Oct. 2, 1951 S. M. BRIGGS ET AL 2,569,705

BALL PAINTING MACHINE

Filed June 15, 1948 4 Sheets-Sheet 1

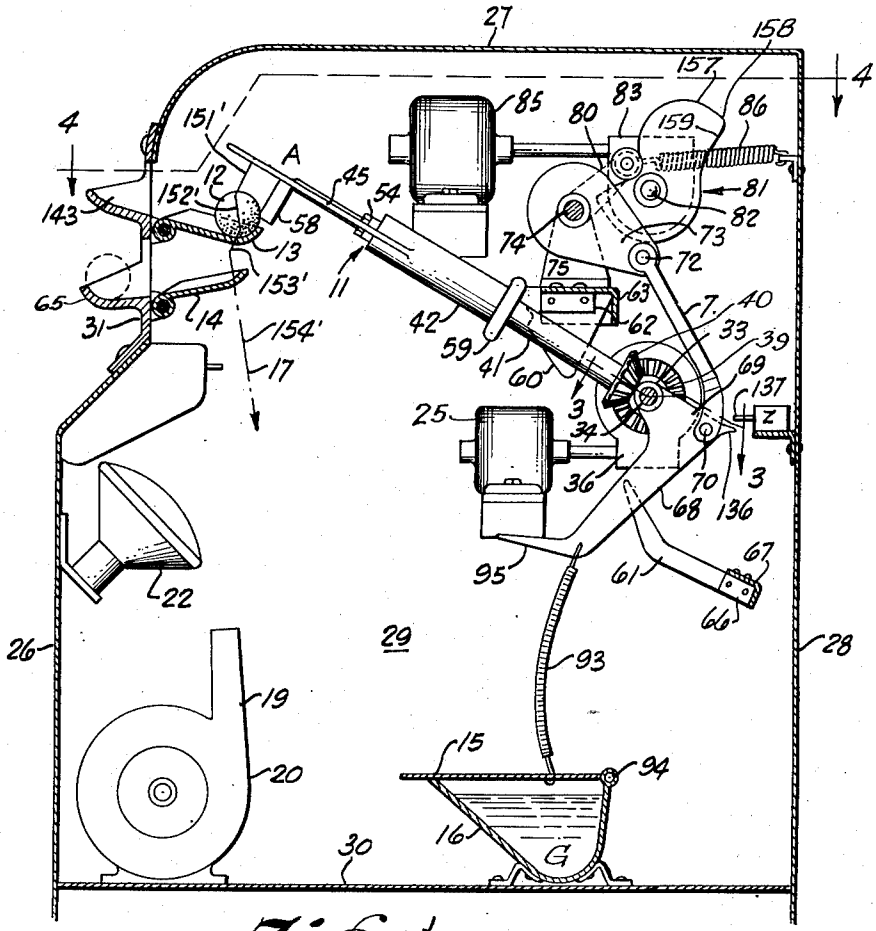


Fig. 1

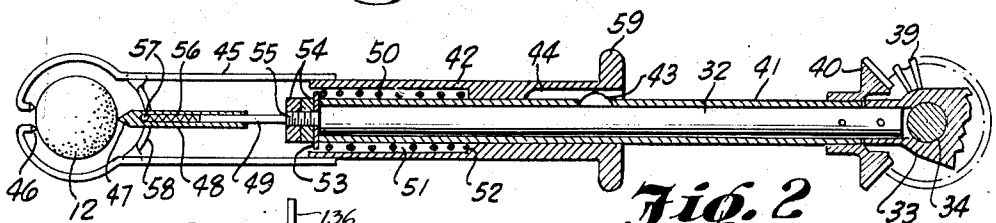


Fig. 2

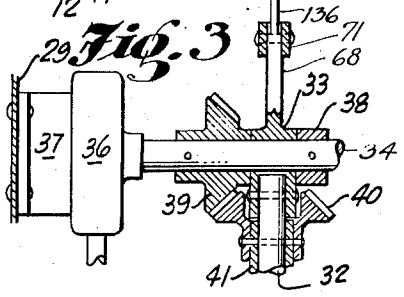


Fig. 3

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BALL PAINTING MACHINE

Filed June 15, 1948 4 Sheets-Sheet 2

Fig. 5

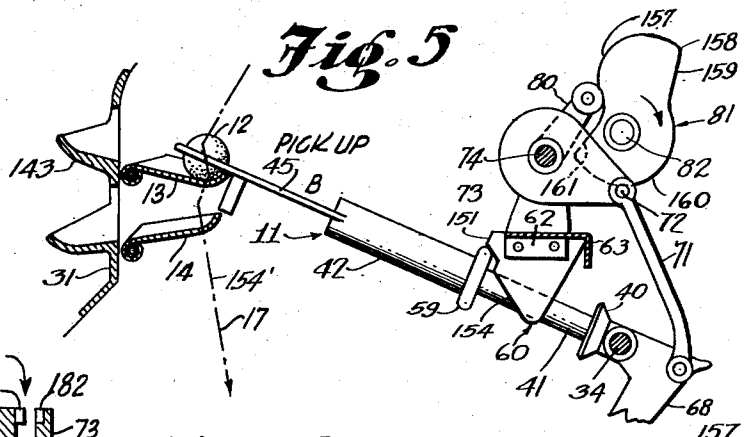


Fig. 8

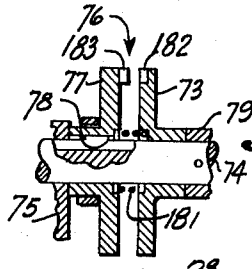


Fig. 6

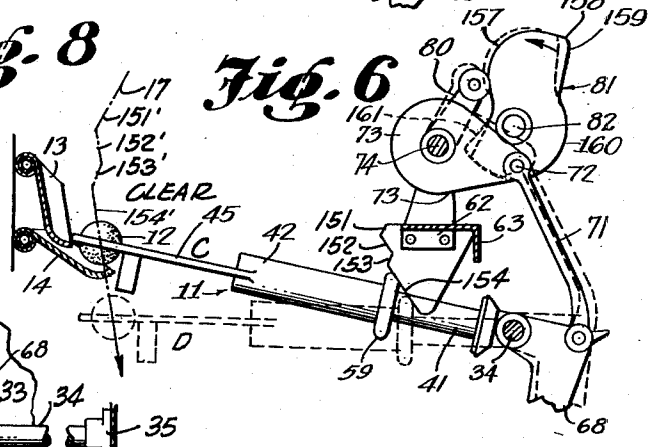
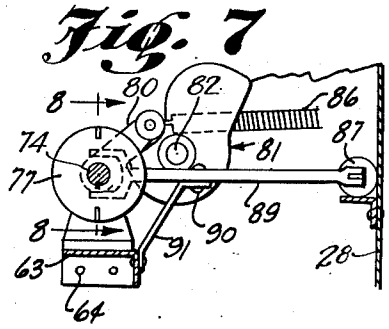


Fig. 7



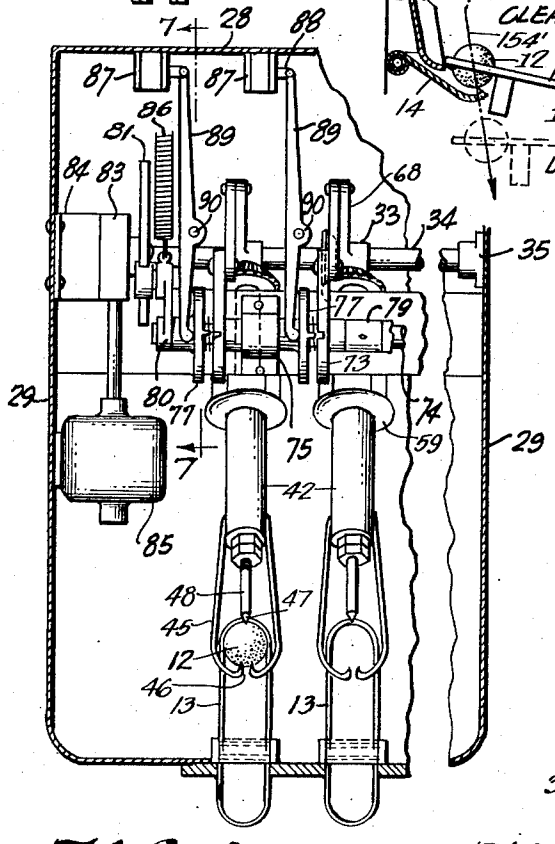


Fig. 4

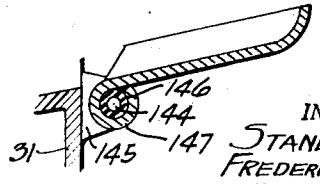


Fig. 9

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BALL PAINTING MACHINE

Filed June 15, 1948 4 Sheets-Sheet 3

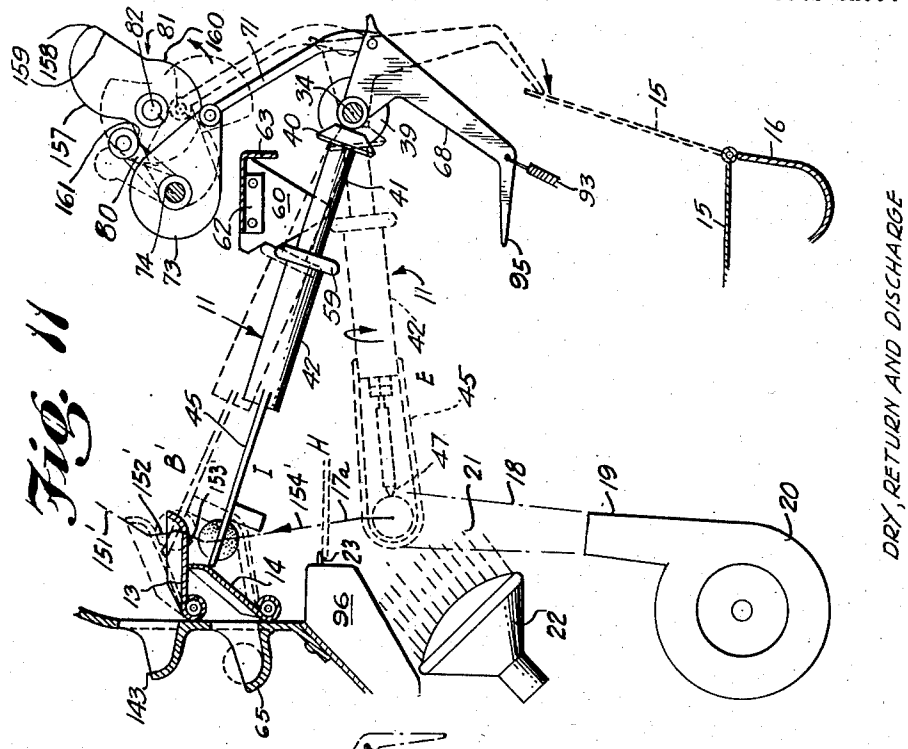


Fig. 11

DRY, RETURN AND DISCHARGE

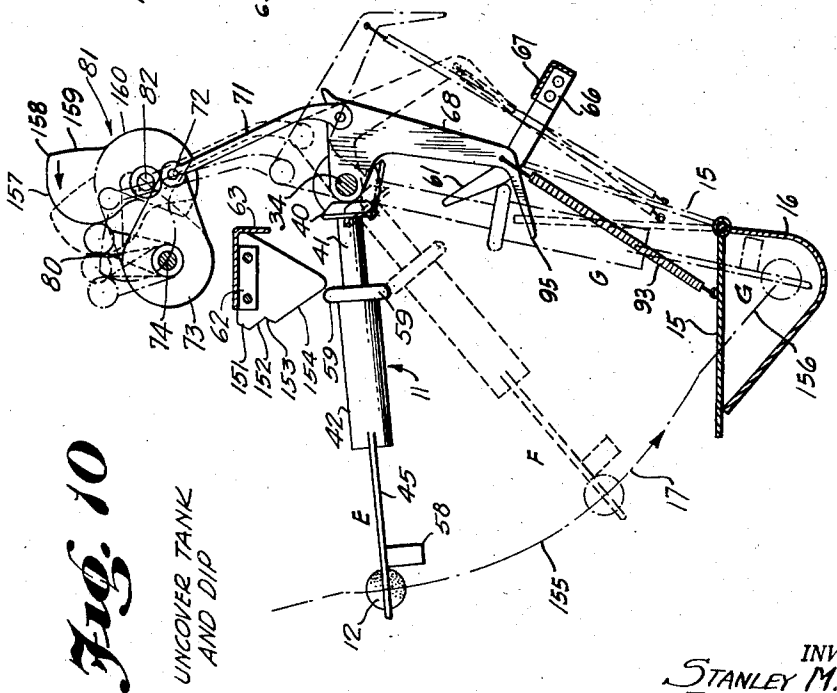


Fig. 10

UNCOVER TANK AND DIP

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BALL PAINTING MACHINE

Filed June 15, 1948 4 Sheets-Sheet 4

Fig. 12

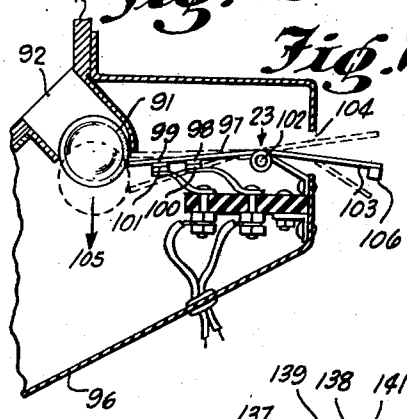


Fig. 14

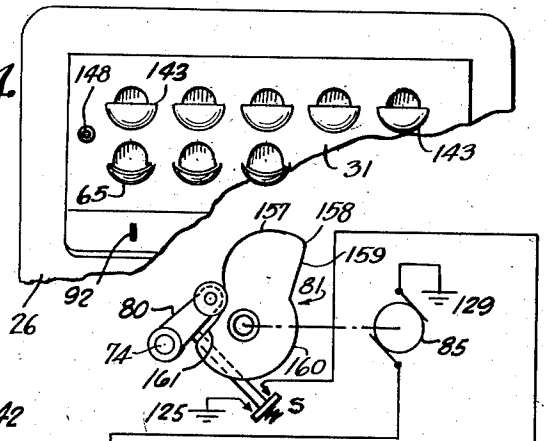


Fig. 15

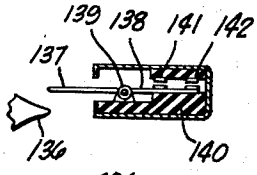
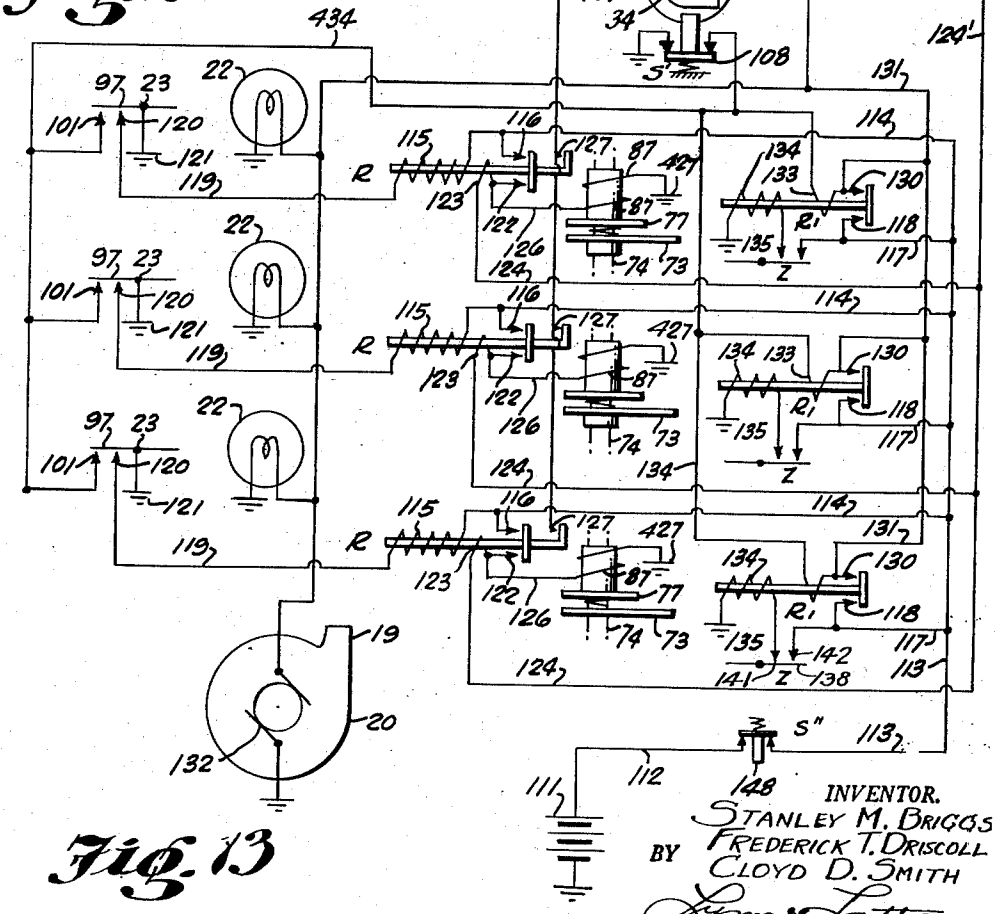


Fig. 13



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Patented Oct. 2, 1951

2,569,705

UNITED STATES PATENT OFFICE

2,569,705

BALL PAINTING MACHINE

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Application June 15, 1948, Serial No. 33,104

8 Claims. (Cl. 91—46)

1

This invention relates to ball painting machines. While the invention may be used for painting balls of various types, it is particularly adapted for the repainting of golf balls. Also, the invention is particularly adapted for embodiment in a coin-controlled machine that can be used by a golfer at a golf course.

A primary object of our invention is to provide a coin controlled ball painting machine adapted to operate simultaneously upon one or several balls. Another object is to provide a coin controlled ball painting machine embodying a plurality of ball painting units each selectively operative in response to the insertion of a coin for that particular unit, but all operated by common actuating mechanism.

A further object of the invention is to provide a ball painting machine embodying means for picking up a ball that has been inserted into the machine, carrying the ball to a paint tank and dipping it therein, and thence carrying the ball past drying mechanism to a discharge point and discharging it at the discharge point, in which the movement of the ball carrying mechanism is so timed as to provide a maximum period of exposure to the drying mechanism and a speeded up movement in other stages of the cycle of operation thereof.

Another object of the invention is to provide a ball painting machine having a paint tank that is covered to protect the paint therein against evaporation, in which the paint tank is uncovered for a minimum portion of the cycle of operation of the machine. Another object is to provide a ball painting machine having a paint tank providing a plurality of painting stations corresponding to a plurality of ball conveying units, together with sectional cover mechanism for the paint tank and automatic cover opening mechanism adapted to open a cover section only at the station at which the ball carrying mechanism has been rendered operative, leaving the remainder of the tank covered. A further object of the invention is to provide a ball painting machine embodying ball conveying mechanism which, in general, comprises one or more arms adapted to swing in a generally circumferential path about an axis of arcuate movement, together with means for modifying the swinging movement by radial movement during a portion of the arc of swing, whereby to provide for moving the ball into the paint tank along a path which permits the area of the open side of the tank to be maintained at a minimum, that is, at a smaller value than would be required if the movement were a purely circumferential one.

2

One feature of the invention, directed toward maximum efficiency of utilization of the movement of a swinging arm, is the arrangement for moving the arm, not in a complete circle, but in an arcuate swing through approximately a quarter of a circumference and a return in the opposite direction to the starting point. This has the advantage not only of providing for greater efficiency of utilization of the movement of the ball carrying means in subjecting the ball to the several operations of painting and drying, but also makes it possible to reduce the amount of equipment required and to concentrate the mechanism in a smaller space than is possible with a machine operating on the principle of movement through a full circular path.

A further object of the invention is to provide a ball painting machine having improved means for rotating the ball during the drying process so as to prevent the formation of a tear thereon, in which the rotation takes place while the ball carrying means is arrested at the drying station and in which the operation of the ball rotating means as well as the drying mechanism is automatically cut off by the movement of the ball carrying means away from the drying station.

A further object is to provide a multiple unit coin controlled ball painting machine having an individual drying unit for each painting station and having coin controlled means for energizing the drying units only at the stations that have been rendered operative by the insertion of a coin.

Other objects will become apparent in the ensuing specifications and appended drawings in which:

Fig. 1 is a transverse sectional view through a coin operating golf ball painting machine embodying our invention.

Fig. 2 is an axial sectional view of one of the ball conveying units;

Fig. 3 is a detail sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a horizontal sectional view through one end of the machine, taken on the line 4—4 of Fig. 1;

Fig. 5 is a fractional transverse sectional view showing the ball carrying mechanism at the pick up position;

Fig. 6 is a fractional transverse sectional view showing the ball carrying mechanism as it clears the pick up and return chutes;

Fig. 7 is a detail sectional view taken on the line 7—7 of Fig. 4;

Fig. 8 is a detail sectional view taken on the line 8—8 of Fig. 7;

Fig. 9 is a detail sectional view of the return chute;

Fig. 10 is a fractional transverse sectional view illustrating the movement of the ball carrying machine from the point where the paint tank cover raising mechanism commences to function to the point where the cover is fully raised and the ball is immersed in the paint;

Fig. 11 is a fractional transverse sectional view illustrating (in dotted lines) the ball carrying mechanism arrested at the drying position and (in full lines) in the stage of bi-passing the chutes;

Fig. 12 is a detail sectional view of the coin operated switch mechanism;

Fig. 13 is a wiring diagram of the control mechanism;

Fig. 14 is a partial front view of the machine; and

Fig. 15 is a detail sectional view of the drying circuit starting switch.

General features and cycle of operation

As an example of one form in which the invention may be embodied, we have shown in the drawings a coin controlled golf ball painting machine in which one or more ball carrying units 11 are adapted to swing arcuately back and forth between a starting station indicated at A in Fig. 1, and a dipping station indicated at G in Fig. 10. A complete cycle of movement of the arm A includes a first half cycle in which the unit 11 moves downwardly from station A to station G and a return half cycle of movement in which the unit 11 moves upwardly from station G back to station A. In the initial half cycle of movement, the unit 11 successively arrives at a pick up station B (Fig. 5) in which it picks up a golf ball 12 resting in a ball support 13; stations C and D (Fig. 6) where it moves aside the ball support 13 and a return chute 14 and clears the chute 14 for further downward movement; a station E (Fig. 10) where the cover 15 of a paint tank 16 commences to rise; a station F, where the cover 15 is substantially fully raised; and the station G where the cover 15 has moved rearwardly out of the way of the unit 11 and the latter has dipped the ball 12 into the tank 16. The path of movement of the ball during this initial half cycle of operation is indicated by the broken arrows 17 in Figs. 1, 5, 6 and 10.

In the return half cycle of movement, the ball is carried from the dipping station G to the drying station E (Fig. 11) where the cover 15 is dropped back to the closed position. At the station E, also, unit 11 is rotated on its axis to rotate the ball 12 while a blast of air (indicated at 18) from a nozzle 19 of a blower 20, and infra-red rays (indicated at 21) from an infra-red lamp 22, are directed upon the ball 12. The unit 11 remains at station E for an extended period of time which will be referred to hereafter as the drying period. Subsequently, the unit 11 moves back to a cut-off station H where it trips a switch lever 23 to de-energize the blower 20 and drying lamp or lamps 22; and thence proceeds to a position, indicated at I in Fig. 11, in which it moves the return chute 14 upwardly out of the way and clears it to arrive at the discharge station which is indicated in broken lines at B' in Fig. 11. At the discharge station B', the unit 11 is in substantially the same position as at the pick-up station B. However, the ball support 13, instead of being below the ball as at the pick-up station, has been moved upwardly and remains above the ball so that the ball may drop into the return chute 14 as it is released by the unit 11.

The apparatus is housed in a suitable casing (Fig. 1) having a front wall 26, a top 27, a rear wall 28, side walls 29, a horizontal supporting platform 30, and a chute panel 31 inset into the front wall 26. The panel 31 is provided with receiving chutes 143, communicating with respective ball supports 13, and discharge chutes 65, which communicate with respective return chutes 14. Each of the ball supports 13 and return chutes 14 is yieldingly mounted for yielding pivotal movement on a pivot pin 144 (Fig. 9) which is suitably supported on the inner side of panel 31, as by means of a pair of ears 145 between which the ball support or return chute is confined. Any suitable yielding means for biasing the ball support or return chute, as the case may be, to the normal intermediate position thereof shown in full lines in Fig. 1 may be employed. Such means may, for example, comprise a sleeve 146 of soft rubber or equivalent elastic material, bonded to the pin 144 and to a loop 147 on the end of the ball support or return chute, in which loop the sleeve 146 is confined.

Ball carrying units

Each ball carrying unit 11 includes a shaft 32 one end of which is secured in a bracket 33 which is freely journalled on an arm supporting shaft 34. The shaft 34 extends from side to side of the machine, its ends being suitably journalled, as in a bearing 35 secured to one side wall 29 (Fig. 4) and in the casing of a gear reduction unit 36 (Figs. 1 and 3) which may be supported by means of a bracket 37 on the other side wall 29 and driven by an electric motor 25. Referring now to Figs. 2 and 3, each bracket 33 is axially confined between a collar 38 secured to the supporting shaft 34 and a bevel gear 39 likewise secured to the shaft 34. The bevel gear 39 transmits rotation to a bevel gear 40 which is secured to one end of a tubular shaft 41 that is rotatable on the shaft 32. A second, outer sleeve 42 (Fig. 2) is keyed (as by means of a key 43 received in a key way 44 in the sleeve 42) to the tubular shaft 41 so as to be axially shiftable on the sleeve 41 while receiving rotation therefrom. Secured to the outer end of the sleeve 42 are a pair of arms 45 each having at its outer end a pointed, ball engaging claw 46. A ball 12 is adapted to be clutched between the claws 46 and the point 47 of a tubular tail stock 48 which is rotatably mounted on a spindle 49 projecting from the free end of the shaft 32. The claws 46 are positioned to engage the ball 12 at spaced points on either side of the axis of the tail stock 48 so as to be able to transmit rotation to the ball from the sleeve 42. The tail stock 48 has a free rotating fit on the spindle 49 so that it may rotate with the ball.

The sleeve 42 is shiftable axially on the sleeve 41 in order to clutch and unclutch the ball 12 and in order to vary the radial distance of the ball 12 from the supporting shaft 34 during the various stages of movement of the unit 11. The limit of retraction of the sleeve 42 toward the shaft 34 may be determined by the engagement of the end of the key way 44 against the key 43, while the extent of movement of the sleeve 42 away from the shaft 34 is determined by cam mechanism which will later be described. The sleeve 42 is biased toward the shaft 34 by a coil

spring 50, disposed within a counterbore 51 in the sleeve 42, one end of the spring acting against a shoulder 52 defining the inner extremity of the counterbore 51 and the other end of the spring acting against a washer 53 which is secured against the end of the shaft 32 by a pair of nuts 54 threaded onto a reduced threaded extension 55 of the shaft 32. The spindle 49 may constitute an integral extension of the threaded portion 55. The tail stock 48 is retractable to accommodate the retraction of the sleeve 42, and is yieldingly biased outwardly by a very light coil spring 56 disposed within its tubular bore and engaged between the end of the spindle 49 and a ball thrust bearing 57 which in turn is engaged against the closed end of the tail stock 48.

Secured to the arms 45 is a short chute 58 which guides the ball into the return chute 14 in the discharge operation. The chute 58 is shaped and positioned to clear the ball support 13.

The inner end of the sleeve 42 is provided with a cam following collar 59, which engages one or more cams 60 during the progress of the unit 11 between stations A, B, and C and between stations G and E. The collar 59 engages one or more cams 61 during the movement of the unit 11 between stations F and G. The cams 60 are suitably supported in properly spaced relation so that the tubular shaft 41 may be received between them. For example, a cam 60 may be secured to a block 62 which in turn may be supported from a bar 63 extending between and secured, as at 64 (Fig. 7), to the side walls 29 of the casing. The cams 61, of blade shape, may in a similar manner be secured in spaced relationship to blocks 66 carried by a bar 67 similarly supported at its ends on the side walls 29.

Selective operating mechanism

Each mounting bracket 33 forms part of an L-shaped arm 68 which has an elbow portion 69 to which is linked, at 70, the forked end of a connecting rod 71. The other end of the connecting rod 71 is linked at 72, to the swinging end of an actuator arm 73. The actuator arm 73 is journalled on a rock shaft 74 which in turn is journalled in bearing brackets 75 supported upon the bar 63. Each arm 73 forms one member of a dog clutch 76 (Fig. 8) the other member of which comprises a disk 77 which has a hub that is keyed as at 78 to the shaft 74. Each pair of clutch members 73, 77 is confined in spaced relationship between members that are axially fixed. For example, one pair may be confined between a bearing 75 and a collar 79 secured to the shaft 74, while another pair may be confined between a bearing 75 and a transmitting arm 80 on one end of the shaft 74. Each pair of clutch members 73, 77 is yieldingly urged apart by a coil spring 181 interposed therebetween. The respective clutch members 73, 77 have a clutch recess 182 and a clutch tooth 183 respectively, the tooth 183 being adapted to mate with the recess 182 to establish a drive from the clutch member 77 to the actuator arm 73.

The shaft 74 is adapted to be rotated, first in one direction and then in the other direction, by movement transmitted to it through the arm 80 from a cam 81 which is secured on a short stub shaft 82 constituting the driven shaft of a reduction gear unit 83. As shown in Fig. 4, the reduction gear unit 83 may be supported on a side wall 29 by means of a bracket 84. The reduction gear 83 is driven by an electric motor 85. A coil spring 86, one end of which is attached to the swinging end of the transmitting arm 80 and the other end of which is attached to the rear wall 28 of the casing, is arranged under tension so as to exert a pull against the arm 80 yieldingly urging it toward a starting position which is shown in Fig. 1. The cam 81 as it rotates will first move the arm 80 counterclockwise, stretching the spring 86, and will subsequently permit the arm 80 to return in the clockwise direction to the starting position under the pull of the spring 86.

Selective operation of the units 11 is controlled through a series of solenoids 87 (Figs. 4 and 7), one for each of the units 11. Each solenoid 87, suitably mounted on the rear wall 28 of the casing, has an armature 88 which is connected to one end of a lock lever 89. Each lever 89 is fulcrumed at 90 upon a bracket 91 carried by the bar 63, (Fig. 7). The other end of each arm 89 is in the form of a fork which engages against the outer side of a corresponding clutch disk 77. Energization of a solenoid 87 will transmit movement through a corresponding lock lever 89 to the corresponding clutch disk 77 to move the latter into clutching engagement with its mating arm 73, whereby there will be transmitted to the corresponding ball carrying unit 11 a complete cycle of movement as hereinbefore generally described.

Selective energization of the solenoids 87 is controlled by the operation of coins 91 inserted in the series of coin slots 92 in the panel 31 and actuating coin switches 23 (Fig. 11) as will be described more fully in detail hereinafter.

At this point it may be noted that in each cycle of operation of the machine, the cam 81 will rotate through one complete revolution, transmitting a full cycle of movement to each of the ball carrying units 11 that has been rendered operative by the insertion of a coin in a coin slot corresponding to that arm, and that the arms that have not been thus rendered operative, will remain stationary at station A.

During the cycle of operation of a ball carrying unit 11, the paint tank 12 will be uncovered, in an area just sufficiently wide for the dipping operation, by the lifting of a cover section 15 lying immediately beneath the unit 11 that is operating. This is accomplished by rearward swinging movement of a corresponding arm 68, transmitted to the corresponding cover section 15 through a light coil spring 93, one end of which is linked to the end of the arm 68 and the other end of which is linked to the cover section 15. The cover sections 15 are hinged at 94. The spring 93 is linked to the cover section 15 at a point spaced forwardly of the hinge 94 but fairly close thereto so that the cover 15 will be raised quite rapidly when a pull is applied thereto by the spring 93. The raising of the cover commences when the unit 11 arrives at the station E, i. e. when the unit 11 has completed about a third of its downward half-cycle of movement. In this respect, the invention provides for maintaining the tank closed throughout a major portion of the cycle of operation of the machine, reducing the time period in which the paint is exposed to the drying effect of atmosphere, to a minimum. To this end, the arm 68 when the unit 11 is at station A, extends downwardly and forwardly of a line between the shaft 34 and the trough 16, and the spring 93 hangs with some slack therein, as shown in Fig. 1. The slack in the spring 93 is not taken up until the arm 68 has moved through dead center and passed to the rear thereof to the position shown in full lines in Fig. 10 (station E). At this point, the cover 15 com-

mences to rise and is rapidly raised to the upstanding position shown in dotted lines in Fig. 10, which it reaches as the arm 11 arrives at station F, about two thirds of the way through the first half cycle of movement. In arriving at this position, the cover section has cleared the path of downward movement of the unit 11, and as the unit 11 moves on to station G, the cover section moves rearwardly out of its way to the positions shown in broken lines corresponding to the broken lines showing of unit 11 at station G. In this position, the outer end of the cover section 15 has engaged the cams 61 and has been stopped thereby and the spring 93 becomes stretched as the arm 68 moves upwardly to its uppermost position shown in broken lines in Fig. 10.

At the end of arm 68 is a toe 95 which engages behind the cover section 15 as the arm 68 swings downwardly and forwardly on the return half cycle, and pushes the cover section toward the closed position as indicated in dotted lines in Fig. 11. Thus the cover section is closed at an earlier stage of operation than would occur if the spring 93 were utilized for closing.

Control mechanism

The control mechanism (Fig. 13) includes a series of the coin operated switches 23, one for each of the ball carrying units, a series of solenoids 87, a corresponding series of relays R for controlling the solenoids 87 and the main motor drive 85, and a plurality of relays R' for controlling the motor that powers the rotation of units 11. The control mechanism also includes a limit switch S for opening the main circuit and stopping the operation of the main drive motor 85 at the completion of a cycle of operation, a switch Z for initiating operation of the drying units 20 and 22, and rotation of units 11, a limit switch S' for terminating the operation of the drying units 20 and 22 and the rotation of unit 11 and a push button switch S'', biased to the closed position, for opening all circuits during the time that coins are being inserted in the coin slots 92.

The coin operated switches 23 function, first to initiate the operation of the machine, controlling energization of motor 85, and clutching of the actuating mechanisms of the ball carrying units (corresponding to switches 23 that are closed) to the shaft 74. A secondary function of the coin controlled switches 23 is to time the operation of the switch S' in terminating the drying operation.

As an illustrative embodiment of a switch arrangement capable of executing these functions, the switch 23 may comprise a switch lever 97 carrying contacts 98 and 99 adapted to engage yieldably mounted contacts 100 and 101 respectively. The switch lever 97 is pivoted at 102 to the switch casing (which may comprise an extension of the coin receptacle 96 as shown) and has a tail member 103 projecting through an opening 104 in the receptacle 96, the tail 103 being positioned in the path of movement of the outer extremity of the corresponding ball carrying arm 11. The end of switch arm 97 is disposed beneath the inner extremity of the coin chute 92, whereby a coin 91 travelling downwardly in the chute 92 will strike the end of switch lever 97 and move it downwardly from its normal position engaged against the extremity of the coin chute 92, (the upper dotted line position of Fig. 12, in which the switch is open) to the full line position of Fig. 12 in which the switch lever is arrested by engagement of the contacts 98, 99 with contacts 100, 101. In this position, the coin 91 will be arrested by its engagement between the ends of the switch lever 97 and the opposite extremity of the discharge end of chute 92. This closing of the switch will function to energize a corresponding relay R and to thereby initiate operation of the machine as will be described more fully hereinafter.

As the ball carrying unit 11 brushes past the tail 103 on its downward trip, the lever 97 will be raised back to the normal position, but will continue to hold the coin 91 arrested. Upon contact of the lever 97 against the coin chute, the tail 103, which is sufficiently resilient for the purpose, will yield downwardly to permit the unit 11 to clear it.

As the unit 11 brushes past the tail 103 on its return trip upward, the switch lever 97 will be moved downwardly beyond its full line position to approximately the lower dotted line position shown in Fig. 12 (the resilient mountings of contacts 100 and 101 yielding downwardly) and the pass between the end of the switch lever and the opposed extremity of the coin chute will be thus widened sufficiently to allow the coin 91 to drop into the receptacle 96 as indicated by arrow 105. With the weight of the coin removed from it, the lever 97 will move upwardly to its normal, switch opening position, as the result of the biasing action of, for example, a weight 106 on the tail 103. This opening of switch 23 functions to condition the main circuit and drying circuit for opening by the limit switch S'.

The limit switch S is spring biased toward closed position and is opened by the arm 80 (or a part associated and moving therewith) when it is in the starting position shown in full lines in Fig. 10. The function of the switch S is to deenergize the entire electric system when a cycle of operation has been completed.

The switch S' has as its function to stop the rotation of the ball carrying unit 11 when the arms 45 are horizontally opposed and the chute 58 is extending downwardly. To this end, a cam 107 secured on the shaft 34 is positioned to engage the stem of a movable switch element 108 of switch S' and depress the same to open the switch at exactly the right point in the rotation of the shaft 34 to accomplish this function. The switch S' is spring urged to the closed position as indicated.

The switch S' and the contacts 99, 101 of switches 23 are arranged in parallel, both grounding the circuits that energize the drying apparatus and rotating motor. To deenergize this part of the system, the switches 23 and S' are opened successively, the opening of a switch 23 determining the general position of units 11 (just subsequent to leaving the drying station H) where deenergization takes place and the opening of switch S' immediately following to terminate the circuit at the exact proper point to leave the ball carrying units 11 properly oriented as above stated.

Proceeding now with a detailed description of the circuit, power is brought from an electric power source which is indicated at 111, through a conductor 112 and switch S'' to a conductor 113, from which branch power leads 114 and 117 carry the live side of the circuit up to the initial energizing coil 118 of relays R' and up to switches Z, respectively.

The main starting relays R have their initial energizing coils 115 connected through conductors 119 to contact 120 of coin operated switches 23. The switch levers 97 of coin switches 23 are grounded at 121, whereby closing of a coin switch

23 will establish a circuit to energize a corresponding main starting relay R. Switch contacts 122 of main starting relays R are connected to holding coils 123 of relays R, which holding coils are grounded through conductors 124, trunk conductor 124', and limit switch S to ground at 125. Contacts 122 are also connected, through conductors 126, to solenoids 87, each of which is grounded at 427. It will now be apparent that upon initial energization of a main relay R as the result of the closing of a coin operated switch 23, a holding coil circuit will be established which maintains the corresponding relay R closed through a subsequent opening of coin operated switch 23, and establishes a circuit to energize the corresponding solenoid 87, whereby to establish a clutching connection between shaft 74 and a corresponding actuating arm 73.

Each relay R has a third contact 127 which, when any one of these relays is energized, establishes a circuit through a conductor 128 to bring current to the main drive motor 85 which is grounded at 129. Thus the closing of a relay R will simultaneously establish a drive from shaft 74 to a corresponding actuator arm 73 and energize the motor 85 to rotate the cam 81 and thereby move shaft 74.

The cycle of operation thus initiated will continue until the arm 80 returns to its starting position and opens limit switch S.

Each secondary relay R' has a contact 130 which is connected to a conductor 131 for carrying current to the infra-red lamps 22 and to the motor 132 of blower 20. To each contact 130 there is also connected one side of a holding coil 133, the other side of which is connected through a conductor 434 to the several contacts 101 of coin switches 23. A relay R' is initially energized by closing of its corresponding control switch Z which establishes a circuit from current lead 117 through its energizing coil 134 to ground at 135.

Each switch Z is operated by a projecting finger 136 at the elbow 69 of a corresponding actuator arm 68. The closing of a switch G occurs during the return cycle of a ball carrying unit 11, the finger 136 moving the lever 137 of switch Z downwardly to close the switch. Upward movement of the lever 137 by the finger 136 does not close the switch. It may be absorbed by upward flexing of the lever 137, which may be sufficiently flexible for that purpose.

As shown in Fig. 15, the switch Z may embody a switch arm 138 pivoted at 139 on a suitable insulating base 140, for upward movement to establish a bridging connection between contacts 141 and 142. It is normally biased toward open position, either by spring pressure or by the weight of the lever 138.

Operation

A golf ball to be repainted is inserted in a receiving chute 143 of any selected ball carrying unit. From the receiving chute 143, the ball rolls into a ball support 13.

Having placed balls in one, several, or all of the receiving chutes 143, the operator, following instructions which may be posted upon the machine, manually depresses the push button 148 of master switch S'' rendering all circuits of the machine inoperative while he places coins 91 in the coin chutes 92 below the ball receiving chutes 143 in which he has placed the balls to be painted. Each of the coins thus deposited in chutes 92 will close respective coin switches 23, and when the master switch S'' is released to the closed

position, current will be carried through conductors 112, 113 and 114 to energizing coils 115 of primary relays R, the circuits being completed through coin switches 23 to ground at 121. The relays R thus energized will establish connections from lead wires 114 and contacts 116 to contacts 122 and 127 thus energizing corresponding solenoids 87 through conductors 126 and the main drive motor 85 through conductor 128. Each solenoid 87 this is energized will establish a drive connection from shaft 74 through clutch member 77 to actuator arm 73 so that movement of shaft 74 will be transmitted through connecting rods 71 to actuator arms 68 and thus to ball carrying units 11 and tank cover sections 15. Simultaneously, energization of main drive motor 85 will commence rotation of cam 81, thereby moving follower arm 80 counterclockwise as viewed in the drawings. After a slight movement of follower arm 80, limit switch S will close, thus completing the circuits to holding coils 123 of primary relays R. As the ball carrying units that have been rendered operative move downwardly, they will trip the corresponding coin switches 23, temporarily opening them without, however, releasing coins 91. Switches 23 will consequently be reclosed by the respective coins when units 11 have passed by. A momentary de-energizing of coils 115 of primary relays R resulting from this tripping of switches 23 will not affect the circuits established through primary relays R for the reason that by this time the holding coils 123 will be energized by the closing of limit switch S, thus maintaining the relays R closed.

The movement of ball carrying units 11 in the first half cycle of operation will be controlled by cam members 60. Each of these cam members embodies a first dwell portion 151 which provides for a circumferential movement of units 11 (with no radial movement) along that portion of path 17 which is indicated at 151'. In this portion of the path claws 46 are held clear of a ball 12 as they approach the ball. The next section of each cam 60 is an inwardly inclined section 152 which provides for drawing the claws radially inwardly as they are moved downwardly with their plane approaching the center of the ball. This inwardly inclined portion of path 17 is indicated at 152'. As they reach the center of the ball, they will engage the ball and press it inwardly against the point 47 of tail stock 48. Simultaneously, the arms 45 will engage the ball support 13 and commence to press it downwardly. The radially inward movement of claws 46 will continue as the support 13 is moved downwardly, until the ball is firmly grasped between claws 46 and point 47. There will follow a short section of circumferential movement indicated at 153', as follower flange 59 moves against dwell portion 153 of cam 60. Following the path 153', the path 17 includes an extended stretch of downward and inwardly inclined movement 154', as follower 59 travels against inclined portion 154 of cam 60. At the lower limit of this inclined portion of thepath, key member 43 of the ball carrying unit 11 will engage against the end of key-way 44, preventing further inward movement of sleeve 42, whereupon there will follow a circumferential section of the path of movement, which is indicated at 155 in Fig. 10. The final stretch of downward movement is one in which the sleeve 42 moves outwardly from the axis of shaft 34, as indicated at 156 in Fig. 10. This portion or the path of movement provides for moving the ball

into tank 16 in a downwardly direction instead of a purely circumferential one, whereby the width of the open top of the tank may be considerably less than would be required to receive the ball moving in a circumferential path. This section of movement is provided for by the riding of follower flange 59 against cam 61.

Instead of moving the unit 11 at a constant rate, the invention provides for a more rapid rate of travel in the downward movement than in the return movement. Movement past the ball support 13 is relatively slow in order to facilitate pick up of the ball. Thereafter, a somewhat accelerated rate is provided for by the initial rising portion 157 of cam 81. This rate may be maintained until the unit 11 reaches its lower limit of movement, determined by high point 158 of the cam. Immediately preceding the high point 158, the rate of rise of cam portion 157 may be reduced so as to slow down the movement of the ball as it enters the tank 16. Following the high point 158, a falling portion 159 of the cam provides for a fairly rapid movement of the ball from station G back to the drying station E, where the follower 80 meets a dwell portion 160 of cam 81. Dwell portion 160 provides for maintaining the unit 11 arrested at the drying station E for approximately a full half of the entire movement of the cam 81. Thus the time period when the unit 11 is arrested at the drying station may be equal to the time utilized for all of the movements of the unit 11 from station A to station G and back to station A.

Just prior to arrival at station E, fingers 136 will momentarily close the switch Z for each of the operative ball carrying units. Corresponding secondary relays R' will thus be closed by the momentary energizing of the main coils 134. As previously noted, the switches Z have remained open during the first half cycle of operation when fingers 136 brushed downwardly past their levers 137. Closing of relays R' establishes circuits through their holding coils 133, which circuits include conductor 434 and coin switches 23. Closing of relays R' also establishes circuits through conductor 131 to infra-red lamps 22 and blower 20, thus starting the drying operation, and to motor 25 which drives shaft 34, from which rotation is transmitted through bevel gears 39 and 40 to the respective shafts 32, rotating the ball carrying unit 11 to inhibit the formation of tears on the balls, i. e., to spread the paint evenly over the surfaces of the balls. The drying operation is completed at the drying station E, and in due time a falling section 161 of cam 46 will provide for return movement of follower 80 to its starting position, and will cause ball carrying units 11 to resume their upward return movement along section 154' of path 17. During this stage of movement, coin switches 23 will be tripped to dump coins 91 into receptacles 96, permitting switches 23 to open, thereby preparing relays R' for de-energization by removing grounds 121 from holding coils 123. Relays R' will however remain energized until units 11 have completed their rotation to the points where arms 45 are horizontally opposed and chutes 58 project downwardly, and at this point, cam 107 will open limit switch S' to deenergize holding coils 133 and thereby cause relay R' to open and terminate further rotation of units 11, simultaneously deenergizing infra-red lamps 22 and blower 20. It will now be apparent that opening of coin switches 23 determines the general timing of the drying mechanism cut-off (shortly after the ball carrying units 11 have left the drying stations E on the return trip). The position of ball supporting arm 11 at station H, where ball supporting arm 11 engages coin switches 23 to initiate cutoff of the drying apparatus, is shown in dotted lines in Fig. 11.

The units 11 will then follow the section 154' of return path 17a, moving radially outwardly and upwardly, engaging and lifting the return chutes 14 as shown in Fig. 11. This inclined approach to a return chute makes it possible to initially engage the chute nearer its free end than would be the case if the unit 11 were fully extended at the time of initial engagement. In the latter case, it would be necessary for the chute 14 to be longer. The circumferential portion 153' of the return path 17a provides for speeding up the clearing of chute 14 and permitting it to drop back to its normal position which is shown in dotted lines in Fig. 11.

When the units 11 reach station B', they will commence to follow the outwardly inclined section 152' of return path 17a, which provides for movement of the claws 46 radially outwardly to a point where compression in springs 56 is completely released so as to release the clutching pressure against the balls and permit them to drop away from the arm. In the meantime, the ball supports 13 have been raised by engagement of the claws 46 against their undersides, and the balls are therefore disposed beneath the ball supports 13 and above the return chutes 14. As the balls drop away from the claws 46, short guide chutes 58 will guide them to the return chutes 14. From chutes 14 the balls will roll into discharge chutes 65.

From the discharge station B', the units 11 will return upwardly to the starting station A, whereupon the follower arm 80 will open limit switch S to terminate the cycle of operation by deenergizing holding coils 123 of primary relays R so as to stop motor 85 and deenergize solenoids 87, permitting arms 73 to become unclutched from shaft 74. Thus the entire mechanism is reset for another cycle of operation initiated by dropping one or more coins into coin chutes 92.

During the last section 151' of the return movement, the ends of arms 45 clear the ball supports 14 and permit them to drop back to the normal position shown in Fig. 1.

The machine has the advantage of providing for selective operation of any member of ball painting units all operated in unison by common actuating mechanism, with independent control of the individual units through remotely controlled clutching mechanism.

We claim:

1. In a ball painting machine, a plurality of ball carrying units each comprising a supporting shaft and a sleeve rotatably mounted thereon, means carried by said shaft and sleeve respectively for clutching a ball to be painted, an axially slidably but nonrotatable connection between said sleeve and shaft, a common shaft on which said supporting shafts are mounted for arcuate swinging movement between raised starting positions and lowered dipping positions, a paint reservoir positioned to receive the ball in said dipping position thereof; means for rotating said common shaft, means including said supporting shaft for transmitting rotation from said common shaft to the several sleeves, thereby to rotate the balls carried by said units, to prevent the formation of paint tears thereon, and means for transmitting to selected supporting shafts, swinging movement between said starting and dipping positions.

2. In a ball painting machine, a ball carrying unit comprising a nonrotating shaft and a tubular shaft rotatably mounted thereon, a ball clutching unit having a slidable drive connection with said tubular shaft, said ball clutching unit and non-rotating shaft including coacting ball clutching claws for engaging opposite sides of a ball, means for relatively moving said ball clutching means axially upon said tubular shaft in order to clutch and unclutch a ball, means for transmitting rotating movement to said tubular shaft for rotating said ball clutching means and the ball, and means for swinging said non-rotating shaft in order to move said ball carrying unit between a raised starting position and a lowered dipping position.

3. In a ball painting machine, a ball carrying unit including a nonrotating supporting shaft, a tubular shaft rotatably mounted thereon, claw mounting means carried by said tubular shaft and having an axially slidable driving connection therewith, said supporting shaft being provided with a ball engaging tail stock located on the axis thereof, a pair of spaced ball clutching claws carried by said mounting means in positions substantially diametrically opposed to said tail stock for engaging a ball against said tail stock, means for axially shifting said mounting means upon said tubular shaft so as to clutch and release a ball, and means for transmitting rotation to said tubular shaft whereby to rotate said mounting means and claws and thereby rotate the ball about the axis of said tail stock.

4. In a ball painting machine, a ball carrying unit including a supporting shaft, ball clutching means mounted on said shaft for sliding movement longitudinally of the shaft, means for swinging said shaft about an axis transverse to its own longitudinal axis from a raised starting position to a lowered dipping position and back to the starting position, and means for shifting said ball clutching means inwardly toward the axis of swinging movement as it approaches said dipping position, whereby the dipping movement will be a movement at an angle to a circumferential direction.

5. In a ball painting machine, ball clutching means, means on which said ball clutching means is supported for swinging movement about a generally horizontal axis from a raised starting position to a lowered dipping position and return, said ball clutching means including means providing for radial movement of the ball clutching means with reference to the axis of swinging movement, and means for projecting the ball clutching means radially away from said axis of swinging movement as it approaches the dipping position, thereby to produce a dipping movement that is at an angle to a circumferential direction.

6. In a ball painting machine, a casing having an inlet and an outlet, a ball support communicating with said inlet, a ball return chute communicating with said outlet and disposed below said support, said chute and support being each mounted for vertical yielding movement on either side of normal neutral positions in which they are inclined downwardly and inwardly from said inlet and downwardly and outwardly to said outlet respectively, a ball carrying unit, means on said unit to grasp a ball, means for moving said unit downwardly past said support and return chute in a path in which said grasping means will successively reach positions to grasp a ball carried by said support, to then deflect said support and return chute downwardly until they are cleared by said unit, and then moving said unit upwardly past said return chute and support in a path in which said chute is deflected upwardly until it clears the unit and drops back to its neutral position so as to dispose the ball between said chute and support, and means to cause said grasping means to grasp a ball carried by said support as the unit moves downwardly past the support, and to release the ball when the ball is disposed between the chute and support during the return movement of the unit.

7. In a ball painting machine, a supporting shaft; ball clutching means carried by said shaft and including ball engaging claws spaced from each other longitudinally of said shaft; a ball support, a ball outlet, painting means and drying means; means to swing said supporting shaft arcuately about an axis transverse to its own axis, from a position registering with said support, to said painting means, then to said drying means and then to said outlet, and to effect pick-up of the ball at said support and discharge of the ball at said outlet, said last mentioned means including means for effecting movement of at least one of said ball engaging claws relatively longitudinally of said shaft toward another ball engaging claw for grasping the ball and away from said other claw for releasing the ball.

8. A ball painting machine as defined in claim 7, wherein the last mentioned means includes means for arresting the movement of the supporting shaft opposite the drying means, said machine further including means for effecting rotation of at least one of said ball engaging claws while the supporting shaft is thus arrested whereby to rotate the ball.

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