Jan. 8, 1957 J. D. KLOPFENSTEIN ET AL 2,776,511

MACHINE FOR APPLYING FILMS TO BASE SHEETS

Filed July 9, 1953 3 Sheets-Sheet 1

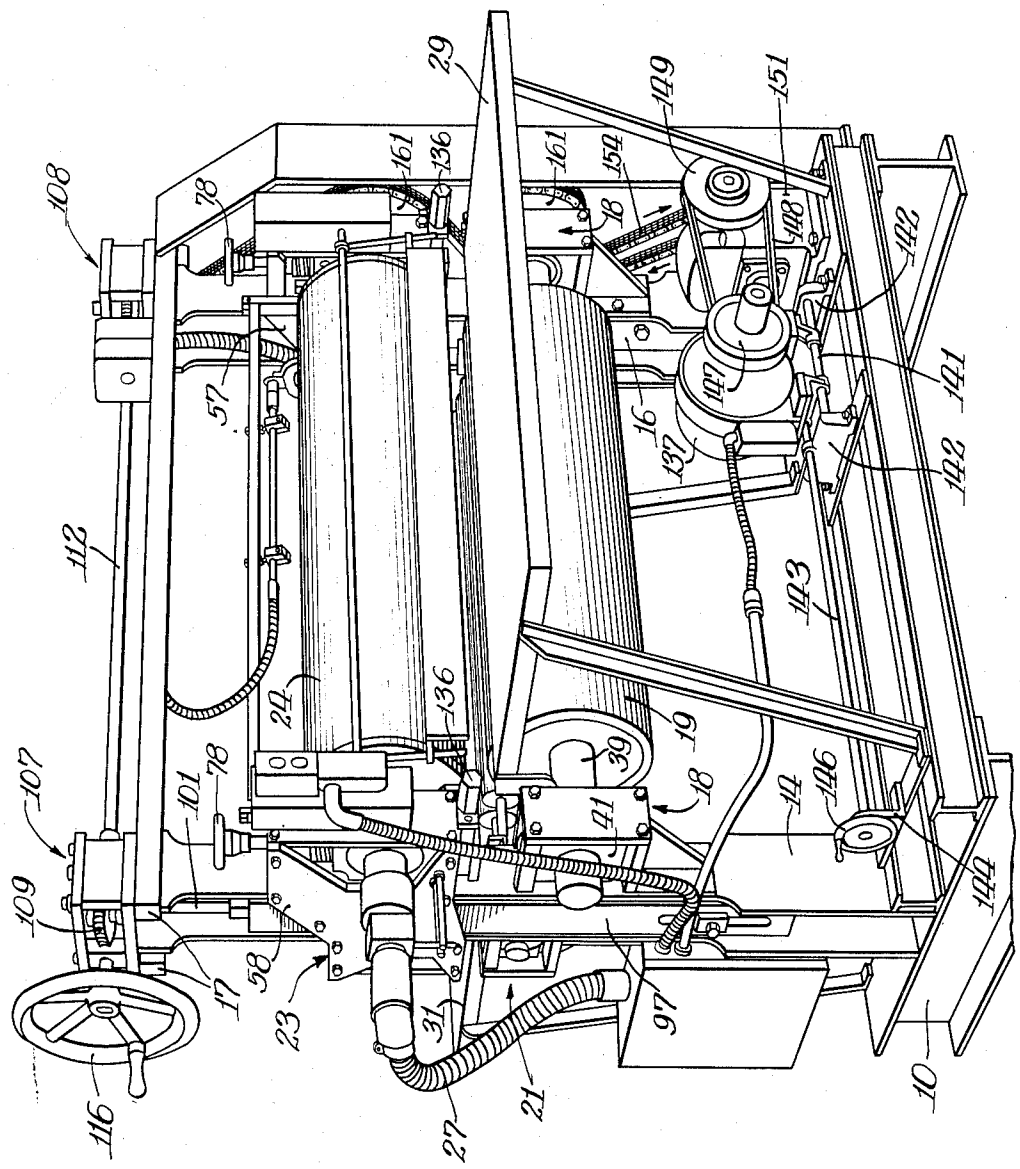


Fig. 1.

Inventors:-
Jess D. Klopfenstein,
Edwin T. Zimmerman,
Knute F. Engstrom,
BY
Davis Lindsey Hilken & Noyes
Atty's.

Jan. 8, 1957 J. D. KLOPFENSTEIN ET AL 2,776,511

MACHINE FOR APPLYING FILMS TO BASE SHEETS

Filed July 9, 1953 3 Sheets-Sheet 2

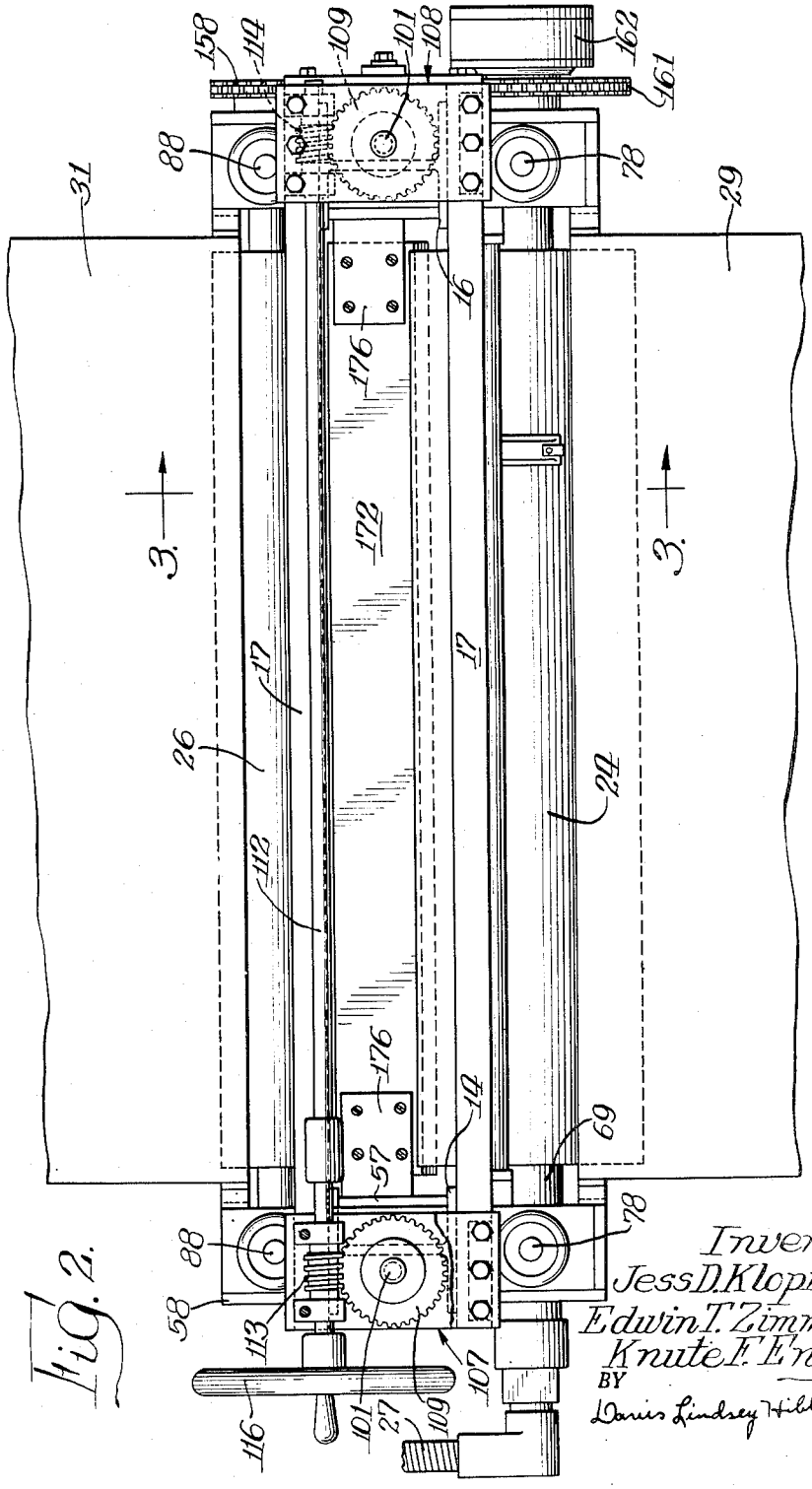


Fig. 2.

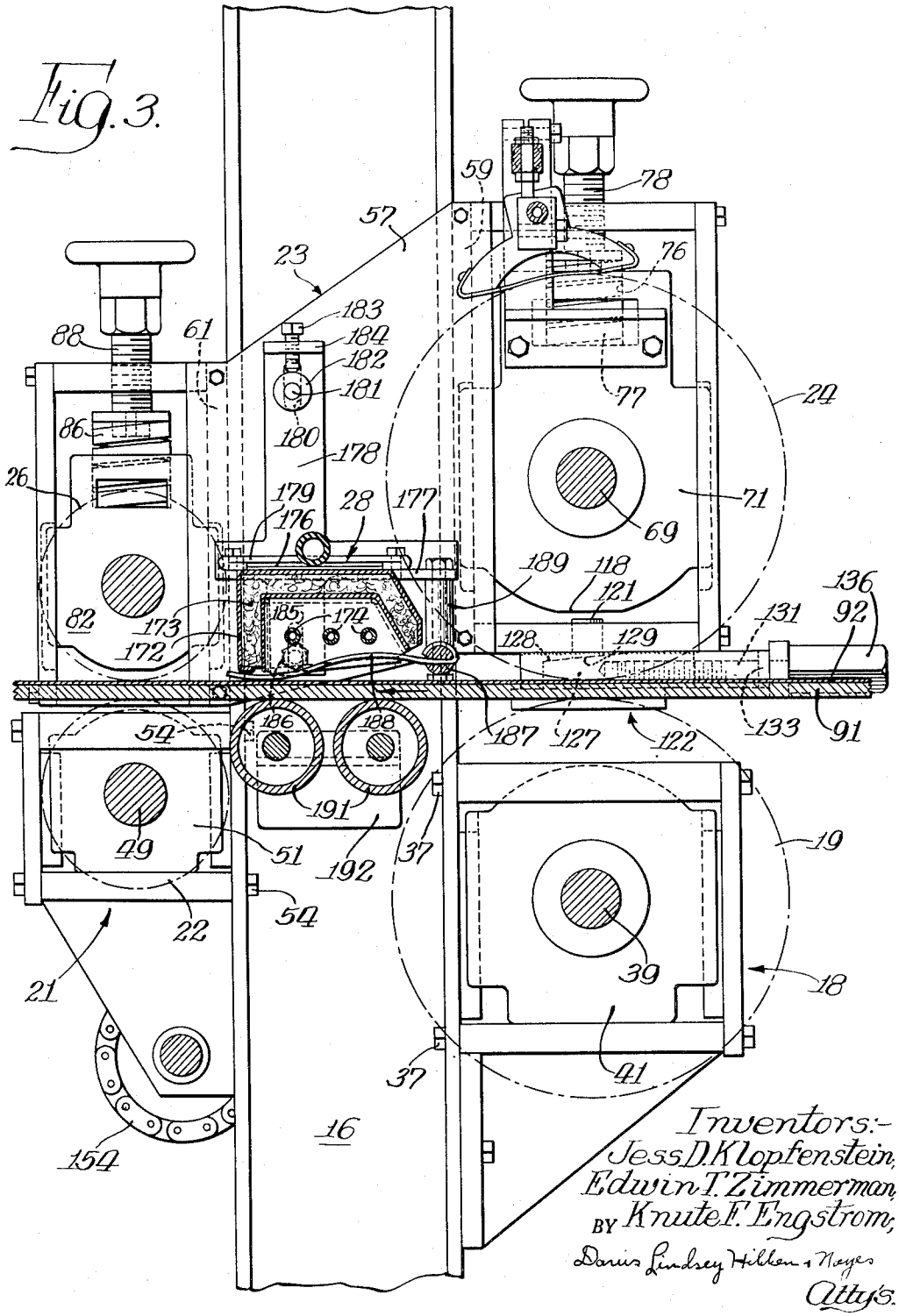
Inventors:-
Jess D. Klopfenstein,
Edwin T. Zimmerman,
Knute F. Engstrom,
BY
Davis Lindsey Hibben & Noyes
Attys.

Jan. 8, 1957 J. D. KLOPFENSTEIN ET AL 2,776,511

MACHINE FOR APPLYING FILMS TO BASE SHEETS

Filed July 9, 1953 3 Sheets-Sheet 3

Fig. 3.



Inventors:-
Jess D. Klopfenstein,
Edwin T. Zimmerman,
BY Knute F. Engstrom,
Davis Lindsey Hilken & Noyes
Attys.

United States Patent Office 2,776,511 Patented Jan. 8, 1957

2,776,511

MACHINE FOR APPLYING FILMS TO BASE SHEETS

Jess D. Klopfenstein, Oak Park, Edwin T. Zimmerman, Berkeley, and Knute F. Engstrom, Wheaton, Ill., assignors to The Meyercord Co., Chicago, Ill., a corporation of Illinois

Application July 9, 1953, Serial No. 366,935

2 Claims. (Cl. 41—1)

This invention relates to improvements in the application of films to base sheets and more particularly to an improved roll type machine and method for applying decalcomania transfers by heat and pressure to base sheets of wood, fibrous materials and other types of sheet material.

In a copending U. S. Patent No. 2,643,475 by Jess D. Klopfenstein there is described and claimed a novel machine of the foregoing character having a pair of opposed rolls between which a base sheet and a superimposed film may be passed under heat and pressure. As described therein, the machine is provided with an overrunning clutch arranged so that the driving connection with one of the rolls is disrupted in response to an increase in surface speed of the roll thereby permitting initial positive drive of both rolls followed by positive drive of only one roll and free running of the other roll. In this way both rolls rotate during the major portion of the process at the same surface speed thereby avoiding creepage, slippage or buckling of the thin transfer film relative to the base sheet.

The present invention is directed to still another problem which is frequently encountered in the application of a thin decorative film, such as a decalcomania transfer, to a base sheet by means of a heated pressure roll device. One important application of this scheme is in the production of large wood panels of plywood, Masonite or the like having an artificial wood grain or other decorative finish, the desired finish being provided by a decalcomania transfer film which is firmly adhered or bonded by heat and pressure to the wood surface. It has been found that incomplete or faulty bonding of the decorative film is frequently encountered, especially along the marginal edges of the panels, because of irregularities and lack of smoothness in the surfaces of the original wood panels. During the sanding operation which takes place in the manufacture of plywood or Masonite sheets there is apparently an unavoidable tendency to sand off the marginal edges of the sheets a few thousands of an inch more than the main central portions of the sheets. Consequently, the edges of the sheets tend to be rounded off to a degree which varies somewhat with individual manufacturers but is sufficient in most cases to cause a marginal edge bond failure on the order of 10 to 15% when the decorative film is applied by heat and pressure rolls.

As described in the copending Klopfenstein patent hereinbefore mentioned, the base sheet or panel having a heat activatable coating of nitrocellulose or the like and the superimposed transfer film are passed between a pair of opposed pressure rolls. The roll in contact with the base sheet has a traction surface such as rubber, and the roll in contact with the transfer film is a heated metal roll which is necessary in order to activate the heat responsive material of the base sheet coating and the transfer film for bonding the latter to the base sheet. Under normal roll pressures the heated metal roll is unable to press the decorative film into tight engagement with the

rounded-off edge portions of the base sheet and as a result sufficient heat does not penetrate the work to obtain a satisfactory bond in these areas. If excessive roll pressures are used, the transfer film is crushed or squeezed to such an extent that the desired decorative appearance of the film is disfigured or destroyed. Consequently, the problem is presented of securing adequate bonding over the entire area of the base sheet in spite of edge rounding and other surface irregularities in the sheet while at the same time avoiding detrimental squeeze pressure between the rolls.

A primary object of the present invention is to provide an improved machine for applying a decorative film or the like to a base sheet which is capable of producing an effective bond over the entire area of the sheet.

A further object of the invention is to provide an improved machine of the foregoing character which is adapted to produce proper bonding of the film to the base sheet in spite of the presence of rounded marginal edges or other irregularities in the surface of the base sheet while at the same time avoiding the application of detrimental squeeze pressure to the film.

Still another object of the invention is to provide a novel and improved means for applying heat and pressure to a base sheet and superimposed film in order to adhere the film uniformly and effectively over the entire area of the base sheet.

An additional object of the invention is to provide a novel method of heating a base sheet and superimposed film and pressing the film into complete bonded engagement with the sheet including the uneven and irregular surface areas of the sheet.

Other objects and advantages of the invention will become apparent as this description progresses, reference being had to the accompanying drawings, in which:

Figure 1 is a perspective view of a machine embodying the principles of the present invention;

Fig. 2 is a top plan view of the machine shown in Fig. 1; and

Fig. 3 is a fragmentary vertical sectional view on an enlarged scale as seen along the line 3—3 of Fig. 2.

Referring to the drawings, a decalcomania applying machine is shown having a stationary base or frame **10** with a pair of upright posts or standards in the form of H beams **14** and **16** mounted thereon and connected near their upper ends by a pair of cross-bars **17**. A pair of stationary bearing supports **18** are rigidly mounted on the standards **14** and **16** at the front or forward sides thereof for journaling a bottom inlet or feed roll **19** having a rubber traction surface. A similar pair of stationary bearing supports **21** are rigidly secured to the standards **14** and **16** at the back or rearward sides thereof for journaling a bottom outlet or delivery roll **22** which is of rubber for pressure application. A pair of vertically movable bearing boxes or supports, designated generally at **23**, are carried on the upright standards **14** and **16**. The movable boxes **23** extend both forwardly and rearwardly from the standards **14** and **16** for rotatably mounting an upper feed roll **24** which coacts with the roll **19** and an upper delivery roll **26** which is the same as the roll **22** and coacts therewith. The roll **24** is a hollow metal roll having a plurality of internal electric heating elements which are connected through one end of the roll to suitable electrical conductors contained in a flexible conduit **27**, as more fully illustrated and described in the copending Klopfenstein Patent 2,643,475. In addition, a radiant heating unit **28**, more fully described below, is located between the inlet rolls **19—24** and the outlet rolls **22—26**.

Thus, the machine in its broadest aspect comprises two sets of upper and lower rolls arranged side-by-side so that work may be fed from a feed table **29** at the

front of the machine into the rolls 19 and 24, which are power driven at least in part, thence beneath the radiant heater 28, and finally discharged through the rubber pressure rolls 22 and 26 onto an outlet work-receiving table 31 at the rear of the machine. By this sequence of steps the difficulties heretofore encountered with faulty bonding due to surface irregularities in the base sheet are completely overcome and effective uniform adherence of the film to the base sheet is obtained.

As seen more particularly in Fig. 3, the bearing supports 18 for the bottom feed roll 19 are box-shaped structures which are rigidly mounted by a plurality of screws 37 on the front walls of the standards 14 and 16. The roll 19 is provided with end shafts 39 which are journaled in a pair of bearing blocks 41 which are in turn slidably received in the bearing supports 18 and rest upon the bases of the latter. The roll 19 is an elongated metal cylinder on the outer surface of which is a relatively thick layer of rubber, as previously mentioned. This rubber layer is slightly compressible and by its gripping characteristics is adapted for frictional engagement with the under surface of a base sheet to drive the same between the feed rolls 19 and 24 during operation of the machine. The stationary bearing supports 21 for the lower delivery roll 22 at the rear of the machine are similar to the supports 18. The end shafts, indicated at 49, of the roll 22 are journaled in a pair of bearing blocks 51 which are received within the supports 21, and the supports 21 are rigidly mounted on the rear sides of the uprights 14 and 16 by a plurality of screws 54.

The structural details of the movable bearing boxes or supports 23 for the upper rolls 24 and 26 form no part of our present invention and a brief description will suffice. Reference is made to another copending application S. N. 363,643, filed June 23, 1953, by Jess D. Klopfenstein wherein this subject matter is more fully described and claimed. Referring particularly to Figs. 2 and 3, each bearing box 23 comprises a pair of parallel inner and outer plate members 57 and 58 disposed closely adjacent the inside and outside of each of the upright standards 14 and 16. The plates 57 and 58 are interconnected by transversely extending plates or walls 59 and 61 at the front and rear of the standards, respectively, thereby defining a central opening of rectangular cross section through which the corresponding upright standard 14 or 16 extends for slidable mounting of the bearing box relative to the standard. The plate members 57 and 58 extend both forwardly and rearwardly of the upright standards 14 and 16 to define the inner and outer side walls of a pair of box-like bearing enclosures. The upper rolls 24 and 26 are journaled in bearing blocks which are generally similar to the bearing blocks 41 and 51 for the lower rolls hereinbefore described. Thus, the roll 24 is provided with end shafts 69 which are received within a pair of bearing blocks 71 mounted for limited vertical sliding movement in the forwardly extending enclosures of the bearing box 23. The upper portion of each bearing block 71 is formed with a cylindrical recess 76 for receiving a helical spring 77 which is seated therein and which extends above the bearing block 71. An adjustable pressure screw 78 is mounted in the top of the bearing enclosure and coacts with the spring 77 for varying the degree of compression of the spring. A similar arrangement is provided for journaling each end of the upper pressure roll 26 and comprises a bearing block 82 slidably mounted in the rearwardly extending portion of the box 23 with a helical spring 86 coacting between the upper end of each bearing block 82 and an adjustable pressure screw 88.

Prior to the introduction of a work piece between the respective sets of rolls, the upper bearing blocks 71 and 82 will rest on the bottoms of their respective bearing enclosures. However, when a piece of work, such as a base sheet 91 and a superimposed film 92, as illustrated in Fig. 3, is fed in between the rolls, the upper rolls 24 and 26 will be forced upwardly to a slight degree corresponding substantially to the thickness of the work. The vertical slidability of the bearing blocks 71 and 82 permits this upward movement of the upper rolls and the springs 76 and 86 are thus compressed during upward shifting of the rolls so that the work is subjected to a predetermined resilient spring pressure between the respective sets of upper and lower rolls. Obviously, the roll pressure between the feed rolls 24—19 and the roll pressure between the delivery rolls 26—22 can thereby be adjusted independently of each other by means of the pressure screws 78 and 88. As hereinbefore mentioned, the upper feed roll 24 is made of metal in order to permit heating thereof and as a result there is a limit to the amount of pressure which can be exerted between the rolls 24 and 19 without crushing and disfiguring the transfer film 92. However, the pressure or delivery rolls 22 and 26 are both compressible and resilient so that the screws 88 can be adjusted to provide a substantially greater pressure loading between these rolls thereby obtaining intimate final bonding between the film 92 and the base sheet 91 without crushing the film.

For slidably mounting the bearing boxes 23 on the upright standards 14 and 16, an elongated upright channel member 97 (Fig. 1) is rigidly bolted to the outer plate 58 of each bearing box 23 and is received within the outermost channel portions of the H beam comprising the corresponding upright standard 14 or 16. The upper end portions of the channel members 97 have secured thereto a pair of elongated hanger rods 101 having threaded upper end portions projecting upwardly above the standards 14 and 16 for operative engagement with an adjusting gear mechanism which coacts with the threaded hanger rods. The adjusting mechanism for raising and lowering the threaded hanger rods 101 comprises a pair of worm gear boxes 107 and 108 mounted on the cross-bars 17 at the upper ends of the standards 14 and 16, respectively. A worm gear 109 is mounted within each of the gear boxes 107 and 108 and operatively engages the threaded upper end portion of the corresponding hanger rod 101 so that by rotation of the worm gears 109 in either direction the hanger rods 101 and the bearing boxes 23 suspended thereon are thereby raised or lowered as required for adjusting the spacing of the upper rolls 24 and 26 relative to the fixed rolls 19 and 22. For raising or lowering both of the hanger rods 101 simultaneously, an elongated shaft 112 extends between the bearing boxes 107 and 108 and a pair of worm gears 113 and 114 are carried on the worm shaft 112 in operative engagement with the worm gears 109. A hand wheel 116 is affixed to a projecting end portion of the shaft 112 adjacent the upright 14 for manually rotating the shaft 112 and thereby operating both of the worm gears 109 simultaneously.

Although the mechanism just described provides for vertical adjustment of the upper rolls 24 and 26 as a unit, it will be desirable on occasion to effect vertical adjustment of one of the upper rolls relative to the other without disturbing the elevation of the bearing boxes 23 relative to the standards 14 and 16. For this purpose, a sliding wedge arrangement is provided at each end of the upper feed roll 24. Briefly, this arrangement comprises a wedge member 127 having a tapered upper surface 128 which slidably engages a tapered lower surface 129 on a lifting stud 121 which coacts with a flattened bottom edge 118 on the corresponding bearing block 71. The wedge member 127 is slidably mounted within a channel track housing 122 at the bottom of the bearing enclosure, and an elongated adjustment screw 131 extends into the forward end of the housing 122 and is operatively engaged with the wedge 127. The outer end of the adjusting screw 131 carries a rigid thrust member 133 which coacts with the front of the housing 122, and a hexagonal handle portion 136 is provided which also coacts with the front of the housing 122 for manually

adjusting the screw 131. By manipulating the hexagonal head 136 of the adjusting screw 131, the sliding wedge 127 may be shifted forwardly or rearwardly of the machine for lowering or raising the position of the lifting stud 121 and thereby varying the relative spacing between the rolls 24 and 19 without disturbing the spacing between the rolls 26 and 22 as determined by the adjustment of the bearing boxes 23 on the standards 14 and 16.

The details of the drive means for the machine likewise forms no part of the present invention so that a brief description will again suffice, reference again being made to the copending Klopfenstein application S. N. 363,643 for a more complete disclosure. The feed and delivery rolls are each positively driven by means of an electric motor 137 (Fig. 1) through a chain and sprocket drive. The motor 137 is slidably supported on two spaced elongated rods 141 extending between a pair of spaced upright supports 142 secured to the base 10. An elongated threaded screw 143 is journaled between the supports 142 and has an operative threaded engagement with the motor 137. The outer end of the screw 143 is journaled in a bracket 144 and has secured thereto an operating wheel or handle 146 so that by rotating the screw 143 the motor 137 can be shifted for varying the drive ratio and the rotating speed of the rolls. This latter result is accomplished by means of a variable speed pulley 147 mounted on the motor shaft, the driving diameter of the pulley 147 being self-adjusting as the motor 137 is shifted in one direction or the other as is well understood in the art. A belt 148 extends around the pulley 147 and around a larger pulley 149 which is rotatably supported from a gear box 151 containing reduction gearing of conventional form. A drive shaft (not shown) projects from the gear box 151 at the drive end of the machine and carries a drive sprocket (not shown) which engages a drive chain 154. The chain 154 is trained over suitable sprockets 158 (Fig. 2) carried on the pressure rolls 22 and 26 and also over a pair of sprockets 161 on the feed rolls 24 and 19, the usual idler sprockets being interposed in the arrangement. Each of the sprockets 158 on the pressure rolls 26 and 22 are of the same size and pitch so that these rolls will be driven at the same rate of speed, and the same is true of the sprockets 161 on the feed rolls 24 and 19 so that the latter are likewise driven at the same rate of speed. As viewed in Fig. 1, when the motor 137 is operated to drive the chain 154 in the direction of the arrows, the lower rolls 19 and 22 are rotated in a counterclockwise direction while the upper rolls 24 and 26 are rotated in a clockwise direction so that the work 91—92 when placed in position on the feed table 29 will be drawn between the feed rolls 19 and 24 and moved through the machine from the front to the rear thereof for delivery from the pressure rolls 22 and 26 to the rear delivery table 31. An overrunning clutch 162 (Fig. 2) is provided for the heated feed roll 24 and the sprocket 161 is mounted on a projecting sleeve portion (not shown) of the clutch 162 so that the heated roll 24 is driven through the overrunning clutch. This feature of the machine is more fully described and claimed in the aforementioned copending Klopfenstein patent. In order to avoid disturbing the driving efficiency between the drive chain 154 and the various sprockets when the roll spacing is adjusted by vertical movement of the bearing boxes 23, the invention utilizes an automatically adjustable idler sprocket arrangement (not shown) for adjusting and maintaining a predetermined chain tension. Reference is again made to the copending Klopfenstein application S. N. 363,643 wherein this portion of the machine is more fully described and claimed.

As hereinbefore mentioned, the primary feature of the present invention is the provision of the radiant heating unit 28 which is interposed between the feed rolls and the delivery rolls. This heating unit comprises an elongated generally U-shaped reflector or housing 172 (Fig. 3) which has a pair of spaced metal walls with a suitable insulating material 173 therebetween. A plurality of elongated electrical radiant heating elements 174 are mounted within the housing 172 so that the radiant heat is reflected downwardly through the open bottom portion of the housing against the film side of the work 91—92 passing thereunder. The heating unit 28 is suspended between the inner walls 57 of the bearing boxes 23 and is thus carried immediately between the upper rolls 24 and 26. For thus supporting the heating unit 28, a pair of bracket plates 176 (Fig. 2) are fastened to the opposite ends of the top portion of the housing 172 and are supported on the horizontal flanges 177 of a pair of adjustable brackets 178 (Fig. 3). A straddle strap 179 is secured to each of the flanges 177 and extends over the bracket plates 176 for retaining the same thereon. Each of the heater brackets 178 has an upright portion with an elongated slot 180 and a stud 181 carrying a collar 182 extends through the slot 180 into the adjacent wall 57 of the corresponding bearing box 23. An adjusting screw 183 is threaded through a horizontally extending upper flange 184 on the bracket 178 and engages the collar 182 so that the elevation of the brackets 178 relative to the bearing boxes 23 may be adjusted by means of the screws 183. The brackets 178 also have depending portions provided with endwise slots 185 which coact with a pair of guide screws 186 extending from the bearing box walls 57 to insure vertical alignment of the brackets.

Consequently, it will be seen that the radiant heating unit 28 is carried between the bearing boxes 23 and is, therefore, adjustable as a unit with the upper rolls 24 and 26 during regulation of the roll spacing. Moreover, the elevation of the heating unit 28 may also be adjusted relative to the bearing boxes 23 and the rolls carried therebetween by means of the adjusting screws 183. By this arrangement, the proximity of the heating unit 28 relative to the work passing thereunder may be controlled and regulated to a high degree in order to accommodate a wide variety of operating conditions.

As will be hereinafter explained, the radiant heater 28 is normally operated at a relatively high temperature in order to permit effective operation of the machine at relatively high speeds. If for any reason, the film 92 should not be preliminarily bonded to the base sheet 91 during use of the machine, there would be a dangerous tendency for the heat sensitive film 92 to curl or buckle upwardly and come into contact with the radiant heating elements 174 thereby creating a serious fire hazard. In order to eliminate this possibility, a guard is preferably provided over the lower open end of the heating unit 28. This guard is in the form of an elongated comb comprising a shaft 187 having a plurality of rearwardly extending fingers 188 which are rigidly secured to the shaft 187 and extend across the opening of the heater housing to guard the same. The fingers 188 are preferably of resilient construction and have an upwardly bent or bulged configuration to insure their tight engagement with the lower edges of the heater housing. The shaft 187 is suspended from the horizontal flanges 177 of the heater brackets 178 by means of a pair of tubular collars 189 bolted to the opposite ends of the shaft 187 and also to the bracket flanges 177.

For supporting the work 91—92 as it passes between the feed rolls 19—24 and the pressure rolls 22—26, a pair of intermediate idler rolls 191 (Fig. 3) are journaled in a pair of brackets 192 secured to the insides of the upright standards 14 and 16. As will be apparent from Fig. 3 of the drawing, the idler rolls 191 are so positioned that they engage and support the under surface of the base sheet 91 in alignment with the upper edges of the rolls 19 and 22.

During operation of the machine, the rolls 19 and 24 will normally be spaced from each other a distance slightly less than the thickness of the base sheet 91 and the film 92 so that the roll 24 will necessarily lift slightly during passage of the work through the rolls. In this manner,

the effective spring pressure of the springs **76** is applied to the roll **24** and likewise to the work. The base sheet **91** may comprise a sheet of plywood, Masonite, or the like having a dry hard coating of a thermoplastic material such as nitrocellulose containing a relatively high percentage of plasticizer. The film **92** may comprise a decalcomania transfer which is superimposed on top of the base sheet **91**. The decalcomania transfer is of the heat releasable dry strip type having a paper backing and a lacquer design film of ethylcellulose, nitrocellulose, or the like. As is well understood in this art, the design film side of the decalcomania transfer is disposed adjacent the thermoplastic coated side of the base sheet **91** so that upon the application of heat and pressure the material of the design film and the base sheet coating will be activated to develop adhesive properties therebetween and at the same time permitting release and dry stripping of the paper backing.

According to the present invention, the base sheet **91** and superimposed film **92** are introduced between the feed rolls **19** and **24** and the latter are regulated both as to heat and pressure so as to obtain a preliminary bond of the film **92** to the base sheet **91**. Because of the fact that the base sheet **91** of plywood or the like frequently has substantial surface irregularities and especially a pronounced rounding off or beveling adjacent the edges of the base sheet, it is not possible to obtain intimate bonded contact between the film **92** and the base sheet **91** merely by means of the feed rolls **19** and **24**. The upper roll **24** must be heated and, therefore, must be of metal. If excessive pressure loading is provided for the metal roll **24**, detrimental crushing and disfiguration of the transfer film **92** is frequently experienced. Accordingly, in the present invention the feed rolls **19** and **24** provide merely a preliminary bonding of the film **92** to the base sheet **91**.

As the work passes from the feed rolls **19—24** it is introduced between the pressure or delivery rolls **22—26** which are made of resiliently compressible material such as rubber and can, therefore, be pressure loaded by the springs **86** to a substantially greater degree sufficient to press the film **92** into intimate bonded engagement over the entire surface area of the base sheet **91** including even the surface irregularities and rounded edge portions of the sheet. In other words, the compressible resilient nature of the rolls **22** and **26** permits these rolls to conform closely to all usual surface irregularities under substantially increased pressure while at the same time avoiding detrimental crushing of the film.

However, in order to insure complete final bonding of the film to the base sheet by means of the pressure rolls **22** and **26** the intermediate radiant heating provided by the heating unit **28** is essential. As previously explained, the heated metal roll **24** under normal non-crushing pressures is unable to press the film **92** into complete engagement with the irregular surface area of the base sheet **91** and for that reason the heat of the metal roll **24** does not penetrate the transfer film **92** down to the heat activatable nitrocellulose coating on the base sheet to any satisfactory degree. However, the radiant heater **28** is operated at a relatively high temperature so that the radiant heat readily penetrates through the film **92** into the surface coating of the base sheet **91** and develops to a high degree the latent adhesive properties in these materials. Immediately thereafter the base sheet and superimposed film pass between the pressure rollers **22** and **26** and the high degree of intimate engagement obtained by these rolls insures completely effective bonding of the film **92** over the entire surface area of the base sheet.

Normally, the heated metal roll **24** may be operated at a surface temperature on the order of 200 to 400° F. dependent upon the nature of the transfer film and the base sheet. With moderate pressure loading of the roll **24**, preliminary bonding of the film **92** to the base sheet **91** is effected so that there is no tendency for the transfer film **92** to curl or buckle under the extreme heat of the subsequent radiant heater **28**. The radiant heater is normally operated at a temperature on the order of 1500° F. so as to obtain the necessary complete heat activation and penetration into the base sheet coating at relatively high operating speeds, e. g., 30 linear feet per minute. Thus, by the successive steps of preliminarily bonding the film to the base sheet under moderate heat and pressure between the feed rolls, subjecting the work to high temperature radiant heat, and then effecting complete final bonding by means of unheated resilient pressure rollers, the present invention overcomes all of the difficulties resulting from surface irregularities in the base sheet. As the work emerges from the pressure rollers at the delivery side of the machine, the heat releasable dry strippable paper backing comprising a portion of the transfer film may be readily stripped from the decorated base sheet.

Although the invention has been described with particular reference to a preferred structural embodiment of the machine for supplying decalcomania transfer films to base sheets, it will be understood that various modifications and changes in details of structure may be made without departing from the scope of the invention as defined in the appended claims.

We claim:

1. A machine for applying a film to a base sheet comprising a pair of driven upper and lower feed rolls between which a base sheet and superimposed film may be passed under pressure, said upper feed roll comprising a metal cylinder having internal heating means for effecting preliminary bonding of the film to the base sheet under heat and pressure and said lower feed roll having a traction surface for frictionally gripping the base sheet and driving the same through the rolls, a pair of driven upper and lower rubber pressure rolls mounted adjacent said feed rolls for receiving the base sheet and preliminarily bonded film from said feed rolls, said rubber pressure rolls being resiliently compressible to conform to the surface irregularities of said base sheet for pressing the film into intimate bonded engagement with the base sheet over substantially the entire surface area of the sheet, adjustable support means for said upper feed and pressure rolls for varying the spacing between the upper and lower rolls, adjustable resilient pressure applying means coacting with said upper feed and pressure rolls for urging the upper rolls toward the lower rolls, and heating means interposed between said upper feed roll and said upper pressure roll for heating the film and the adjacent surface of the base sheet prior to the application of final bonding pressure by said pressure rolls.

2. The machine of claim 1 further characterized in that said heating means comprises a radiant heater.

References Cited in the file of this patent

UNITED STATES PATENTS

161,290	Sochefsky	Mar. 23, 1875
846,233	Munnecke	Mar. 5, 1907
1,897,862	Randall	Feb. 14, 1933
2,433,965	Upson	Jan. 6, 1948
2,643,475	Klopfenstein	June 30, 1953