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BONDING MACHINE WITH OSCILLATOR KEYING CONTROL

Filed April 6, 1949 2 SHEETS—SHEET 1

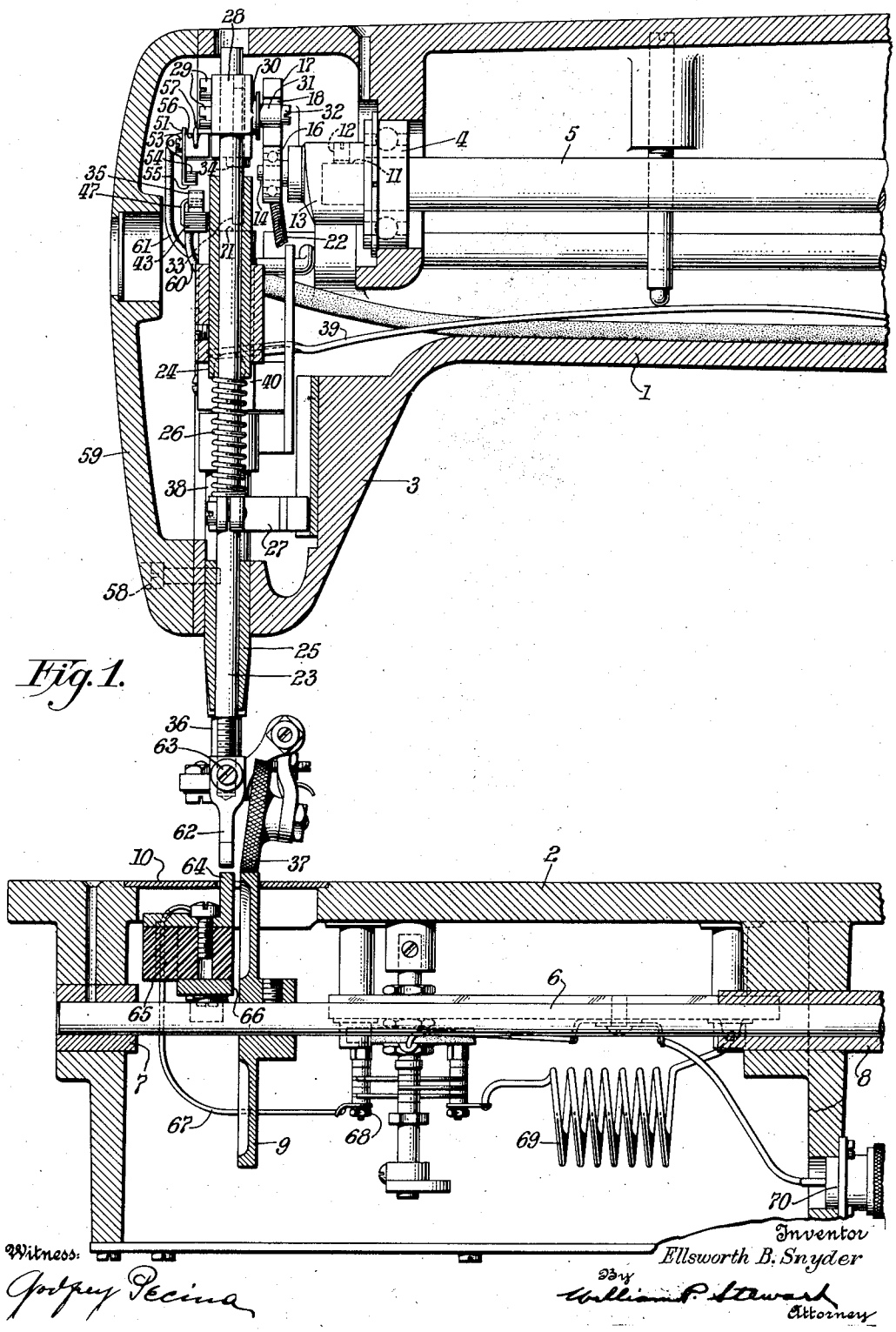


Fig. 1.

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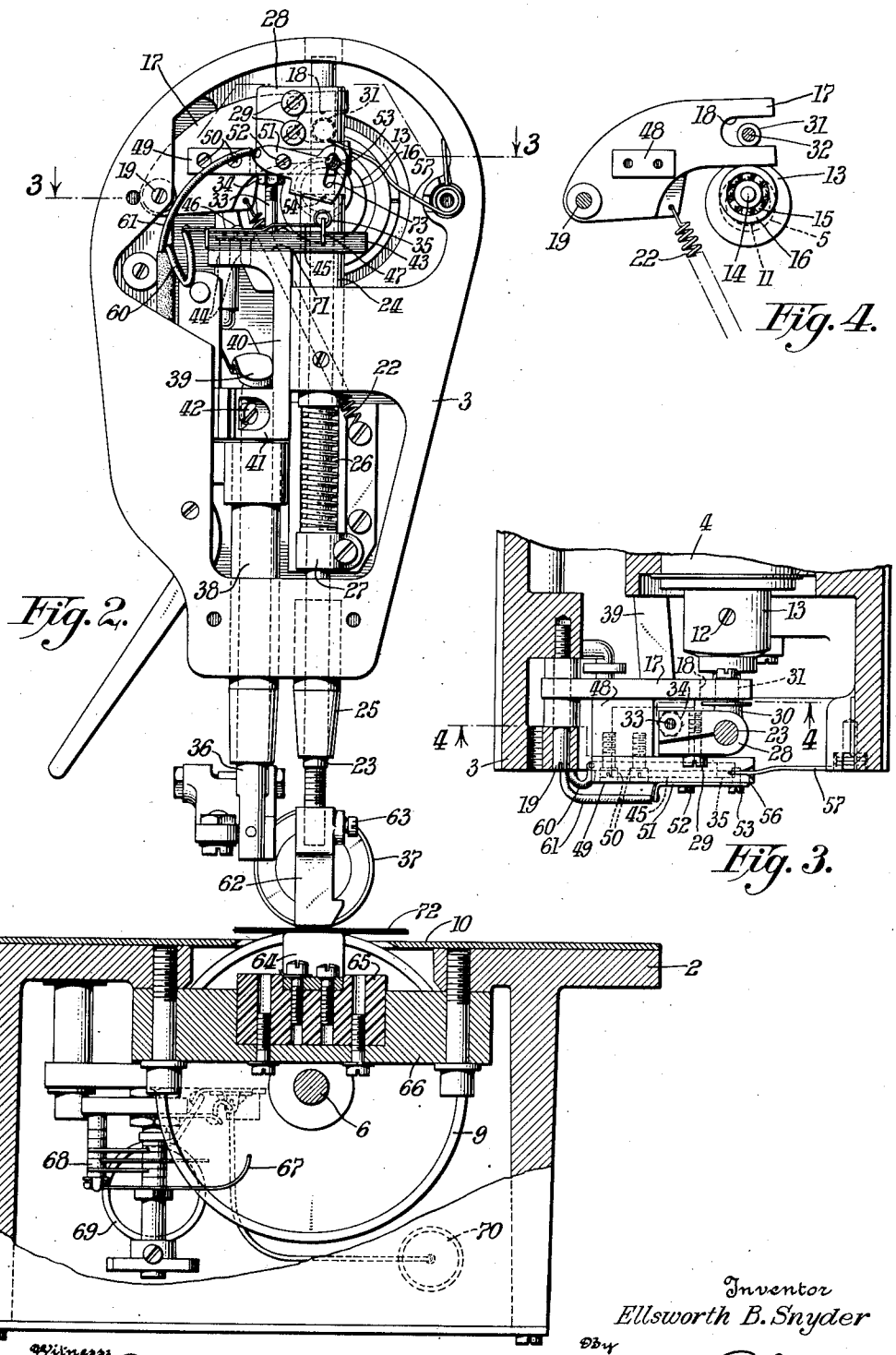


Fig. 2.

Fig. 4.

Fig. 3.

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BONDING MACHINE WITH OSCILLATOR KEYING CONTROL

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8 Claims. (Cl. 219—47)

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This invention relates to switching mechanism for keying the oscillator of an electronic bonding machine. More particularly, it relates to a switching mechanism in which the time relation between the switch operations and the electrode position may be adjusted so that the switch must be opened before the bonding electrode can begin its lift.

This general type of oscillator control is well illustrated by the U. S. application of Hacklander et al., Serial No. 47,356, filed September 2, 1948, to which application reference may be made for a more complete understanding of the invention. It has been determined that, in order to prevent all detrimental sparking, it is necessary that the electrode be in engagement with the material to be bonded whenever the oscillator is turned on and off. While the mechanism of the aforesaid patent application Serial No. 47,356 is, in general, satisfactory in this respect, there are conditions under which sparking may occur, and it is to prevent this that the improved mechanism of this invention has been developed.

The prior mechanism referred to is so constructed that the reciprocatory electrode must start to lift before the switch can operate to turn off the oscillator. After bonding, the material at the seam line is neither as thick nor as resilient as it was before bonding, and, for this reason, the electrode does not have to rise much vertically before it is completely out of the material. Thus it may happen, particularly in the case of thin material, that the electrode emerges from the material before the oscillator has been turned off, in which case undesirable arcing and burning may occur.

It is, therefore, a primary object of this invention to provide a switch mechanism for a bonding machine of the reciprocatory electrode type, including mechanism for interlocking the action of switch and electrode whereby the switch must be opened before the electrode can begin its lift.

It is a further object of this invention to provide adjustable elements for an oscillator switch mechanism for use with a bonding machine employing a reciprocatory electrode, whereby the timing between the switch operation and the contact of the material with the electrode may be precisely adjusted to gain the maximum bonding time for each electrode reciprocation.

In the present embodiment of the invention, these objects are attained by interposing a pivoted fork between the lift eccentric and the lifting stud of the electrode bar, the fork embracing the

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lifting stud in such a manner as to provide a lost motion connection therebetween. An adjustable switch contact is carried by the fork which, due to the lost motion, must move upwards before lifting the electrode bar. This upward movement of the work opens the switch contact and turns off the oscillator before it can lift the electrode.

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 longitudinal section taken through a portion of a bonding machine embodying the invention.

Fig. 2 is a front end elevation, partly in section, of the machine of Fig. 1 with the cover plate removed.

Fig. 3 is a horizontal section of the bracket-arm head and taken on the line 3—3 of Fig. 2.

Fig. 4 is a section, partly in elevation, taken on the line 4—4 of Fig. 3.

Referring to Fig. 1, 1 represents an overhanging bracket-arm of a bonding machine of the general type shown and described in the above mentioned U. S. application Serial No. 47,356 to which reference may be had for a detailed description of the parts not fully disclosed herein. A bed 2 carries the overhanging arm 1 which terminates in a hollow head 3. Journaled in a bearing 4 in the bracket-arm 1 is an arm shaft 5 to which is imparted a rotary motion by means clearly set forth in the aforesaid application. A second shaft 6 is journaled beneath the bed 2 in bushing bearings 7 and 8 and to this shaft is imparted an intermittent rotary motion in one direction by means also set forth in the aforesaid application. A feed wheel 9 is secured to the shaft 6 and extends through a suitable slot in a plate 10 carried by the bed 2.

Secured to a reduced terminal portion 11 of the arm shaft 5 by means of a set screw 12 is a hub 13 carrying an eccentric pin 14 on which is mounted the inner race ring 15 of a ball bearing. The outer race ring 16 serves as a lifting cam surface as will be presently set forth.

A fork member 17 formed with a throat portion 18 is pivoted in the head 3 by means of a pivot screw 19. A tension spring 22, secured at

one end to the head 3, urges the fork member into engagement with the outer race ring 16 as shown clearly in Fig. 4.

An electrode-bar 23 is carried for vertical reciprocation in bearings 24 and 25 secured in the head 3. A spring 26 encompasses the electrode-bar and is held compressed between a guide-piece 27 fixed to the electrode-bar and the bearing 24 fixed in the head so that said electrode bar is biased downwardly. Clamped upon the upper end of the electrode-bar is a split collar 28 secured thereto by screws 29, and formed with a stud portion 30. A roller 31 is secured to said stud 30 by means of a pivot screw 32, said roller being positioned to loosely engage the throat portion 18 and to form therewith a lost motion connection. Threaded into and depending from the split collar 28 is a stop-pin 33 which may be adjustably secured thereto by means of a lock nut 34. A presser bar 36, carrying a roller presser 37, is journaled in a vertical bearing 38 fixed in the head 3. A leaf spring 39 exerts pressure upon the upper end of the presser bar 36 to bias it in a downward direction. An extension bar 40 is secured to the upper end of the presser bar by tightening a split portion 41 thereof around said presser bar by taking up on a screw 42.

To the upper end of the extension bar 40 is secured a switch plate 43 by means of screws 44. The switch plate 43 is made of insulation material and carries a switch contact 45 secured thereto by means of rivets 46. The switch contact 45 is formed as a leaf spring of electrically conducting material and has its free end bent to form a transverse tubular portion 35. A pin 47 is secured to the switch plate 43 and is bent to enter the tubular portion of the leaf spring and provides a stop to limit the upward movement of the contact.

The fork member 17 is formed with a boss portion 48 which carries an insulated switch plate 49 secured thereto by means of screws 50 threaded into the boss portion. An adjustable switch contact 51 is made of electrically conducting material and is secured to one side of the switch plate 49 by means of screws 52 and 53. The switch contact 51 is formed with a portion 54 bent over to present a contacting surface 55 for engagement with the tubular portion 35 of the lower contact 45 when the fork member moves to follow the cam surface provided by the outer race ring 16.

A notch 56 formed in the upper surface of the switch plate 49, as seen best in Fig. 3, provides a seat for a hair-pin spring 57, the main body of which is recessed in the head 3 and embraces one of the screws 58 employed to secure a cover plate 59 to the head. The spring 57 provides a downward biasing force for the switch contact 51 which minimizes the tendency to bounce at contact impact.

Conductors 60 and 61 connect the switch contacts 45 and 51 respectively, to a radio-frequency oscillator to provide "cathode keying" therefor, precisely as shown and described in the aforementioned application Serial No. 47,356 to which reference may be made for the specific oscillator and electrode connections.

An upper electrode 62 is threaded upon the lower terminal portion of the electrode-bar 23 and is secured in proper position relative to the direction of feed by means of a set screw 63.

A lower stationary electrode 64 is secured to an insulation block 65 carried by a bracket 66 which is secured to the bed 2. A conductor 67 connects the lower electrode 64 to load-end tuning elements 68 and 69 which, in turn, are connected to a radio-frequency oscillator through terminal 70 in the same manner as shown and described in application Serial No. 47,356.

Operation

It will be understood that rotation of the arm-shaft 5 imparts a rising and falling motion to the electrode-bar 23 through the agency of the eccentric-pin 14, bearing ring 16, fork 17, roller 31 and spring 26. However, the falling motion of the electrode-bar is arrested when the stop pin 33 engages the top surface 71 of the extension bar 40. The fork 17 continues to move downward and finally the surface 55 of contact 51 engages the tubular portion 35 of contact 45, thus closing the oscillator keying circuit and bonding begins with the electrode 62 fully seated in the material 72. The fork will continue to drop until all the yield in the contacts 45 and 51 has been taken up, at which time the roller 31 will be spaced from the lower limb of the fork 17 by a certain clearance distance. After the outer race ring 16 engages the fork 17 for the lifting movement, the fork must move upwards by a distance equal to the aforesaid clearance distance before the fork 17 engages the roller 31 to lift the electrode-bar 23. During this movement of the fork, the contacts 45 and 51 are separated to open the oscillator keying circuit and stop the bonding before the electrode 62 begins to lift away from the material 72.

Thus, by the interposition of a lost-motion fork between the lift eccentric and the electrode-bar and by employing the work motion to operate the switch contacts, the operation of said switch may be restricted to occur only when the electrode 62 is seated in the material 72. This is the desired condition for no sparking.

It will be seen that the maximum penetration of the electrode 62 into the material 72 may be controlled by adjusting the stop pin 33 relative to the surface 71 of the extension bar 40. Further, for any given adjustment of the pin 33, the per cent penetration tends to be constant regardless of thickness because (1) the surface 71 responds to changes in the material thickness sensed by the roller presses 37 and transmitted through the presser-bar 36, and (2) the yield of the material is substantially proportional to the thickness.

It is, of course essential that the time during which the oscillator is turned on be the maximum possible for each reciprocation of the electrode 62. Thus, it becomes important to close the switch contacts 45 and 51 as soon as possible after the electrode is fully seated in the material 72. To accomplish this, the contact 51 is made adjustable relative to the plate 49 by providing a slot 73 for the screw 53 so that the contact 51 may be rotated about the screw 52 and locked in position by means of the screw 53. Thus, the machine may be set to the position in which the electrode 62 has just reached its maximum penetration in the material, and, while in this position, the contact 51 may be adjusted as described so as to just fail to engage the contact 45. This insures the desirable results that (1) the switch operations, both opening and closing, will occur always with the electrode in the material, and (2) the time for bonding will be a maximum consistent with the desirable conditions of (1).

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

1. In an electronic seaming machine having a reciprocatory electrode electrically connected to a radio-frequency oscillator, and a movable presser cooperating with a feed mechanism for advancing material past the electrode, a lift eccentric, a fork operated by said lift eccentric, a switch operated by said fork for turning on and off said oscillator, an electrode-bar carrying said electrode, and a lost-motion connection between said fork and said electrode-bar, for moving the fork to take up the lost motion and open the switch before the electrode can begin its lift.

2. An electronic seaming machine comprising a frame, a shaft mounted for rotation in said frame, a lift eccentric carried by said shaft, a fork pivoted in said frame and biased to engage said eccentric for operation therewith, an electrode-bar carried by said frame for vertical reciprocation, a lifting stud connected to said electrode-bar and loosely embraced by said fork to provide a lost motion connection therewith, a first electrical contact mounted on said fork, a presser-bar, a second electrical contact mounted on said presser bar and cooperating with said first electrical contact to form a switch which opens and closes periodically responsive to the rotation of said shaft.

3. In a machine for seaming material by the application thereto of a radio-frequency electric field, a frame, a shaft mounted for rotation in said frame, a lift eccentric carried by said shaft, an electrode-bar mounted for vertical reciprocation in said frame, a spring for biasing said electrode downwardly, a lifting stud secured to said electrode-bar, a fork pivoted to said frame and loosely embracing said lifting stud to provide a lost motion connection therewith, said fork being operatively connected to said lift eccentric, a presser and a feed wheel for feeding the material past the electrode, and a switch comprising a resilient contact carried by said presser and a cooperating contact carried by said fork.

4. In a machine for seaming dielectric material by the application thereto of a radio-frequency electric field, a frame, a shaft mounted for rotation in said frame, a lift eccentric carried by said shaft, an electrode-bar mounted for vertical reciprocation in said frame, a spring for urging said electrode-bar downwardly, a lifting stud secured to said electrode-bar, a fork pivoted to said frame and formed with a throat portion which loosely engages said lifting stud and forms therewith a lost-motion connection, means for urging said fork into driving connection with said lift eccentric, a presser in continuous contact with the material, and a switch comprising a first contact mounted on said fork, a second contact mounted on said presser and cooperating with said first contact to open and close a circuit for controlling said electric field.

5. In a machine for seaming dielectric material by the application thereto of a radio-frequency field, means for progressively feeding said material through said field, a reciprocatory electrode for periodically engaging said material, a stop to limit the material-engaging movement of said electrode, an oscillator, switch contacts for turning on and off said oscillator, a pivoted element carrying one of said contacts, means for directly actuating said element to periodically close and open said contacts, and a lost-motion link connecting said electrode with said contact-carrying element whereby said electrode is actuated after the lost motion has been taken up by said link.

6. In a machine for seaming dielectric material by the application thereto of a radio-frequency field, an electrode, an oscillator electrically connected to said electrode to establish said field, a switch mechanism for turning on and off said oscillator, means for operating said switch mechanism periodically, link means providing a lost-motion connection between said switch-operating means and said electrode for imparting to said electrode a reciprocatory motion into and out of said dielectric material in timed relation with the turning on and turning off of said oscillator, and stop means for limiting the travel of said electrode into the work, said stop means cooperating with said lost-motion link to provide continued movement of said switch mechanism after the electrode has come to a stop in the material.

7. In a machine for seaming dielectric material by the application thereto of a radio-frequency field, a reciprocatory electrode, an oscillator electrically connected to said electrode to establish said field, switch contacts for turning on and off said oscillator, pivoted fork means connected directly to one of said switch contacts and, through a lost-motion connection, to said electrode, stop means for arresting the movement of said electrode, and means for operating said fork means for moving said one of said switch contacts to engage the other switch contact to turn on said oscillator after the electrode comes to rest against said stop means.

8. In a machine for seaming dielectric material, a reciprocatory electrode, a source of energy connected to said electrode, switch contacts for turning on and off said source of energy, pivoted fork means connected directly to one of said switch contacts and, through a lost motion connection, to said electrode, stop means for arresting the movement of said electrode, and means for operating said fork means for moving said one of said switch contacts to engage the other switch contact to turn on said source of energy after the electrode comes to rest against said stop means.

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