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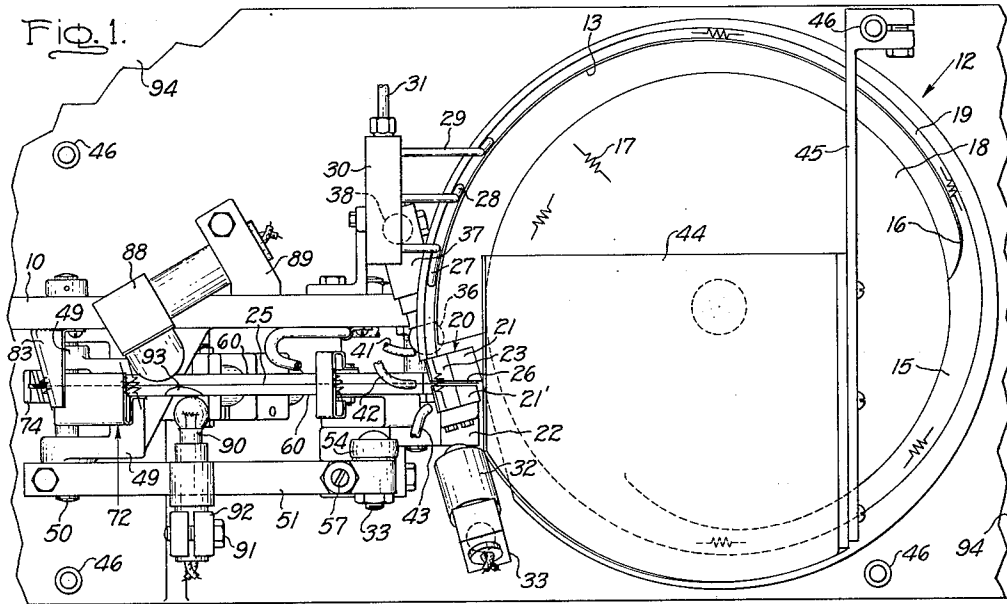
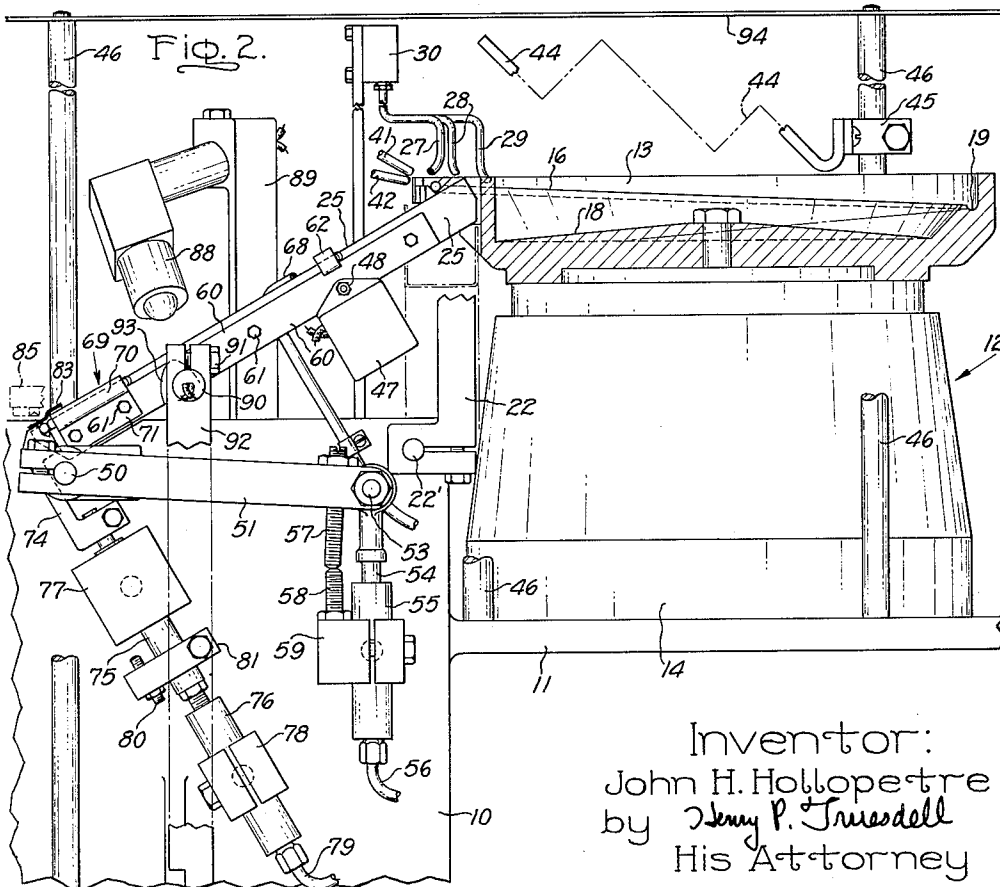
J. H. HOLLOPETRE

3,033,418

FILAMENT FEEDING AND STORAGE APPARATUS

Filed Dec. 18, 1959

2 Sheets-Sheet 1



Inventor:
John H. Hollopetre
by *Jerry P. Truesdell*
His Attorney

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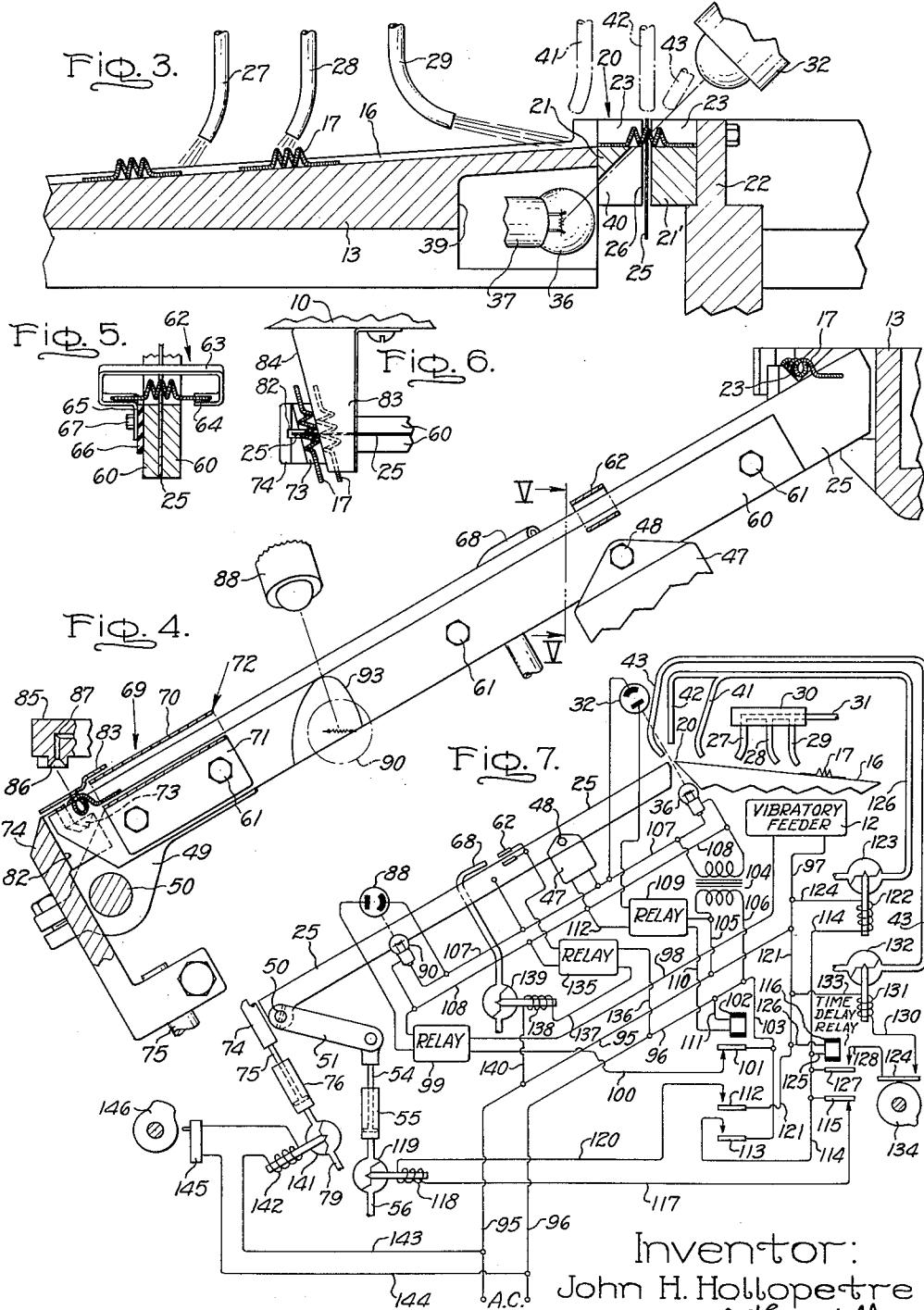
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His Attorney

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3,033,418 FILAMENT FEEDING AND STORAGE APPARATUS

John H. Hollopetre, Mayfield Heights, Ohio, assignor to
General Electric Company, a corporation of New York
Filed Dec. 18, 1959, Ser. No. 860,488
7 Claims. (Cl. 221-13)

This invention relates to apparatus for feeding and storing electric lamp filaments and other articles.

In the manufacture of electric lamps it is necessary to provide a suitable supply of filaments so arranged that they may be grasped on an individual basis for incorporation into the filament supporting or mount structure of the lamp. One type of electric lamp filament in common use is a coiled-coil filament of tungsten wire having straight ends for fastening to the mount structure. Such filaments are fragile. Moreover, due to the nature of the filament manufacturing processes, and the necessity for transporting them in large volume, the filament coils arrive at the lamp manufacturing operation as a loose collection or aggregation with the filament coils and ends intertwined with each other. As such, it is difficult to separate individual filaments from the mass. It is even more difficult to so arrange or align the filament coils upon separation that they may be handled individually by automatic equipment for assembly onto the mount structure. The apparatus of the instant invention overcomes these difficulties and provides a storage or reserve supply of the individually separated filaments.

Accordingly, it is an object of the present invention to provide apparatus for separating and feeding individual lamp filament coils from a loosely intermingled mass of such filaments without damage to the filaments.

It is another object of the invention to provide apparatus for feeding and storing a plurality of such filament coils in side-by-side relationship so that the filaments may be handled on an individual basis for incorporation into the electric lamp mount structure.

Another object of the invention is to provide a new and improved apparatus for feeding and storing filament coils or the like in which feeding and storage of the filaments is started and stopped automatically in accordance with the requirements of the associated lamp-making machine.

It is a further object of the invention to provide new and improved storage apparatus for filament coils or the like from which the filaments may be dispensed one at a time and in which a predetermined number of filaments are stored during operation.

In brief, according to one aspect of the invention, a mass of loosely intermingled filament coils is placed in a vibrating feeder bowl and individual filaments are moved one by one along a conveyor track in the feeder bowl to a receiving or pick-up station. Arrival of a filament coil at the receiving station triggers a control means causing an inclined blade element to be elevated beneath the filament to lift it out of the receiving station. The filament coil then travels along the length of the blade to a storage station at the other end. Filament coils are stored in side-by-side parallel relationship at the end of the blade in position to be grasped by a holder on the lamp-making equipment. When a predetermined quantity of the filament coils has been stored along the length of the blade the vibratory feeder bowl is shut down. Travel of the filament coils along the vibratory conveyor track, and also along the blade, is checked at spaced intervals to make sure that only a single, properly oriented, filament coil is fed to the storage area. The arrangement is such that feeding and storage of the filaments takes place intermittently at a higher rate than the speed of opera-

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tion of the lamp-making machinery. This means that filament coils are always available for the lamp-making equipment.

Further objects and advantages of the invention will appear from the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a plan view of apparatus constructed in accordance with the invention for feeding and storing electric lamp filaments in association with lamp-making machinery;

FIG. 2 is a side elevation of the filament feeding and storage apparatus with part of the apparatus shown in section for clarity of view;

FIG. 3 is an enlarged view in section of part of a vibratory feeder incorporated in the apparatus;

FIG. 4 is an enlarged view, partly in section, of an inclined blade associated with the vibratory feeder for receiving and storing the filament coils;

FIG. 5 is a sectional view through the blade taken along the line V—V of FIG. 4 and illustrating an electrical contact structure mounted on the blade;

FIG. 6 is a detailed view of the filament coil storage area at the end of the blade together with the mechanism for removing the coils from the blade; and

FIG. 7 is a diagrammatic view of a filament feeding and storage apparatus construction in accordance with the instant invention and showing the electrical control circuits and pneumatic supply lines of the apparatus.

As shown in FIG. 2, the apparatus provides an upstanding support plate 10 provided with a laterally extending shelf 11 on which a vibratory feeder 12 is mounted. The vibratory feeder is provided with a circular bowl 13 for receiving a large tangled mass of the filament coils and includes a mechanism 14 for vibrating the bowl. A generally spiral track or runway 15 (FIG. 1) extends upwardly out of the bottom of the bowl and along the outer periphery thereof, the track narrowing at the point 16. The mechanism 14 for vibrating bowl 13 is conventional and forms no part of the present invention. It may be said, however, that in one suitable mechanism the bowl is mounted on springs and is driven by an electromagnet in a manner to cause the bowl to vibrate both vertically and in an arc thereby advancing the filament coils upwardly along the track 15. Such a mechanism is disclosed in Simer Patent 2,832,462, issued April 29, 1958 and assigned to the same assignee as the present invention. By this arrangement, feeding of the filament coils can be made on an intermittent basis by starting or stopping the vibratory feeder.

As shown in FIG. 1, the vibratory action of the bowl 13 is such as to move individual groups of lamp filament coils 17 upwardly along the inclined track 15. Under the vibratory action, groups of coils on the track 15 tend to thin out, some of the coils dropping back off the edge of the track onto a sloping bottom wall 18 of the bowl where they are again moved to the outer periphery of the bowl for movement up the inclined track. As the individual filaments reach the point 16 at which the track narrows they drop into a groove 19 formed in the remaining circular portion of the track and continue on their way around the track periphery to a receiving station 20. As the filaments enter the narrower portion of the track at the point 16 and drop into the groove 19 they must do so in single file inasmuch as groove 19 is only slightly larger than the diameter of the coil. Although two coils cannot move along track 16 in side-by-side parallel relationship without one dropping off, it is possible for the leg of one filament coil to be entangled with the body of another coil, or, alternatively for one coil to be carried on top of another in piggyback style. However, such entangled or piggyback filaments will be removed later on

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in their travel through the apparatus in a manner to be described later.

Referring to FIGS. 1 and 3, the receiving station 20 constituting an extension of track 16 is formed by aligned blocks 21 and 21'. The blocks are positioned in a recess cut radially into the side wall of bowl 13. Block 21 is fastened to vibrating bowl 13 in any convenient way. Block 21' is bolted to a bracket 22 mounted for adjustment on pin 22' carried by plate 10. Each block is provided with a V-shaped groove 23 which forms, in effect, a continuation of the groove 19 of the vibratory feeder. The lengths of the blocks and sizes of the V-shaped grooves are such as to accommodate the particular size of filament coil being fed by the apparatus. The blocks are spaced from each other to form a slot 26. In this way block 21 may vibrate with bowl 13 without transmitting vibrations to other parts of the apparatus.

Filament coils are discharged from the receiving station 20 by means of a pivoted knife blade 25 one end of which is located beneath the coil and is adapted to move upwardly to lift the coil out of the V slot 23. Blade 25 extends across grooves 23 in a direction radially to the circle bowl 13. From another viewpoint, the blade is located on a line substantially normal to grooves 19 and 23 with the angular position of the blade corresponding to the angle of the coils of the filament so that the blade may be inserted between adjacent coils of the filament. The blade moves in slot 26 which is also set at an angle to grooves 23 depending upon the angular arrangement of the convolutions of the coil. In lifted position the coil is balanced upon the blade the thickness of the blade being such as to fit easily between the adjacent convolutions of the coiled filament. In lifted position, the coil slides along the length of the blade such movement being facilitated by inclining the blade downwardly at an angle with respect to the horizontal plane of the bowl 13. If the length of the filament is changed, or if the size and configuration of the coil form is modified, appropriate adjustment of the vibratory feeder may be made by replacing blocks 21 and 21' with others in which the sizes and lengths of the V grooves 23, and the angle of slot 26, is modified to accommodate the new filament coil. With a change in angular location of slot 26, a slight angular adjustment of the vibratory feeder on base 11 may be required to position blade 25 in the slot and to insure proper guidance of the blade between adjacent coils of the filament.

To assist in feeding the filament coils to receiving station 20 on an individual basis, and to prevent stack-up of the coils on the track 16 immediately in front of the receiving station, the coils are advanced below a series of three air jets 27, 28 and 29 fed from a manifold 30 connected to a low pressure air supply pipe 31. As best illustrated by FIG. 3, the first two jets 27 and 28 are located to direct air back downwardly along the incline of track 16 so as to slow down movement of the coils upwardly along the track toward the receiving station 20. On the other hand, the third jet 29 is directed to blow air in the opposite direction upwardly along the length of the track so as to accelerate movement of the first filament coil, once it has passed jets 27 and 28, to position it in the receiving station 20.

Operation of blade 25 to lift a filament coil out of the receiving station 20 is determined by a control means actuated by positioning of the coil at the station. When actuated, the control means lifts the blade and simultaneously stops operation of the vibratory feeder to prevent coil feeding when the blade is out of position. The control means includes a phototube 32 (FIGS. 1 and 3) carried by a standard 33, the phototube being exposed to a lamp 36 carried by a bracket 37 mounted for adjustment on a supporting rod 38 (FIG. 1). Lamp 36 extends into and is housed in a recess 39 in the wall of bowl 13 (FIG. 3). To expose phototube 32 to the light rays from the lamp, a portion of block 21 is cut away, as indicated at

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40, permitting travel of the light rays across the path occupied by the filament coil at the receiving station.

As previously indicated, when a filament coil interrupts the path of light from lamp 36 to phototube 32 an electric-pneumatic control circuit (to be described later) stops operation of the vibratory feeder 12 and simultaneously lifts the blade 25 to remove the filament coil from the receiving station. The filament coil then travels down the length of the blade. At the same time, the control circuit energizes another series of air jets 41 and 42 (FIG. 3). The fourth jet 41 is directed downwardly along the length of track 16 to keep any following filament coils clear of the receiving station until the blade 25 returns to its lower position. The fifth jet 42 directs air downwardly onto the end of blade 25 thereby seating the filament coil firmly in position on the narrow edge of the blade. If desired, a sixth jet 43 may be brought into operation by the control circuit at this time to direct air downwardly into the V groove 23 to clear any foreign material or stray filament coil from the groove before blade 25 returns to its initial position. To keep the filament coils from being blown by the air jets beyond the confines of bowl 13, a deflector plate 44 is mounted at an angle over a portion of the receptacle (FIGS. 1 and 2). It is fastened to bracket 45 adjustably mounted on a standard 46.

With the apparatus thus far described the filament coils have been segregated out of the tangled mass contained in the bowl 13 and fed one by one to blade 25 which acts as a storage means for the coils prior to mounting on the lamp. Movement of the filament coils along the length of blade 25 is facilitated, not only by the inclined path of the blade, but also by a continuous vibration of the blade effected by a buzzer 47 fastened to the blade by pin 48. To lift coils out of bowl 13, blade 25 is pivoted at its lower end. Spaced trunnions 49 fastened to the lower end of the blade are secured to an arbor 50 pivotally mounted in supporting plate 10. One end of a lever 51 is likewise fastened to arbor 50 and the other end is attached by a pin 53 to a plunger 54 movable in an air cylinder 55. Air under suitable pressure is applied to cylinder 55 through a supply pipe 56. Proper movement of plunger 54 within the air cylinder, and correspondingly, of lever 51 and blade 25, is determined by an adjustable stop screw 57 carried by lever 51 and a second screw carried by a supporting block 59. Block 59 is fastened to supporting plate 10 and carries air cylinder 55. When air pressure is applied to cylinder 55, plunger 54 is moved to pivot the lever 51 counterclockwise thereby rotating arbor 50 slightly to raise the upper end of blade 25 to grasp a filament coil. Blade 25 is strengthened by side plates 60 fastened on opposite sides of the blade by pins 61.

As stated before, it is possible for two intertwined filament coils to be fed to blade 25 in piggyback relationship, one on top of the other, or, alternatively, the ends of the coils may be entangled so one coil dangles from the other. In either case it is important to remove such intertangled coils from the blade as quickly as possible before they arrive at the storage station at the lower end of the blade. To this end, a contact bar 62 is placed in position across the blade 25 so that entangled filament coils extending outwardly more than the normal diameter of a coil will engage the contact bar and close an electrical circuit between the bar and the blade 25. As shown by FIG. 5, contact 62 is in the form of a metal strip 63 shaped as a loop around the blade 25 and of a width and height to accommodate one filament coil as it travels along the length of blade 25. One end 64 of the loop extends inwardly in a direction toward the blade 25 and the other end 65 is bent downwardly and rests against an insulating strip 66 on side plate 69 to which it is fastened by a pin 67. When an electrical circuit is closed through the contact bar 62, either by a tilted filament or entangled coils, an air jet 68 is operated (by a circuit

to be described later) to direct air along the length of blade 25 to blow all coils off the blade in the immediate area of contact 62.

As the filament coils travel down the length of blade 25 past contact 62 they begin to stack up in what may be termed a storage station 69. As shown by FIGS. 1 and 4, the storage station extends along a substantial length of the lower end of blade 25 and is covered by means of a U-shaped metal shield 70 one end 71 of which is secured to the side plates 60 by the aforesaid pins 61. The other end 72 of the shield extends outwardly to form a loop around the ends of the filament coils stacked on blade 25 and overlies the top face of the blade so as to maintain the coils in stacked relationship on the edge of the blade without buckling or displacement.

The lowermost filament coil slides out from beneath the upper portion 72 of the shield and rests in a groove 73 formed in a slide member 74 which is operable to lift the coils one at a time off of blade 25 for transfer to the filament mounting apparatus. As shown in FIGS. 1 and 4, the transfer slide is formed in the shape of a U one end of which is provided with the aforementioned groove 73 located adjacent blade 25 and the other end of which extends around the arbor 50 between trunnions 49 for attachment to a plunger 75 of an air cylinder 76. A block 77 carried by supporting plate 10 guides plunger 75. Air cylinder 76 is mounted in a supporting block 78 likewise mounted on plate 10. Air under pressure is supplied to cylinder 76 through a supply pipe 79. Movement of plunger 75 and slide 74 is limited by an adjustment screw 80 fastened by means of a clamp 81 to plunger 75.

As shown most clearly by FIGS. 4 and 6, the grooved end of slide 74 is also provided with a slot 82 transverse to groove 73 for accommodating the end of the blade 25. This makes it possible for the V-shaped groove 73 in the slide to be positioned beneath the lowermost filament coil 17 at the end of blade 25 with the coil resting against the slide, as shown in FIGS. 4 and 6. Groove 73 is arranged at an angle to blade 25 to accommodate the particular configuration of the filament coil. A protective cover 83 is mounted on wall 10 and extends across two or three of the lowermost filament coils on blade 25 to hold them in position on the blade. In effect, cover 83 forms an extension of the protective cover 72. However, one edge 84 of the cover is shaped at an angle corresponding to that of the groove 73 and slide 74 so that slide 74 just clears the cover 83 when moving upwardly with a coil seated in the groove. As the slide moves upwardly it engages a transfer arm 85 (FIG. 4) formed with a notch 86 for receiving the filament coil and a passageway 87 for applying vacuum to the filament coil to hold it in the notch. Transfer arm 85 comprises part of conventional lamp-making equipment and forms no part of the present invention. Once seated in groove 86 the filament coil may then be transferred by arm 85 in any suitable manner to the equipment for mounting the coil in position on the lamp mount. In transfer position, the inner face of slide 74 prevents movement of the next succeeding coil off of blade 25 until the slide returns to initial position and the next coil can drop into groove 73.

The supply of filament coils stored on blade 25 can vary considerably. Such supply is determined by the rate of feed of the vibratory feeder 12 and the rate at which the coils are transferred by slide 74 to the lamp-making equipment. Usually these rates are not the same. By providing the storage station 69 at the lower end of the blade the apparatus makes it possible to accommodate or adjust the higher feeding rate of the vibratory feeder 12 to the lower rate of the lamp-making equipment. However, to prevent build-up of filament coils along the entire length of blade 25, means is provided to stop operation of the vibratory feeder 12 when the selected reserve supply of filament coils is available on blade 25.

To this end, a phototube 88 is supported by a standard 89 in position above blade 25 at a point adjacent the storage station 69 where it may be exposed to light from a lamp 90 adjustably mounted by clamp 91 on a standard 92 (FIG. 2). Lamp 90 extends into a recess 93 (FIG. 4) formed in the side plate 60 so that the light rays may be intercepted by the filament coils 17 spread along blade 25. The sensitivity of phototube 88 is such that a single filament coil traveling down the length of blade 25 will not interrupt light rays from lamp 90 to an extent sufficient to actuate the phototube. However, as a plurality of the filament coils stack up along the length of blade 25 they will reach a point at which several of the coils will interrupt the light rays to thereby actuate phototube 88. This energizes a suitable electrical control circuit to stop operation of the vibratory feeder 12 so that a filament coil is no longer placed in the receiving station 20 to actuate phototube 32 so as to cause blade 25 to remove the filament coil from the feeder.

In order to protect the several phototubes from extraneous light which might lessen their sensitivity, the equipment is shielded by an opaque plate 94 (FIGS. 1 and 2) carried by a plurality of the standards 46.

Operation of the feeding and storage apparatus will now be summarized with particular attention to the electrical circuitry and pneumatic pressure systems for controlling the sequence of operations. Referring to FIG. 7, power supply conductors 95 and 96 are connected to the usual 110 volt A.C. current supply. The electrical circuit to the vibratory feeder 12 is from conductor 95 through a conductor 97, vibratory feeder 12, conductor 98, a relay 99, conductor 100, a normally closed contact 101 of a relay 102, and conductor 103 to the other supply line 96. A low voltage source of current supply for the electric lamps, buzzer 47, contact 62, the phototubes, and the associated relays is provided by a transformer 104 the primary of which is connected to supply lines 95 and 96 by conductors 105 and 106, respectively. The secondary of the transformer supplies the low voltage source through supply lines 107 and 108. The arrangement is such that transformer 104, the electric lamps, buzzer 47, contact 62, the phototubes, and the associated relays are electrically energized at all times during operation of the apparatus.

At the start of a filament coil feed cycle the vibratory feeder 12 moves a filament coil 17 up the track 16 which, upon reaching receiving station 20, interrupts the light beam exposing phototube 32. Actuation of phototube 32 operates a conventional relay 109 causing current to flow from supply line 95 through conductor 105, relay 109, a conductor 110, the coil of relay 102, and a conductor 111 to the other supply line 96. The coil of relay 102 picks up contactor 101 to open the circuit from supply line 96 to relay 99, and hence to vibratory feeder 12, to discontinue feeding of the filament coils. Energization of relay 102 also closes its normally open contacts 112 and 113 which operate electrical and pneumatic circuits to cause lifting of blade 25, operation of air jets 41 and 42, and, by means of a time delay relay, ultimate retraction of blade 25 and operation of air jet 43.

To lift blade 25, closure of contacts 112 and 113 completes an electrical circuit from supply line 96, conductor 103, contact 113, a conductor 114, a normally closed contact 115 of a time delay relay 116, a conductor 117, coil 118 of a solenoid operated air valve 119 inserted in the air supply line 56, a conductor 120, contact 112 which is now closed, a conductor 121 and thence to the other current supply line 95. Energization of coil 118 of the solenoid operated air valve 119 admits air to cylinder 55 so that plunger 54 rotates the arbor 50 through the link 51 to pivot blade 25 in a counterclockwise direction, as viewed in FIG. 7. The upper end of blade 25 then passes upwardly beneath the coils of the filament and lifts the coil out of the receiving station 20 for movement down the vibrating blade 25.

To operate air jets 41 and 42, closure of contact 113

completes an electrical circuit from supply line 96, conductor 103, through contact 113, conductor 114, the coil 122 of solenoid operated air valve 123, a conductor 124, conductor 97 to the other supply line 95. Upon operation of valve 123, the flow of air from jet 41 pushes the next succeeding filament coil 17 back along the inclined track 16 until the next cycle of operation takes place and the air jet 42 is directed against the particular filament coil picked up by blade 25 to seat it firmly on the blade.

To retract blade 25 to initial position, closure of contact 113 completes an electrical circuit from current supply line 96, conductor 103, through contact 113, conductor 114, a conductor 125, the coil of time delay relay 116, a conductor 126, conductor 121 and thence to the other supply line 95. Time delay relay 116, after a suitable delay on the order of one second or less, picks up its normally closed contact 115 to open the electrical circuit to the coil 118 of solenoid operated air valve 119; this permits retraction of plunger 54 and lowers the blade 25 into position at the receiving station for engaging the next succeeding filament coil to be fed by the vibratory apparatus. It will thus be seen that blade 25 is lowered by the action of the time delay relay irrespective of whether or not the filament coil has moved downwardly along blade 25 out of the path of the light rays reaching phototube 32. If the filament coil moves quickly enough, as frequently happens, phototube 32 will release relay 109 to deenergize relay 102; this permits contact 101 to close to thereby start the vibratory feeder 12, and contacts 112 and 113 to open to thereby retract air plunger 54 and blade 25. Also, deenergization of relay 102 opens the circuit to coil 122 shutting off air jets 41 and 42.

To operate air jet 43, the time delay relay 116 picks up its normally open contact 127 to close a circuit from the energized conductor 114, contact 127, a conductor 128, a normally open contact 129, conductor 130, a coil 131 of a solenoid operated air valve 132 placed in the air supply line of jet 43, and thence by conductor 133, conductor 121 to the other supply line 95. If contact 129 is closed the solenoid operated air valve 123 will be energized to blow air from jet 43 across the face of the receiving station 20 to remove any debris or filament coil from the groove 23. A cam 134, rotated in synchronism with the associated lamp-making machinery, closes contact 129 each time a filament coil is mounted on a lamp structure. The purpose of air jet 43 is to clear the receiving station 20 of anything which will block light from reaching phototube 32 and hence prevent start of another cycle of operation. For example, the blade may be retracted by operation of the time delay relay with a filament coil lodged at its end. It is necessary to remove this coil to unblock light to the phototube before the vibratory feeder will operate to feed additional coils. This is so because with a coil blocking light to phototube 32 relays 109 and 102 are operated to open contact 101 thereby breaking the electrical circuit to the vibratory feeder 12. However, since contact 129 is closed only momentarily, it will only occasionally be in timed sequence with proper operation of the vibratory feeder and blow off a properly mounted filament coil from blade 25.

If several filament coils ride down blade 25 in piggy-back fashion, or if one of the coils becomes tipped on the blade, the coil will engage the contact 62 to complete an electrical circuit and operate the air jet 68 to remove the incorrectly oriented coils. Contact 62 energizes a conventional relay 135 which, in turn, completes an electrical circuit from supply line 96, through a conductor 136, relay 135, a conductor 137, the coil 138 of a solenoid operated air valve 139, a conductor 140 to the other supply line 95. Opening of air valve 139 releases air under pressure to jet 68 to remove the obstructing coil from engagement with contact 62.

In stored position the filament coils extend in parallel side-by-side relationship back along the lower length of

blade 25. Eventually they will back up to a point at which the light rays from lamp 90 exposing phototube 88 will be interrupted to thereby energize relay 99. Operation of relay 99 opens the electrical circuit through conductors 98 and 100 thereby shutting down operation of vibratory feeder 12 until such time as a sufficient number of the filament coils are removed from blade 25 to again start operation of the apparatus.

As previously indicated, the filaments are removed one by one from the end of blade 25 by means of the slider 74 operated by air cylinder 76. Air cylinder 76 is operated by means of a solenoid operated air valve 141 having a coil 142 electrically connected to supply line 95 by conductor 143 and to the second supply line 96 by a conductor 144 and normally open switch 145. Switch 145 is actuated by a cam 146 rotated in synchronism with the conventional lamp-making equipment. When a filament coil is to be fed to the transfer arm 85 for incorporation into the lamp structure, cam 146 closes switch 145 to energize coil 142 of the air valve 141 thereby admitting air under pressure from pipe 79 to the air cylinder to move the slide 74 upwardly bringing a filament coil into engagement with the groove 86 of transfer arm 85.

Filament feeding and storage apparatus constructed in accordance with the instant invention provides a means for separating individual filament coils from a loose mass of the coils and so aligning and storing the coils that they may be easily handled for incorporation into the lamp mount. The arrangement prevents the coils from being damaged or deformed as they are sorted out and stacked in a storage area. Variations in operational speeds of the lamp-making equipment and filament feeding device are compensated for by means of the storage capacity of the apparatus.

Although a preferred embodiment of the invention has been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims.

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

1. Apparatus for feeding individual filament coils from a loose collection of such coils comprising, in combination, a vibratory feeder bowl for receiving a loose collection of coils, said bowl having a helical conveyor track to permit vibratory movement of individual coils along the track, a pivoted blade, the free end of said blade extending substantially normal to said track and intersecting said track so that a coil may be moved to a position overlying said blade, means responsive to positioning of a coil over said blade to pivot said blade to raise the free end to engage the convolutions of the filament coil and lift the coil out of said track, and means for vibrating said blade to cause the filament to travel along the length of the blade.

2. Apparatus for feeding individual filament coils from a loose collection of such coils comprising, in combination, a vibratory feeder bowl for receiving a loose collection of coils, said bowl having a helical conveyor track to permit vibratory movement of individual coils along the track, a pivoted blade inclined downwardly at an angle with respect to the horizontal axis of said feeder bowl, the free end of said blade extending substantially normal to and intersecting said track so that a coil may be moved over the blade, control means energized by positioning of a coil over said blade, means responsive to said control means to pivot said blade to raise the free end into engagement with the coil to lift it out of said track for movement downwardly along the blade and means responsive to said control means to stop said vibratory feeder bowl.

3. Apparatus for feeding individual filament coils comprising, in combination, a vibratory feeder bowl for receiving a loose collection of coils, said bowl having a helical conveyor track to permit vibratory movement of individual coils along the track to a receiving station on

the track, a vibratory blade pivotally mounted at an angle inclined downwardly with respect to the horizontal axis of said feeder bowl, the free end of said blade extending beneath the path of said conveyor track at the receiving station, a control circuit energized by positioning of a coil at the receiving station, means responsive to said control circuit to pivot said blade to raise the free end to engage a filament coil and lift it out of said receiving station onto said blade, and means including an air jet directed along said conveyor track and responsive to said control circuit to prevent movement of the next succeeding coil into the receiving station while said blade is in raised position.

4. Apparatus for feeding individual filament coils comprising, in combination, a vibratory feeder bowl for receiving a loose collection of coils, said bowl having a helical track to permit vibratory movement of individual coils along the track, a vibratory blade pivotally mounted at an angle inclined downwardly with respect to the horizontal axis of said feeder bowl, the free end of said blade extending beneath the path of said conveyor track, a control circuit energized by positioning of a coil over said blade, means responsive to said control circuit to pivot said blade to elevate its free end to engage a filament coil and lift it out of said track onto said blade, and means including an air jet directed against the elevated coil and responsive to said control circuit to seat the filament coil on said blade.

5. Apparatus for feeding individual filament coils comprising, in combination, a vibratory feeder bowl for receiving a loose collection of coils, said bowl having a helical conveyor track emerging from the bottom of the bowl and extending upwardly around the periphery of the bowl to permit vibratory movement of individual coils in succession along the track to a receiving station on the track, a blade pivotally mounted at an angle inclined downwardly with respect to the horizontal axis of said feeder bowl, the free end of said blade extending substantially radially to and beneath the path of said conveyor track at the receiving station, a control circuit energized by positioning of a filament coil at the receiving station, means responsive to said control circuit to pivot said blade to elevate its free end to engage a coil and lift it out of said receiving station onto said blade, means responsive to said control circuit for stopping said vibratory feeder, and means including an air jet directed along said conveyor track and responsive to said control circuit to

blow the next succeeding filament coil away from the receiving station back along the conveyor track.

6. Apparatus for feeding individual filament coils comprising, in combination, a vibratory feeder bowl for receiving a loose collection of coils, said bowl having a conveyor track to permit vibratory movement of a succession of coils along the track, a movable blade inclined downwardly at an angle with respect to the horizontal axis of said feeder bowl, one end of said blade extending substantially normal to and beneath the path of said conveyor track so that a coil may be moved to a position overlying said blade, means responsive to positioning of the coil over said blade to raise the said one end of the blade into engagement with convolutions of the coil to lift the coil out of said track, means for vibrating said blade so that the coil travels along the inclined length of the blade, electric contact means carried by said blade, and means including an air jet directed along the length of said blade and operative when a filament coil actuates said electric contact means to remove the coil from the blade.

7. Apparatus for feeding individual filament coils comprising, in combination, a vibratory feeder bowl for receiving a loose collection of coils, said bowl having a helical track to permit vibratory movement of individual coils along the track, a vibratory blade pivotally mounted at an angle inclined downwardly with respect to the horizontal axis of said feeder bowl, the free end of said blade extending beneath the path of said conveyor track, a control circuit including a phototube, said phototube being activated by positioning of a coil over said blade, means responsive to said control circuit upon activation of said phototube to pivot said blade to elevate its free end to engage a filament coil and lift the coil out of said track onto said blade for movement downwardly along the edge of said blade to deactivate said phototube, and means responsive to said control circuit to stop said vibratory feeder upon activation of said phototube.

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