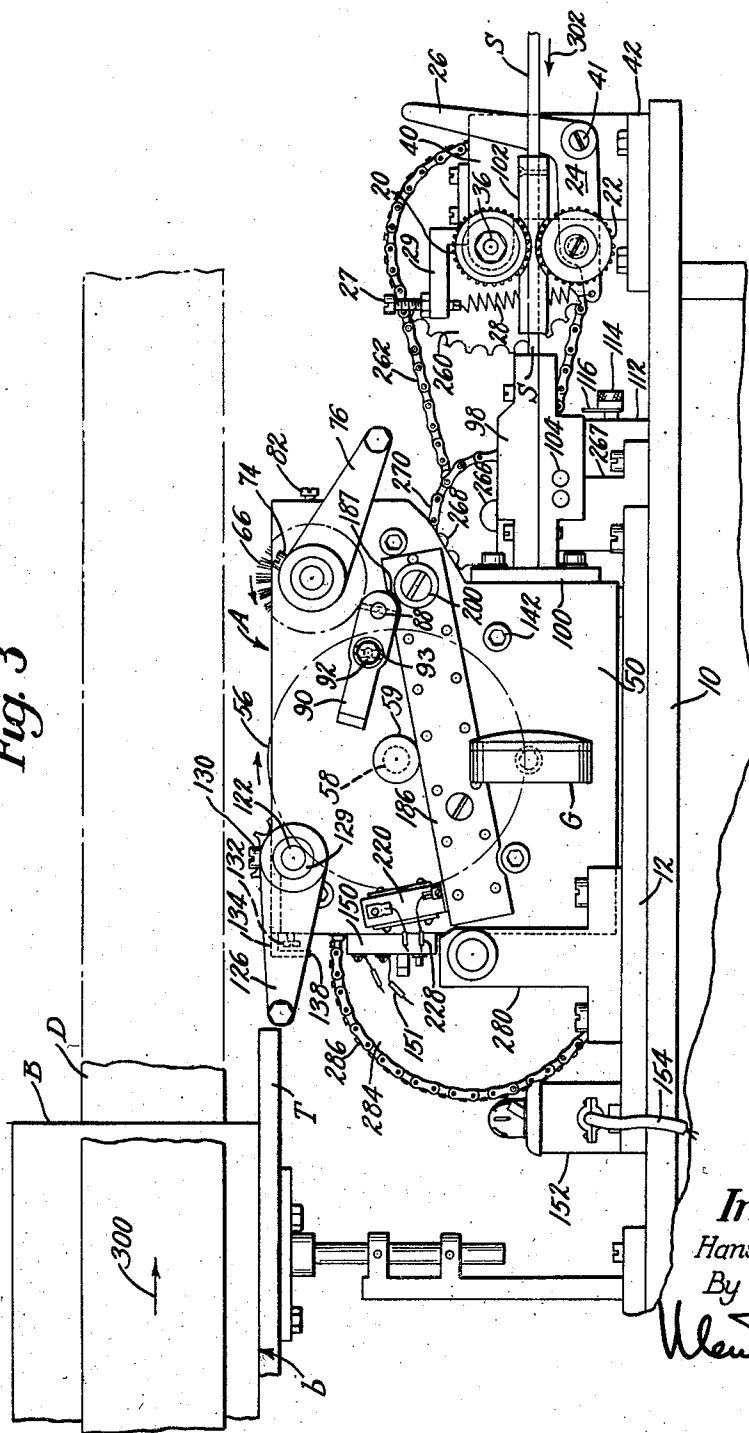
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5 Sheets-Sheet 3

Fig. 3



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5 Sheets-Sheet 4

5 Sheets-Sheet 4



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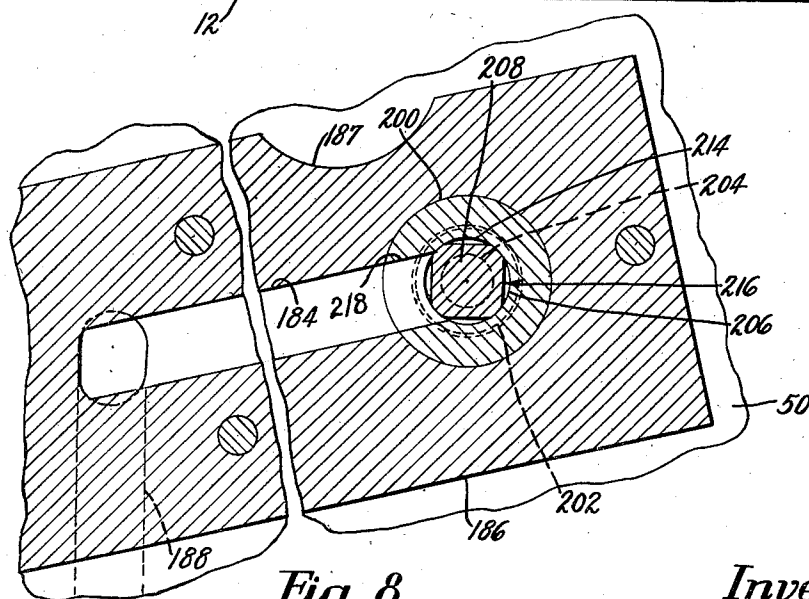
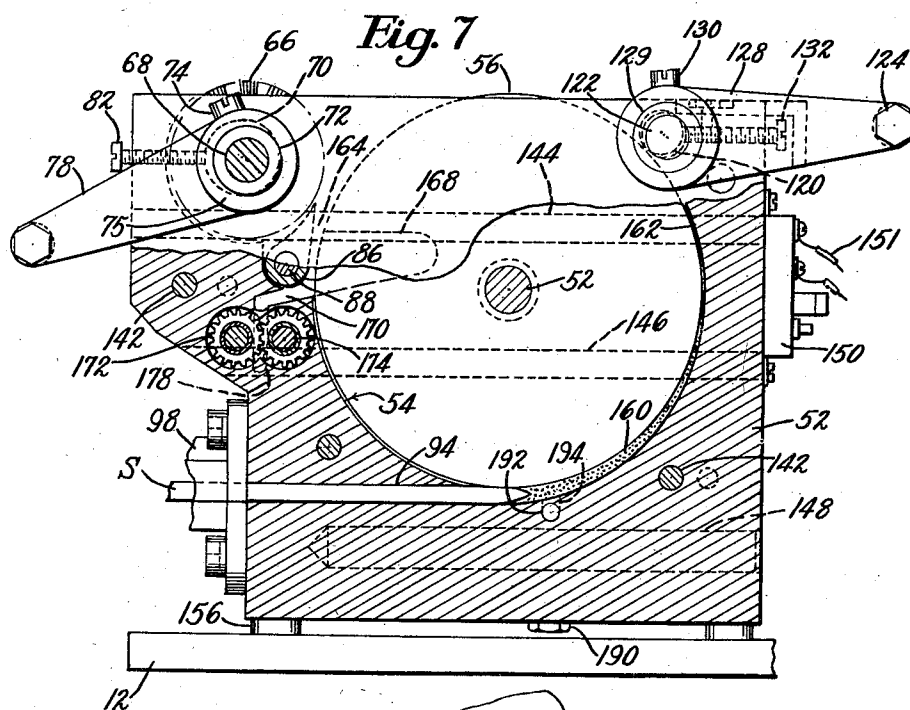
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5 Sheets-Sheet 5



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"GLUING-OFF" MACHINES FOR BOOKS USING HEAT-SOFTENABLE CEMENT IN ROD FORM

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Application August 4, 1954, Serial No. 447,794

7 Claims. (Cl. 118—7)

This invention relates to machines for melting a heat-softenable cement in rod or strip form and applying it to pieces of work which in the illustrated machine are shown as the backs of "books" at a time when the signatures have been assembled and are being readied for the application of a cover thereto. In the bookbinding art this is called "gluing off."

In the application of adhesive to pieces of work of the type mentioned, it is necessary to apply a considerable quantity to a surface of substantial width, and also to make sure that the adhesive is worked well into the creases or grooves between the adjacent signatures which have been assembled as a unit and sometimes have been stitched together at this stage of the operation. The adhesive is used for attaching a strip of cloth called crash which in turn is stuck to the cover to hold the latter on the assembled book. Most manufacturers of books present the books, at this stage, to an applying roll with their backs down and the sheets in an upright plane.

In the handling of heat-softenable adhesives there are many problems which follow when a quantity of the adhesive is melted in a pot and removed therefrom for application to the work. These problems result frequently from overheating of the adhesive and the possibility that some of the adhesive remains in the pot too long and becomes "cooked" or browned so that it is no longer useful. Then there ensues a difficult problem of cleaning the pot before a new supply of adhesive is furnished to it. This and many other allied problems have led to the utilization of an adhesive in rod or strip form which is delivered to a melting device and liquified and applied to the work substantially as fast as it is melted so that the possibility of not using an adhesive while it is still fresh is greatly minimized.

A machine for melting a thermoplastic rod and applying it forms the basis of United States Letters Patent No. 2,726,629, granted December 13, 1955, on an application filed in my name, for improvements in Mechanisms for Applying Rod Cement in Tipping Book Parts. In that application, the mechanism includes a strip feeding means adjacent to a heated casing to which the cement strip is delivered, said casing being provided with a recess containing a driven disk which protrudes from the lower side of the casing to transfer the melted cement to the work. This general principle has been utilized herein with the exception that the disk protrudes from the top of the casing rather than from the bottom.

One object of the invention is to provide an improved mechanism including a heated, open top casing from which project a melting and applying disk and a spreader brush which is so driven as to wipe the cement well into the work.

Inasmuch as many uses for such a machine involve the intermittent presentation of pieces of work thereto for the application of the cement, there is necessarily an opportunity between such intermittent presentations for the cement to accumulate in the melting device. Another

2

object of the invention is to provide an improved device for handling such accumulations by forcibly transferring them back from an open part of such a casing into the entrance passage through which the cement strip is introduced.

A feature of the invention resides in the provision of control means which regulates the feed mechanism for delivering the unmelted strip of cement to the melting and applying device. This, as illustrated, comprises means which is responsive to the pressure of the melted cement in the heated casing to control the drive for the cement feeding device, interrupting it when the pressure becomes too high.

These and other features of the invention will best be understood from a consideration of the following specification taken in connection with the accompanying drawings, in which,

Fig. 1 is a side elevation of the machine, plus a diagrammatic showing of a device for presenting pieces of work such as books to the applying member therein, the figure omitting certain control parts in the foreground;

Fig. 2 is a plan view thereof which adds to the showing of Fig. 1, the aforesaid control parts comprising an electro-mechanical device arranged to operate a clutch in the drive for the strip-feed mechanism;

Fig. 3 is a side elevation taken from the back side of the machine shown in Fig. 1;

Fig. 4 is an elevation on a larger scale of the rear half of a casing in which the cement is melted and showing in outline an applying disk and a spreading brush which are associated therewith;

Fig. 5 is a transverse vertical section on the line V—V of Fig. 4;

Fig. 6 is another transverse vertical section on the line VI—VI of Fig. 4;

Fig. 7 is a front elevation partly in section on the line VII—VII of Fig. 6 and hence at the bottom of a pump recess in the front half of the casing to show the location of a gear pump positioned therein; and

Fig. 8 is a section, much enlarged, taken on the line VIII—VIII of Fig. 6.

The machine is illustrated as supported on a table 10 and various parts are assembled upon a base plate 12 which rests upon the table. This machine employs a rod or strip S of heat responsive or softenable adhesive i. e. a normally solid, nontacky adhesive which may be softened or melted by heat. The strip shown is approximately a quarter of an inch thick and an inch and one-half wide, and is delivered to a melting and applying unit A (Figs. 1 and 2) by means of a strip feed mechanism F as regulated by a control mechanism C.

The handling of successive pieces of work may be carried out in any suitable fashion but is herein illustrated schematically as including a worktable T associated with which is a pair of belts D which are designed to grip the sides of books B standing in an upright plane with their backs b downward and to carry them across the applying device. The belts are pressed firmly against the books by any suitable mechanism, not herein shown.

The strip feed mechanism F is constructed substantially as in my prior application and includes feed rolls 20 and 22 (Figs. 2 and 3) which are provided with external corrugations or ribs 23 to cause them to grip the strip S firmly. The lower roll is mounted on a bell crank 24 (Fig. 3) having a handle 26 and is drawn into engagement with the strip by a spring 28 secured to an overhanging arm 29 by a screw 27. The upper roll 20 embodies slip clutches 30, 31 to permit the rolls to stand still when the entrance of the strip to the melting mechanism A is opposed by the back pressure of unmelted material therein. The degree of friction for these slip clutches is con-

trolled by a thumb nut 32 regulating the compression of a spring 33. The two feed rolls are interconnected by pinions 34. A shaft 36 for the upper roll is mounted in a bearing 38 (Fig. 2) supported upon an upright member 40 integral with an auxiliary base plate 42 which is secured to the table 10. The upright member 40 also supports the arm 29, a strip guide 102 and a pivot 41 for the bell crank 24.

The melting mechanism A involves a recessed casing divided longitudinally at 49 in a central plane (Fig. 2) so that it is made up of a back half 50 and a front half 52. The inner faces of these coacting parts are cut away to provide a central recess 54 receiving a melting and applying disk 56 having a shaft 58 which is supported in a bearing cap 59 in the rear half 50 of the casing and protrudes through the front half 52 to receive a driving gear 60 and a small sprocket 62. The top of the disk 56 extends above the casing through an outlet opening 64, Figs. 2 and 4, to apply adhesive to the back *b* of a book.

Also journaled in the casing and protruding slightly from the top thereof through a portion of the outlet opening 64 is a spreading brush 66 having a shaft 68 which passes through eccentric bearing sleeves 70 (Fig. 6) which are mounted to turn in the casing parts to adjust the brush heightwise. To this end the eccentric sleeves have concentric extensions 72 which are secured by setscrews 74 (Figs. 2 and 7) to enlarged ends 75, 77 of arms 76, 78 of an operating yoke having a handle 80. After these eccentric bearings have been adjusted by manipulating the handle 80 of the yoke they are held in adjusted position by clamp screws 82 (Fig. 4) threaded in the end portion of the casing. The brush 66 is made in two halves (Fig. 6) which are joined at adjacent ends by an internal screw 84.

This brush is driven, as will be later described, so that its top moves in a direction opposite to the direction of movement of the books and therefore spreads or wipes the cement applied by the disk 56 thoroughly into the crevices between the adjacent signatures of the book. Any adhesive which is carried back into the casing by the downgoing side of the brush 66 is removed by a scraper 86 having a supporting rod 88 journaled in the sides of the casing within the recess thereof. The position of this scraper is determined by a hand lever 90 (Fig. 3) which is secured to the rear end of the rod 88 and which is held in adjusted position by a clamp screw 92 which passes through a slot 93 in the hand lever and is threaded in the casing.

The halves of the casing are grooved to provide an entrance passage 94 for the solid strip *S* of cement. This passage is substantially tangential to the periphery of the applying disk 56 and at the entrance communicates with a similarly shaped passage 96 in an inlet block 98 which has an attaching flange 100 secured to the end of the casing by suitable screws. This inlet block 98 protrudes a substantial distance from the casing 50, 52 but, in order to avoid the conduction of heat, is spaced from a guide member 102 which forms a part of the strip feed mechanism F. The guide member is cut away at the top and bottom to admit the feed rolls 20 and 22 to grip the strip.

Some heat from the casing is conveyed to this block 98 which for convenience is divided in two parts on a horizontal plane. However, when a substantial amount of work is being continually presented to the machine, the cooling effect of the oncoming strip is great enough to cut down or even to eliminate the lubrication provided by the melting of the surface of the strip in this block 98. Consequently, it has been found desirable to provide the block with heating units 104 (Fig. 3) having leads 103 which are supplied with electricity through a junction box 105 under the control of a thermostat bulb 106 (Fig. 2). The bulb has a tube 108 leading to an extension 110 in a control box 112 which is provided with

an adjusting handle 114 having a pointer 116 (Fig. 3). Leads 107 join the box 105 to the box 112. This arrangement enables the operator to adjust the temperature of the inlet block 98 in accordance with average conditions at the moment by adjusting the control handle 114 with the result that the inlet block 98 allows the strip to slide smoothly into the melting apparatus A but tends to prevent undue heating of the strip at the entrance point such as might cause drooling at the outer end of said block 98.

Associated with the disk 56 which applies the cement to the work, there is a rotary doctor roll 120 (Fig. 4) driven in the same sense of rotation as the disk 56 so that the adjacent surfaces move in opposite directions. This doctor roll 120 has a shaft 122 which is journaled in eccentric bearing sleeves 123 like those employed for the brush 66. The position of these eccentric sleeves controlling the spacing between the doctor roll 120 and the periphery of the disk 56 may be determined by a yoke having a handle 124 (Fig. 2) secured to side members 126 and 128 which are clamped by setscrews 130 to the concentric outer end portions 129 of the eccentric sleeves. These sleeves are held in adjusted position by clamp screws 132 and a scraper 134 is provided for the top surface of the doctor roll so that surplus adhesive is held back within the casing of the melting apparatus A. Screws 136 (Figs. 2 and 4) are provided for holding the scraper in adjusted position and, for convenience in moving it, the scraper has a downturned flange 138.

It should be noted that the two halves 50 and 52 of the melting apparatus A may be readily assembled by reason of the provision of projecting dowel pins 140 and sockets 141 and the halves are clamped together by transverse screws 142 (Figs. 4 and 6). Heating units 144, 146, and 148 are provided in each half of the casing and the heat delivered thereto is held uniform by a thermostat 150 (Figs. 3 and 7) which is connected by leads 151 (Figs. 2 and 7) to the various heating units through a control box 152 to which power may be supplied by an electric cord 154 (Figs. 2 and 3).

Inasmuch as it is necessary to supply a considerable amount of heat to the casing of the melting unit A in order to insure a continuous supply of melted cement it is desirable to support the casing 50, 52 on the base plate by means of insulating washers 156 through which are passed attaching screws 158.

The action of the device in melting the thermoplastic strip *S* as fast as it is fed thereto is similar to that which takes place in the device of my prior application, to which reference was made above. That is to say, the entrance passageway 94 is connected to a gradually tapering passageway 160 (Figs. 4 and 7) around a portion of the periphery of the disk 56 with a restricted portion 162 therein just before the doctor roll 120 is reached. Heat is delivered from the casing to three sides of the groove 160 as the strip is gradually melted and crushed and is dragged along by the friction of the disk 56. The latter assists in heating the strip by reason of the fact that the sides of said disk contact the sides of the recess 54 in the casing 50, 52 (Figs. 2, 5 and 6) and, therefore, pick up heat, which is delivered to the adhesive.

It will be recognized that when no work is being presented to the machine, then the melted adhesive which has been taken out of the casing by the disk 56, is returned to it in the space 164 (Figs. 4 and 7) between the brush 66 and the disk 56 and some cement will be carried through the clearance amounting to approximately twenty thousandths of an inch between the disk and the curved wall of the recess as the periphery of the disk moves downward toward the entrance passage 94 for the strip. The face of the brush is also descending into the casing at this space 164 and surplus cement thereon is removed by the scraper 86 and deposited into this same portion of the casing.

Accordingly, to provide for any accumulation, the inner

faces of the casing are cut back to provide pockets 166 and 168 (Fig. 6), beside the ends of the disk 56, in which surplus cement may be received temporarily. Furthermore the casing part 52 has a slot 170 (Figs. 6 and 7) which merges with its recess 168 and this slot 170 slopes downward to the inlet of a gear pump 172 one of the gears of which has a shaft 174 extending out through the front half 52 of the casing and is provided with a sprocket 176 for driving. The outlet 178 of said pump communicates with an upwardly extending passage 180 (Fig. 6), which is formed in the block 50 and which emerges in a cylindrical recess 182 therein. These passages and spaces 170, 178, 180, 182 form part of a by-pass system which communicates with the entrance passage 94 to return surplus cement thereto.

Another portion of this by-pass system comprises an inclined groove 184 (Figs. 4 and 8) which, merely for ease in manufacturing, is formed upon the inner face of a slab 186 (Figs. 2, 4, 5 and 6) screwed to the rear side of the block 50. The top face of the slab 186 is recessed at 187 to give room (Fig. 3) for the lower end of the hand lever 90. The lower end of the groove 184 communicates with a downwardly extending passage 188 (Figs. 4, 5, 6, and 8) formed in the block 50 and is closed at its lower end by a screw plug 190 (Fig. 5). The down passage 188 in turn communicates with a cross passage 192 lying just below the entrance passage 94 and communicating therewith through two vertical holes 194, 196 enabling molten cement which is forced through the by-pass by the pump 172 to return to the entrance passage 94 where it may join with the cement being admitted through that passage.

Any pressure developing in this passage 94 will not be effective to push molten cement in the other direction through the by-pass passage 188, for example, because of the interposition in the connections of a check valve 200 (Fig. 6) which is screwed into the slab 186 at a point aligned with the cylindrical recess 182. The valve has a screen 202, made like a perforated cylinder with one end closed which projects into the recess 182 and prevents any particles of dirt or paper, collected by the applying and spreading members, from being carried back into the cement system. This screen fits a circular slot at the end of the valve 200 around an inlet opening 204 therein.

In alignment with the inlet opening 204, the valve body has a passage 206 in which there slides a valve member 208 spring pressed toward the casing 50 by a spring 210 held by a cap screw 212. The inner end of this valve member 208 has a frusto-conical end fitting against an annular valve seat 214 and adjacent thereto the member is slabbled off at 216 on four sides so that, when the valve member is displaced to the left in Fig. 6, room is provided to allow passage of melted cement into an outlet opening 218 which communicates with the groove 184. Accordingly, when the pressure of the pump exceeds the pressure provided by the spring 210, cement is pushed through the valve and out into the groove 184 and thence back into the by-pass system through the passages 188, 192 and one or the other of the openings 194 or 196. With this arrangement there is no danger that a sufficient quantity of cement will accumulate in the space 164 between the disk and the brush so that it could overflow the top outlet opening 64 in the casing.

Obviously there will be times when pieces of work are presented with sufficient regularity so that the accumulated cement in the space 164 will lessen and the level will fall to a point where the gear pump 172 will take in air. It will, however, be impossible for the pump to force this air into the by-pass system because of the by-pass valve 200. This is set to open at a certain liquid pressure but, because of the compressibility of air, this predetermined pressure will not be reached, when the pump is delivering air. This will avoid making bubbles in the melted cement at a point opposite to the vertical passages 194, 196

and hence will avoid the application to the work of cement which contains such bubbles that would produce an undesired unevenness in the layer of cement.

Still another control arrangement stops the action of the strip feeding mechanism F whenever the pressure of cement between the disk 56 and the casing, as at the restricted portion 162, exceeds a predetermined limit. To this end, a pressure responsive device 220 (Fig. 5) is provided which is threaded in the rear half 50 of the casing near the upper end of the tapering passage 160. This device has a tubular inner end provided with an opening 222 opposite a short passage 224 (Fig. 4) which opens into the tapering passage 160. The device 220 includes a pressure-operated diaphragm arranged to close an associated electrical switch 226 when the pressure reaches a certain limit. This switch 226 has leads 228 which for convenience enter the box 152 (Fig. 2) and are interconnected in a circuit for activating a solenoid 232. A wire 230 forms one side of the circuit while the other side is grounded in the thermostat casing 112.

This solenoid 232, mounted on the table 10 by means of brackets 234, is provided with a core 236 having an extension rod 238 which is forked at 240 to receive a pin 242 passing through a slot in a lever arm 244. This lever is swingable, against the tension of a spring 245, about a pivot screw 246 at the top of an extension 248 of a bracket 254 (Fig. 1). The upper end of the lever is reduced to enter the groove of a collar 250 which is attached to a sliding shaft 252 rotatable in a bearing 253 at the top of the upstanding bracket 254. The shaft 252 has pinned to its inner end one half of a separable clutch 256 for driving the upper shaft 36 of the strip feed F. Loose on the shaft 252 but held against axial movement is a sprocket 260 carried in a bearing 255 and integral with the other half 257 of the clutch. The sprocket 260 is connected by a chain 262 to a sprocket 264 upon a countershaft 266 journaled in a bracket 267. This countershaft has another sprocket 268 joined by a chain 270 to the sprocket 62 upon the shaft 53 of the melting and applying disk 56.

Driving power is supplied from a motor (not shown) through a chain 272 which passes through a slot 274 in the table and meshes with a sprocket 276 upon a countershaft 278. The latter is mounted in bearings provided by brackets 280 and 281 (Figs. 1 and 3) secured to the base plate 12 and has a gear 282 meshing with the gear 60 on the shaft of the disk 56. The transfer of power from the driven countershaft 278 to various other shafts of the machine is effected by a large sprocket 284 carried by the countershaft 278 and surrounded by a chain 286. This passes under a sprocket 288 of the shaft 122 of the doctor roll 120, then over the sprocket 163 attached to the brush shaft 68 and under the sprocket 176 attached to the pump shaft 174. The chain is held taut by an idler sprocket 290 (Fig. 1) carried by an adjustable arm 292 attached to the front face of the forward half 52 of the casing for the melting device A.

In operation, a layer of cement of the desired thickness is carried out of the melting device by the disk 56 and is applied to the backs *b* of the books B. It should be noted, however, that the surface speed of the disk 56 is from 10 to 15% faster than the linear speed of the backs *b* of the books B with the result that the thickness of the coating applied is somewhat greater than the thickness of the cement on the disk. This coating is spread out and worked into the creases between the signatures by the spreading brush 66 and any surplus cement is removed therefrom by the scraper 86 to the extent that when no work is being presented, the peripheral surface of the brush 66 may be touched with one's finger without receiving any cement therefrom.

The return passage between the downgoing periphery of the disk 56 (Fig. 7) and the portion of the disk receiving recess 54, which terminates at the entrance passage 94, is slightly greater in radius than the normal thick-

ness of the coating of adhesive on said disk, being of the order of 20 or 25 thousandths of an inch. Accordingly, some of the unused cement will be transferred back directly to the entrance passage 94. For the convenience of the operator, a pressure gage G is provided on the casing part 50 and communicates with the entrance passage through an opening 294. This is merely for the assistance of the operator in noting whether the control provided by the by-pass system and by the pressure responsive system is effective.

The direction of movement of the work is indicated by the arrow 300 in Figs. 1, 2 and 3. The direction of inward movement of the strip S is indicated by the arrows 302 which appear in Figs. 2 and 3. The direction of rotation of the disk 56 and the spreading brush 66 has been indicated by arrows 304 and 306 respectively in various figures.

It will be recalled that during the operation of the machine any accumulation of cement in the space 164 between the disk and the brush is prevented by the action of the pump 172 and the by-pass system in sending any collected cement therethrough and finally up through the openings 194 into the entrance passage 94. At the same time and in addition, the pressure responsive switch 220 disconnects the drive for the feed rolls of the strip feeding mechanism F when the pressure becomes too high within the melting passage 160 of the casing.

Having described my invention, what I claim is new and desire to secure by Letters Patent of the United States is:

1. In combination, a heated casing having an entrance passage to the interior of said casing for the admission of a strip of meltable adhesive and also having an outlet opening, a driven feeding mechanism for said strip, movable means within the casing adjacent to said outlet opening to remove melted adhesive for application to a piece of work, said means communicating with said entrance passage and providing with the casing a restricted passage along which the strip is melted, and means responsive to the fluid pressure in said casing for controlling the drive for the strip feeding mechanism.

2. In combination, means including a clutch for feeding a strip of solid adhesive material, an electromechanical means for controlling said clutch, a heated casing having a recess and an entrance passage for the strip communicating with said recess, a rotatable disk received in said recess in said casing forming a passage adjacent to said disk, fluid pressure responsive means communicating with said passage, and an electric switch controlled by said pressure-responsive means for energizing said electromechanical means to control the clutch in the drive for said strip-feeding means.

3. In combination, a heated casing having a recess, a driven disk nearly filling said recess to form a restricted passage adjacent to the periphery of the disk and protruding slightly from the casing, means to supply solid thermoplastic adhesive to the passage for melting and removal by said disk and application thereby to a piece of work supported in position for contact with the disk, a spreading brush mounted in said recess and protruding adjacent to said disk for contact with the work, and means for driving said brush and said disk in opposite directions of rotation.

4. In combination, a heated casing having a recess

therein, an applying disk and a spreader brush rotatable in said recess and protruding slightly from the casing for contact with a piece of work presented thereto, said applying disk nearly filling the recess to form a restricted passage adjacent to the periphery of the disk, a rotatable doctor roll coacting with the periphery of the disk at a point prior to the emergence of the disk from the casing, means on the outside of the casing for controlling the position of said roll with respect to said disk, a scraper in said recess coacting with the in-going side of the brush, and means on the outside of the casing for adjusting the position of said scraper.

5. In combination, a heated casing having a recess, an entrance passage having an inner end opening into the recess and a by-pass, a rotary applying member and a rotary spreader member located in said recess and protruding from said casing and positioned for successive contact with moving pieces of work presented thereto, the portion of said recess which lies between said two members and the entrance passage through which adhesive material is supplied to the applying member being interconnected by said by-pass, driven means for feeding a strip of solid adhesive to said entrance passage thereby creating a pressure in the recess adjacent to the inner end of the entrance passage, and a driven pump in the by-pass receiving the accumulated material between said members and forcing it back through the by-pass to the recess adjacent to the inner end of the entrance passage against said pressure.

6. In combination, a heated hollow casing, a driven applying roll in said casing and projecting slightly therefrom for engagement with a piece of work, said casing being shaped to provide a passage along a portion of the periphery of said roll, mechanism for providing melted thermoplastic adhesive in said passage, said mechanism including electromechanical means for moving a solid strip of adhesive, and means responsive to pressure of adhesive in said passage for controlling the action of said electromechanical means.

7. In combination, an applying roll, a recessed heated casing surrounding the major portion of said roll and engaging the end surfaces thereof to transfer heat from the casing to the roll, said casing being cut away internally to provide a passage along a portion of the periphery of the roll, mechanism for providing melted thermoplastic adhesive in said passage, said mechanism comprising an electrically controlled device for feeding a solid strip of adhesive into said passage, and means responsive to pressure of the adhesive in the passage and having a pressure operated switch in circuit with the strip feeding device for stopping the feeding of the strip when there is a surplus of molten adhesive in said passage.

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