June 3, 1947. V. C. ENSOR ET AL 2,421,690

RECIPROCABLE MEANS FOR AUTOMATICALLY MOVING A SERIES OF ARTICLES IN TANDEM THROUGH A DRYING CHAMBER

Filed Sept. 8, 1944 3 Sheets-Sheet 1

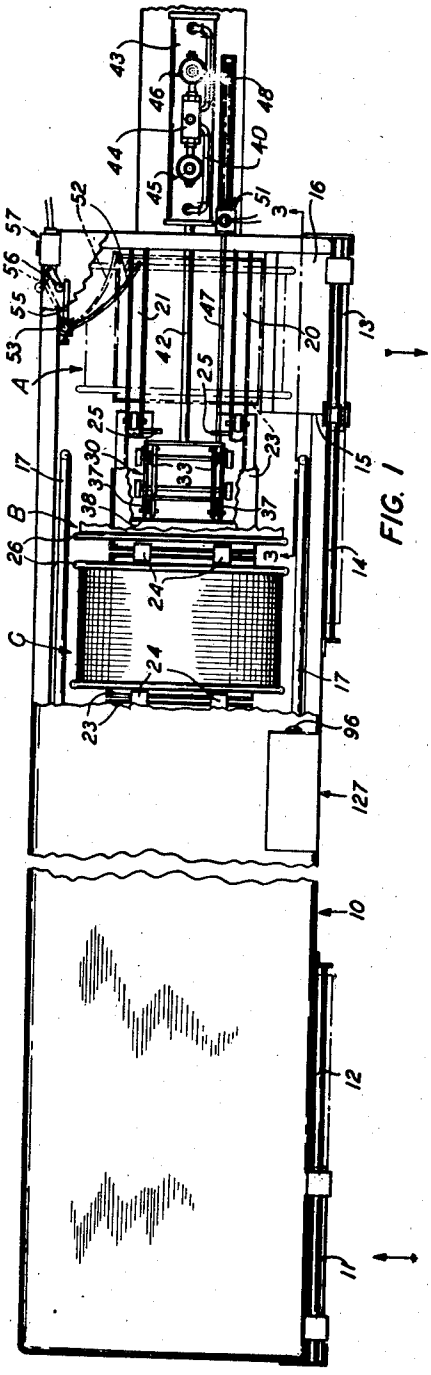


FIG. 1

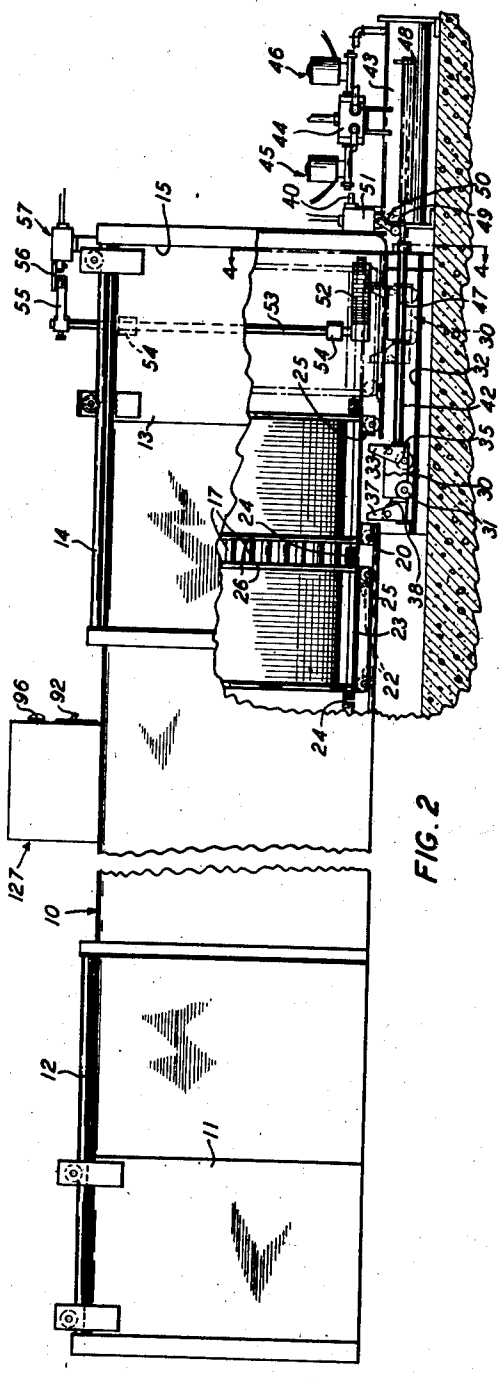


FIG. 2

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Filed Sept. 8, 1944 3 Sheets-Sheet 2

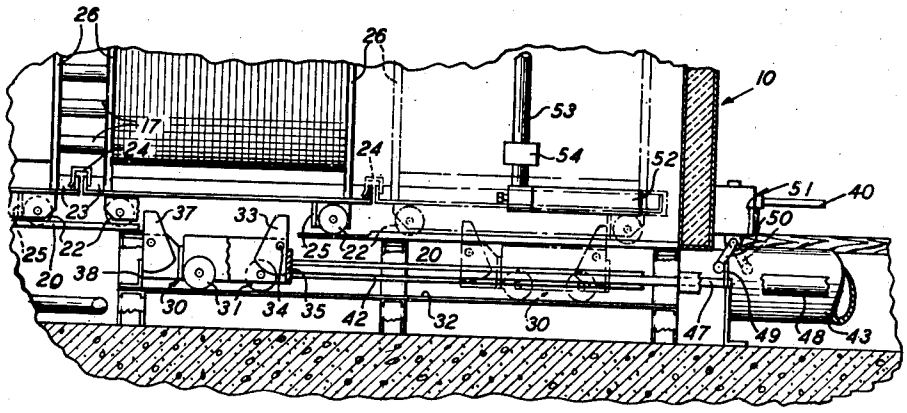


FIG. 3

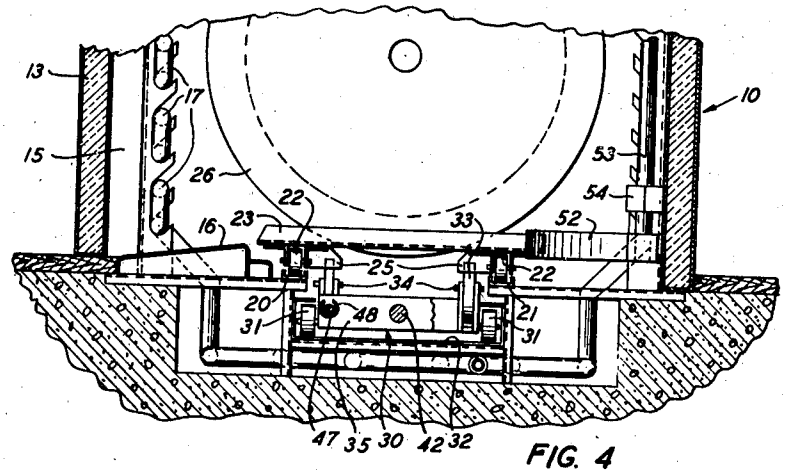


FIG. 4

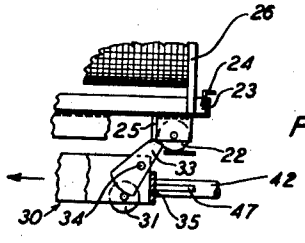


FIG. 5

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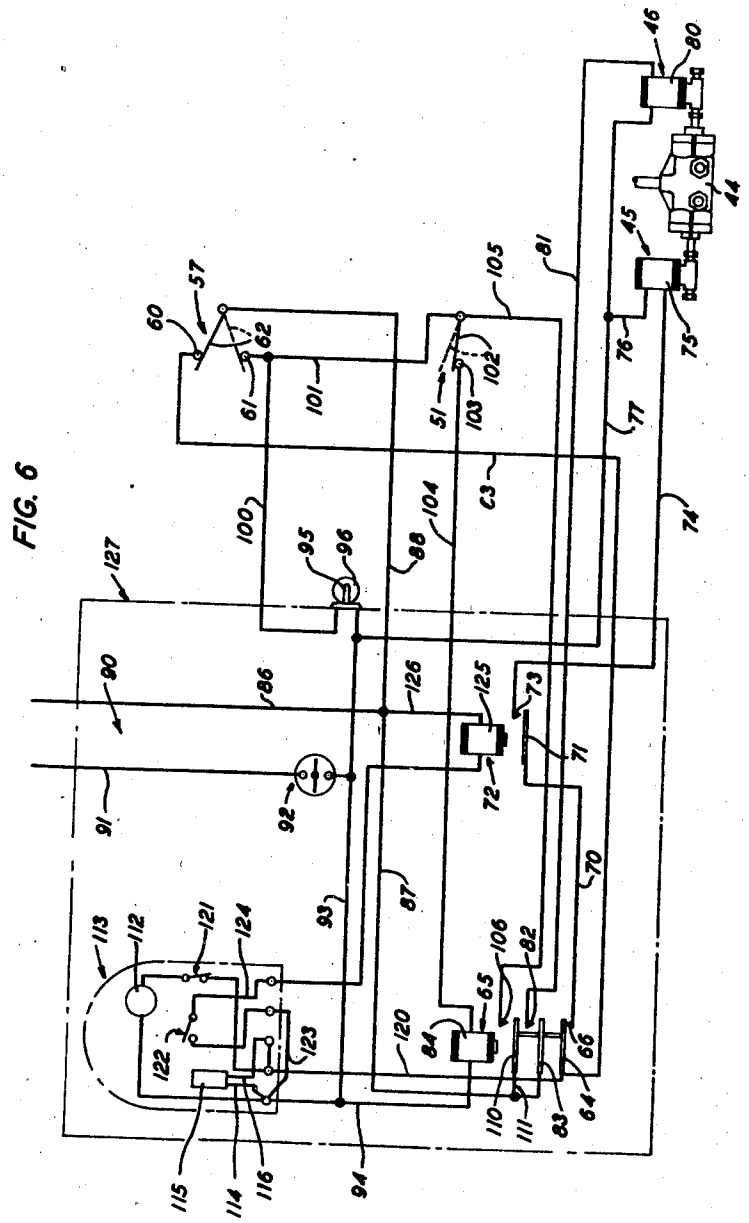
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Filed Sept. 8, 1944 3 Sheets-Sheet 3

FIG. 6



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RECIPROCABLE MEANS FOR AUTOMATICALLY MOVING A SERIES OF ARTICLES IN TANDEM THROUGH A DRYING CHAMBER

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Application September 8, 1944, Serial No. 553,186

7 Claims. (Cl. 34—53)

1

This invention relates to drying apparatus and more particularly to drying apparatus in which articles are subjected to a drying cycle of at least a predetermined length.

In the manufacturing of some types of insulated cables it is necessary to thoroughly dry the core portions of the cables before insulation is applied thereon. Such portions must be dried for a minimum period of time in order to make certain that the desired degree of dryness is obtained. In apparatus heretofore known for drying core portions it is difficult for operators to ascertain when the core portions have been dried the required period of time and to prevent the core portions being dried from being removed from the apparatus before the expiration of the required minimum period of drying.

An object of the invention is to provide new and improved drying apparatus.

An apparatus constituting one embodiment of the invention includes an elongated oven having an entrance at one end and an exit at the other end. There are provided means for carrying a plurality of articles in tandem through the oven and means for actuating the carrying means to present an article at the exit of the oven at a predetermined period of time after the next previous article has been presented at the exit.

A complete understanding of the invention may be obtained from the following detailed description of a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a fragmentary, top plan view of an apparatus embodying the invention;

Fig. 2 is a fragmentary, front view of the apparatus;

Fig. 3 is an enlarged, fragmentary, vertical sectional view of the apparatus taken on line 3—3 of Fig. 1;

Fig. 4 is an enlarged, fragmentary, vertical sectional view of the apparatus taken on line 4—4 of Fig. 2;

Fig. 5 is an enlarged, fragmentary, vertical sectional view of a portion of the apparatus, and

Fig. 6 is a diagrammatic view of an electrical circuit suitable for use in controlling the operation of the apparatus.

Referring more in detail to the drawings, there is illustrated therein an apparatus for drying core portions of cables prior to the formation of insulating coverings thereover. This apparatus includes an elongated oven 10 (Figs. 1 and 2), which has an entrance door 11 slidable along a rod 12 and an exit door 13 slidably supported

2

upon a rod 14. The exit door 13, when closed, covers an exit opening 15 formed in the oven 10. A ramp 16 is provided in the oven 10 adjacent to the exit opening 15 and a ramp (not shown) identical with the ramp 16, is positioned behind the entrance door 11. A plurality of steam pipes 17—17 positioned in the oven 10 are supplied with steam from a suitable source of steam (not shown), and serve to heat the interior of the oven 10.

A pair of channel-like tracks 20 and 21 (Fig. 4) extend longitudinally in the oven 10. The tracks 20 and 21 serve to receive wheels 22—22 rotatably mounted on dollies 23—23 (Fig. 2). The dollies are designed to carry reels 26—26 containing supplies of core portions which are to be dried. Each of the dollies is provided with a pair of hooks 24—24 at one end thereof, which connect the dollies together in a train extending from the entrance end to the exit end of the oven, which train is in effect a conveyor. Each dolly also has a pair of abutment plates 25—25 (Fig. 4) positioned near the forward end thereof.

When a dolly 23 is in front of the exit door 13, that is, in the position designated A in the drawings, it is accessible to an operator of the apparatus and the operator can remove the dolly readily. The dolly position next adjacent to position A to the left thereof, as seen in Fig. 1, is designated position B and the dolly position just to the left of position B is designated position C. The dollies in the oven 10, including that in position B and those extending therefrom to the entrance end of the oven, and the reels carried thereby normally are inaccessible to the operator and cannot be removed from the oven until they are moved successively to position A.

A carriage 30 (Fig. 3) provided with supporting rollers 31—31 is mounted for reciprocation along a trackway 32, which is positioned below the tracks 20 and 21. The carriage 30 normally is located under a dolly 23 in position B and may be moved to a point below position A and back to its normal location. A pair of dogs 33—33 are counter-balanced on a pair of pins 34—34 secured adjacent to the end of the carriage 30 nearest to the exit. The dogs 33—33 may be rotated in a clockwise direction, as viewed in Figs. 3 and 5, so that the upper ends thereof clear the abutment plates 25—25 of a dolly in position B and these plates are struck by the dogs when the carriage 30 is moved to the left relative to the dolly. However, when the upper ends of the dogs 33—33 clear the plates 25—25, the dogs are swung to vertical positions by the heavier lower portions

thereof, which movement is limited by a bar 35. Thus, when the carriage 30 is moved to the right as viewed in Fig. 3, the upper ends of the dogs 33—33 engage the abutments 25—25 of the dolly 23 in position B, and this dolly is moved to the right toward position A with the carriage. Since the dollies are connected together by the hooks 24—24, all the dollies are moved to the right with the end dolly.

A pair of dogs 37—37 (Fig. 3), which are identical with the dogs 33—33, are pivotally mounted near the end of the carriage 30 opposite to that carrying the dogs 37—37, and when the carriage is in its full line position, as shown in Fig. 3, the lower portions of the dogs 37—37 strike an abutment 38, which is secured to the oven in a position between the tracks 20 and 21. Thus, when the carriage is so positioned, the dogs 37—37 are held against rotation by the abutment 38 and strike the abutment plates 25—25 of the dolly in position C if an attempt is made to move the dollies manually to the right as viewed in Fig. 3.

A ram 42 fastened to a piston (not shown) enclosed in a pneumatic cylinder 43 is rigidly secured to the bar 35. A conventional four-way valve 44 is supported on the cylinder 43 and is provided with a solenoid 45 and a solenoid 46, which operate the valve 44. The four-way valve 44 is a standard bleeder-valve-controlled type of valve, and is connected by pipes 40 and 41 to opposite ends of the cylinder 43. When the solenoid 45 is energized, the valve 44 is actuated to supply air into the cylinder 43 so as to cause the piston in the cylinder 43 to draw the ram to the right, as viewed in Fig. 3, whereby the carriage 30 is drawn along the track 32 from its full line position, as shown in Fig. 3, to its dotted line position. This movement of the carriage 30 moves the dolly in position B from position B to position A. When the solenoid 46 is energized, the ram 42 is thrust to the left, as viewed in Fig. 3, and the carriage 30 is moved from its dotted line position, as shown in that figure, to its full line position, the dogs 33—33 and 37—37 clearing the plates 25—25 of the dolly in position B. The dogs 33—33 then prevent the train of dollies from being moved to the left, while the dogs 37—37 prevent the dollies from being moved to the right.

A rod 47 (Fig. 3) is secured to the bar 35 and rests in a U-shaped guide 48. When the carriage 30 is moved to its full line position, an arm 49 carried by the rod 47 strikes a spring-pressed arm 50 and moves the arm 50 from its position shown in dotted lines to that shown in full lines, which movement opens a rear limit switch 51.

A curved arm 52 (Fig. 3) is rigidly mounted on a vertical rod 53, which is rotatably mounted in a pair of bearings 54—54 secured to the wall of the oven 10, and a kicker 55 (Fig. 1) is rigidly secured to the upper end of the rod 53. A spring-pressed arm 56 of a forward limit switch 57 normally urges the kicker 55 to its full line position, as shown in Fig. 1. In this position the arm 52 is in the path of a dolly in position A, and when a dolly is moved forward from position B to position A by the carriage 30, it strikes the arm 52 and moves it to its dotted line position, whereby the kicker 55 moves the spring-pressed arm 56 to its dotted line position to actuate the forward limit switch 57.

The forward limit switch 57 (Figs. 1 and 6) includes a pair of contacts 60 and 61 and a contactor 62. When the spring-pressed arm 56 is in its full line position, as shown in Fig. 1, the contactor 62 is in engagement with the contact 60. When the spring-pressed arm 56 is moved to its dotted line position, the contactor 62 is brought into engagement with the contact 61.

The contact 60 (Fig. 6) is connected by a conductor 63 to a contactor 64 of a relay 65. When the relay 65 is not energized, the contactor 64 is in engagement with a contact 66 of the relay 65. A conductor 70 serves to connect the contact 66 to a contactor 71 of a normally open relay 72. The relay 72 includes a contact 73, which is engaged by the contactor 71 when the relay 72 is actuated. The contact 73 is connected by a conductor 74 to a winding 75 of the solenoid 45.

A conductor 76 (Fig. 6) connects the winding 75 to a conductor 77, which is connected to a winding 80 of the solenoid 46. A conductor 81 connects the winding 80 to a contact 82 of the relay 65. A contactor 83 of the relay 65 is brought into engagement with the contact 82 when a winding 84 of the relay is energized. The contactor 83 is connected by conductor 87 to a conductor 86 of a power line 90. The conductors 86 and 87 are connected by a conductor 88 to the contactor 62. The power line 90 includes a conductor 91, which has a manually operable switch 92 therein and is connected to a conductor 93.

The conductor 93 (Fig. 6) is connected to a conductor 94, to the conductor 77, and to one end of a filament 95 of an incandescent lamp 96. The other end of the filament 95 is connected by a conductor 100 to a conductor 101. The conductor 101 is connected to the contact 61 of the limit switch 57 and to a normally closed contactor 102 of the limit switch 51. The contactor 102 is normally in engagement with a contact 103, which is connected by a conductor 104 to the winding 84 of the relay 65. The contactor 102 is connected by a conductor 105 to a contact 106 of the relay 65. A contactor 110 of the relay 65 serves to engage the contact 106 when the winding 84 is energized, and is connected by a conductor 111 to the conductor 87.

The conductor 94 leads to a synchronous motor 112 of a conventional timer 113. A conductor 114 serves to connect an end of a clutch coil 115 of the timer to the conductor 94, and a conductor 116 connects the other end of the clutch coil 115 to a conductor 120, which is connected to the motor 112 of the timer and to the contactor 64. The conductor 120 has therein a normally closed safety limit switch 121, which is opened by the timer 113 in case of failure of the apparatus and thereby prevents damage to the apparatus.

The timer 113 (Fig. 6) includes a normally open main contact 122, which is connected by a conductor 124 to a winding 125 of the relay 72 and by a conductor 123 to the conductor 94. A conductor 126 connects the winding 125 to the conductor 86. A housing 127 (Fig. 2) mounted on the top of the oven 10 serves to enclose the relays 65 and 72 and the timer 113, and the lamp 96 and the switch 92 are supported thereby in obvious and accessible positions.

In the operation of the apparatus described hereinabove, the dollies 23—23 (Fig. 1) and the reels 26—26 are placed successively in the oven 10 to fill the oven, which is heated by steam supplied to the steam pipes 17—17, and the switch 92 (Fig. 6) is closed. After the apparatus is in its normal operating cycle with the oven 10 filled with dollies except for position A, which is vacant, and the timer 113 has been in operation for a predetermined period of time, the main contact

122 is closed by the timer. The closing of the main contact closes the circuit to the winding 125 of the relay 72 and the winding is energized by current from the power line 90 through the conductors 86 and 126 to the winding 125, and through the conductors 91, 93, 94 and 123, the main contact 122, and the conductor 124.

When the winding 125 is energized, the winding 75 of the solenoid 45 is supplied with current from the power line 90 through the conductors 91, 93, 77 and 76, and through the conductors 86 and 88, the contactor 62, the contact 60, the conductor 63, the contactor 64, the contact 66, the conductor 70, the contactor 71, the contact 73, and the conductor 74. The energization of the solenoid 45 causes the valve 44 to be actuated to supply air under pressure to the left hand end of the cylinder 43, as viewed in Fig. 2, and to exhaust the right hand end thereof, whereby the ram 42 draws the carriage 30 to its dotted line position, as shown in Fig. 3. As the carriage 30 moves to the right the dogs 33—33 engage the dolly in position B and move that dolly to position A. The dolly advanced by the carriage 30 pulls the entire train of dollies to the right through a distance equal to the length of one dolly.

As the carriage 30 is moved to the right, as viewed in Fig. 3, the arm 49 is moved out of engagement with the spring-pressed arm 50, which moves to its dotted line position, thereby causing the engagement of the contactor 102 (Fig 6) and the contact 103. When the dolly moved from position B to position A engages the arm 52 and moves it from its full line position to its dotted line position, as shown in Fig. 1, the forward limit switch 57 is actuated and the contactor 62 is moved out of engagement with the contact 60, whereby the circuit to the winding 75 of the solenoid 45 is broken, and the contactor 62 is moved into engagement with the contact 61.

As soon as the contactor 62 (Fig. 6) engages the contact 61, the lamp 96 is supplied with current through the conductors 91 and 93, and the conductors 86 and 88, the contactor 62, the contact 61, and the conductors 101 and 100, and the filament 95 of the lamp is lighted. The lighting of the lamp 96 indicates that a dolly 23 and its reel 26 are in position A, and can be removed from the oven 10.

Upon the engagement of the contactor 62 (Fig. 6) and the contact 61, the winding 84 of the relay 65 is energized through the conductors 91, 93 and 94, and through the conductors 86 and 88, the contactor 62, the contact 61, the conductor 101, the contactor 102, the contact 103, and the conductor 104. The energization of the winding 84 moves the contactors 110 and 83 into engagement with the contacts 106 and 82, respectively, and moves the contactor 64 out of engagement with the contact 66.

When the engagement between the contactor 64 (Fig. 6) and the contact 66 is broken, the circuits to the winding 75 of the solenoid 45, to the clutch coil 115, and to the motor 112 of the timer 113 are broken. The timer 113 then resets to zero, whereby the main contact 122 is opened which breaks the circuit to the winding 125 of the relay 72 and the engagement between the contactor 71 and the contact 73 is broken.

When the engagements are effected between the contactor 110 (Fig. 6) and the contact 106, and the contactor 83 and the contact 82, the winding 80 of the solenoid 46 is energized through

the conductors 91, 93 and 77, and through the conductors 86 and 87, the contactor 83, the contact 82, and the conductor 81. The solenoid 46 then causes the valve 44 to be moved to the position in which it directs air under pressure to the right hand end of the cylinder 43, as seen in Fig. 2, and exhausts air from the opposite end thereof, whereby the carriage 30 is moved back along the trackway 32 to its full line position, as shown in Fig. 3. As the carriage is so moved, the dogs 37—37 and 33—33 rotate as they are moved past the abutment plates 25—25 of the dolly in position B so that the carriage is not obstructed in its travel. When the carriage reaches its full line position, the dogs 37—37 engage the abutment 38 and are prevented from rotating in a clock-wise direction. Also, when the carriage 30 reaches its full line position, the arm 49 strikes the spring-pressed arm 50 of the rear limit switch 51, which causes the engagement between the contactor 102 (Fig. 6) and the contact 103 to be broken, whereby the winding 84 of the relay 65 is de-energized.

When the winding 84 of the relay 67 (Fig. 6) is de-energized the contactor 64 engages the contact 66 and the contactors 110 and 83 are disengaged from the contacts 106 and 82, respectively, whereby the solenoid 46 is de-energized. However, the valve 44 continues to supply air under pressure to the right hand end of the cylinder 43 and the carriage 30 is held in its full line position.

The circuit to the timer motor 112 (Fig. 6) is closed at this time except for the contact 60 and the contactor 62, which are out of engagement. Upon seeing the lighted lamp 96 (Fig. 2) an operator removes from the oven 10 the reel 26 and the dolly 23 which are in position A, and places another dolly and reel in the oven at the entrance end thereof, the dolly which is inserted being hooked to the next adjacent dolly in the oven. Thus, the train of dollies is maintained throughout the length of the oven 10 except for position A, which is vacant.

The removal of the dolly from position A permits the arm 52 to be swung to its full line position, as shown in Fig. 1, by the spring-pressed arm 56, and the contactor 62 of the forward limit switch is moved into engagement with the contact 60. This causes the lamp 96 to be darkened and completes the circuit to the motor 112 and the clutch coil 115 of the timer 113. The timer motor 112 is supplied with current from the power line 90 through the conductors 91, 93 and 94, and through the conductors 86 and 88, the contactor 62, which is in contact with the contact 60 when no dolly is in position A, the contact 60, the conductor 63, and the conductor 120 which includes the limit switch 121, which is closed. The clutch coil 115, which is in parallel with the motor 112, also is energized at this time.

Since the valve 44 (Figs. 1 and 2) at this time is in a position in which air under pressure is supplied to the right hand end of the cylinder 43, as viewed in Fig. 2, and the carriage 30 is held below position B, the dogs 37—37 then are held against the abutment 38 so that the dollies 23—23 cannot be moved forward manually far enough to place the end dolly in position A, which is the only position in which it can be removed from the oven 10 through the exit opening 15. The dollies cannot be moved to the rear because of the dogs 33—33. Thus, none of the dollies in the oven may be moved manually along the tracks 20 and 21 to position A.

The main contact 122 (Fig. 6) is open for a predetermined period of time after the start of the timer 113, which period is equal to the minimum period of time for drying the core portions on the reels 26—26 divided by the number of dollies 23—23 which may be contained in the oven 10. The timer 113, of course, may be adjusted suitably.

While the main contact 122 (Fig. 6) is open the circuit to the winding 125 of the relay 72 is open and the contactor 71 and the contact 73 are out of engagement, whereby the circuit to the winding 75 of the solenoid 45 is open. After the timer 113 has operated for the predetermined period of time, it closes the main contact 122 and the cycle of operation described hereinabove is repeated.

The dogs 37—37 (Fig. 3) are held by the abutment 38 in positions obstructing the movement of the dollies 23—23 when the carriage is in its rear position. Consequently, the dollies cannot be moved manually to position A and each remains in the oven 10 for the required minimum period of time of drying.

The apparatus described hereinabove is entirely automatic and an operator thereof need only insert the loaded dollies into and remove them from the oven 10. Consequently, while very little effort and attention are required, each reel will be dried for the required minimum period of time.

What is claimed is:

1. In a drying apparatus including an elongated enclosure having an entrance and an exit, reciprocable means movable from a starting position to a forward position for moving a series of articles arranged in tandem through the enclosure, means for driving the moving means and means for preventing movement of articles moved by the moving means except by the moving means, means for controlling the operation of the driving means which comprises a starting solenoid for causing the driving means to drive the reciprocable means from its starting position to its forward position to move a series of articles toward the exit end of the enclosure, a reversing solenoid for causing the driving means to drive the reciprocable means from its forward position to its starting position, and a limit switch positioned near the exit of the enclosure and serving when engaged by an article moved by the reciprocable means to the exit to de-energize the starting solenoid and to energize the reversing solenoid.

2. In a drying apparatus including an elongated enclosure having an entrance and an exit, reciprocable means movable from a starting position to a forward position for moving through the enclosure a series of articles arranged in tandem and means for driving the moving means, means for controlling the movement of articles positioned in the enclosure which comprises means for preventing movement of the articles except by the moving means, a starting solenoid for causing the driving means to drive the reciprocable means from its starting position to its forward position to move a series of articles toward the exit end of the enclosure when energized, a reversing solenoid for causing the driving means to drive the reciprocable means from its forward position to its starting position when energized, a switch serving when actuated to de-energize the starting solenoid and to energize the reversing solenoid, means positioned near the exit of the enclosure for actuating the switch when engaged by an article moved by the reciprocable means to the exit, means for de-energizing the reversing solenoid when the reciprocable means is moved to its starting position, a second switch for causing the energization of the starting solenoid, and a timer in circuit with the first switch and started when the article engaging the actuating means is removed from the exit of the enclosure for closing the second switch at the end of a predetermined period of time after the article is removed.

3. In a drying apparatus including an elongated enclosure having an entrance and an exit, reciprocable means movable from a starting position to a forward position for moving a series of articles arranged in tandem through the enclosure, means for driving the moving means and means for preventing movement of articles in the enclosure except by the moving means, means for controlling the operation of the driving means which comprises a starting solenoid for causing the driving means to drive the reciprocable means from its starting position to its forward position to move a series of articles toward the exit of the enclosure when energized, a reversing solenoid for causing the driving means to drive the reciprocable means from its forward position to its starting position when energized, a double throw limit switch positioned near the exit of the enclosure serving when engaged by an article moved by the reciprocable means to the exit to de-energize the starting solenoid and energize the reversing solenoid, means for de-energizing the reversing solenoid when the reciprocable means is moved to its starting position, a starting switch in series with the starting solenoid for causing its energization, and a timer started when the article moved to the exit of the enclosure is removed therefrom for closing the starting switch a predetermined period of time after the article at the exit is removed.

4. In a drying apparatus including an enclosure having an entrance and an exit, a track extending from the entrance to the exit of the enclosure, a series of connected article-carrying dollies movable along the track, a carriage having ratchet means thereon for engaging one of the dollies when moved toward the exit of the enclosure to move the dollies therewith and pneumatic means for reciprocating the carriage along the track a distance equal to the length of one of the dollies, means for controlling the movement of the dollies which comprises means for preventing movement of the dollies when the carriage is not reciprocated, a valve for controlling the pneumatic means, a starting solenoid for actuating the valve so as to cause the pneumatic means to move the carriage toward the exit of the enclosure when energized, a starting switch for causing the energization of the starting solenoid when closed, a reversing solenoid for actuating the valve to cause the pneumatic means to move the carriage away from the exit of the enclosure when energized, a timer for closing the starting switch after it has run a predetermined period of time, a reversing switch serving to stop the timer, de-energize the starting solenoid and energize the reversing solenoid when actuated and start the timer when unactuated, and means positioned in the path of the dollies at a point adjacent to the exit of the enclosure for actuating the reversing switch when struck by one of the dollies moved to the exit.

5. In a drying apparatus including an enclosure having an entrance and an exit, a track extending from the entrance to the exit of the enclosure,

a series of connected article-carrying dollies movable along the track, a carriage having ratchet means thereon for engaging one of the dollies when moved toward the exit of the enclosure to move the dollies therewith and pneumatic means for reciprocating the carriage along the track a distance equal to the length of one of the dollies, means for controlling the movement of the dollies which comprises means for preventing movement of the dollies when the carriage is not reciprocated, a valve for controlling the pneumatic means, starting solenoid for actuating the valve to cause the pneumatic means to move the carriage toward the exit of the enclosure when energized, a starting switch for causing the energization of the starting solenoid when closed, a reversing solenoid for actuating the valve to cause the pneumatic means to move the carriage away from the exit of the enclosure when energized, a timer for closing the starting switch after it has run a predetermined period of time, a double-throw switch serving to stop the timer, de-energize the starting solenoid and energize the reversing solenoid when actuated and start the timer when unactuated, and means positioned in the path of the dollies at a point adjacent to the exit of the enclosure for actuating the double-throw switch when struck by one of the dollies moved to the exit, said double-throw switch serving to restart the timer when the dolly moved to the exit is moved out of engagement therewith.

6. In a drying apparatus including an elongated enclosure having an entrance and an exit, a train of connected dollies positioned in the enclosure and movable therealong, a reciprocable ratchet mechanism for moving the train of connected dollies toward the entrance or the enclosure a distance equal to the length of one of the dollies at each reciprocation thereof and pneumatic means for reciprocating the ratchet mechanism, means for controlling the movement of the train of dollies which comprises means for preventing movement of the train of dollies relative to the enclosure when the train of dollies is not moved by the ratchet mechanism, a supply line associated with the pneumatic means, a valve positioned in the supply line serving to cause the pneumatic means to move the ratchet mechanism toward the exit of the enclosure when in an advancing position and cause the pneumatic means to move the ratchet mechanism away from the exit when in a reversing position, starting electromagnetic means for moving the valve to the advancing position, reversing electromagnetic means for moving the valve to its reversing position, a timer in circuit with the starting electromagnetic means for energizing that electromagnetic means after it has run a predetermined period of time, and a limit switch positioned so as to be engaged by the one of the dollies which is moved to the exit of the enclosure and serving to stop and reset the timer, de-energize the starting solenoid and energize the reversing solenoid when so engaged.

7. In a drying apparatus including an elongated enclosure having an entrance and an exit, a train of connected dollies positioned in the enclosure and movable therealong, a reciprocable ratchet mechanism for moving the train of connected dollies toward the entrance of the enclosure a distance equal to the length of one of the dollies at each reciprocation thereof and pneumatic means for reciprocating the ratchet mechanism, means for controlling movement of the train of dollies which comprises means for preventing movement of the train of dollies relative to the enclosure when the train of dollies is not moved by the ratchet mechanism, a supply line, a four-way valve connecting the supply line to the pneumatic means, a starting solenoid for actuating the valve to cause the pneumatic means to drive the ratchet mechanism toward the exit of the enclosure when energized, a reversing solenoid for actuating the valve to cause the pneumatic means to drive the ratchet mechanism away from the exit when energized, a starting relay including a winding and normally open contacts in series with the starting solenoid for energizing that solenoid when energized, an automatically resetting timer having a motor and normally open timer contacts in series with the winding of the relay and serving to close the timer contacts a predetermined period of time after the timer is started, whereby the starting solenoid is energized a predetermined period of time after the timer is started, a reversing relay having a winding and normally open contacts in series with the reversing solenoid for energizing the reversing solenoid when energized, a single-pole double-throw limit switch positioned in the path of the dollies at the exit of the enclosure and having a starting contact in series with the motor of the timer, a reversing contact in series with the reversing relay and a contactor normally in engagement with the starting contact thereof but movable out of engagement therewith and into engagement with the reversing contact thereof when the limit switch is engaged by one of the dollies moved to the exit of the enclosure, whereby the timer resets, the starting solenoid is de-energized and the reversing solenoid is energized when one of the dollies is moved to the exit, and a stopping limit switch having normally closed contacts in series with the winding of the reversing relay and positioned so that the contacts thereof are opened by the ratchet mechanism at the end of a reciprocation thereof, whereby the reversing relay is de-energized and the reversing solenoid is de-energized at the end of a reciprocation of the ratchet mechanism.

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1,161,587	Ayres	Nov. 23, 1915
2,347,346	Wright	Apr. 25, 1944
1,798,485	Mulvihill	Mar. 31, 1931
1,511,662	Dirkson et al.	Oct. 14, 1924
1,861,659	Fox	June 7, 1942
2,292,284	Ogden	Aug. 4, 1942
1,942,247	Johnson	Jan. 2, 1934
1,610,366	Fox et al.	Dec. 14, 1926
2,101,353	Waalkes	Dec. 7, 1937