Dec. 15, 1953 E. B. SNYDER 2,662,967

BONDING MACHINE

Filed July 3, 1948 2 Sheets-Sheet 1

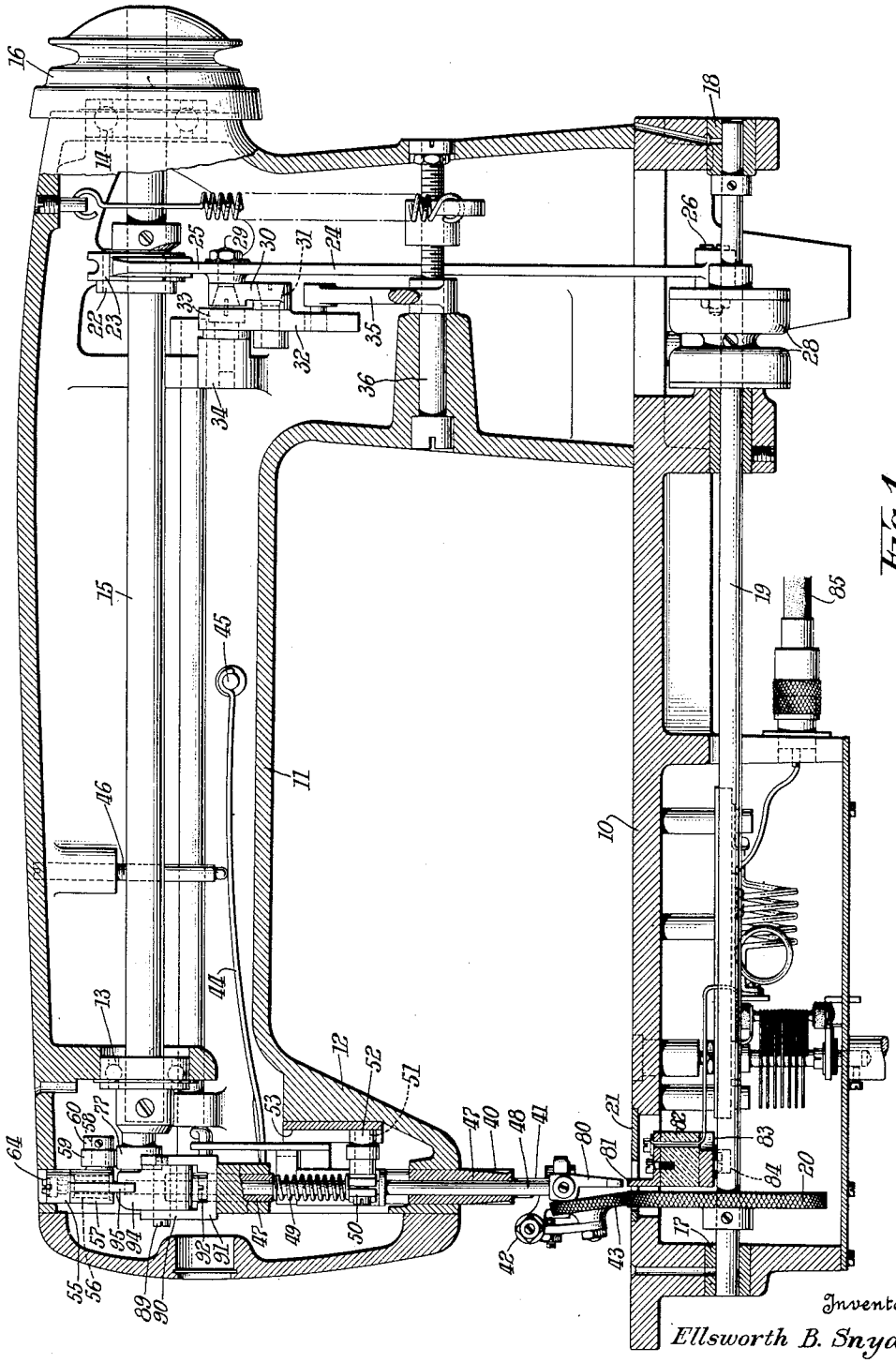

Fig. 1.

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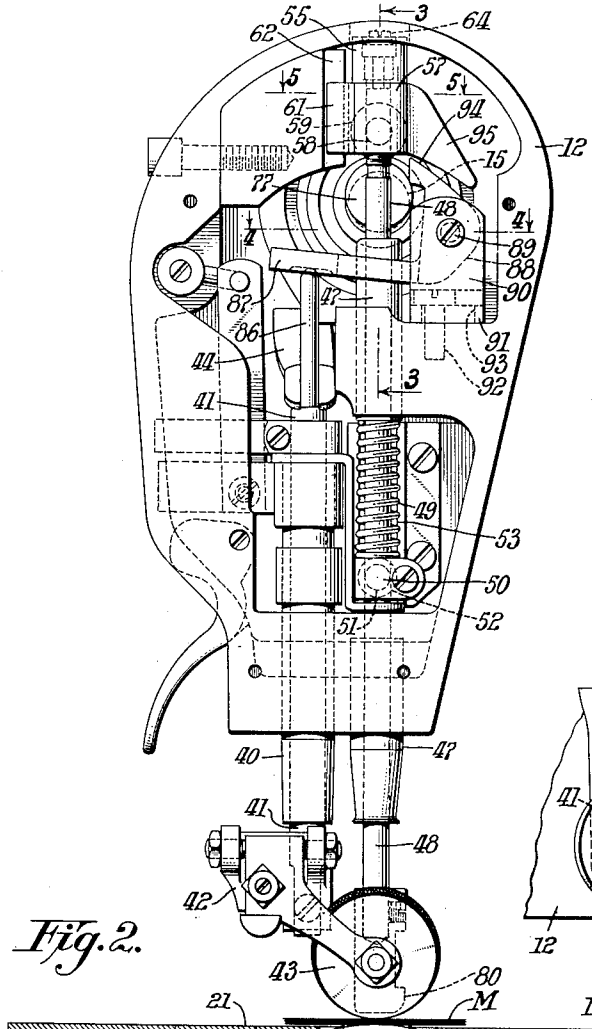

Fig. 2.

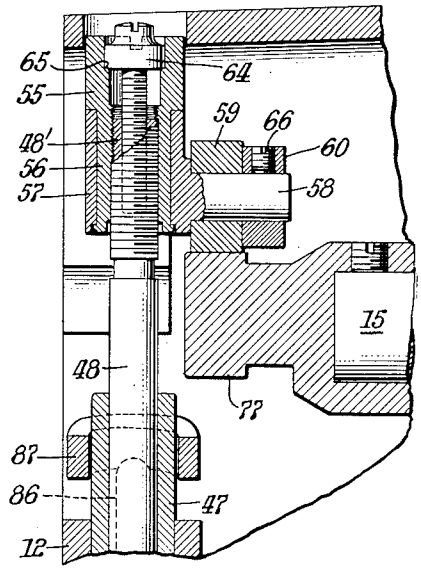

Fig. 3.

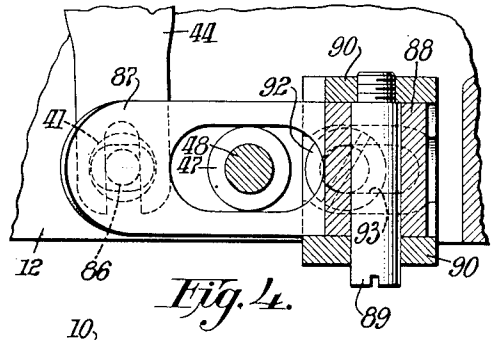

Fig. 4.

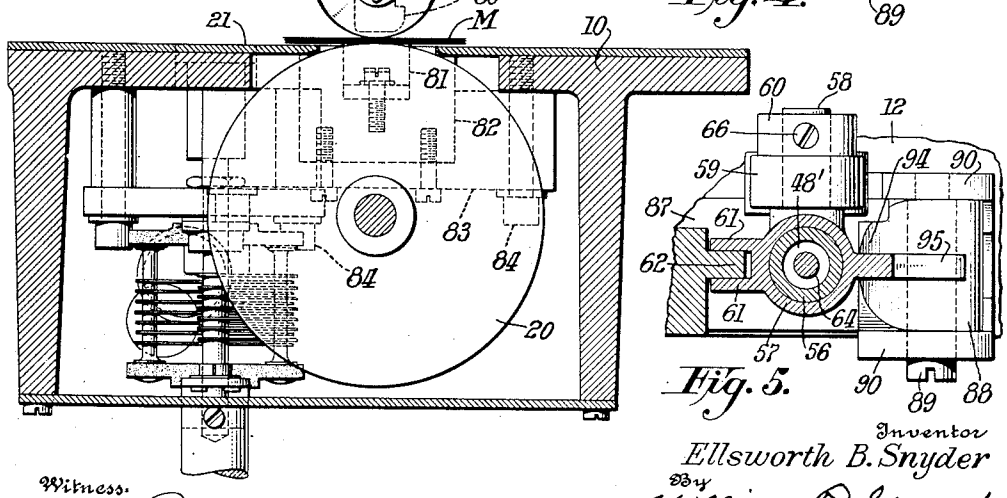

Fig. 5.

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2,662,967

UNITED STATES PATENT OFFICE

2,662,967

BONDING MACHINE

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9 Claims. (Cl. 219—47)

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This invention relates to electronic seaming machines which are more particularly adapted for bonding together plies of dielectric materials in continuous seams by the use of high frequency electric currents.

The present invention is in the nature of an improvement in the electronic seaming machine disclosed in the U. S. patent of H. Hacklander, No. 2,432,412, December 9, 1947, and has for its primary object to facilitate the bonding of materials varying in thickness during the seaming operation.

More specifically, this invention has for an object to provide means for automatically controlling the depth of work-penetration by a work-engaging electrode of an electronic seaming machine throughout the seaming operation, and in accordance with variations in thickness of the plies being bonded.

Another object of this invention is to provide work-controlled means for limiting the depth of penetration of the work by a work-engaging electrode.

A still further object of this invention is the provision of improved means for adjusting the minimum distance between the electrodes.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the drawings:

Fig. 1 is a vertical longitudinal section taken through the center of a machine embodying my invention.

Fig. 2 is a left end elevation, partly in section, of the machine shown in Fig. 1, the face-plate of the machine being removed to expose the operating parts within the hollow head.

Figs. 3, 4 and 5 are detailed sectional views taken substantially along the lines 3—3, 4—4 and 5—5, respectively, of Fig. 2.

In the embodiment of this invention selected for illustration, my improved bonding machine has a frame comprising a bed 10 carrying an overhanging bracket-arm 11 terminating in a hollow head 12. Journaled in bearings 13 and 14 in the bracket-arm 11 is a main shaft 15 having a combined pulley and hand wheel 16 secured to its outboard end. The pulley 16 may be connected to any suitable source of power for the

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purpose of rotating the shaft 15. Journaled beneath the bed 10 in the bearings 17 and 18 is a second shaft 19 arranged parallel to the main shaft 15; and secured to the shaft 19 intermediate its bearings is a feed wheel 20, the periphery of which extends through a suitable slot in a plate 21 carried by the bed 10.

The rotary shaft 15 imparts an intermittent step-by-step rotary movement to the shaft 19 through a mechanism comprising an eccentric 22 secured upon the main shaft 15, a block 23 surrounding the eccentric, and a connecting rod 24 having its forked upper end 25 engaging the sides of the block 23 and its lower end pivotally connected at 26 to an arm of a one-way clutch 28 which is secured to the shaft 19.

Adjacent its upper end, the connecting rod 24 has pivotally secured to it, at 29, one end of an anchor link 30, the other end of which is pivotally connected at 31 to a normally stationary crank arm 32 fulcrumed on a shouldered screw 33 which is threaded into a bearing boss 34 formed on the bracket-arm 11. The arm 32 may be shifted about its pivot 33 by means of a bell-crank lever 35 pivotally secured at 36 to the bracket-arm 11. This mechanism for imparting a step-by-step motion to the feed wheel 20 is fully described in the patent to Hacklander, No. 2,432,412, dated December 9, 1947, for a Bonding Machine, to which reference may be had for a more complete and detailed description of the feeding mechanism.

Journaled in a bearing 40 carried by the hollow head 12 is a vertically movable bar 41 (Fig. 2) having secured to its lower end a bracket 42 which rotatably carries an upper feed wheel 43. The upper feed wheel 43 is inclined at an angle to the vertical and its periphery is adapted to overlie and cooperate with the lower feed wheel 20 to advance the material M. The vertically movable bar 41 is constantly urged downwardly by a flat spring 44, the ends of which bear upon the top of the bar 41 and stud 45. An adjusting screw 46 is located intermediate the ends of the spring for the purpose of varying the tension. This spring 44, through the bar 41, functions to urge the top feed wheel 43 into yielding engagement with the lower feed wheel 20 to grip the material therebetween. From the above description, it will be understood that the feed wheels 20 and 43 impart a step-by-step motion to the material M.

The hollow head 12 is provided with vertically aligned bearings 47 in which an endwise reciprocatory electrode carrying bar 48 is journaled. The bar 48 is urged downwardly by a coil com-

pression spring 49 which encircles the bar 48 and reacts between the upper bearing 47 and a split collar 50 adjustably clamped to the bar 48. The split collar 50 carries a laterally extending pin 51 having on its free end a roller 52 which is located in a guideway 53 (Fig. 1) formed in the hollow head of the machine. This construction prevents the bar 48 from turning in its bearings.

Threaded on the upper end 48' of the electrode-bar 48 in an adjusting nut 55, with a reduced portion 56 which is embraced by a bracket 57, having a laterally extending pin 58 with a roller 59 journaled thereon and held against lateral displacement by a collar 60. In order to prevent the bracket 57 from turning and to guide it in a right line movement the bracket is formed with laterally extending spaced arms 61 (Fig. 5) which embrace a guide-rib 62 carried by the hollow head. It will be understood that the adjusting nut 55 turns relative to the bracket 57 and that the position of the bracket may be varied relative to the electrode-bar 48 by adjustment of the nut 55. The nut 55 is held in its adjusted position by means of a locking bolt 64 which bears on a shoulder 65 (Fig. 3) formed in the adjusting nut 55.

The roller 59 is located above and cooperates with an eccentric 77 fixed on the free end of the main shaft 15 and, when the shaft 15 is rotated, the eccentric 77 will engage the roller 59 and raise the bar 48 against the action of the spring 49 through a part of each revolution of the shaft and will then move away from the roller and permit the spring 49 to force the bar 48 downwardly during the remaining portion of the revolution of the eccentric.

The bar 48 carries at its lower end an upper electrode 80 which cooperates with a lower electrode 81 located below the bed 10 of the machine. The lower electrode 81 is L-shaped in cross-section and is secured upon a block of insulating material 82 carried by a U-shaped strap 83 fixed to the under side of the bed 10 by the screws 84.

From the above it will be understood that the feed rollers 20 and 43 impart a forward feeding movement to the superposed plies of plastic material and then bring it to rest and that the upper electrode 80 is moved in timed relation with the feeding mechanism and engages the material while it is at rest for the purpose of creating a bond between the plies. The electrodes 80 and 81 are supplied with a high frequency electrical current through a coaxial cable 85; the electrical connections between the source of high frequency current and the electrodes being fully shown and described in the above cited Hacklander patent to which reference may be had for a detailed description.

In order automatically to control the depth of work penetration of the electrode 80 throughout the seaming operation and in accordance with variations in thickness of the work presented to the electrodes, I have provided a variably positioned stop-mechanism which comprises an upstanding extension 86 on the end of the pressure-bar 41, the upper end of which underlies a limb 87 of a bell-crank lever 88 pivoted at 89 to the upstanding ears 90 of a block 91 adjustably secured by a screw 92 and slot 93 to the head of the machine. The other limb 94 of the bell-crank lever 88 underlies and cooperates with a downwardly inclined nose or cam-arm 95 formed on the bracket 57.

In the operation of my improved mechanism

for limiting and automatically controlling the depth of penetration of the material by the electrodes, the electrode 43 is set by adjustment of the nut 55 so that the desired amount of work penetration is obtained when the material under the electrode is at the minimum the machine will be called upon to handle. This adjustment is accomplished by turning the shaft 15 until the eccentric 77 is at its lowest position and the electrode bar is urged downwardly by the spring 49. With the parts in this position, the nut 55 is adjusted relative to the end of the bar, and the block 91 is adjusted by the screw and slots 92, 93 until the predetermined minimum distance between the electrodes and the maximum time the electrode will remain at its lowest position is obtained. The adjustable parts having been set in their correct position, upon operation of the machine the material is advanced between the electrodes and any change in thickness of the material in the bonding zone will cause the roller presser 43 to move up and down in accordance with the thickness of the material. This up and down motion is imparted through the vertically movable presser-bar 41 and upstanding rod 86 to the pivotally mounted stop member or bell-crank lever 88. The shifting of the bell-crank lever 88 about its pivot 89 varies the position of the upstanding end 94 of the lever relative to the complemental cam-arm or nose 95 and the position of the end 94 of the lever functions as a stop which determines the lowest position to which the electrode-bar 48 and the electrode 80 can descend. From the above, it will be observed that the lowest position to which the electrode 80 will descend is determined by the thickness of the material between the feed wheels 20 and 43 and that with any variation in thickness of the material the lowest position to which the electrode 80 descends for any given reciprocation is automatically controlled by the presser mechanism which acts as a work thickness detecting mechanism, thereby positively limiting the depth of work penetration by the electrodes.

Having thus set forth the nature of the invention, what I claim herein is:

1. In an electronic seaming machine having a frame including a work-support, means including an electrode movable toward and from said work-support for establishing a very high frequency electric field, a work-thickness detecting member disposed for engagement with work in the region of said field, a stop-member fulcrumed upon said frame and controlled by said detecting member in accordance with variations in the thickness of the work, and a member carried for movement with said electrode and cooperating with said stop member to limit movement of said electrode towards said work-support.

2. In an electronic seaming machine having a frame including a work-support, means including an electrode movable toward and from said work-support for establishing a very high frequency electric field, a work-thickness detecting member disposed for engagement with work in the region of said field, a stop-member fulcrumed upon said frame and variably positioned by said detecting member in accordance with variations in the thickness of the work, a complemental member carried for movement with said electrode and cooperating with said stop-member to limit movement of said electrode toward said work-support, and adjustable means for repositioning said complemental member relatively to said electrode.

3. In an electronic seaming machine having a frame, a reciprocatory electrode bar journaled in said frame, a shaft journaled in said frame and carrying an actuating eccentric, a bracket carried at the upper end of said electrode bar and having two laterally extending portions one of which cooperates with said actuating eccentric and the other cooperating with the frame of the machine to provide a guide, and an adjustable nut threaded on the upper end of said electrode bar for varying the position of the bracket relative to the electrode bar.

4. In an electronic seaming machine having a frame, a reciprocatory electrode bar journaled in said frame, a shaft journaled in said frame and carrying an actuating eccentric, a bracket carried at the upper end of said electrode bar and having a laterally extending portion which cooperates with said actuating eccentric, an adjusting nut threaded for longitudinal movement on the upper end of the electrode bar having a reduced portion embraced by said bracket for adjusting the position of said bracket relative to the bar and a bolt threaded into said bar and having a head portion in locking engagement with said adjusting nut.

5. In an electronic seaming machine, a frame, opposed electrodes carried by said frame, means for establishing a very high frequency electric field between said electrodes, spring means for biasing one of said electrodes towards the other electrode for engagement with work disposed within said field, a work engaging member adapted to yieldingly engage the work and mounted for movement in response to variations in thickness of the work, a bell-crank lever movably mounted on the frame of the machine, said lever being mechanically connected to said work engaging member for movement thereby, and a lug mechanically connected to said spring biased electrode and overlying and cooperating with said lever whereby the depth of work penetration by the electrodes is automatically limited by the position to which said lever is moved by the work engaging member.

6. In an electronic seaming machine, a frame, a lower electrode carried by said frame, an electrode carrying bar journaled in said frame, an upper electrode carried by said bar and cooperating with said lower electrode, a spring for yieldingly urging said upper electrode towards said lower electrode, means for establishing a very high frequency electric field between said electrodes, yielding work engaging mechanism mounted adjacent said electrodes for movement in response to variations in thickness of the work, a stop member located adjacent said electrode bar and secured to the frame of the machine for movement relative to said frame, means for mechanically connecting said stop member with said work engaging member whereby said stop member is moved in accordance with the movement of said work engaging member, and a bracket secured to said electrode bar and having a portion adapted to cooperate with said stop member whereby the depth of work penetration by the electrodes is automatically limited in accordance with the thickness of the work being acted upon by the electrodes.

7. In an electronic seaming machine, a frame, a lower electrode carried by said frame, an electrode carrying bar journaled in said frame, an upper electrode carried by said bar and cooperating with said lower electrode, a spring for yieldingly urging said upper electrode towards said lower electrode, means for establishing a very high frequency electric field between said electrodes, yielding work engaging mechanism mounted adjacent said electrodes for movement in response to variations in thickness of the work, a stop lever located adjacent said electrode bar and pivotally secured to the frame of the machine, mechanism operatively connecting said work engaging member with said lever whereby said lever is moved in accordance with the movement of said work engaging member, and means secured to said electrode bar and cooperating with said stop lever for automatically limiting the degree of approach of said electrodes toward each other in accordance with the thickness of the work being operated upon.

8. In an electronic seaming machine, a frame, opposed electrodes carried by said frame, means for establishing a very high frequency electric field between said electrodes, mechanism for moving one of said electrodes toward and from the other electrode for engagement with work disposed between said electrodes, and automatic mechanism for controlling the depth of work penetration of said movable electrode in accordance with variations in the thickness of the work between the electrodes comprising, a work-thickness detecting mechanism disposed for engagement with the work at a point adjacent said electrodes, a stop member connected to said electrode, a second stop member carried by the frame of said machine and cooperating with said first stop member to limit its downward movement, said second stop member being shiftable to various effective positions, and a mechanical connection between said second stop member and said work-thickness detecting mechanism whereby the position of said stop member is varied in accordance with the thickness of the work between said electrodes.

9. In an electronic seaming machine, opposed electrodes, means for establishing a very high frequency electric field between said electrodes, mechanism for moving one of said electrodes toward the other electrode for engagement with work disposed between said electrodes, stop means associated with said electrodes and movable to various positions for limiting the approach of the movable electrode toward the stationary electrode, a work-thickness detecting mechanism disposed for engagement with the work at a point adjacent said electrodes, means yieldingly biasing said detecting member into engagement with the work being acted on by said electrodes, and mechanism actuated by said work-thickness detecting member and operatively connected to said stop means for varying the position of said stop means in accordance with variations in the thickness of the work.

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