May 10, 1966 J. C. SECORD 3,249,957

APPARATUS FOR CLEANING AND/OR POLISHING A BOWLING BALL OR THE LIKE

Filed Jan. 9, 1963 4 Sheets-Sheet 1

FIG. 1

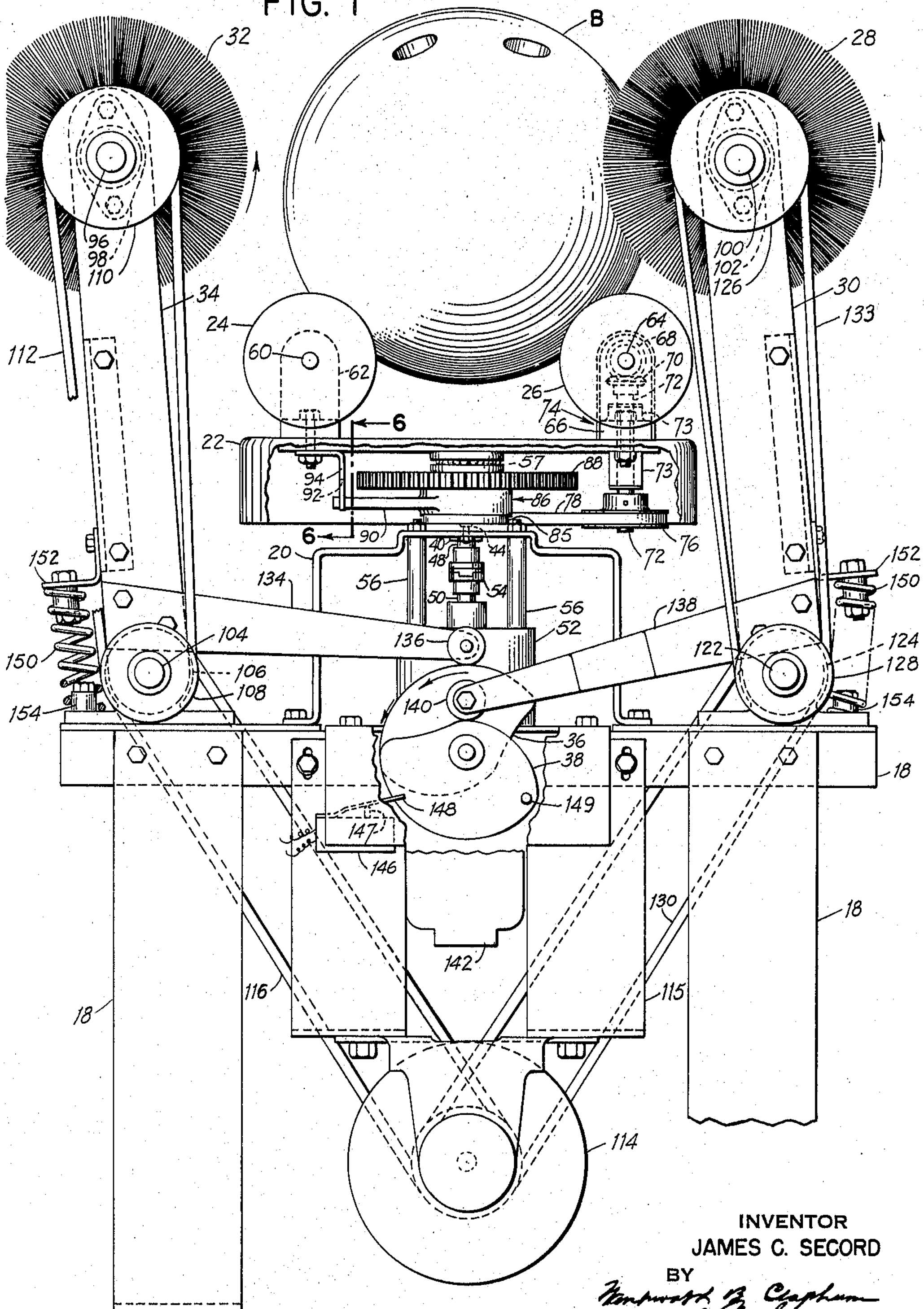

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FIG. 2

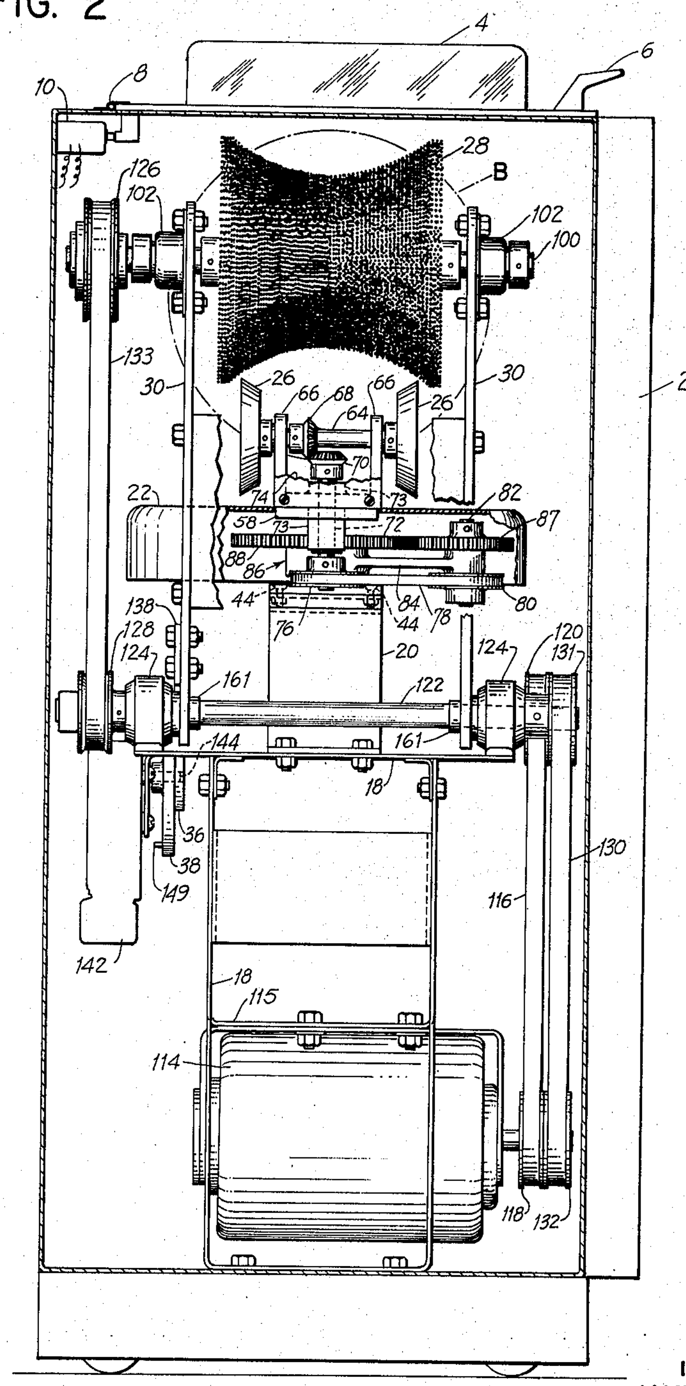

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FIG. 3

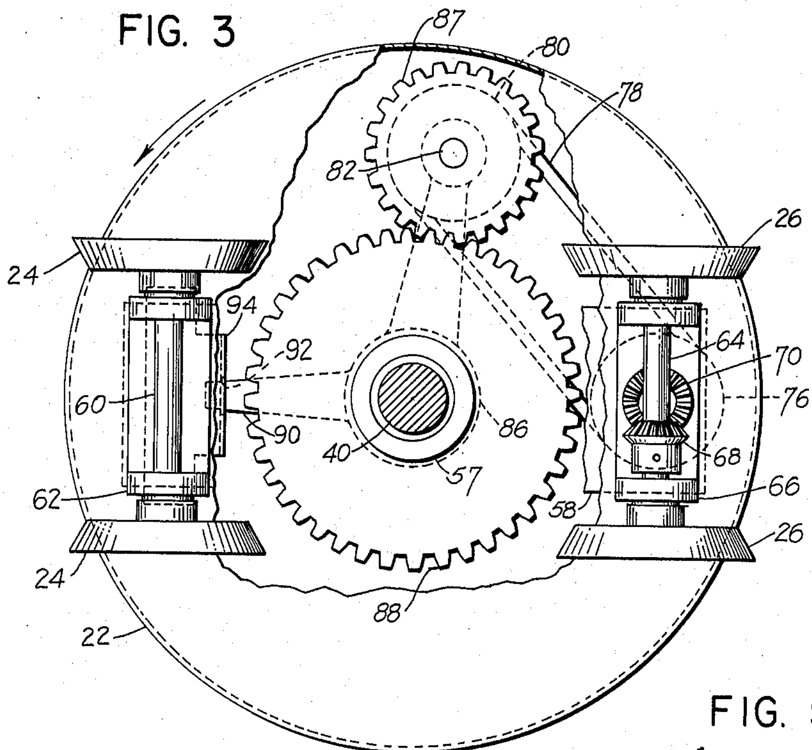

FIG. 5

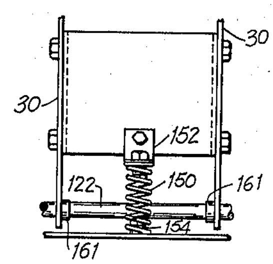

FIG. 4

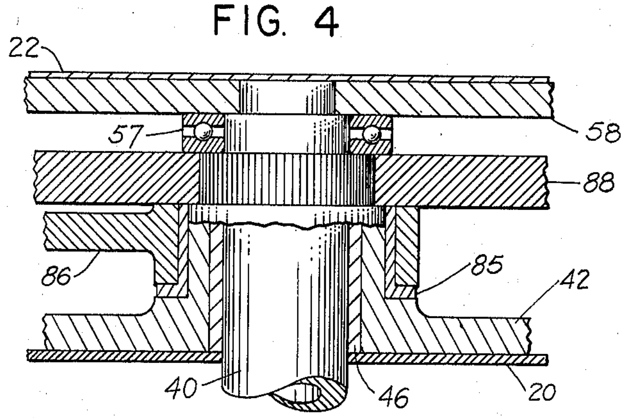

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FIG. 6

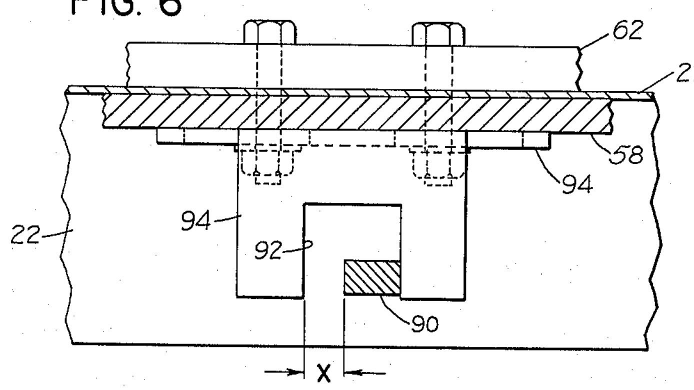


FIG. 7

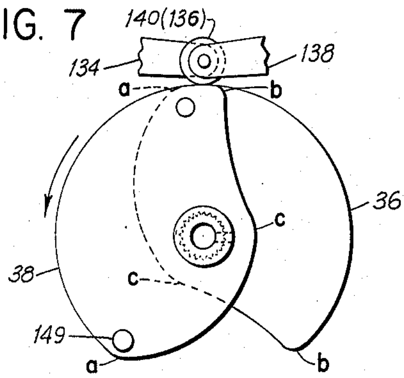


FIG. 8

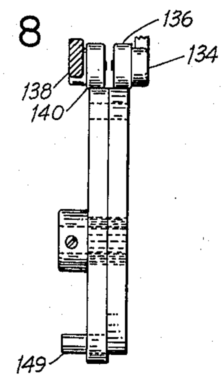
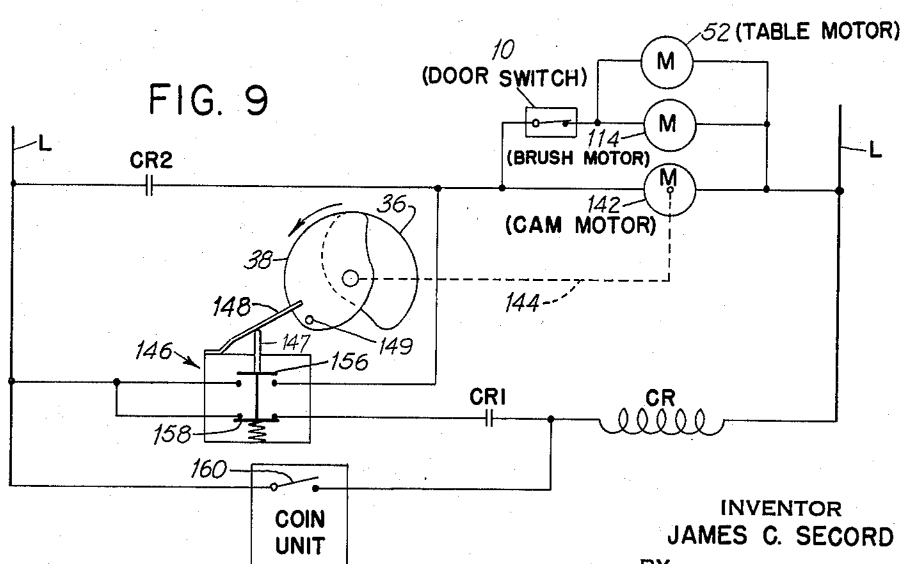


FIG. 9



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3,249,957

APPARATUS FOR CLEANING AND/OR POLISHING A BOWLING BALL OR THE LIKE

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11 Claims. (Cl. 15—21)

This invention relates to improved apparatus for cleaning and/or polishing a bowling ball or the like. In the cleaning and polishing of a bowling ball it is a principal object to effect thorough and uniform surface treatment. To this end various types of apparatus have been devised wherein a progressive shifting of the position of the ball relative to a travelling brush or the like is intended to result in coverage of the entire surface.

It is the principal object of the invention to provide a machine which will very rapidly, thoroughly, uniformly and safely effect the desired surface treatment on a bowling ball, and which is smoothly operating and simple in construction.

In accordance with the invention the ball is continuously revolved about a pair of crossed axes as it is being acted upon by the cleaning and polishing devices. Because of this continuous change in position, as distinguished from periodic shifting of position, the treatment of the ball surface necessarily is very uniform. Specifically, the principal parts of the subject apparatus are a travelling, ball-engaging brush assembly and a ball supporting assembly. This ball supporting assembly comprises a turret-like table which revolves continuously about a central vertical axis and which carries means for imparting to a ball supported thereon a continuous rotational movement about another axis. Because of the nature of the particular nature of this arrangement for supporting and spinning the ball, it can be caused to travel at a desirably high peripheral speed relative to the cleaning and polishing means. Furthermore, this invention is in the form of a highly feasible product from a commercial manufacturing standpoint. Also, the ball is handled and motions imparted to it in a manner which minimizes the possibilities of scratching thereof or other damage.

Further objects, details and advantages will become apparent from the following description, read in conjunction with the accompanying drawings in which:

FIGURE 1 is a front view of the operating mechanism of the ball polishing and cleaning machine with the cabinet removed, constructed in accordance with the invention,

FIGURE 2 is a vertical cross-section of the machine, providing a side view of the operating mechanism shown in FIGURE 1,

FIGURE 3 is a plan view of the rotary table unit, with parts thereof broken away to show the planetary gear unit,

FIGURE 4 is an axial section through the central table spindle, bearing and epicyclic gearing assembly,

FIGURE 5 is a side view illustrating the spring arrangement acting on each brush assembly,

FIGURE 6 is a view taken as indicated by lines **6—6** in FIGURE 1,

FIGURES 7 and 8 are face and edge views respectively, of the cams for controlling positioning of the brushes, and

FIGURE 9 is a schematic wiring diagram of controls for this machine.

As shown in FIGURE 2, the machine selected for illustration of the embodiment of the invention has an outer cabinet 2 which shields the machine parts and protects them from unauthorized tampering while also presenting an attractive appearance. On the top of the

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cabinet there is a lid or door **4** through which a bowling ball is put into and removed from the machine, the door **4** preferably being of a transparent material such as plastic to permit a person to view the cleaning and polishing operation. Door **4** has a handle **6** and is mounted by a piano type of hinge **8**. A switch **10** (FIGURE 9) the operation of which will be described hereafter, is mounted for actuation by the opening and closing movements of the door **4**.

The operating machine parts are supported on a structure comprising a main frame **18**. An upper frame section **20** provides a platform for mounting of the ball supporting turret or table **22** which is rotatable about a vertical axis in a counterclockwise direction (FIGURE 3). On the table **22** a ball rest is comprised of a plurality of rollers or wheels which are tapered inwardly (see FIGURE 2) so that they securely cradle a spherical bowling ball designated B. Of these rollers, the two rollers indicated at **24** are idlers and the two rollers indicated at **26** are driven about their common axis by means described hereafter. (In an optional assembly, three triangularly arranged rollers may be used instead of four rollers.) By virtue of the rotation of rollers **26** simultaneously with rotation of table **22**, a ball B which is supported on the table **22** is constantly being moved in a pattern which is the resultant of spinning about a horizontal axis which in turn sweeps, about a vertical central axis, through a horizontal plane. While the ball is being continuously handled in such manner, in a single cleaning and polishing cycle of operation it is rubbed first by a wire brush **28** which is mounted on arms **30** and then rubbed by a soft polishing or buffing brush **32** which is mounted on arms **34**. This bringing of the brushes **28** and **32** alternately into engagement with the ball B is effected by means of cams **36** and **38** for moving the arms **30** and **34**, respectively, inwardly and outwardly relative to the spinning ball B. The above represents only a brief, introductory description of the operation of this machine and will be followed by a more detailed description.

A hub or spindle **40** is rotatably journalled in a collar **42** which is affixed to the frame member **20** by bolts **44** and has an Oilite bearing insert **46** therein. Spindle **40** has a reduced lower end **48** which is connected to the output shaft **50** of an electric motor **52** by means of a coupling **54**. Motor **52** is suspended from frame member **20** by rod and bolt means **56**. The upper end of spindle **40** is press-fitted or otherwise secured in a plate **58** which constitutes a rigid understructure for table **22**. A thrust bearing **57** supports the table **22** on the upper end of collar **42**.

On table **22** the rollers **24** are carried by a shaft **60** which is freely mounted for rotation in bearings provided by the spaced upstanding arms of a bracket **62** secured to the table. Rollers **26** are keyed to a shaft **64** which is rotatably journalled in the vertical arms of a bracket **66** secured to the table **22**. A bevel gear **68** affixed on shaft **64** meshes with a similar bevel gear **70** affixed to a vertical shaft **72** that is rotatable in bearing portions **73** provided by the bracket **66**. The gears **68** and **70** are shielded by a cover **74** secured to the bracket **66**. The lower end of shaft **72** carries a pulley **76**, and a V-belt **78** is trained between pulley **76** and a pulley **80** which is carried by a spindle **82** rotatable in an arm **84** of a two-armed member **86**. Member **86** contains a bearing insert **85** which rides on collar **42**, with the member **86** being freely rotatable about the bearing provided by the upstanding hub thereof. A sun gear **88** is pressed on to the upper end of the hub provided by collar **42** and is thereby fixed against rotation. Gear **88**, however, meshes with a planet gear **87** that is fixed on vertical spindle **82**, and therefore if arm **84** is carried about the axis of central spindle **40** this will result in a driving of pulley **76** through pulley **80** and, consequently, a rotation of wheels **26** through gearing **68, 70**. This desired rotation of the arm **84** about the axis of central spindle **40** is effected by the connection of an arm **90** of member **86** with the table **22**, whereby rotation of table **22** carries with it the number **86**. The connection between arm **90** and table **22** comprises a bracket **94** extending downwardly from plate **58** and having a wide slot **92** in which the end of arm **90** is received with substantial lateral clearance. This clearance x, which represents the difference between the widths of slot **92** and arm **90**, is evident from FIGURE 6 and its significance will be more fully explained hereafter.

The brush **32** is affixed to a shaft **96** which is journalled in bearings **98** on the spaced arms **34** and, similarly, brush **28** is affixed to a shaft **100** journalled in bearings **102** on the spaced arms **30**. Arms **34** are affixed to Oilite bearings, by means of which the arms are pivotally journalled on a shaft **104**. Shaft **104** is mounted in pedestal bearings **106** on the frame **18**, and motion is transmitted from a pulley **108** on shaft **104** to a pulley **110** on shaft **96** by a V-belt **112**. Shaft **104**, in turn, is driven by an electric motor **114**, carried by supporting framework **115**, through means of a belt **116** trained between the motor drive pulley **118** and a pulley **120** on the rearward end of shaft **104**. Arms **30** also are affixed to Oilite bearings, by means of which the arms are pivotally journalled on a shaft **122**. Shaft **122** is rotatably journalled in pedestal bearings **124**, and motion is transmitted from a pulley **128** on shaft **122** to a pulley **126** on shaft **100** by a V-belt **130**. The shaft **122** is driven by motor **114** through means of a belt **130** trained between a motor drive pulley **132** and a pulley **131** on the rearward end of shaft **122**. Though in the illustrated case the brushes **28** and **32** rotate counterclockwise, they may be rotated in the opposite direction.

The connection of arm **34** to cam **36** to effect movement of the polishing brush **32** toward and away from the ball B is effected through an arm **134** rigidly connected to arm **34** and having a follower **136** adapted to ride on the cam **36**. The corresponding connection of arm **30** to cam **38** is effected through an arm **138** having a follower **140** adapted to ride on cam **38**. Referring to FIGURE 7 in particular, it may be seen that each of the cams **36** and **38** is characterized by a circular portion of uniform radius extending from a to b, and when either of the cam followers **136** and **140** is in one of these cam portions its associated brush **32** or **28**, respectively, will be in a fully withdrawn, outer position in which it will not touch bowling ball B. A further portion extending from b to c has a progressively decreasing radius which will cause lowering of a cam follower to bring its associated brush into a ball engaging position. As a cam follower rides from c back to a it will then be engaged and lifted by the cam to return its associated brush to an inactive outer position. Further, it will be noted that cams **36** and **38** are approximately out of phase so that when one follower is resting on a cam portion extending from b to c and its associated brush is in the active position wherein a ball is being scrubbed, the other cam follower will be riding upon the portion a to b to maintain its associated brush in a withdrawn, inactive position. As one cam follower rides from c to a to begin withdrawal of its associated brush to an inactive position the other cam follower will ride from b to c so as gradually to move its associated brush into an active scrubbing position. Finally, both cam followers **136** and **140** will arrive at a position, shown at the overlapping portion of these cams at the top of FIGURE 7, in which both of the brushes, **28** and **32**, will be in the inactive, withdrawn position. This is the point at which a cycle of cleaning by brush **28** and polishing by brush **32** begins and ends. Thus, in FIGURE 1 the apparatus is shown in a condition in which the cams **36** and **38** have rotated counterclockwise more than 60° from their starting position, and the follower **140** having been lowered to the point where the brush **28** rests by its own weight against the ball B and the follower **136** being fully raised to maintain the brush **32** completely out of contact with the ball.

The cams **36** and **38** are driven by a small motor unit **142** having an output shaft **144** on which these cams are fixed. The driving of this unit **142** is controlled by a circuit, shown in FIGURE 9, having a pushbutton-type switch **146**. The actuator **147** of the switch **146** is normally urged upwardly by a spring, thereby holding the contacts **156** open and the contacts **158** closed. A pin **149** extending from the face of cam **38** protrudes sufficiently to engage spring **148** in the course of counterclockwise rotation, thereby depressing the same, and operating switch **146** in the manner hereafter described.

Associated with each of the arms **30** and **34** is a coil spring **150** which is anchored at **154** and resiliently acts upwardly against a bracket **152** on the associated arm. By means of springs **150**, as the arms **30** and **34** withdraw to their inactive positions they are prevented from dropping backwardly by their own weight. It will be noted in this respect that as either of the brushes **28** and **32** is moved from its inactive to its active position its central axis moves past a position in which it is directly above either the axis at **104** or **122**, and its weight then begins to urge it toward the ball. After the brush contacts the ball the cam follower associated with this brush leaves its cam and the moment of force of the brush weight about the pivot of its associated arms becomes partially responsible for the scrubbing pressure exerted against the ball. Also, this action is resiliently supplemented by the action of one of the springs **150**. Automatic compensation is thereby afforded for changes in diameter of brushes caused by wear and for the usual differences in diameter among bowling balls.

The means for controlling the cycle of operation of the machine will be described with reference to FIGURE 9. For commercial purposes the operation of a bowling ball cleaning and polishing machine ordinarily is initiated only in response to and consideration for the deposit of money. In the circuit shown, operation of the machine is initiated by momentarily closing a switch **160**, and this switch is shown as being controlled by a conventional coin operated control unit shown in block diagram. However, it should be understood that the switch **160** can be an ordinary pushbutton switch operated independently of any means for receiving money as a precedent condition for operation.

The cams **36** and **38** are shown in FIGURE 9 in the position which they occupy at the beginning and end of each cycle of operation. Pin **149** has released the spring **148** allowing switch **156** to open and switch **158** to close. Thus, the rotation of pin **149** in a counterclockwise direction away from the position shown will not affect the switch spring **148** until just prior to completion of a revolution. Spring **148** will then be momentarily depressed by pin **149** until the cams rotate sufficiently for pin **149** to release the spring. Cam **38** and pin **149** will then have returned to their zero position. A relay has its coil indicated at CR and its two sets of normally open contacts indicated at CR1 and CR2. Thus the contacts CR1 and CR2 will be closed as long as coil CR is energized through either switch **158** and its holding contacts CR1 or through momentary closing of the switch **160** of the coin operated unit. It will be noted that the door switch **10** is in series with both the table motor **52** and the brush motor **114**, whereby these motors cannot be operated when the door is lifted open and its switch **10** thereby opened.

In the operation of the control circuit, upon the insertion in the machine of the required coin or coins the switch **160** is closed momentarily to energize relay coil CR, which in turn effects the closing of contacts CR1 and CR2. Immediately upon closing of contacts CR2 the cam motor **142** begins rotation of cams **36** and **38**.

The closing of CR1 contacts establishes a hold-in circuit for relay coil CR through normally closed switch **158**. Thus, the subsequent opening of coin operated switch **160** does not interrupt energization of relay coil CR. Relay coil CR will remain energized through the entire ball cleaning cycle until pin **149** approaches the completion of a revolution and contacts spring **148**. At this point, as spring **148** is depressed by pin **149**, switch **158** will be opened, de-energizing relay coil CR, and the normally open switch **156** will close to provide an alternate path to the ball cleaner motors as CR2 contact opens. The cam motor **142**, brush motor **114**, and table motor **52** will continue to operate through the now closed switch **156** until the pin **149** is rotated sufficiently to release spring **148**, at which point the cycle of operation has been completed.

During the rotation of cams **36** and **38**, each cam follower **136**, **140** will ride progressively on the portions *a*, *b* and *c* of these cams. By virtue of the contours of these cams, and their out of phase physical relation, the cleaning brush **28** will first be brought into contact with ball B for a brief period of time and then withdrawn to an active position as its associated follower **140** rides along portion *b–c–a* of cam **38**. Throughout most of this period the follower **136**, associated with polishing brush **32**, will ride along portion *a–b* of cam **36** and will be maintained thereby in its withdrawn, inactive position. As cleaning brush **28** begins to withdraw from operative contact with the ball B, polishing brush **32** will be brought into contact and withdraw from contact with ball B due to riding of cam follower **136** along the portion *b–c–a* of cam **36**.

During operation of brushes **28** and **32**, these brushes then being driven by motor **114**, the ball is being reoriented continually in relation to the brushes as it rests on table **22**. Table **22** rotates by virtue of direct connection to motor **52**, and as it does so it rotates member **86** (by virtue of the bracket **94** connecting arm **90** to the table), which causes planet gear **87** to revolve around fixed sun gear **88** and be rotated about its axis. The rotation of gear **87** is transmitted to rollers **26** through pulleys **76** and **80**, belt **78**, and gearing **68** and **70**. Therefore, as the ball rests on the table **22**, which spins on a vertical axis, it is rotated about an intersecting horizontal axis which is fixed in relation to the table but actually sweeps through a horizontal plane. Thus the ball is moved in such a way that thoroughness and uniformity of surface treatment is assured.

In a preferred embodiment of the invention, the table **22** rotates at approximately 55 revolutions per minute and the rollers **26** rotate at approximately 82.5 revolutions per minute. Assuming a maximum bowling ball diameter of approximately nine inches (actually less than nine inches according to regulations), the peripheral, tangential component of movement in a horizontal plane, attributable to rotation of the table **22** about a vertical axis, is approximately 130 feet per minute. The peripheral, tangential component of motion in a vertical axial plane and at right angles to the axis of spindle **64**, attributable to the rotation of rollers **26**, is approximately 65 feet per minute. The actual pattern of motion by which the surface of the ball is subjected to the cleaning and polishing brushes, of course, involves summation of vector components due to spinning of the ball on different axes.

When the ball is placed in and removed from the machine through the opened door **4**, it is desirable that the user of the machine can freely move the ball about on the rest provided by rollers **24** and **26**. For example, it may be desired to shift the ball to bring the finger holes into uppermost position to facilitate lifting of the ball. To this end, a declutching feature is incorporated, in that when the machine is at rest the driving rollers **26** (the rollers **24** being merely idlers) are not tightly coupled to their driving mechanism, whereby rollers **26** do not resist shifting of the ball. Referring to FIGURE 6, when the table **22** rotates in a counterclockwise direction (FIGURE 3) it pushes on the arm **90**, thereby taking up the clearance *x* and pulling taut the belt **78**. However, when the table **22** is at rest, due to the clearance *x* the tension on belt **78** is relaxed. Now, due to the play in belt **78** the rollers **26** can be turned easily and they do not, therefore, resist the rotation of the ball B by the user of the machine as previously mentioned.

A significant advantage of the aforedescribed arrangement is that the arrangement whereby the ball is moved is such that the possibility of scuffing, scratching, or otherwise damaging the ball surface is not present. As far as the ball is concerned, it does not have members simultaneously acting upon it directly in different directions so as to give frictional reaction. The ball is acted upon directly only by the rollers **26**, which act in one direction only, while the second mode of spinning is imparted only indirectly through bodily rotation of the entire table assembly **22**.

Thus it will be seen that present objects are attained in a smoothly operating machine which imparts a very uniform and continuous pattern of motion to the ball; which represents a rugged, simply operating and commercially feasible apparatus; and which affords other desirable details and advantages.

It will be understood that various departures from the specifically disclosed embodiments of the invention can be effected without departing from the scope thereof as defined in the following claims.

What is claimed is:

1. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising a single turret-like means for supporting said ball, said turret-like means being unobstructed from above for manual placement of the ball thereon, means for rotating said supporting means about a central vertical axis, means carried by said supporting means for rotating said ball about a central axis transverse to said vertical axis and having a fixed relation to said supporting means, and brush means stationarily located adjacent the rotational path of travel of said ball for cleaning and polishing the surface thereof.

2. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising means freely supporting said ball for continuous rotation simultaneously about a vertical axis and about a transverse axis intersecting said vertical axis, means for rotating said ball continuously about both said axes simultaneously, and a pair of automatically operable brush means adjacent the rotational path of travel of said ball for alternately cleaning and polishing the surface thereof.

3. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising means for freely supporting said ball and for continuously rotating the same simultaneously on a vertical central axis and on an intersecting central axis which sweeps about said vertical axis in a substantially horizontal plane, and rotary brush means adjacent the rotational path of travel of said ball for cleaning and polishing the surface thereof.

4. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising a supporting structure, a single turret mounted on said structure for rotation about a substantially vertical axis, a plurality of rollers arranged on said turret to support a bowling ball thereon, said turret being unobstructed from above and said supporting structure permitting access thereto for manual placement of said ball on the turret, means for simultaneously rotating said turret on said vertical axis and driving at least one of said rollers to impart components of rotational movement to said ball, and brush means movably supported by said structure adjacent the path of rotational movement of said ball for movement bodily into contact with the surface thereof.

5. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising a supporting structure, a single ball-supporting turret mounted on said structure for rotation about a substantially vertical axis, means carried by said turret for rotating a ball supported thereon about a substantially horizontal axis having a constantly fixed relation to said turret, said turret being unobstructed from above and said supporting structure permitting access thereto for manual placement of said ball on the turret, means continuously operable during a cycle of operation to rotate said turret and drive said ball rotating means simultaneously, and brush means positioned by said structure adjacent the rotational path of travel of said ball for cleaning and polishing the surface thereof.

6. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising a supporting structure, a single turret mounted on said structure for rotation about a substantially vertical axis, a plurality of spaced ball-supporting rollers carried by said turret on at least two horizontal parallel axes whereby said rollers are suitably arranged to cradle and support said ball, said apparatus including said supporting structure providing unobstructed access to said single turret to permit manual placement of a ball on said rollers, drive means for rotating at least one of said rollers to effect rotation of the ball and for rotating said turret, a pair of travelling brushes adjacent said turret, means for moving said brushes independently in turn into and out of the range of rubbing contact with said ball, and control means for said drive means and the last-mentioned means effecting a complete cycle of operation thereof during a predetermined period of time.

7. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising a supporting structure, a single turret mounted on said structure for rotation about a substantially vertical axis, means supported by said structure adjacent said turret for rubbing a ball supported thereon, means carried by said turret for rotating said ball supported thereon, means for rotating said turret, and epicyclic gear means for driving said ball rotating means carried by the turret, the last-mentioned means comprising a fixed sun gear coaxial with the rotational axis of the turret, a freely journalled planet gear connected to said turret to be carried thereby around said sun gear, and means transmitting the rotation of said planet gear to said ball rotating means.

8. The invention according to claim **7**, wherein said transmitting means comprises belt drive means having considerable slack to permit slippage of said ball rotating means relative to said gearing when the turret is at rest, and being taut to transmit driving motion when the turret is rotating.

9. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising a supporting structure, means carried by said structure for supporting said ball or the like and for imparting rotational movement thereto, pairs of arms extending upwardly from said structure at opposite sides of said means and pivotally mounted on parallel horizontal axes, rotating brushes carried by said pairs of arms on axes parallel to the first-mentioned axes, said pairs of arms being pivotally operable to move said brushes independently into and out of contact with said ball, a single assembly of cams located between said pairs of arms and coaxially operable on a common horizontal axis parallel to the first and second-mentioned axes, a pair of cam-follower levers operatively connected between said respective arms and said cam assembly, said cams being contoured to effect movement of each of said wheels in turn into and out of rubbing contact with said ball in a single cycle of operation, and timer control and driving means for said cam assembly operable to effect said cycles of operation thereof.

10. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising a supporting structure, a turret mounted on said structure for rotation about a substantially vertical axis, a plurality of ball-gripping rollers arranged on said turret to cradle and support a ball thereon, drive means including means for rotating said turret and a drive train for driving at least one of said rollers to impart components of rotational movement to said ball, clutch means interposed in said drive train automatically permitting slippage between said driven roller and drive means when said drive means is inactive, and means supported by said structure adjacent said turret for rubbing a ball supported thereon.

11. Apparatus for cleaning and/or polishing the surface of a bowling ball or the like comprising a supporting structure; a turret mounted on said structure for rotation about a substantially vertical axis; a plurality of ball-gripping rollers arranged on said turret to cradle and support a ball thereon; drive means including means for rotating said turret and a drive train for driving at least one of said rollers to impart components of rotational movement to said ball, said drive train including a belt drive; means acting on said belt drive to produce slack therein when the drive means is inactive and to tension said belt drive when the drive means is in operation; and means supported by said structure adjacent said turret for rubbing a ball supported thereon.

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