

Oct. 2, 1956

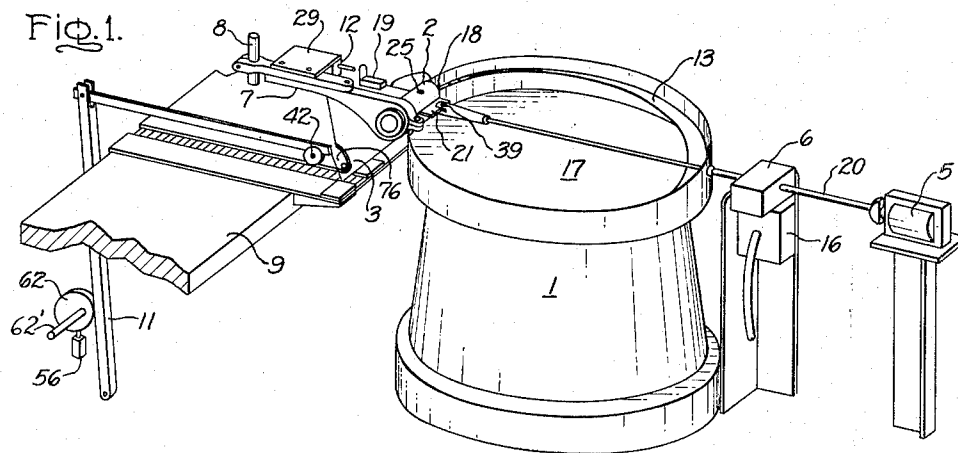
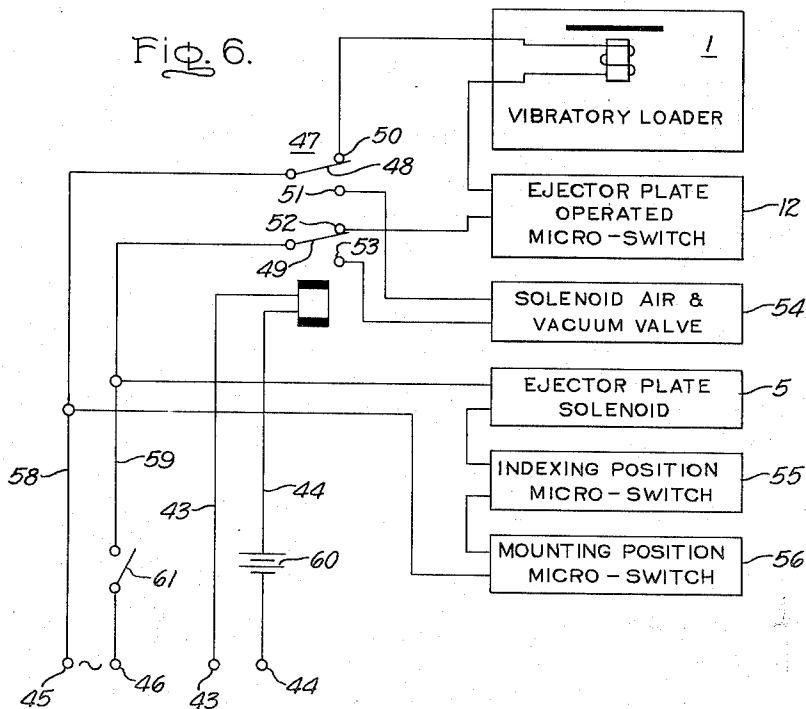
D. HARWOOD

2,764,800

LAMP FILAMENT FEEDING APPARATUS

Filed March 11, 1955

4 Sheets-Sheet 1



Inventor:
Douglas Harwood,
by *Vernon C. Kauffman*
His Attorney.

Oct. 2, 1956

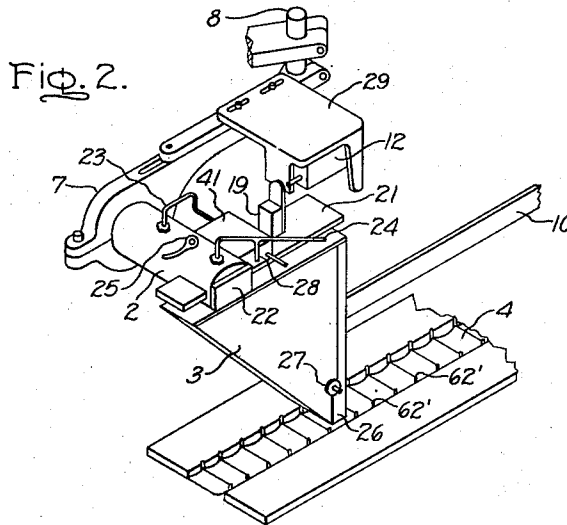
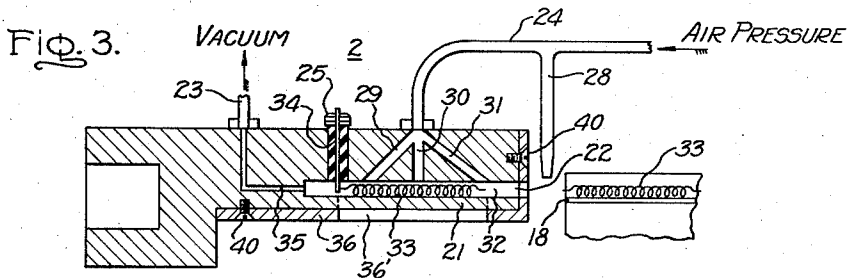
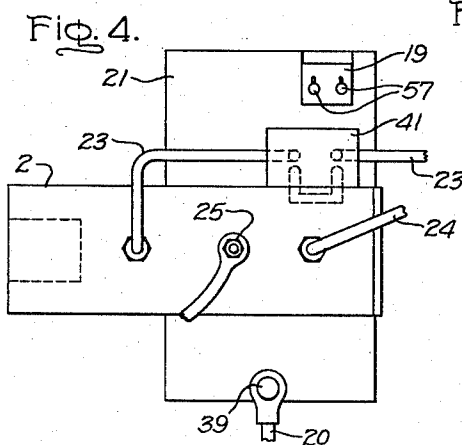
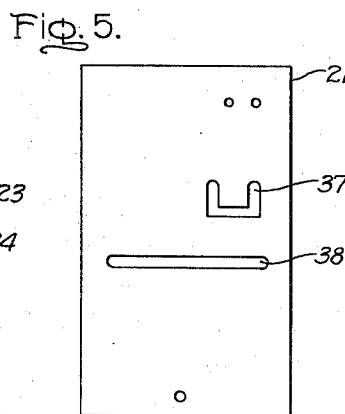
D. HARWOOD

2,764,800

LAMP FILAMENT FEEDING APPARATUS

Filed March 11, 1955

4 Sheets-Sheet 2



Inventor:
Douglas Harwood,
by *Vernon C. Kaufman*
His Attorney.

Oct. 2, 1956

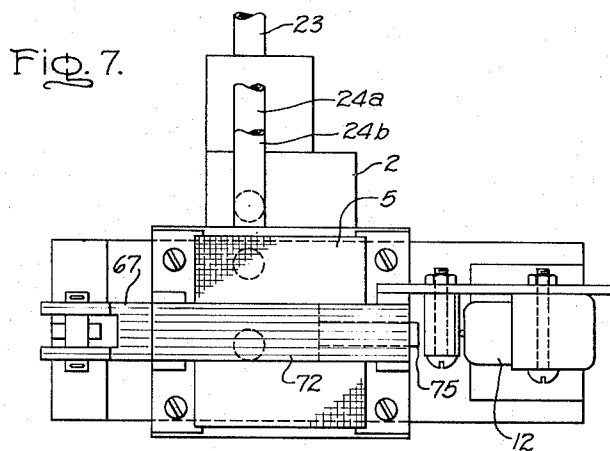
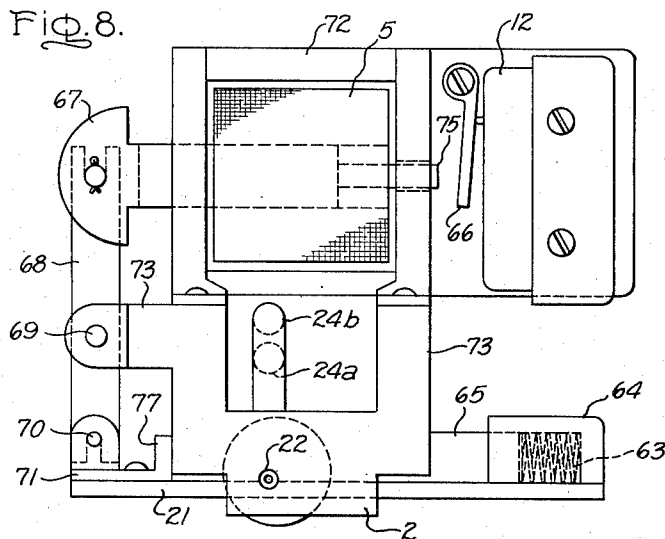
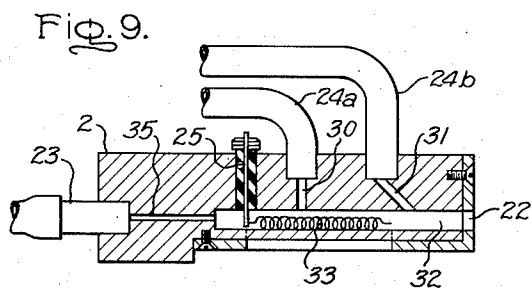
D. HARWOOD

2,764,800

LAMP FILAMENT FEEDING APPARATUS

Filed March 11, 1955

4 Sheets-Sheet 3



Inventor:
Douglas Harwood,
by *Kenneth C. Kauffman*
His Attorney.

Oct. 2, 1956

D. HARWOOD

2,764,800

LAMP FILAMENT FEEDING APPARATUS

Filed March 11, 1955

4 Sheets-Sheet 4

FIG. 10.

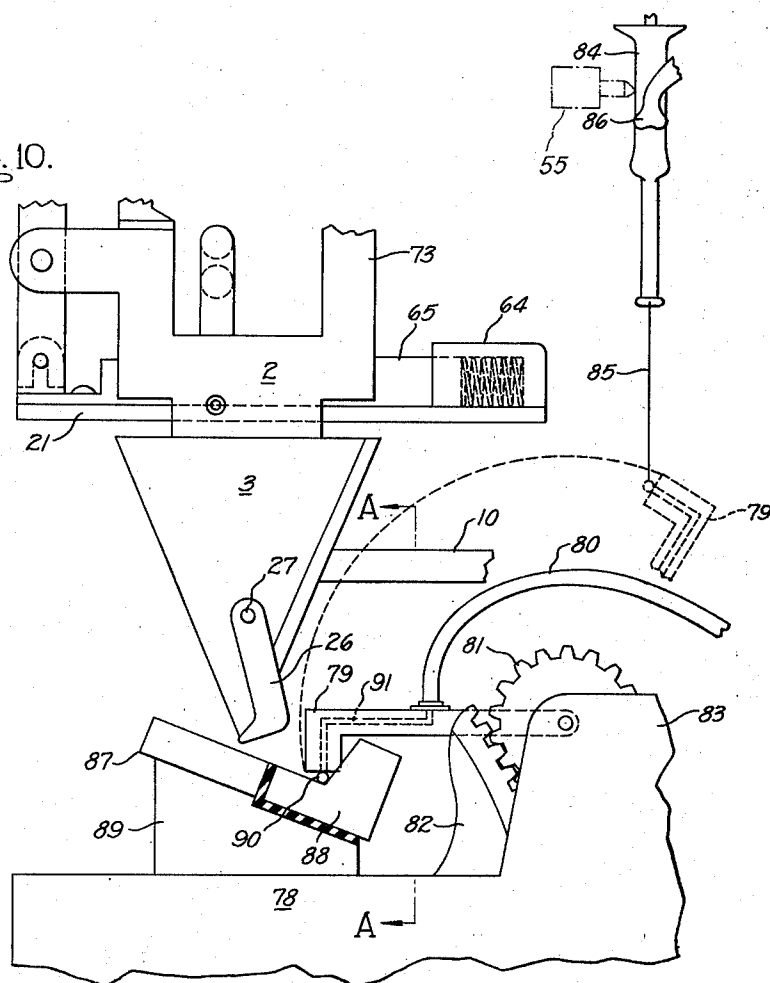
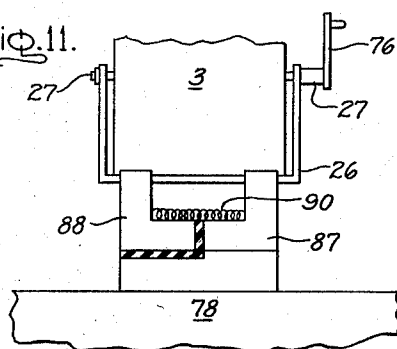


FIG. 11.



Inventor:
Douglas Harwood,
by *Vernon C. Kauffman*
His Attorney.

1

2,764,800

LAMP FILAMENT FEEDING APPARATUS

Douglas Harwood, Toronto, Ontario, Canada, assignor to Canadian General Electric Company Limited, Toronto, Ontario, Canada, a corporation of Canada

Application March 11, 1955, Serial No. 493,781

Claims priority, application Canada June 30, 1954

11 Claims. (Cl. 29—25.19)

My invention relates to lamp making machines and more particularly to lamp filament feeding apparatus adaptable for use with an automatic stem making and filament mounting machine.

Automatic stem and mount making machines comprise a plurality of heads which are caused to be advanced step by step through a series of stations at each of which a particular operation is performed. The glass flares, filament support tube, and exhaust tubes are assembled with the lead-in wires inserted in position. This assembly is then fused as a unit and is ready to have filament support wires attached and the filament mounted.

At the filament loading station, a vacuum type pick-up arm picks up a lamp filament from a predetermined position and places it in position to be mounted on the support wires. Operation of the machine therefore requires that a coiled lamp filament be placed in a precisely located position from where it may be readily picked up by the pick-up arm. In a known form of apparatus, the filaments, before mounting, are placed on a loading track having parallel grooves which accommodate the filaments. Indexing fingers, by an eccentric type of movement synchronized with the lamp machine, advance the filament from groove to groove along the loading track to the position from which they are picked up by the pick-up arm. Whether or not the filaments are advanced one position at a time along the track is dependent on the presence of a mount at the position prior to the actual loading position hereinafter referred to as the indexing position. It will be seen that a filament must be in each groove of the loading track in order to ensure that a filament is always at the pick-up position when required.

In the past an operator has been required to pick up the filaments by means of a pair of tweezers and to place these filaments in parallel relation in the grooves of the loading track from where they are automatically advanced step by step to the pick-up position. The work of picking up the filaments is very tedious and furthermore limits the speed of production. The filaments moreover are delicate and subject to damage by the tweezers.

The coiled filaments are in a tangled mass as they come from the manufacturing process. It is very difficult and laborious to sort out the individual filaments manually. My invention is concerned, in one of its aspects, with the problem of removing single filaments from the tangled mass and placing them in an orderly array.

My invention is further concerned with the segregation of single filaments from a tangled mass and the feeding of them to the pick-up arm of an automatic stem making machine.

My invention is further concerned with a mechanism of the type described in which a filament is advanced to the pick-up arm only when required by the presence of a stem on the head at its filament-receiving position.

My invention will be understood and further objects and advantages thereof will become apparent as the following detailed description of specific embodiments thereof proceeds.

2

Taken in conjunction with the drawing in which the same reference numbers refer to the same parts throughout the several views and in which Fig. 1 is a perspective view showing one modification of the over-all mechanism;

Fig. 2 is a perspective view on a larger scale than Fig. 1 showing a portion of the machine in greater detail;

Fig. 3 is a cross-sectional view of the filament-receiving chamber taken centrally and longitudinally thereof;

Fig. 4 is a view looking down on the filament-receiving chamber;

Fig. 5 shows a more detailed view of one part of the mechanism;

Fig. 6 is a circuit diagram of the control system used;

Figs. 7 and 8 are a plan and elevation, respectively, of a modified arrangement of the operating parts;

Fig. 9 is a section taken along the line 9—9 of Fig. 8;

Fig. 10 is a partial view of the machine adapted for direct loading; and

Fig. 11 is a view of the mechanism of Fig. 10 looking in the direction shown by arrows A, A.

A preliminary outline of the operation of the lamp filament feeding machine will now be given in order to ensure a more complete understanding of the present invention. A more detailed description of the associated parts and the operation thereof will follow.

Referring to Fig. 1, which shows a view of the over-all mechanism, an electrically operated vibratory conveyor is generally designated at 1. Filaments in mass, as received from the filament manufacturing process, are placed in the bowl-like top 17 of the conveyor. On the energization of the conveyor, filaments are caused to advance up a spiral track 13 on the inside of bowl 17. At the terminal 18 of the track 17 a filament is drawn, by means of a vacuum, into a chamber 2. The chamber 2 is best shown in Fig. 3.

The entry of the filament into chamber 2 causes a control circuit to be actuated. The control circuit is effective to de-energize the conveyor and may also be arranged to shut off the vacuum applied thereto. At the same time, air pressure is turned onto the chamber 2 to prevent entry of further filaments thereto as well as to assist, at the appropriate time, in the removal of the filament from the chamber.

At the required time, and by means of series connected switches at the indexing and filament mounting positions, the solenoid 5 (Fig. 1) is energized to open the chamber 2 in the underside thereof to drop the filament into a chute 3. At a predetermined time later and synchronized with the actual mounting of a filament on a stem, the chute is opened to drop the filament to a loading track 4 (Fig. 2) from where it is indexed by steps to the position from whence it may be picked up by the pick-up arm and mounted on a stem.

A switch 12, in circuit with the vibratory conveyor, is actuated to its open position during the transfer of the filament from the chamber to the loading track and prevents the entry of a filament to the chamber until the chamber is again closed.

In the embodiment shown in Figs. 10 and 11, the loading track 4 has been dispensed with and filaments are fed directly to the mounting position.

My invention will now be described in detail with particular reference to Fig. 1, attention first being given to the construction and operation of the vibratory conveyor.

The vibratory conveyor consists of a base unit 1 which houses a spring and magnet assembly, and a bowl 17 containing an upwardly spiralling trough 13 on the inside wall thereof. The lower end of the trough is integral with the bottom of the bowl. The trough is gradually narrowed toward its upper end 18 at which the groove is only sufficiently wide to hold one filament lengthwise therein.

3

The principle of operation of the conveyor is based on the tuned spring system, i. e. harmonic motion. The magnet system in the base is energized by a pulsating current to attract the bowl downward. The bowl is seated on springs arranged in a circle about the base thereof. The springs are at an angle to the vertical so that the vertical pull of the magnet causes the bowl to move vertically and in an arc. The downstroke of the bowl due to the pull of the magnet system is quicker than the upstroke caused by the springs. Due to this action the filaments, when placed in the bowl, are carried forward and outward as well as upward on the trough on the upstroke but are left in this new position due to the quick movement of the downstroke. The filaments are thus advanced up the spiralling trough and, because of the high frequency of vibration employed, the movement of the filaments appears continuous and smooth. Vibratory conveyors of this general type are known in the prior art; see for example Patent 2,609,914, H. E. Balsiger et al.

The termination of the track at 18 is adjacent the intake port 22 of a chamber 2. Chamber 2 is supported by clamp means 7 which is in turn supported by a rod 8 mounted on table top 9. Table top 9 is a part of the mount loading machine and normally supports only the loading track shown at 4. The chamber interior or passage 32 is dimensioned to hold a single coiled lamp filament 33 wholly inside thereof.

A switch 12 which is normally open is mounted beneath a plate 29 which is, in turn, supported by clamp means 7. A switch actuating member 19 adjustably mounted on ejector plate 21 holds microswitch 12 closed when the ejector plate is in the unactuated position. Switch 12 is in series circuit with the power supply used to energize the conveyor.

A contact pin 25 shown most clearly in Fig. 3 is arranged to make contact with a filament when such is drawn into the chamber. The filament completes the circuit from pin 25 to the body of the chamber.

Ejector plate 21 is arranged to be slidable through the base portion of the chamber and forms the lower boundary thereof. A slot 38 in the ejector plate 21 is proportioned to allow a filament to pass therethrough to the loading track 4 positioned below.

The construction of the chamber 2 and its associated parts will now be described in detail with reference to Figs. 2 to 5, inclusive. As best seen in the cross-sectional view of the chamber shown in Fig. 3, the interior 32 thereof is dimensioned to hold a single filament 33 of the coiled type therein. The interior 32 may be adapted to take inserts to allow the use of the machine with different sizes of filaments. The insert would have the configuration of a lengthwise hollow cylindrical section, the open side thereof cooperating with slot 38 of ejector plate 21. Ejector plate 21 defines the lower boundary of the interior or filament chamber 32.

A pin 25 insulated from the main body of the vacuum chamber 2, by means of an insulating insert 34, acts as a stop for the filament 33 and prevents its entry further into the vacuum chamber. The filament, while abutting against pin 25 completes a circuit between the pin and the body of chamber 2.

A channel 35 in the body of vacuum chamber 2 connects the inside end of filament chamber 32 to a vacuum line 23 by appropriate coupling means. An air pressure line 24 is connected by appropriate means to three inside channels 29, 30 and 31 in the body of the vacuum chamber. Channel 30 directs air directly downward and laterally onto the filament 33. Channel 29 directs air toward the inside end of the interior and channel 31 directs air toward the entry port 22, preferably at a point just beyond the end of filament 33. A greater or lesser number of channels may be used; for instance, channel 29 may be omitted. By-pass line 28 directs air past the entry port. A composite slide type solenoid-controlled

4

valve 54 (Fig. 6) controls simultaneously air pressure and vacuum, the vacuum being on when the air pressure is off and vice-versa. In the unenergized position of valve 54, vacuum is being drawn on line 23 and air pressure is shut off line 24. However, the vacuum line portion of valve 54 may be omitted and line 23 connected directly to the vacuum source.

The sliding ejector plate 21 is held in position by a combined keeper and end plate 36. The end plate has an opening or slot 36' positioned to be directly beneath the filament chamber when plate 21 is in its actuated position, and proportioned to allow a filament to pass, unimpeded, therethrough. The end plate is held in position by means of screws 40.

The construction of ejector plate 21 is best shown in Fig. 5. As shown, it is a flat plate having an opening or slot 38 therethrough of sufficient width and length to allow filament 33 to pass through when the opening 38 is in alignment with the filament chamber 32. A channel 37, having three sides of a square or U-shaped configuration, is cut in the upper side of the ejector plate. Channel 37 cooperates with a block portion 41 of the vacuum chamber body to form a slide type valve. Vacuum line 23 is connected through valve 41, 37 to the solenoid-operated valve which is shown as block 54 in Fig. 6. The valve 41, 37 is adapted to be fully open when ejector plate 21 is in the unoperated position, that is, when opening 38 does not coincide with filament chamber 32. The U-shaped channel 37 allows for the adjustment of the closed position of ejector plate 21 with respect to vacuum chamber 2. However, the function of valve 37, 41 is not essential and it may be omitted entirely.

A switch actuating member 19 is adjustably secured to the ejector plate 21 by means of screws 57. Member 19 operates a normally open microswitch 12 to its closed position when the ejector plate 21 is in its unoperated position. The adjustment of member 19 with respect to the ejector plate 21 may be used to control the time of closing of microswitch 12. Ejector plate 21 is spring biased to maintain the bottom exit of chamber 32 closed. Movement of plate 21 from its closed position is effected by a solenoid 5 through medium of rod 20 coupled to the ejector plate at 39, best shown in Fig. 4.

A catch or lock mechanism 6 operated by solenoid 16 (Fig. 1) prevents movement of the ejector plate when there is no filament in the vacuum chamber. The operation of solenoid 16 to release lock mechanism 6 is caused by the presence of a filament in chamber 32 making electrical connection between pin 25 and the body of the chamber. The locking means 16, 6 may be of various types and its incorporation in the machine is not considered essential.

Situated below the vacuum chamber 2 is a chute 3. The chute 3, best shown in Figs. 10 and 11, is directly over the loading track 4 and in such a position as to place lamp filaments crosswise on the track 4. A chute closing member 26 is supported in position by pivots 27. The member 26 in its normal position of rest, due to gravity effects, closes the exit of the chute 3 over track 4. Operation to the open position of the chute closing member is effected by mechanical coupling means including a cam, at the loading position of the filament loading machine, the rotation of which is synchronized with the movement of the pick-up arm. This mechanical coupling comprises a cam 62, a cam riding lever arm 11, a coupling link 10, a guide roller 42 and arm 76 which is rigidly secured to the chute closing member 26. Movement of lever 11 caused by the rotation of cam 62 at the mount loading position causes link 10 to move against a pin in arm 76 to effect opening of the closing member 26. Such opening, providing a filament is present in chute 3, allows the filament to pass through to the loading track 4.

The track 4, which is a part of the mount loading machine proper, consists of a channel in table top 9. The

5

channel is machined to have parallel grooves crosswise thereon, the grooves being proportioned to hold single filaments therein. Indexing fingers or pins 62' (Fig. 2) are mechanically coupled to the mount loading mechanism, and the operation of the pick-up arm of the loading machine, providing a mount is present at the indexing position, causes pins 62' to take on a reciprocating motion which advances the filaments, which may be lying in the groove, to the next position toward the mounting position. The track 4 is of a conventional construction.

The electrical control system used for over-all control of the filament feeding machine is shown in Fig. 6. A relay 47 is shown as having four contacts 50, 51, 52 and 53 and two contacting arms 48 and 49. Alternating current power from a main is supplied to contact arms 48 and 49 by means of terminals 45, 46 and lines 58 and 59, respectively, and a switch 61 appearing in line 59. Energization of relay 47 is effected by means of battery 60 and lines 43, 44 which connect to insulated pin 25 in the chamber 2 and to the body of the chamber, respectively. For increased sensitivity a vacuum tube control circuit may replace battery 60, and it may be of the holding circuit type. As such control circuits are well known in the art and form no part of this invention no further description will be given. Relay 47 and associated vacuum tube control circuit, if such is used, may be appropriately housed in a suitable box.

In the unenergized position of relay 47, arm 48 makes connection with contact 50 and arm 49 makes connection with contact 52. If switch 61 is closed, alternating current will be applied across the series circuit consisting of the electromagnets of the vibratory conveyor and switch 12. Operation of the conveyor will then depend on the condition of switch 12 and hence the position of ejector plate 21 which operates said switch.

In the energized position of relay 47, arm 48 makes connection to contacts 51 and arm 49 makes connection to contact 53. Alternating current power may then be supplied to a solenoid valve 54 which controls simultaneously vacuum and air pressure on lines 23 and 24, respectively (Fig. 3.) In the unenergized position vacuum is on line 23 and air pressure is off line 24. In the energized position of valve 54 vacuum is off line 23 and air pressure is on line 24.

Across lines 58 and 59 is connected a series circuit consisting of ejector plate solenoid 5, a switch 55 which is actuated to the closed position by the presence of a mount in the indexing position of the mount loading machine and a further switch 56 operated by cam 62 associated with the operation of the filament pick-up arm at the filament loading position. Switch 56 is normally open and is closed at a predetermined time during the rotation of cam 62. Ejector plate 21 will not be operated to its filament dropping position unless a mount is at the indexing position. The reason for this is that if no mount is at the indexing position movement of a filament into the position to be ready for mount loading is not required.

The operation of the filament feeding machine will now be described with reference to Figures 1 to 6, inclusive.

A quantity of loose filaments are placed in bowl 17 of conveyor 1. Now providing switch 12 is closed, i. e. the ejector plate 21 is in the unoperated position, and relay 47 is unenergized, then closure of mains switch 61 will supply alternating current power by means of lines 58, 59, contact arms 48, 49 and contacts 50, 52 (Fig. 6) to cause operation of the conveyor 1. Filaments are advanced up track 13 (Fig. 1) to the terminus 18. At this time it will be noted from Fig. 6 that the solenoid vacuum, air pressure valve is unenergized and hence, providing vacuum and air pressure are connected via solenoid valve 54 to their respective lines 23 and 24, a filament will be drawn through entry port 22 into chamber 32 (Fig. 3) where the filament provides electrical con-

6

nection between the body 2 of the vacuum chamber and insulated pin 25.

Relay 47 is energized by the grounding of pin 25 to the body of the chamber. Contact arms 48, 49 of relay 47 now make contact and supply alternating current power to contacts 51, 53 respectively and the position of solenoid valve 54 is reversed so that vacuum is turned off line 23 and air pressure onto line 24. It is preferable to maintain a partial vacuum on line 23 when a filament is in the chamber as this prevents filament rebound which may occur when vacuum is suddenly cut off. This partial vacuum may be provided by adjusting solenoid valve 54 to not close vacuum off entirely when in the energized position.

Air pressure, at this time, is applied to channels 29, 30, 31 (Fig. 3). Channel 29 directs air towards the inside end of chamber 32 and helps to maintain the filament against contact pin 25. Channel 30 directs air directly downwards onto the filament, preferably at its center, and channel 31 directs air out port 22. The emission of air from port 22 ensures that a second filament does not enter chamber 32. The air pressure on line 24 now provides air to bypass outlet 28 which blows off any filaments which may be present at terminus 18 of track 13. It has been found that when the chamber has incorporated therein a channel such as 31 that bypass 28 may be dispensed with. Moreover, channel 29 may be omitted, the filament being held in chamber passage 32 by the jet from channel 30.

The filament in chamber 32 with the subsequent grounding of pin 25 ensures that the vibratory conveyor will not operate. Relay 47 will remain in its energized position so long as the filament is present.

The movement of the filament from the chamber 32 depends on the definite sequence of events happening in the mount loading machine. The dropping of the filament into chute 3 is effected by the energization of ejector plate solenoid 5 through two switches 55, 56 on the mount loading machine which are in series therewith across power supply lines 58, 59 (Fig. 6).

Indexing position switch 55, as previously explained, is closed by the presence of a mount at that position. The closure of the switch 55 may be effected by direct engagement with the mount as illustrated in Fig. 10 where the stem portion 84 of the mount carried by the clamps 86 of a head on the mount machine engages the movable element of the switch 55. The switch 55 is illustrated in dot-dash lines inasmuch as it is actually located at the indexing position which is just ahead of the loading position illustrated in Fig. 10. Mounting position switch 56 is closed by cam 62, which operates in conjunction with the action of the pickup arm of the mount loading machine, the cam 62 being mounted on the cam shaft 62' which may be the main cam shaft of the associated filament mounting machine or an auxiliary shaft driven directly therefrom so as to be rotated in timed relation to the filament mounting action. Now providing there is a mount at both the indexing positions of the mount loading machine the ejector plate solenoid 5 is energized and ejector plate 21 is moved to the position where opening 38 is in alignment with the opening in the bottom of chamber 32. The filament, assisted by the air pressure from line 24, passes through the ejector plate opening 38 into chute 3 below. The cam 62 of the mounting machine is so contoured as to maintain the ejector plate open for a period of time sufficient to assure the passage of a filament through the ejector plate 21. The closure member 26 for chute 3 is in the closed position and due to a highly polished surface in the chute and on closure member 26 the filament takes a horizontal position at right angles to the track 4. The ejector plate operated switch 12 in series circuit with the vibratory conveyor is opened by the movement of the ejector plate and this ensures that the conveyor will not operate to bring another filament into the vacuum

chamber until the ejector plate is again in the closed position. The partial vacuum on chamber 2 is also closed off by valve 37, 41 to further ensure that a filament does not enter the chamber as solenoid valve 54 is deenergized when the filament leaves the chamber. However, the valve 37, 41 may be omitted, as well as the vacuum valve portion of solenoid valve 54 so as to apply vacuum at all times to line 23, inasmuch as the vacuum in chamber 32 will, in any event, be effectively broken upon exposure of chamber 32 to the atmosphere through slot 38 in slide 21 when the filament is to be removed from the chamber.

Shortly after the pick-up arm of the mount loading machine has picked up a filament for mounting, indexing pins 62' advance the filaments, on track 4, one position therealong. A filament is thus moved up to the position from where it may be picked up for mounting and a space is cleared beneath chute 3 to accommodate another filament. The cam at the mount loading position has meanwhile rotated further and acts on lever 11 and through the medium of arms 10 and 76 to open the closure member 26 to allow the filament in the chute to drop into the position made open on loading track 4.

As the filament mounting action proceeds switch 56 opens and closure member 26 returns to its normally closed position. It is to be noted that the cam associated with the mount loading position makes one complete revolution during the mounting of a single filament. It will be also noted that the sequence of timing of closure of switch 56 and opening of closure member 26 are adjustable by positioning of these units about the cam 62. Thus the solenoid 5 is energized prior to the opening of closure member 26.

With the opening of switch 56 solenoid 5 is deenergized and ejector plate 21 returns to its closed position where switch 12 is also closed. Closing of switch 12 energizes the conveyor and the events described above are repeated.

It is to be noted that a filament will not drop onto track 4 unless both switches 55 and 56 are closed. This tie-in is necessary since if there is no mount at the filament mounting machine the indexing action of pins 62' does not take place and hence a position would not be free to accommodate another filament. Further if there is no mount in the indexing position and a position is not cleared on the track 4 then switch 55 prevents doubling up of filaments on the track.

It is preferable in the construction of the above described apparatus to make all moving parts, especially those coming in contact with the filaments, of a highly wear-resistant material. A chamber blowout air line may be coupled to the inside end of chamber 32 to clear the chamber of any fine particles, such as filament coatings, that may be present therein.

Figures 7 to 9 show a modification of the chamber and parts directly associated therewith. Parts performing identical functions to those of Figs. 1 to 5 inclusive bear the same designation numbers.

In the modification shown in Figs. 7 to 9 the ejector plate operating solenoid 5 is mounted directly onto the body 2 of the vacuum chamber. Solenoid 5 is supported on legs 73 which are integral with the body 2. Switch 12 is supported from the core 72 of the solenoid. Plunger 67 of solenoid 5 has a portion 75 of reduced diameter which through the medium of lever arm 66 operates switch 12 when the solenoid is energized.

Movement of plunger 67 is transmitted to ejector plate 21 by means of an arm 63 pivoted at 69. Arm 63 is coupled to ejector plate 21 by pin 70 secured between two upright portions of a coupling member 71. An abutment 77 on coupling member 71 limits the movement of ejector plate 21 in the direction to the right of Fig. 8. Abutment 77 is held against body 2 of the vacuum chamber by means of spring 63 and cooperating spring retaining member 64 and piston member 65. Member 64 has

a tunnel-like structure with the end thereof remote from piston 65 being closed. Spring 63 is held in member 64 by piston 65. The force of spring 63 against members 64 and 65 maintains ejector plate 21 in the proper place to close the vacuum chamber filament exit port during the period when solenoid 5 is not energized. Also, by means of arm 68, plunger 67 is maintained in the position shown except for periods when solenoid 5 is energized and overcomes the force of spring 63.

As illustrated in Fig. 9, the vacuum channel 35 extends directly outward to the vacuum line 23 at the end of the chamber body 2. Also, the compressed air channels 30 and 31 are supplied from separate lines 24a and 24b which may be metered to adjust the air flow therebetween in proper relationship to avoid any tendency to carry the filament 33 out of the passage 32.

The operation of this embodiment is similar in all other respects to that described previously.

The embodiment of Figs. 7 to 9 allows for greater compactness and ruggedness of the vacuum chamber unit.

A modified version of my invention is shown in Figs. 10 and 11. In this embodiment, the loading track 4 has been dispensed with and the machine adapted to deliver filament directly to the preselected position from which they may be picked up by the vacuum pick-up arm.

Referring now to the drawings, the lamp filament mounting machine frame is designated generally at 78. Supported and pivoted on portion 83 of frame 78 is a gear 81 to which is secured the vacuum pickup arm 79. Vacuum is supplied to the arm by means of a flexible hose 80 and channel 91. Movement of the arm from the position shown in full lines to that shown in dotted lines is effected by a rack gear 82 which is synchronized with the operation of the filament mounting machine.

Mounted on frame 78 is a composite slide and filament support 87, 88. The portion 88 is insulated from the main portion 87 for reasons which will appear later. Filament support 87, 88 is supported by a piece 89 in such a manner that the slope of the main surface of the filament support 87, 88 is approximately 30°. A portion of the mechanism shown in Figs. 7 and 8 and bearing the same reference numbers is shown generally at 2. Below 2 there is located the chute 3 with its associated closure gate 26 and operating arm 10.

At 84 is shown a lamp mount with attached filament support wires 85 only one of which may be seen. The mount 84 is held in the filament receiving position, as shown, by means of clamp members 86 of which only one is shown.

The operation of this embodiment differs from that previously described only in that the loading track 4 has been replaced by filament support 87, 88. The coiled filament is dropped from chute 3 to the support 87, 88 and, due to the slope of the upper surface thereof, takes up a position as shown at 90. As shown in the drawings the filament is positioned to be picked up directly by the vacuum pick-up arm. Synchronized with the operation of the lamp machine the pick-up arm picks filament 90 up and transfers it to the position shown by the dotted lines where it is secured to the filament support wires 85.

Portion 88 is insulated from the main portion 87 of the filament support or slide in order that a control or indicator circuit may be connected in series therewith to provide a circuit responsive to the presence or absence, as may be desired, of a filament at position 90. This circuit may be employed to only give an alarm if the pick-up arm goes through the motions of mounting a filament on stem 84 and no filament is present at such time. Two such alarm signals in sequence would indicate failure in the operation of the filament feeding machine so that an operator may check same.

It will be apparent that the vacuum chamber may be

so mounted in relation to the filament mounting machine that filaments are picked up directly from the vacuum chamber and the loading track 4 is dispensed with. For direct loading from vacuum chamber to pick-up arm, the vacuum chamber and associated mechanism, as shown in Figs. 7 to 9, is mounted in an inverted position so that ejector plate 21 forms the upper rather than the lower boundary of interior 32 of vacuum chamber 2. The feeding of filaments from the vibratory loader 1 to the vacuum chamber 2 is as described with reference to Figs. 1 to 9 inclusive.

In order that the filament may be taken directly from the vacuum chamber 2 by the vacuum pick-up arm and mounted on a lamp stem, slot 38 of ejector plate 21 is adapted to allow the pick-up arm to pick the filament directly from the chamber. The vacuum chamber mechanism is aligned with the filament mounting machine so that the filament, when in the chamber, lies in the same relative position as a filament would if in the last position or groove on the track 4, from whence it is picked up to be mounted on the stem. The loading track 4 is thus dispensed with and direct loading takes place. The operation of the filament loading machine in this position allows for greater simplicity and ease of operation. Chute 3 is of course dispensed with.

Various other modifications, which do not depart from the spirit and scope of this invention will occur to those skilled in the art, and the appended claims are intended to cover all such modifications.

What I claim as new and desire to secure by Letters Patent of the United States:

1. A machine for delivering coiled lamp filaments to a predetermined position on a lamp mount loading machine comprising, a loader mechanism adapted to singly advance said filaments to a first predetermined position, a chamber having an interior dimensioned to contain one of said filaments wholly inside thereof, an entry port to said chamber adjacent the said first predetermined position, means to apply a vacuum to said chamber to draw one of said filaments from said first predetermined position into the interior of said chamber, contact means arranged to be bridged by said filament when in said chamber, means actuated by said bridged contacts to deactivate said loader, means synchronized with the operation of the lamp mount loading machine adapted to transfer said filament from said chamber to said predetermined position and maintain said loader deactivated during removal of said filament from said chamber.

2. Apparatus for selecting a coiled filament from a quantity thereof and advancing it to the loading position of a lamp filament mounting machine comprising a vibratory type loader adapted to advance single filaments from said quantity to a first predetermined position, a chamber having an entry port, an exit port, and an interior dimensioned to hold one of said filaments wholly inside thereof, means locating said chamber so that said entry port is adjacent said first predetermined position, means to apply a vacuum to said chamber to draw said filament from said first predetermined position to a second position inside the said chamber, switch means actuated by the presence of said filament at said second position, means actuated by said switch to deenergize said vibratory loader, and means synchronized with the operation of the said lamp filament mounting machine adapted to allow said filament to be removed from said chamber and maintain said vibratory loader deenergized.

3. Apparatus for separating a single coiled lamp filament from a quantity thereof comprising, a vibratory loader adapted to advance a single filament from said quantity thereof to a first position, a vacuum chamber, having entry and exit ports, located adjacent said first position, means normally maintaining said exit port closed, means to apply vacuum to said chamber to draw said filament through said entry port and into said chamber, switch means actuated by the presence of said fila-

ment in said chamber to deenergize said vibratory loader, means to open said exit port to allow said filament to pass therethrough to a selected position at a predetermined time, and means operated in synchronism with said means to open to maintain said vibratory loader deenergized when said exit port is open.

4. Apparatus for separating a single coiled lamp filament from a quantity thereof and delivering it to the mount loading position of a lamp filament mounting machine comprising, a vibratory loader adapted to deliver filaments to a first position, and including electromagnetic energizing means, power supply means energizing said electromagnetic means of the vibratory loader to cause filaments to move in end-to-end relation up to said first position, a vacuum chamber having a conductive body and an interior dimensioned to contain one of said filaments wholly inside thereof, an insulated contact pin projecting into said chamber, means to apply vacuum to said chamber to draw one of said filaments from said first position into said chamber to short circuit said pin to said chamber, valve means controlled by said short circuit to deenergize said electromagnetic means, further means adapted to remove said filament from said chamber at a predetermined time and maintain said electromagnetic means deenergized during said period.

5. In combination with a lamp filament mounting machine having indexing and mount loading positions, a vibratory loader having a bowl thereon and comprising means including electromagnetic means arranged to energize said bowl to vibrate vertically and in an arc, guide track means spiralling from the base of said bowl and up the side thereof and terminating at a first position, a first switch in series circuit with said electromagnetic means and controlling the supply of energy thereto, a vacuum chamber located adjacent said first position having an interior dimensioned to contain a lamp filament wholly inside thereof, means to apply vacuum to said chamber to draw a filament thereinto from said first position, a solenoid controlled valve adapted to supply air pressure to said chamber, relay means adapted to supply electrical energy alternately to said series circuit and said solenoid, an insulated pin projecting into said chamber whereby the presence of a filament in said chamber completes a circuit to energize said relay to turn said air pressure on, a second switch actuated to its closed position by the presence of a mount at said indexing position, a third switch actuated to its closed position by the presence of a mount at said mount loading position, second solenoid means adapted when energized to effect removal of a filament from said chamber and open said first switch, means connecting said second solenoid and said second and third switches in series across the power supply.

6. In combination with a lamp filament mounting machine having indexing and mount loading positions, an electrically energized vibratory loader adapted to segregate coiled lamp filaments from a quantity thereof and deliver them in end-to-end relation to a first position, a normally closed first switch in series circuit with said loader, a vacuum chamber having an interior dimensioned to contain one of said filaments wholly inside thereof, means to connect said chamber to a vacuum source, an insulated contact pin projecting into said chamber and adapted to be short circuited to said chamber by the presence of a filament therein, first solenoid controlled means adapted to supply air pressure to said chamber, a second switch actuated to its closed position by the presence of a lamp mount at said indexing position, a third switch actuated to its closed position by the presence of a lamp mount at said mount loading position, a source of electrical energy, second solenoid means adapted, when energized, to open said chamber to allow a filament to be removed therefrom and to simultaneously open said first switch, means connecting said second switch, said third switch and said second solenoid in series circuit across

11

said source of energy, relay controlled switch means alternatively supplying energy from said source to said series circuit and said first solenoid, and means to energize said relay comprising a source of power in series circuit with said pin and said chamber.

7. In combination with a lamp filament mounting machine, having indexing and mount loading positions, means to deliver coiled filaments in timed relation with said machine to said mount loading position comprising, an electrically energized vibratory loader adapted to segregate filaments from a quantity thereof and deliver them in end-to-end relationship to a first position, a vacuum chamber having an interior dimensioned to contain a filament wholly inside thereof, means to supply vacuum to said chamber to draw a filament thereinto, relay means adapted to be energized by the presence of a coiled filament in said chamber, a normally closed first switch in series circuit with said vibratory loader, means to apply electrical energy to said series circuit when said relay is deenergized, second switch means adapted to be actuated to its closed condition by the presence of a mount at said indexing position, third switch means adapted to be closed by the presence of a mount at said mount loading position, a solenoid when energized adapted to effect removal of said filament from said chamber and simultaneously open said first switch, means connecting said solenoid and said second and third switches in series circuit relationship across a source of electrical energy.

8. In apparatus of the class described, filament transporting mechanism comprising a chamber member having an interior passage therein dimensioned to contain a single coiled filament wholly therein, said passage extending longitudinally into the chamber from a surface thereof to provide an entry port and being exposed longitudinally at another surface of the chamber to provide an exit port, closure means normally maintaining said exit port closed, means to apply a vacuum to the inner end of said passage to draw longitudinally thereinto a coiled filament presented at said entry port, means for actuating said closure means to open said exit port to allow the filament to pass therethrough and electric circuit means including contact means in said chamber arranged to be bridged by said filament when in said chamber and to control said means for actuating said closure means.

9. In apparatus of the class described, filament transporting mechanism comprising a chamber member having an interior passage therein dimensioned to contain a single coiled filament wholly therein, said passage extending longitudinally into the chamber from a surface thereof to provide an entry port and being exposed longitudinally at another surface of the chamber to provide an

12

exit port, closure means comprising a slide member normally maintaining said exit port closed and having therein a slot corresponding in shape to said passage, means to apply a vacuum to the inner end of said passage to draw longitudinally thereinto a coiled filament presented at said entry port, and means for actuating said slide member to bring the slot therein into alignment with said passage to open said exit port to allow the filament to pass therethrough.

10. In apparatus of the class described, filament transporting mechanism comprising a chamber member having an interior passage therein dimensioned to contain a single coiled filament wholly therein, said passage extending longitudinally into the chamber from a surface thereof to provide an entry port and being exposed longitudinally at another surface of the chamber to provide an exit port, closure means normally maintaining said exit port closed, means to apply a vacuum to the inner end of said passage to draw longitudinally thereinto a coiled filament presented at said entry port, means to supply jets of compressed air to said passage in directions to maintain the filament in place within the passage and to expel air through the entry port to prevent entrance of another filament, means including switch means energized by the presence of a filament in said passage to turn on the compressed air, and means for actuating said closure means to open said exit port to allow the filament to pass therethrough.

11. In apparatus of the class described, filament transporting mechanism comprising a chamber member having an interior passage therein dimensioned to contain a single coiled filament wholly therein, said passage extending longitudinally into the chamber from a surface thereof to provide an entry port and being exposed longitudinally at another surface of the chamber to provide an exit port, closure means normally maintaining said exit port closed, means to apply a vacuum to the inner end of said passage to draw longitudinally thereinto a coiled filament presented at said entry port, means to supply a jet of compressed air directed laterally into said passage approximately at the middle thereof and another jet directly angularly into the passage adjacent its exit port to blow air outwardly thereof, means including switch means energized by the presence of a filament in said passage to turn on the compressed air, and means for actuating said closure means to open said exit port to allow the filament to pass therethrough.

References Cited in the file of this patent

UNITED STATES PATENTS

1,951,820 Emerson ----- Mar. 20, 1934