

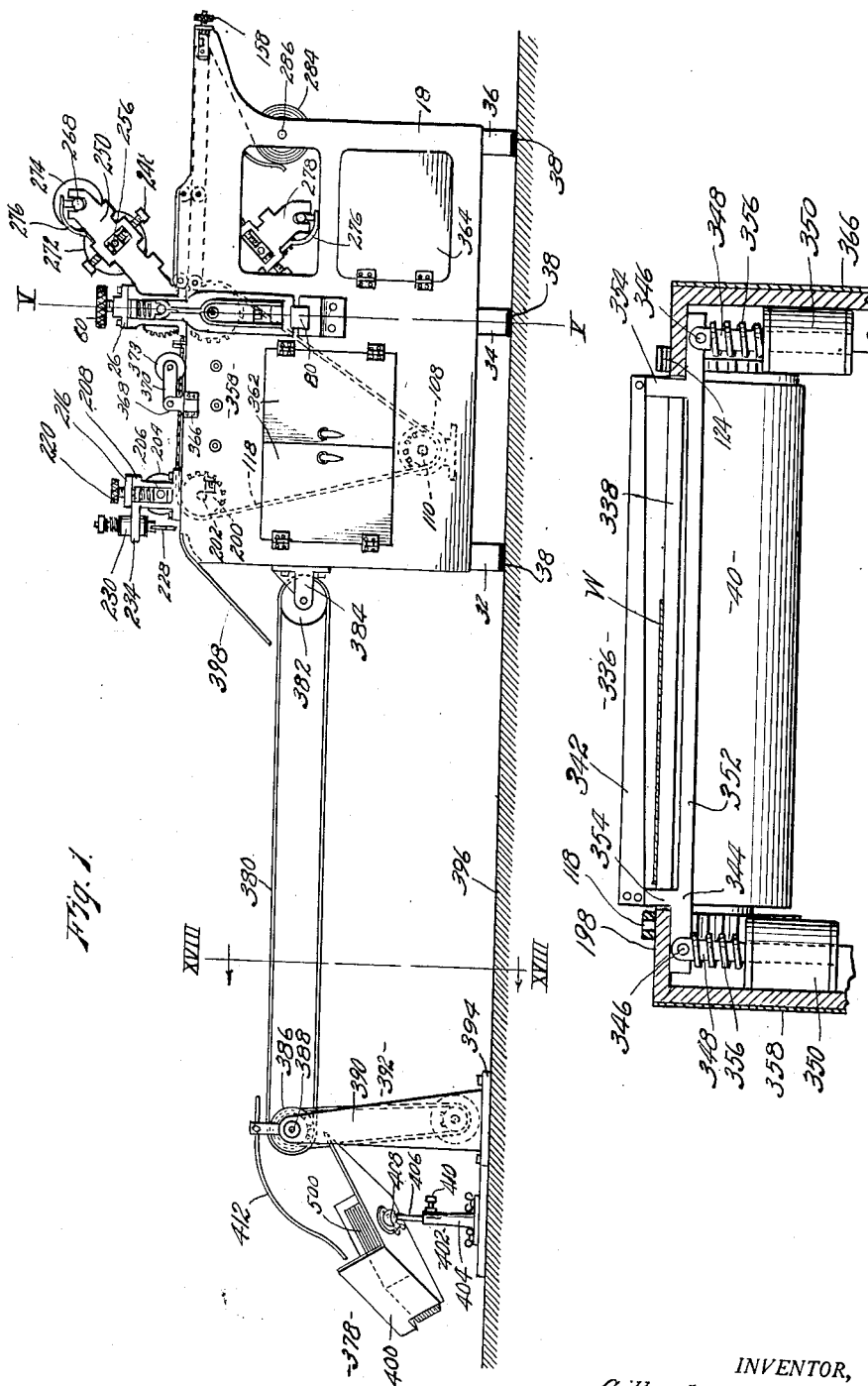
June 8, 1954

G. L. LEWIS
LAMINATING MACHINE

2,680,468

Filed Aug. 1, 1949

11 Sheets-Sheet 1



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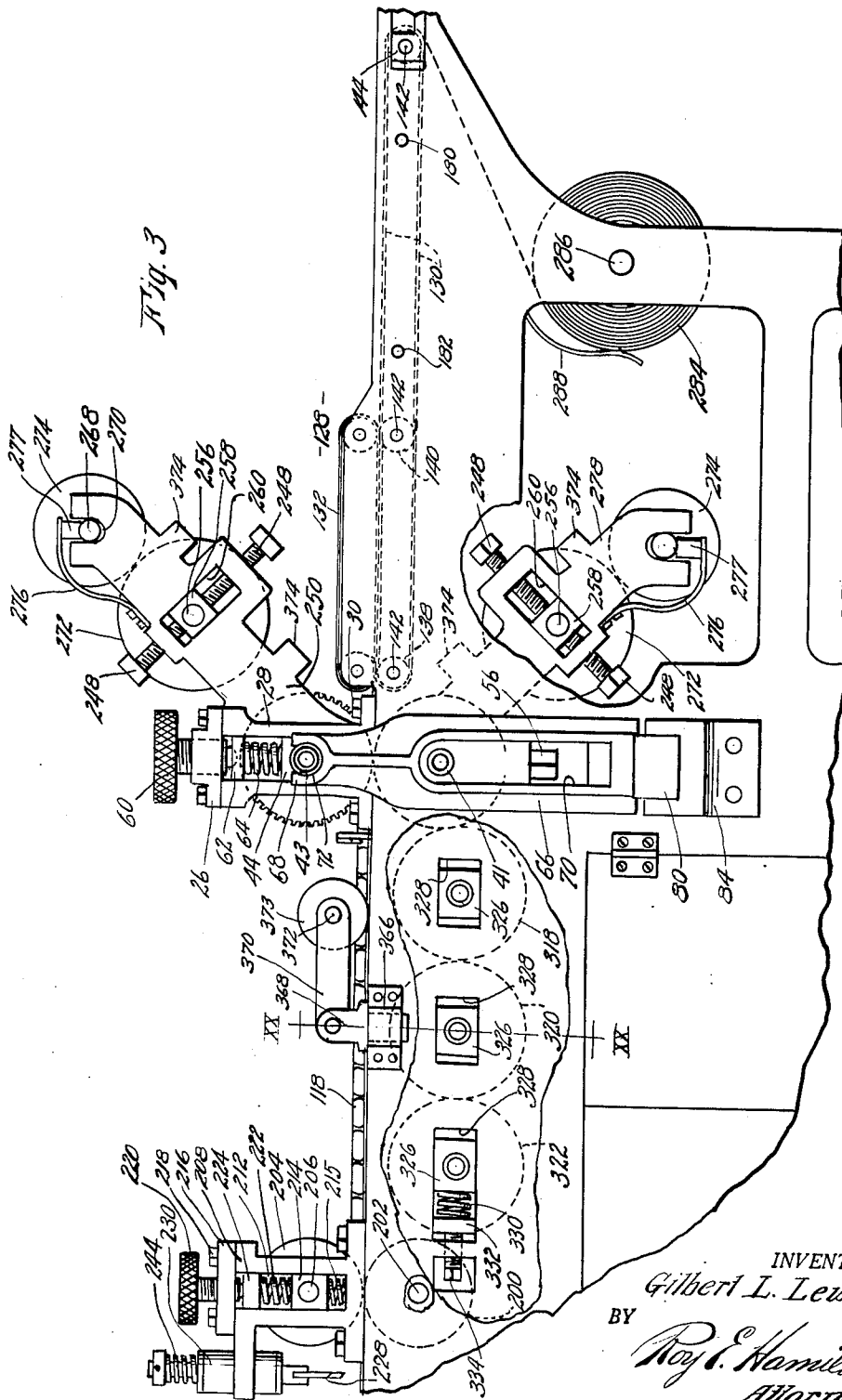
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11 Sheets-Sheet 3



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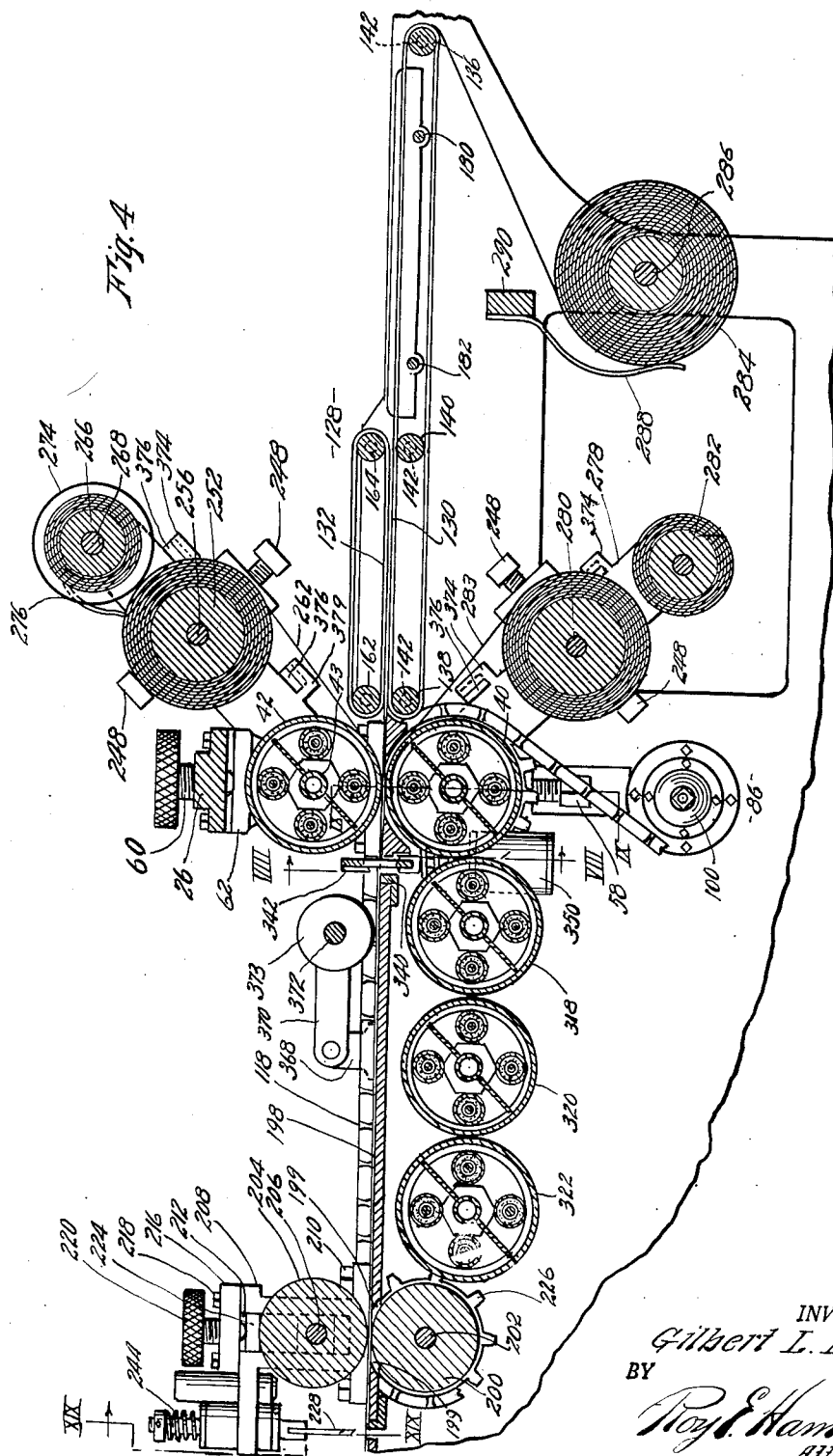
G. L. LEWIS

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LAMINATING MACHINE

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11 Sheets-Sheet 4

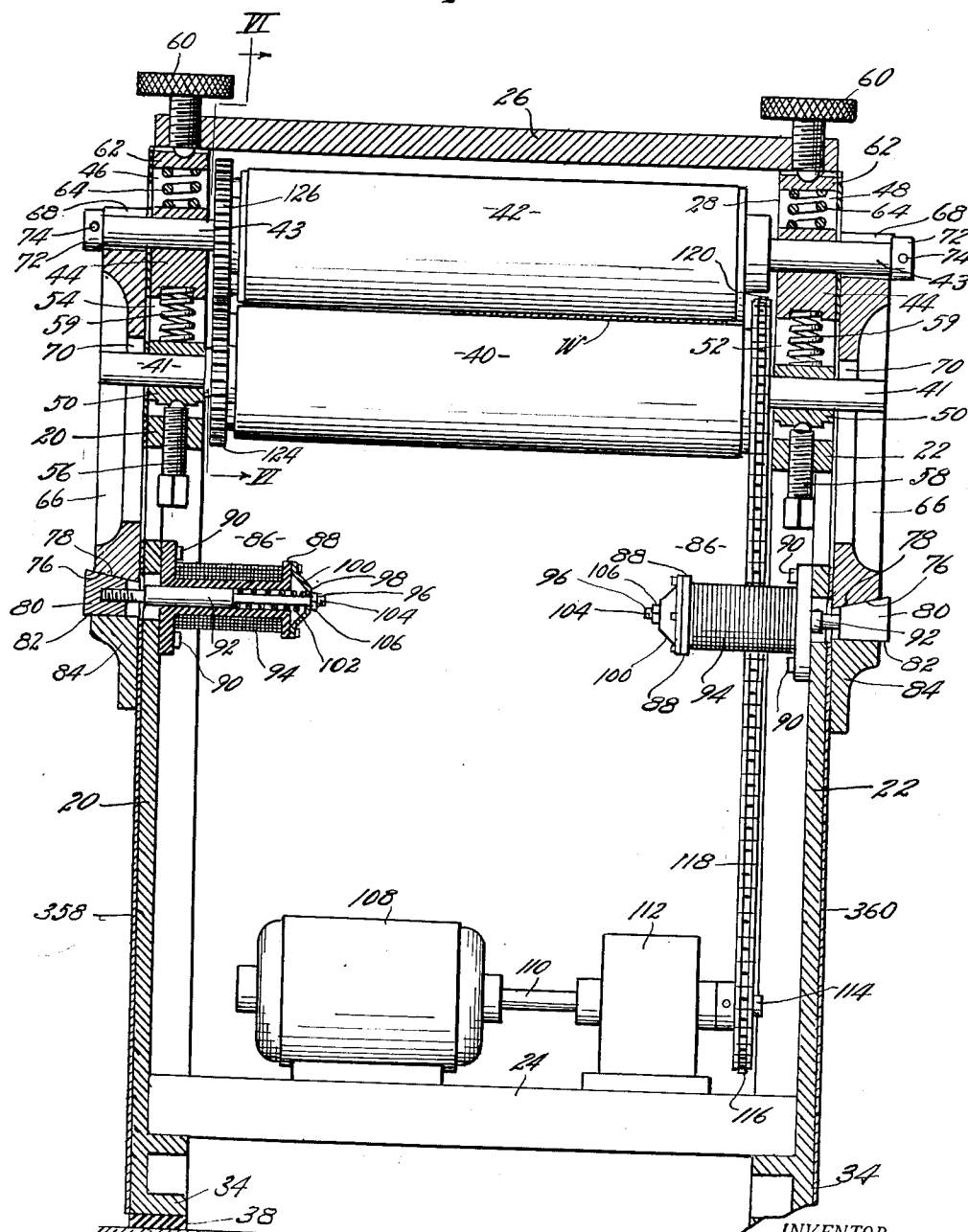


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LAMINATING MACHINE

11 Sheets-Sheet 5

Fig. 5



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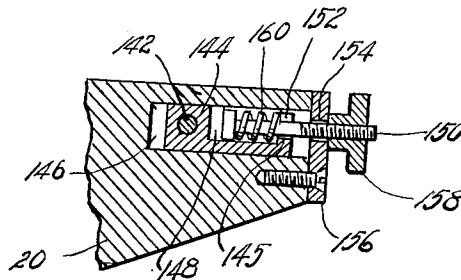
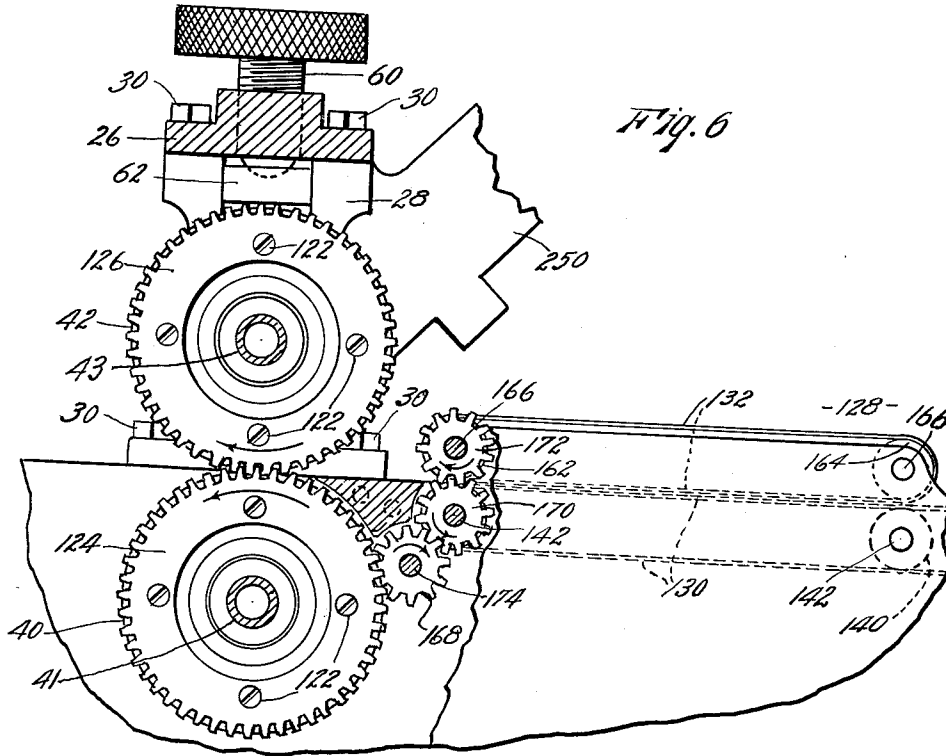
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11 Sheets-Sheet 6



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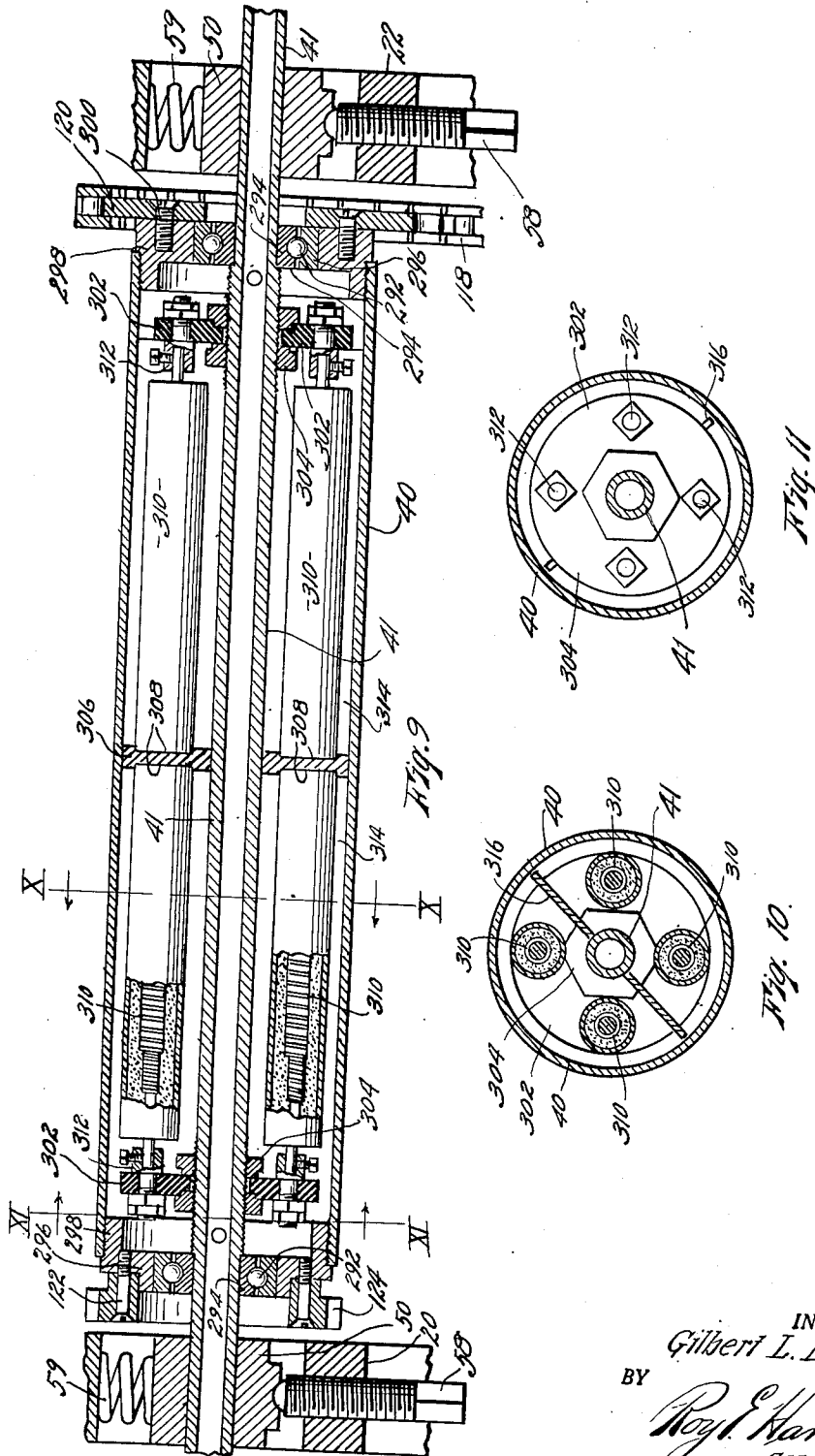
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11 Sheets-Sheet 7



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11 Sheets-Sheet 8

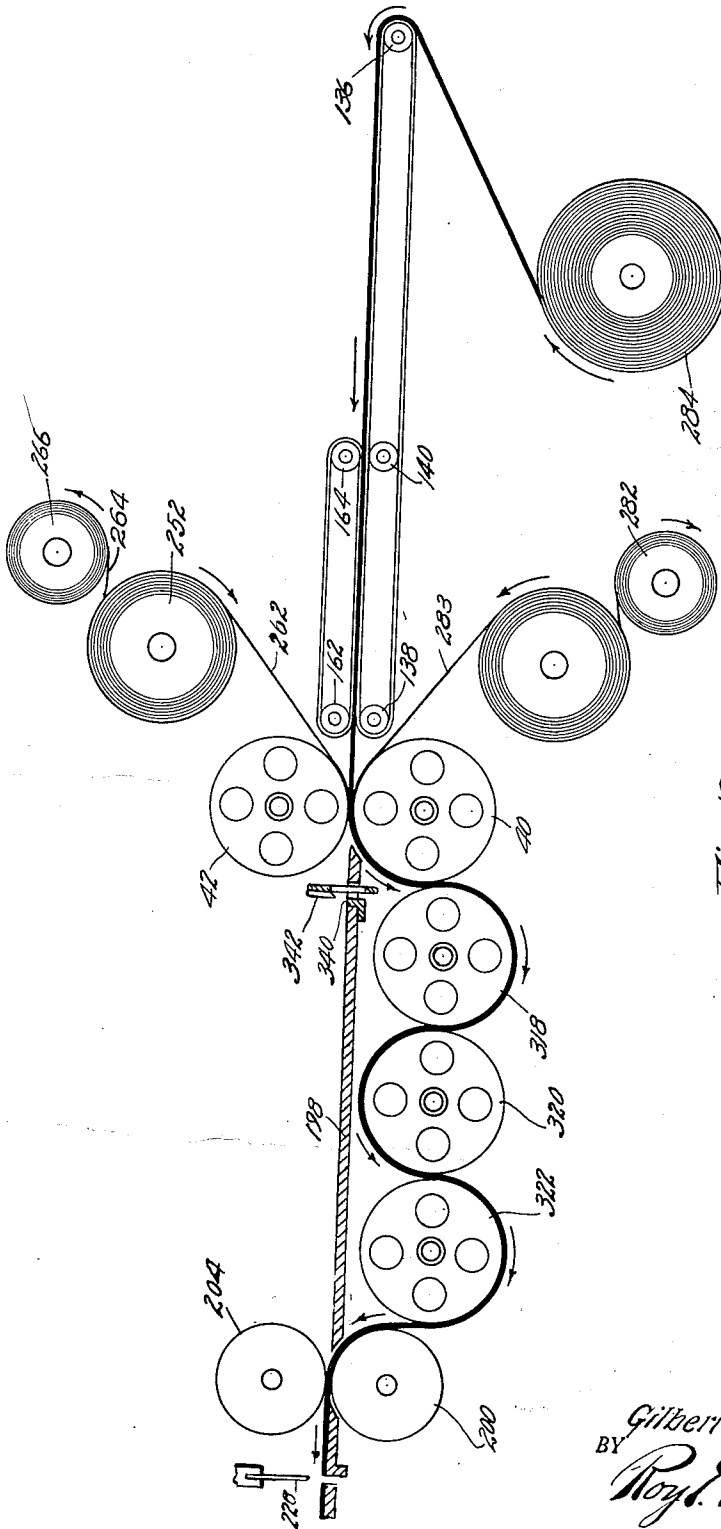


Fig. 13

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11 Sheets-Sheet 9

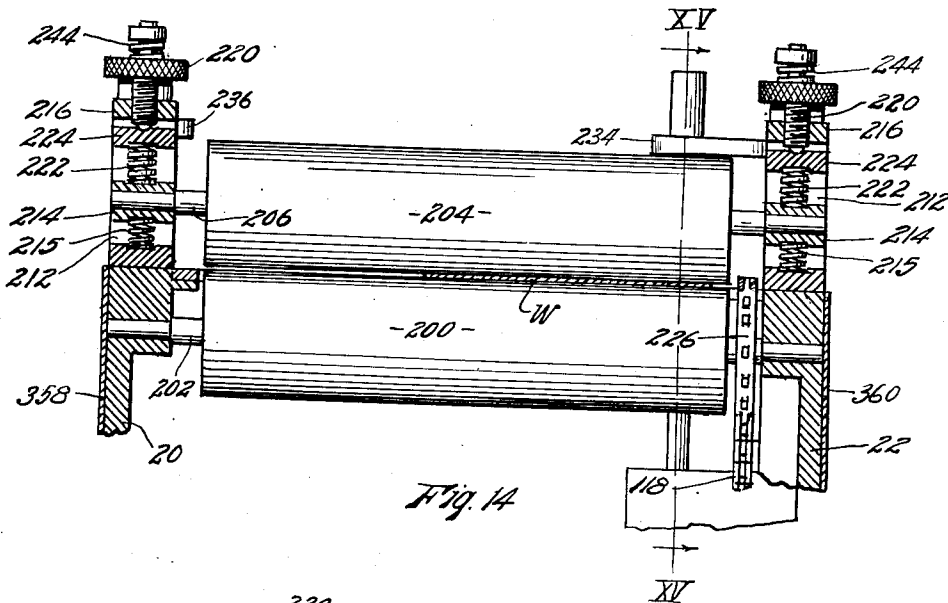


Fig. 14

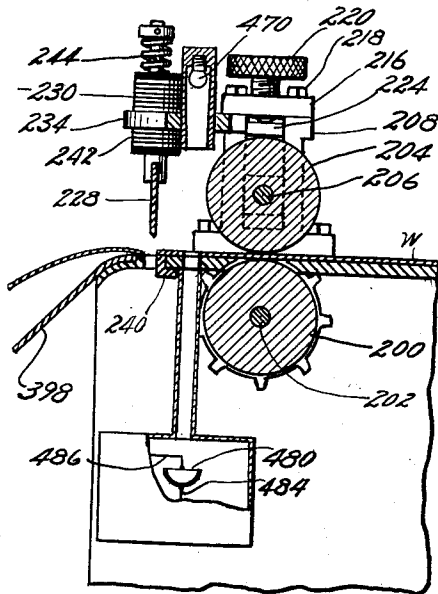
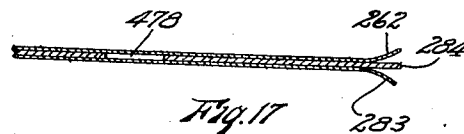


Fig. 15



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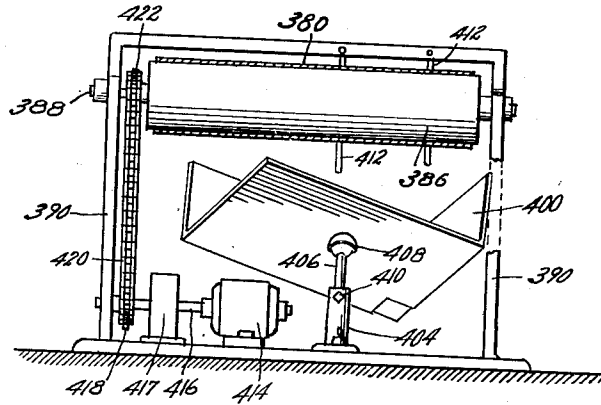


Fig. 18

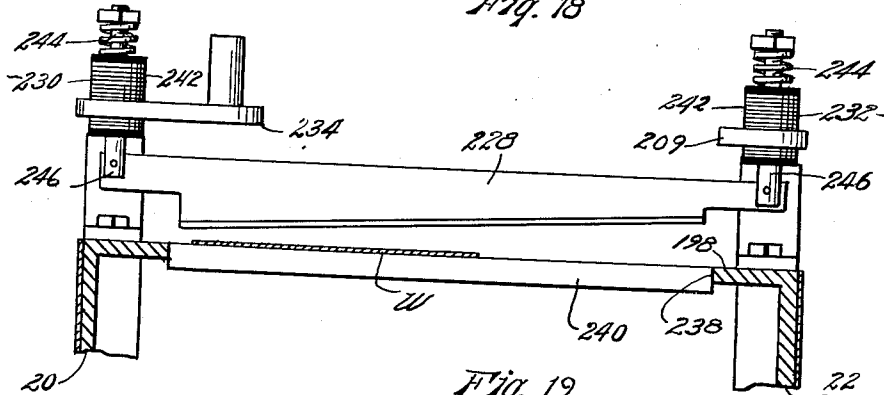


Fig. 19

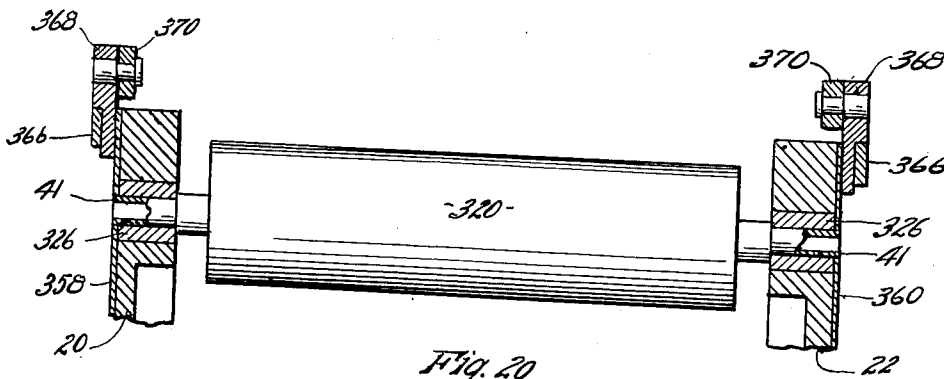


Fig. 20

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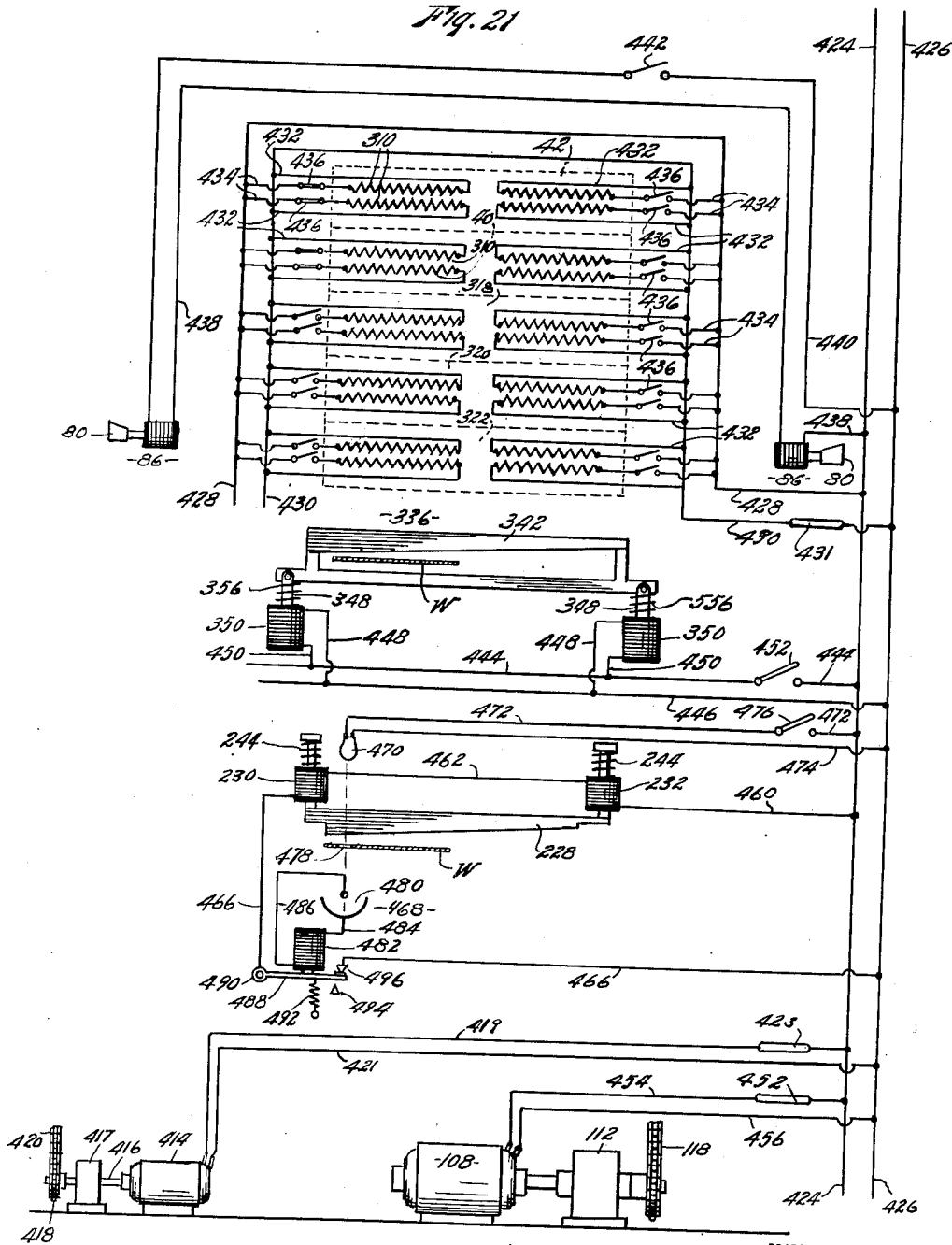
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LAMINATING MACHINE

2,680,468

11 Sheets-Sheet 11

Fig. 21



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UNITED STATES PATENT OFFICE

2,680,468

LAMINATING MACHINE

Gilbert L. Lewis, Kansas City, Mo.

Application August 1, 1949, Serial No. 107,999

3 Claims. (Cl. 154—1)

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This invention relates to improvements in laminating machines whereby sheets of paper may be covered on both sides with relatively thin sheets of film which are caused to adhere thereto by the application of heat or pressure, or by the application of both heat and pressure.

Among the several objects of this invention may be noted the provision of a laminating machine having feed and pressure rollers each provided with a plurality of independently controlled heating units, so that heat may be selectively applied to predetermined portions of the rollers.

A further object is the provision of a laminating machine having feed rollers and curing rollers having manually adjustable means operable to vary the pressure exerted on the work passing between said rollers.

Another feature of this machine is the provision of curing rollers wherein the diameter of each successive roller is slightly larger than the one just preceded whereby work fed therethrough will be maintained in a stretched-out form at all stages of its travel.

A further feature is the provision of manually controlled means whereby the principal feed rollers are separated when the regular travel of the work is interrupted for any reason.

Other novel features of the machine are an electric eye controlled means for cutting said work into sheets of equal length, means for conveying said sheets to a stacker which automatically stacks said sheets, and means integral with the machine for attaching parts thereto for performing special operations on the work.

Other objects are simplicity and economy of construction, ease and efficiency of operation, and adaptability for use in handling various types and kinds of laminating materials.

With these objects in view as well as other objects which will appear during the course of the specification reference will be had to the drawings wherein:

Figure 1 is a side elevational view of the laminating machine with parts shown in dotted lines.

Fig. 2 is an enlarged plan view of the machine shown in Fig. 1 with parts broken away.

Fig. 3 is an enlarged side elevational view of the laminator with parts broken away.

Fig. 4 is an enlarged sectional view taken on line IV—IV of Fig. 2.

Fig. 5 is an enlarged sectional view taken on line V—V of Fig. 1 with parts left in elevation.

Fig. 6 is an enlarged sectional view taken on line VI—VI of Fig. 5.

Fig. 7 is an enlarged fragmentary sectional view taken on line VII—VII of Fig. 2.

Fig. 8 is a fragmentary sectional view taken on line VIII—VIII of Fig. 4.

Fig. 9 is an enlarged sectional view taken on line IX—IX of Fig. 4 with parts broken away.

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Fig. 10 is a cross sectional view taken on line X—X of Fig. 9.

Fig. 11 is a cross sectional view taken on line XI—XI of Fig. 9.

Fig. 12 is an enlarged sectional view taken on line XII—XII of Fig. 2.

Fig. 13 is a diagrammatic view showing the travel of the work through the machine in a typical operation.

Fig. 14 is an enlarged sectional view taken on line XIV—XIV of Fig. 2 with parts broken away.

Fig. 15 is a sectional view taken on line XV—XV of Fig. 14.

Fig. 16 is a plan view of a portion of the work containing one of the windows for admitting light to operate the selenium cell.

Fig. 17 is a sectional view taken on line XVII—XVII of Fig. 16.

Fig. 18 is an enlarged sectional view taken on line XVIII—XVIII of Fig. 1.

Fig. 19 is a sectional view taken on line XIX—XIX of Fig. 4.

Fig. 20 is a sectional view taken on line XX—XX of Fig. 3, with parts broken away.

Fig. 21 is a diagrammatic view of the electric circuit for controlling the laminator.

Throughout the several views like reference characters refer to similar parts and the numeral 13 refers to a laminating machine frame having a left hand side frame 20 and a right-hand side frame 22. These side frames are joined together adjacent their lower portions by means of a platform 24 and at their upper portion by a cross bar 26 which is secured to vertical standards 28 which are in turn secured to frames 20 and 22 by screws 30. Frames 20 and 22 each has corresponding depending legs 32, 34 and 36, each provided with a suitable resilient supporting pad 38 which serves to lessen the vibration of the machine, and also its objectional creeping.

Rotatably and adjustably carried by side frames 20 and 22 is a lower feed roller 40 fixed on an axle 41 and an upper cooperating feed roller 42 having a fixed axle 43. Upper feed roller 42 is mounted for rotation in bearings 44 slidably mounted in slots 46 and 48 formed respectively in the left and right vertical standards 28. The lower feed roller 40 is mounted in bearings 50 which are slidably and adjustably mounted in slots 52 and 54 which are respectively formed in left side frame 20 and right side frame 22.

These slots 52 and 54 are in alignment and register with slots 46 and 48 respectively whereby as hereinafter set forth said feeding rollers may be independently adjusted to set up variable pressures against each other, and may be moved out of contact with each other. Adjusting screws 56 and 58 mounted for vertical adjustment in side frames 20 and 22 respectively are adapted to support bearings 50 whereby when the screws are

operated they may be caused to properly position the periphery of feed roller 40 to register with the bed of the laminator. The upper roller bearings 44 are supported on the respective lower bearings 50 with relatively weak springs 59 positioned therebetween, so that the rollers are normally supported in spaced apart relation.

Pressure adjusting screws 60 at opposite ends of roller 42 are threaded through cross bar 26 to engage the respective slide blocks 62 positioned in slots 46 and 48. The slide blocks 62 are positioned in spaced relation to bearings 44 with a relatively heavy compression spring 64 therebetween. When it is desired to create a predetermined pressure between the rollers the operator screws adjusting screws 60 down so as to compress springs 59 and permit the peripheries of rollers 40 and 42 to contact. Springs 64 may be further compressed to produce the desired pressure on the materials being laminated between said rollers.

Due to certain conditions that may arise during the operation of the laminator it may become expedient to quickly separate the rollers 40 and 42. This is accomplished by the following means: Vertically mounted bars 66, one mounted on each side of the machine are bifurcated at their upper ends at 68 to receive the projecting ends of axle 43 and are slotted adjacent their central portions at 70 to receive the opposite ends of the lower roller axle 41 which serve to guide the bars in a straight line of travel. The outer extremities of axle 43 are each provided with a set collar 72 held in position by pins 74. The set collars serve to hold the upper extremities of bars 66 inwardly against the body of the machine. The lower end portion of bar 66 is inwardly and downwardly inclined at 76 to operatively engage the wedge face 78 of wedge block 80. Wedge block 80 has a horizontally disposed bottom face 82 which rests on a wedge plate 84, secured to the machine frame. It is quite evident that the wedge block thus described will, when removed inwardly, cause the bar 66 to move upwardly to engage and raise the upper feed roller upwardly from the lower feed roller 40, while said lower roller is maintained in its lower position by the springs 59.

Each wedge block is provided with an actuating solenoid 86 having a spool 88 secured respectively to the inside walls of frames 20 and 22 by means of screws 90.

Movable core 92 secured at its one end to wedge block 80 extends into spool 88 and is adapted to be moved inwardly as the solenoid coil 94 is energized. The inner end of core 92 is provided with a non-magnetic stem 96 which extends through an aperture 98 formed through cap 100 removably attached to the inner end of spool 88. Positioned about stem 96 between cap 100 and core 92 is a compression spring 102 which normally forces wedge block 80 to the outward position shown in Fig. 5. The extended end of stem 96 is threaded at 104 to receive the stop nut 106 for limiting the outward movement of wedge block 80.

Mounted on platform 24 is motor 108 having a shaft 110 which is operatively connected with speed reducer 112 having a drive shaft 114 on which is mounted a sprocket wheel 116 which in turn drives an endless sprocket chain 118. Mounted on axle 41 intermediate the right side frame and roller 40 by screws 300 is a sprocket wheel 120 which is operatively engaged by chain 118 to drive the feed roller 40.

Secured to the left end of roller 40 by means of screws 122 is a ring spur gear 124 which rotates

with the roller to operatively engage and drive spur gear 126 which is secured concentrically to the left end of roller 42 by screws 122.

Spur gears 124 and 126 have teeth of sufficient length, so that when roller 42 is raised to disengage roller 40 as hereinbefore set forth the teeth of these gears will remain in mesh so that the timing of the rollers which are of like diameter will always remain in constant engagement. (See Figs. 5 and 6.)

A belt type feeder 128 disposed in a horizontal plane comprises a lower series of endless belts 130 and an upper series of endless belts 132. The lower endless belt section provides a series of spaced apart belts 130 which are operatively mounted on front roller 136, rear roller 138, and intermediate supporting roller 140. These rollers extend transversely across the machine in parallel relation with the axes of feed roller 40 and are rotatably mounted at the opposite ends respectively on their axes 142 in side frames 20 and 22.

Roller 136 is transversely adjustable to properly tension, and position belts 130. Referring to Fig. 12 it will be noted that the axles 142 of roller 136 are mounted in a slidably adjustable bearing block 144 mounted in slots 146 formed in side frame 20 and 22 respectively. Blocks 144 are notched at 148 to receive bolts 150 which are positioned in a longitudinally disposed notch 152 in the forward portion 145 of blocks 144 to extend through an opening 154 formed through end plate 156 secured over the end of slot 146 to serve as a bearing for nut 158. Mounted on bolt 150 between the bolt's head and block portion 145 is a compression spring 160 which when nut 158 is adjusted may move roller 136 to obtain proper tensioning of the belts 130 to properly direct the work to the feed rollers.

The upper series of belts 132 are relatively short and are spaced apart and mounted on rollers 162 and 164 each having axles 166 journaled in side frames 20 and 22 and disposed in parallel relation with axle 41 of roller 40.

This feeder 128 is driven by motor 108 through the spur gear 124 by like spur gears 168, 170 and 172. Spur gear 168 is an idler which is rotatably mounted on stub shaft 174 fixed to side frame 20 to intermesh with spur gear 124 and spur gear 170 fixed for rotation with axle 142. Spur gear 170 intermeshes with spur gear 172 which in turn is fixed to axle 166 of roller 152.

It will be noted that the adjacent reaches of belts 130 and 132 run rearwardly in the same direction, and due to the construction of the train of spur gears, will run at the same peripheral speed as that of the feed rollers 40 and 42.

Referring to Figs. 2 and 7, it will be noted that guide strips 176 and 178 are adjustably mounted on guide rods 180 and 182. These guide rods are threaded and are rigidly supported in side frames 20 and 22. Guide strips 176 and 178 each have a base angle 184 having depending transverse lugs 186 bored at 188 to slidably fit guide rods 180 and 182. Base angle 184 is vertically slotted at 190 to receive an adjusting nut 192 which is operatively mounted on threaded rods 180 and 182. The operator may easily adjust the guide strips to any desired transverse position across the feed bed by operating adjusting nuts 192, and can also produce some slight alignment of the strips to properly direct the work W to the feed rollers.

In many instances it will be found sufficient to use but one of the strips to serve as a guide for directing the work to the feed rollers. For ex-

ample work fed to guide 176 will run true to the direction of travel of film 262 fed from roller 252.

Extending rearwardly from feed rollers 40 and 42 is a planar work bed 198 which is horizontally disposed and is in alignment with the sheet work W being fed from said feed rollers 40 and 42. Rotatably mounted in the rear end portion of work bed 198 is a lower feed roller 200 rigidly fixed to an axle 202 which in turn is rotatably mounted at its opposite ends in side frames 20 and 22 with its upper periphery parallel with the planar work bed 198 to extend through a hole 199 formed therethrough. Operatively related with feed roller 200 is an upper feed roller 204 having an axle 206 rigidly fixed thereto. A bracket 208 is secured on each side of frame 20 by means of screws 210. Brackets 208 and 209 each are vertically slotted at 212 to receive slidably mounted bearings 214 to receive the ends of axle 206. A cap nut 216 fixed to the upper end of bracket 208 by screws 218 operatively receives an adjusting screw 220 by means of which a compression spring 222 positioned in slot 212 between bearing 214 and cap nut 216 is adjusted to vary the tension between the feed roller 200 and 204. A washer 224 positioned on the upper end of spring 222 serves as a bearing for the end of adjusting screw 220. These feed rollers are adapted to receive the work W fed from the feed rollers 40 and 42 across work bed 198 and between feed rollers 200 and 204. In order to pull the work in proper alignment, the axles 202 and 206 of the feed rollers are held in parallel relation with axles 41 and 43 of feed rollers 40 and 42. Positioned between bearing 214 and the lower wall of slot 212 is a relatively light spring 215 which tends to urge roller 204 upwardly against the action of compression spring 222.

Rigidly fixed to axle 202 intermediate roller 200 and bearing frame 22 is a sprocket wheel 226 which intermeshes with drive sprocket chain 118 to drive the work W at a speed equal with or slightly greater than the speed of said chain, since the pitch diameter of the sprocket drive wheels is substantially equal to the diameter of the work drive roller with which it is associated.

Just to the rear of feed rollers 200 and 204 is a shear blade 228 which is operable by solenoids 230 and 232 fixed respectively to flange 234 of bracket 208 and to flange 236 of bracket 209. Planar work bed 198 is transversely slotted at 238 to receive blade 228 therethrough to operatively co-act with stationary shear blade 240 secured to work bed 198 along one edge of slot 238. Solenoids 230 and 232 are similarly constructed each having a coil 242 provided with a magnetic core 244 to which one end of blade 228 is secured by a non-magnetic core extension 246.

Integral with standard 28 and extending forwardly and upwardly therefrom is a bracket 250 disposed at opposite sides of the machine to adjustably carry rollers 252 and 256 transversely across the machine in parallel relation with feed roller 42. Roller 252 is provided with an axle 256 which is mounted at its opposite ends in bearings 258 which are slidably mounted in slots 260. These bearings are held in adjusted position by means of screws 248 adjustably mounted in bracket 250. Mounted on roller 252 is a roll of suitable laminating film 262 which is threaded between feed rollers 40 and 42 whereby the film is drawn from the roll and separated from the cover sheet 264 which is wound on the roller 266 provided with an axle 268 the ends of which ex-

tend into slots 270 formed in the outer end of bracket 250. Mounted on axle 256 at its opposite ends are friction driving discs 272 which, when the film is fed into the machine, rotate to drive roller 266 through the friction discs 274 rigidly mounted on axle 268 and in register with discs 272, whereby said cover sheet is held taut and wound onto the roller 266. To insure a driving relation between discs 272 and 274 a spring 276 secured at its one end to bracket 250 carries a bearing block 277 at its free end to rest on axle 268 thereby urging the two sets of discs together sufficiently to insure proper driving of the rollers 252 and 266.

Brackets 278 carried below the work bed 198 by the frame are similar to brackets 250 and serve a like purpose of carrying rollers 280 and 282 in like manner and for the purpose of applying a coating of film 283 to the lower side of the work sheet W being fed to the machine. This work sheet W comprises a roll of sheet material 284 mounted on a shaft 286 which is mounted in the machine frame in parallel relation to the axes of the feed rollers 40 and 42. This sheet material 284 is usually paper or some other pliable material suitable for being laminated. The lamination may be placed on the top side, the bottom side, or on both sides of sheet 284. A tension spring 288 anchored at its one end to cross bar 290 maintains a constant tension against roll 284 to keep the work sheet taut as it is being fed to the machine about front rollers 136 by the pulling action of feed rollers 40 and 42.

By adjusting screws 248 to move bearings 258 in slots 260 the tangent line of contact of film on roller 42 may be varied to heat the film to various temperatures to obtain proper adhesion of the film to the work sheet 284. By raising the axle 256 farther above the plane of the work bed it is apparent that the film 262 will contact the heated periphery of roller 42 farther from the contact line of rollers 40 and 42, thus giving the film 262 a longer time to heat before it comes in contact with the work sheet 284. The same general effect may be had on film 283 by adjusting screws 248 in bracket 278 to move axle 256 downwardly.

Referring to lower feed roller 40, shown in Figs. 9, 10 and 11 which cooperates with a like upper roller 42 to draw the work through the machine, it will be noted that the roller is mounted for rotation on a hollow, non-rotatable shaft or axle 41 which serves to carry the ball bearings 292, one disposed at each end of the roller to support it in operative alignment with roller 42. The inner ball race 294 is rigidly fixed to axle 41 and the outer ball race 296 is rigidly fixed to an end collar 298 threaded into the end of roller 40. Fixed to one collar 298 by means of screws 300 is a sprocket wheel 120 which intermeshes with sprocket chain 118 to drive feed roller 40. At the other end of roller 40 a spur ring gear 124 is attached to outer ball race 296 by screws 122 engaging end collar 298. Roller 42 is likewise provided at its one end with a ring spur gear 126 identical with gear 124 so that these rollers will constantly run at substantially like speeds.

Mounted on stationary axle 41 in roller 40 are a pair of spaced apart end discs 302 secured in position by clamping nuts 304 which are screw threaded on axle 41. Mounted in roller 40 intermediate discs 302 is a transverse partition 306 which is recessed at its opposite sides at 308 to receive one end portion of electric heating units 310. The other end of heaters 310 is anchored to

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disc 322 by means of connector 312. Referring to Fig. 10 it will be noted that there are four similar heating units 310 in each end section 314 of roller 40 and that each of the sections are longitudinally divided by a longitudinally disposed partition 316 which is carried by axle 41. By so positioning the heating units it is apparent that the heat is controlled to the various parts of the roller 40 which rotates thereabout when the machine is in operation.

By mounting the heating units on the stationary axle 41, it is possible to make the proper wire connections thereto through the hollow axle where they can be properly controlled. The roller 42 is constructed substantially as roller 40 and operates in conjunction therewith to draw the laminated and laminating materials into the machine.

A series of treating or conditioning rollers 312, 320 and 322 mounted at their opposite ends in left and right side frames respectively are disposed in parallel relation with rollers 40 and 42 and below work bed 198. These treating rollers are mounted in horizontally adjustable bearings 326 slidably mounted in openings 328 formed in frames 20 and 22, with roller 312 contacting roller 40 and roller 320 positioned between rollers 310 and 322.

These rollers are all urged together by a compression spring 330 positioned between bearing 326 of roller 322 and pressure blocks 332 which are urged thereagainst by screws 334 mounted for adjustment in side frames 20 and 22 respectively. By adjusting the tension of spring 330 the pressure between all the rollers 322, 320, 312 and 40 may be simultaneously adjusted to accommodate the thickness of the work being passed there-through and also to the desired pressure against the work. It has been found convenient to so drive feed rollers 200 and 204 that the work will always be maintained taut during its travel through the conditioning rollers. This is accomplished by making the peripheral drive speed of the rollers 200 and 204 slightly greater than that of feed rollers 40 and 42.

Referring to Fig. 8 wherein is shown an elevational view of shears 326 which is located just to the rear of rollers 40 and 42, it will be noted that work bed 198 is slotted transversely at 333 and provided with stationary shear plate 340. A movable shear blade 342 mounted in blade frame 344 supported at its opposite ends by pins 346 to solenoid cores 348 is operatively mounted in solenoid coils 350 which are rigidly fixed to side frames 20 and 22 respectively. Blade frame 344 is provided with a cross bar 352 which is normally positioned below the bed plate 198. This cross bar has upwardly extending posts 354 which extend through slot 338 to normally support the shear blade 342 above bed plate 198 so that the work in its travel over the bed plate will pass between blade 342 and cross bar 352. Blade frame 344 is normally supported in the raised positions by compression spring 356, mounted on solenoid core 348 between solenoid coils 350 and cross bar 352. When solenoid coil 350 is energized, shear 342 is forced downwardly to cooperate with shear plate 340 to shear the work in two.

To form a proper covering for the machine, the left side frame 20 and the right side frame 22 are respectively provided with cover sheets 358 and 360. Referring to Fig. 1 it will be noted that sheet 358 is provided with hinged doors 362 at its rear portion and a hinged door 364 at its lower front portion. The doors normally cover suitable

apertures in 358 which give access to storage space provided within the machine for receiving attachments for the machine, rolls of paper and film to be used with the machine, tools, etc. Also for the convenience of access to certain of the adjustments for the machine various openings are formed through the cover sheets.

The laminator frame 13 is provided with side brackets 366 which are adapted to receive supporting frames 368 for carrying various types of attachments for facilitating the proper operating of the laminating machine.

The attachment shown in the drawings is of a work smoothing device comprising frames 368 adapted to be fitted into brackets 366. An arm 370 pivotally carried by each of the frames 368 serves to rotatably support a rod 372 across the work bed 198. Mounted on rod 372 for forced adjustment therealong are suitable rollers 373 which are adapted to be positioned on the opposite edges of the work as shown in Fig. 2. These rollers may be positioned on either side of the axis of rotation. It is intended that these brackets 366 may serve for supporting various tools such as work slitting rollers, rewinding tools, transverse scoring means, etc.

Referring to Fig. 4, it will be noted that the brackets 250 and 278 are each provided with lugs 374, notched at 376 to serve as attaching means for various attachments such as paste spreaders, adhesive sprayers, solvent sprayers, etc.

Work completed on the laminator is cut into sheets and delivered to the rear of the machine in bundles on a stacker 378 from which they are adapted to be manually moved. An endless belt 380 is operatively mounted at its one end on a roller 382 which, in turn, is rotatably mounted on brackets 384 carried by the frame 13.

The belt 380 is relatively long and is mounted at its outer end on a driving roller 386 which is rotatably mounted on its axle 388 in standards 390 of a frame member 392, the base 394 of which is anchored to the floor 396 at a distance from the laminator frame to present an elongated moving table suitable for carrying a plurality of said sheets at a time so that they may be inspected by the operator. A rearwardly and downwardly projecting table 398 anchored to the rear end of frame 13 terminates just above the upper reach of the conveyor 399 to direct the laminated sheets thereon.

The stacker 378 comprises a universally adjustable box 400 mounted on a standard 402 rigidly fixed to base 394. Standard 402 comprises a base 404 of tubular form adapted to receive a rod 406 having its upper end 408 universally connected with the bottom of box 400. The height of standard 402 is variable and adapted to be fixed by means of a set screw 410. A guard member 412 adjustably carried by standard 390 serves to direct the laminated sheets to the proper position in the receiving box. A motor 414 mounted on base 394 serves as a power unit to drive roller 386 through motor shaft 416, speed reducer 417, sprocket wheel 418, sprocket chain 420, and sprocket wheel 422 which is fixed on roller axle 388. Wires 419 and 421 connect motor 414 with two wires 424 and 423. A switch 423 serves for manual opening and closing of wire 419.

Referring to the electrical diagram shown in Fig. 21, it will be noted that the line wires 424 and 426 carry the A. C. current to the various electrical equipments which are used to control the heating elements, the driving of the movable parts, the cutting of the finished laminated strip

and the separation of the feed rollers. Wires 428-430 connected respectively with line wires 424 and 426 serve to conduct the current to the various electric heating coils 310. Each coil 310 is connected in multiple with the line circuit by wires 432 and 434. Wire 434 is manually opened and closed by means of a switch 436 whereby the heat units may be selectively energized to apply heat to the work at any desired intensity and for any desired period of the operation. A switch 431 positioned in wire 430 is manually operable to control the current to the heaters 310. Wires 433 and 440 reaching from wires 424 and 426 respectively are connected in series with the two solenoids 80 whereby both ends of roller 42 may be simultaneously raised to separate it from roller 40.

This separation of the rollers is manually controlled by means of the switch 442 which controls the current to the solenoids. If for any reason the feed rollers should stop, the heat to the work would become too intense to the detriment of the film used in the laminating operation. The lessening of the pressure between these rollers by a slight separation of the rollers will cause the heat to be more or less dissipated so that the work will not be injured. The shear 330 located in the path of travel of the work and just to the rear of feed rollers 40 and 42 is operated by solenoids 350 which are disposed in parallel circuit with line wires 424 and 426 by wires 444 and 446 between which the solenoids are connected by wires 448 and 450. This circuit is controlled by a manually operable switch 452 positioned in wire 444.

The drive motor 100 is interconnected by wires 454 and 456 to line wires 424 and 426, respectively. Wire 454 is opened and closed by means of a switch 452 whereby motor 100 is manually controlled.

The shear 220 is forced to the cutting position by means of the solenoids 230 and 232, which are interconnected therewith. These solenoids are connected in series by means of wire 460 connected to one terminus of coil 232 and to live wire 424, the other terminus of coil 232 connected by wire 462 to one terminus of coil 230, and the opposite terminus of coil 230 being connected by wire 466 with line wire 426, including a source of light 470 which is energized through wires 472 and 474 connected with feed wires 424 and 426. This circuit is opened and closed by a manually operable switch 476 positioned in wire 472. Referring to Fig. 2, it will be noted that the work W is provided with a series of windows or holes 478 equally spaced along one of its edges.

The highly sensitive switch comprises a selenium coil 480 in circuit with relay coil 482 by means of wires 484 and 486. An armature 488 pivoted at 490 is normally held in the open position by means of spring 492 which holds it against stop 494. When the light from lamp 470 is in alignment with selenium cell and the windows 478 in their natural course of travel register with the line of light, the light rays will energize the selenium cell and energize coil 482 and cause armature 488 to move against contact 496 to close the circuit to line wires 424 and 426, thus closing the circuits through solenoids 230 and 232 whereby blade will be moved to sever the work to form a finished sheet 498, which is ready to be delivered to the stack.

What I claim and desire to cover by Letters Patent is:

1. A laminating machine having a frame, a pair of cooperating tubular feed rollers mounted respectively for rotation on a pair of hollow axles fixed to said frame, a plurality of independently controlled heating units mounted on each of said axles within the respective rollers and spaced peripherally about said axle, partition members fixed to each of said shafts and dividing the space within the associated roller into segmental compartments each containing one or more of said heating units, and manually operable means to vary the pressure between said feed rollers.

2. A laminating machine having a frame, a pair of cooperating tubular feed rollers, each mounted for rotation on an axle fixed to said frame, a plurality of independently controlled heating units carried by the axles within the respective feed rollers, means for driving said feed rollers in opposite directions, a series of conditioning rollers adapted to receive laminating material from said feed rollers rotatably mounted for transverse movement in said frame, a compression spring adapted to constantly urge said series of conditioning rollers together and against one of said feed rollers and a pair of feed rollers adapted to receive the laminated material from said series conditioning rollers, said last-named feed rollers being driven at a peripheral speed slightly greater than the peripheral speed of said first named feed rollers, whereby the laminating materials between said pairs of feed rollers are held under tension.

3. A laminating machine having a frame, including a work bed, a pair of cooperating tubular feed rollers each mounted for rotation on a hollow axle fixed against rotation in said frame, a plurality of heating units fixed to each of said axles, means for selectively controlling said heating units extending from said hollow axle, means for driving said feed rollers in opposite directions, including spur gears interconnecting said rollers, means for guiding laminating strips to said feed rollers driven by one of said driven spur gears, whereby work fed from said feed rollers will be moved across said work bed, a pair of feed rollers carried by said frame in spaced relation to said first named feed rollers and driven at a peripheral speed greater than the peripheral speed of said first named feed rollers.

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