Feb. 17, 1953 A. BABCOCK 2,628,462

BALL TURNING MACHINE

Filed Jan. 7. 1952 3 Sheets-Sheet 1

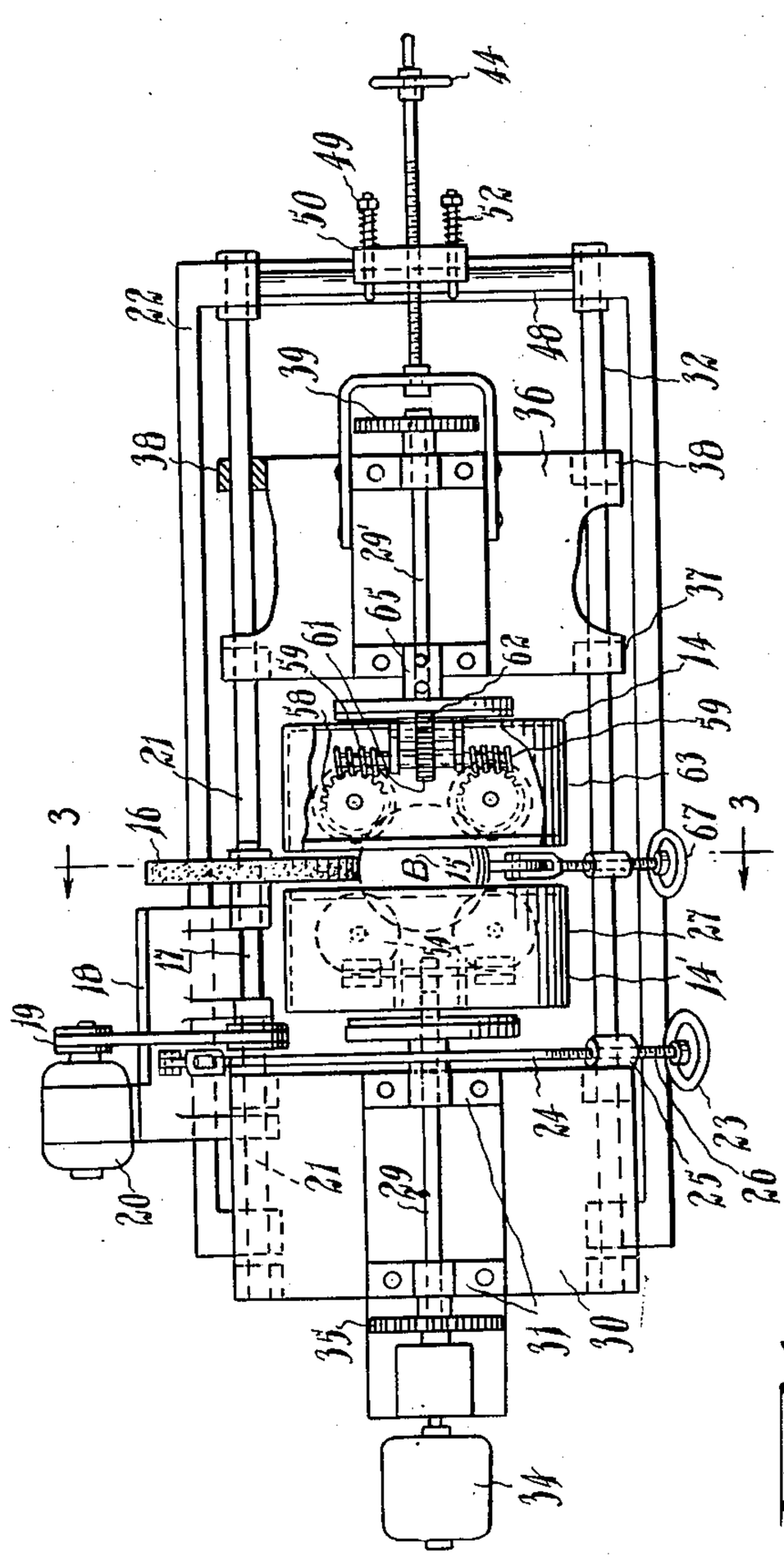

Fig. 1.

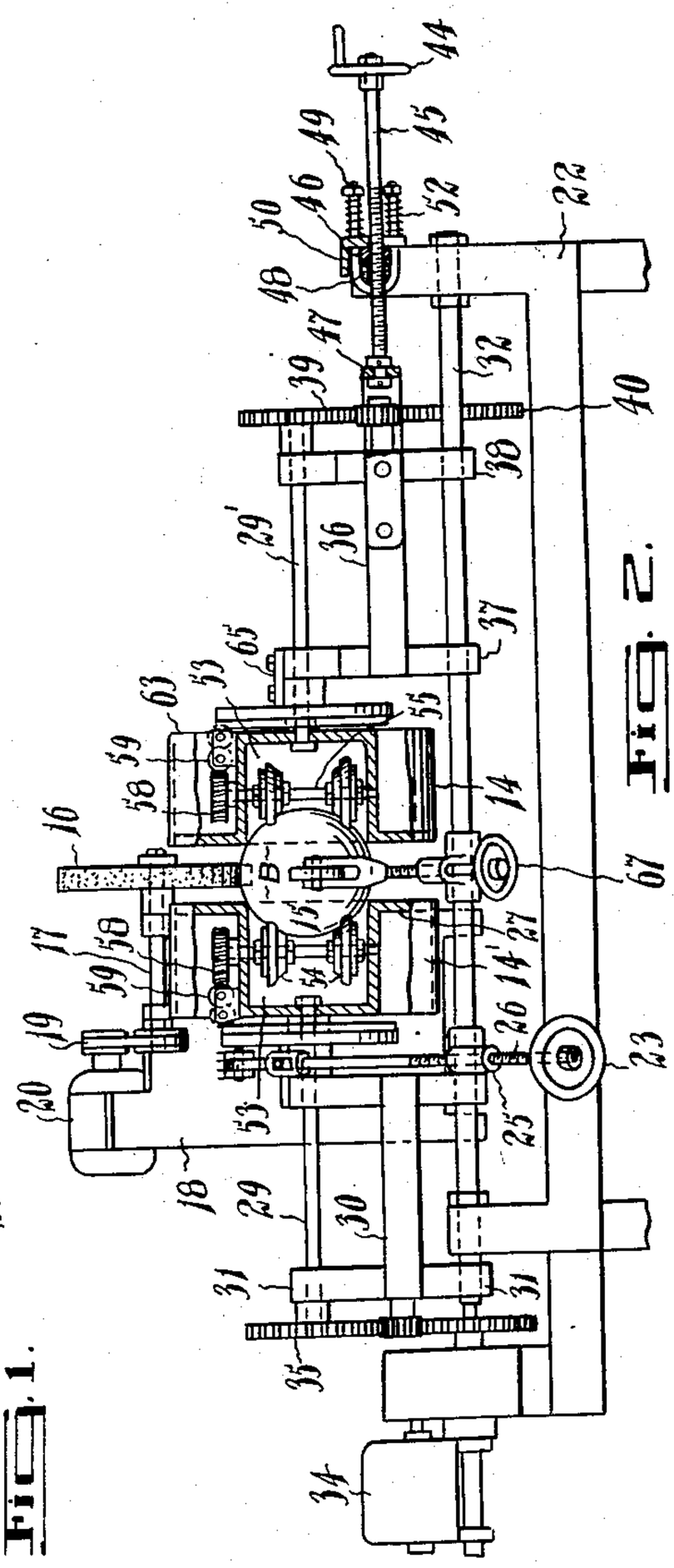

Fig. 2.

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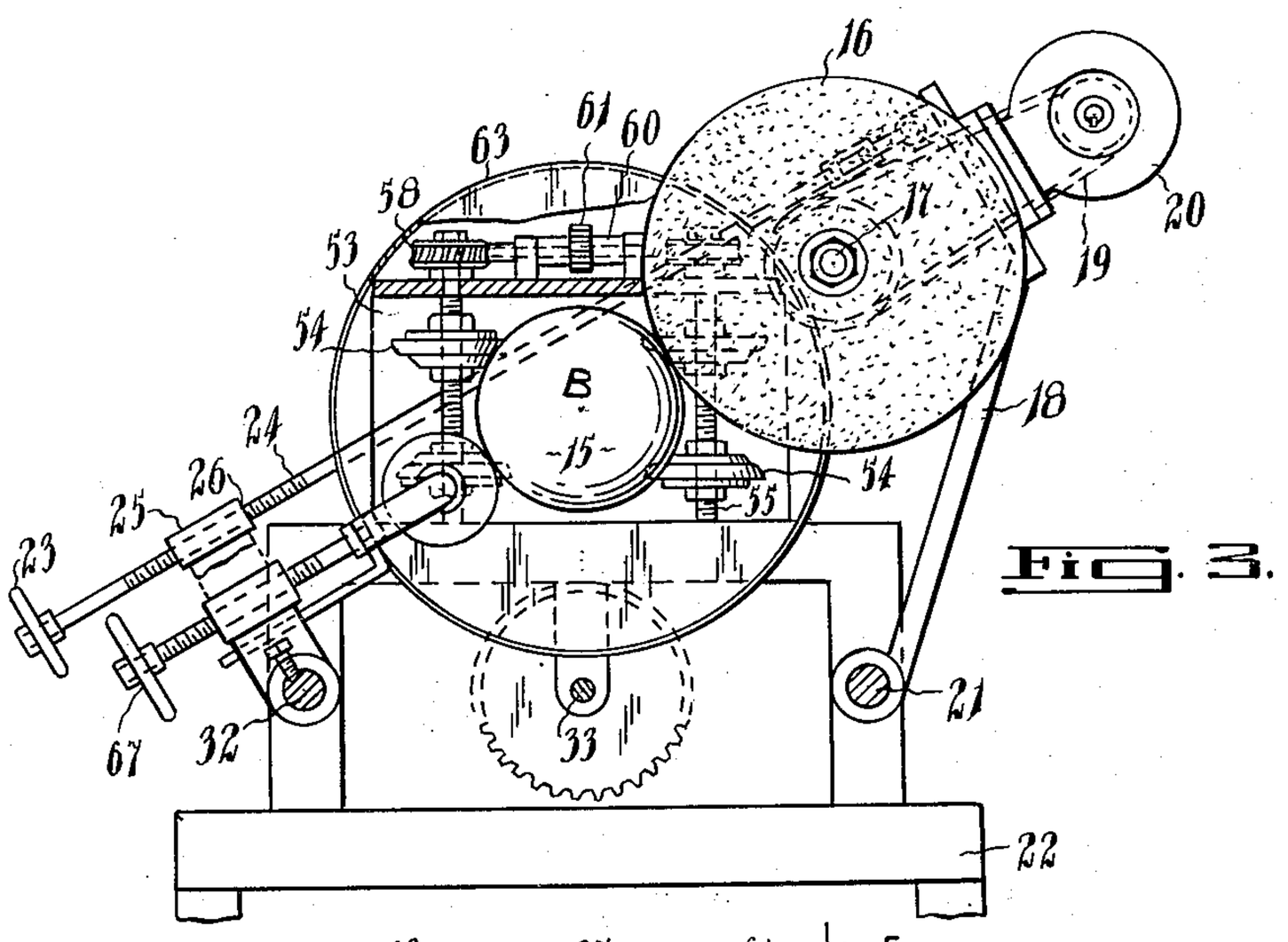

Fig. 3.

Fig. 4.

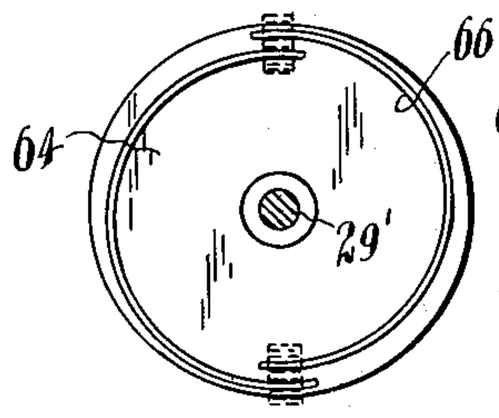

Fig. 5.

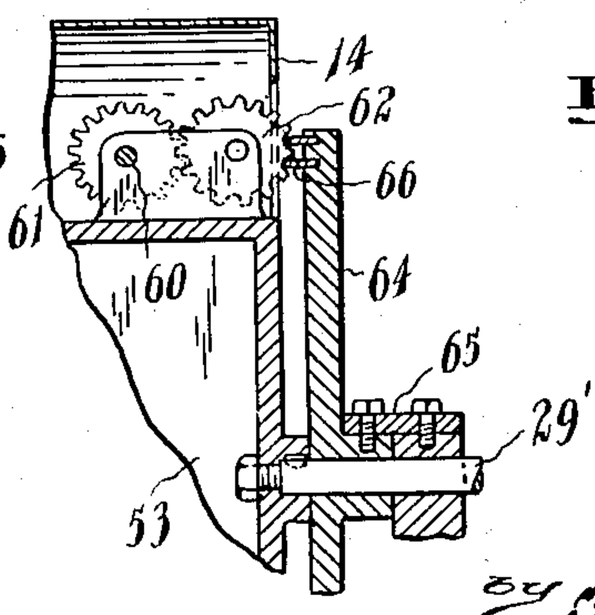

Fig. 6.

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BALL TURNING MACHINE

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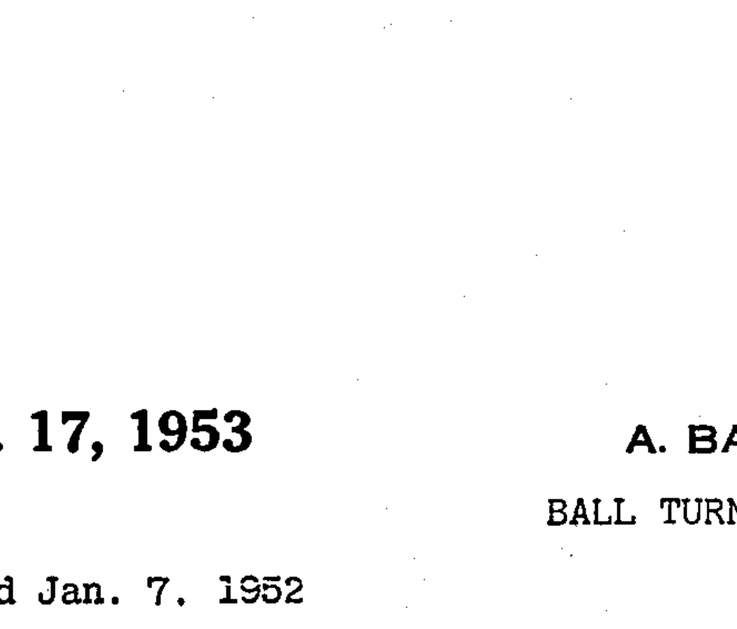

Fig. 7.

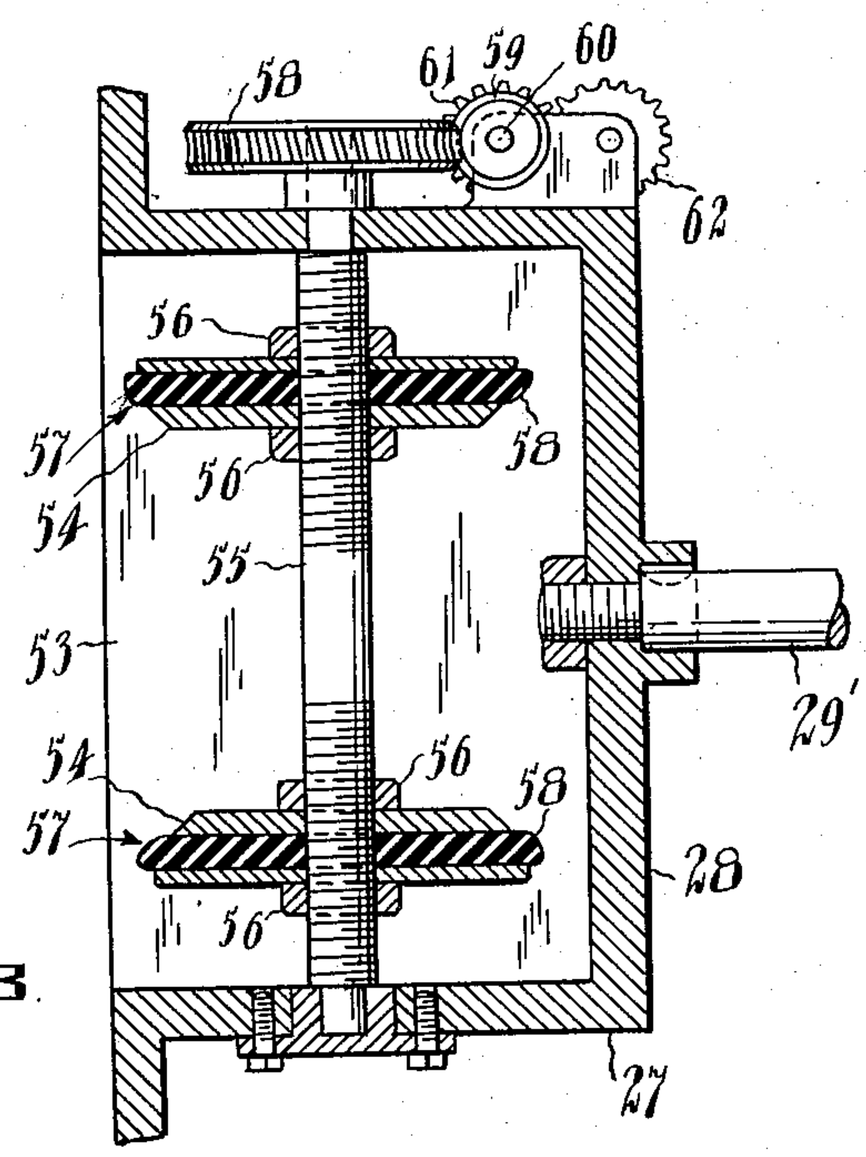

Fig. 8.

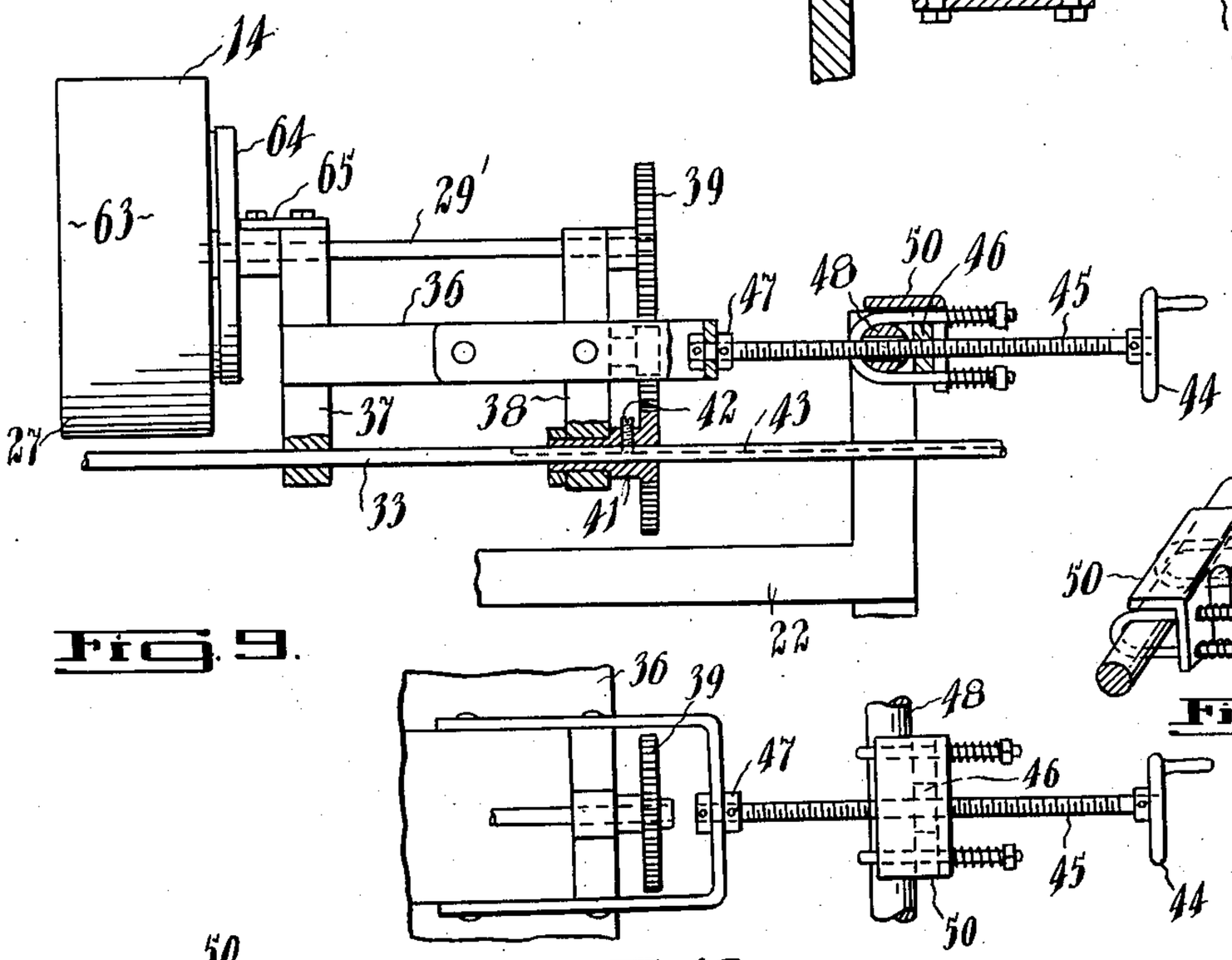

Fig. 9.

Fig. 12.

Fig. 10.

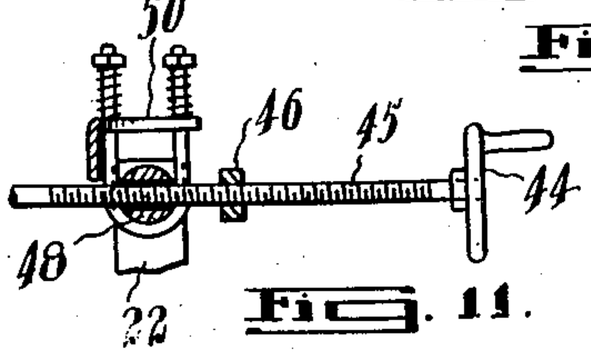

Fig. 11.

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UNITED STATES PATENT OFFICE

2,628,462

BALL TURNING MACHINE

Alexander Babcock, Camp Borden, Ontario, Canada

Application January 7, 1952, Serial No. 265,297

18 Claims. (Cl. 51—237)

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My invention relates to improvements in machines for performing reconditioning operations upon rotund objects such as bowling alley balls of the five pin type. It is usual to recondition balls of this kind when worn, and in doing so it is important that the processing be carried out in a manner to assure of the spherical accuracy of the balls as well as the smoothness of the surface thereof.

A paramount object of my invention is to provide a machine for re-surfacing of bowling balls and the like with an attendant high degree of accuracy and trueness. More particularly it is an object of the invention to provide in such a machine a chuck by which a bowling ball or other spherical workpiece can be held and rotated with a compound motion such as to enable a relatively stationary tool to be progressively brought into engagement with different surface areas of the workpiece.

The invention comprises a support for holding and spinning a ball and at the same time progressively turning the ball at right angles to the axis about which it is spinning. Said support includes diametrically opposite wheels or comparable devices for gripping a ball and allowing it to be turned transversely of the axis about which it is caused to spin. The turning movement is brought about by driving at least one of the wheels and causing it to frictionally engage the ball.

In the preferred construction, two chucks are employed and disposed in confronting relation, each being supplied with friction wheels. There are four such wheels to each chuck, these being arranged in two sets and each set being carried on a shaft to make contact with a ball at a side of the axis about which it spins. A four point contact is established at opposite sides of the ball, and means are employed to drive the wheels in a co-ordinating manner to turn the ball at right angles to the axis about which it spins. The friction wheels of a chuck are geared to a scroll cam to produce the drive for transversely rotating the ball. During the rotative motion of the ball it is processed by a re-surfacing tool common to the art.

The invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a top plan view of a machine incorporating the present invention,

Fig. 2 is a side elevation thereof, showing parts in section,

Fig. 3 is a cross section of the machine taken on line 3—3 of Fig. 1,

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Fig. 4 is a longitudinal mid-sectional view of the machine,

Fig. 5 is a transverse section on line 5—5 of the machine showing the scroll cam for turning the friction wheels of a chuck,

Fig. 6 is a sectional detail of the scroll cam drive similar to the sectional view of Fig. 4 but on a larger scale and fragmentary,

Fig. 7 is a face view of one of the chucks,

Fig. 8 is an axial section of one of the chucks,

Fig. 9 is a fragmentary side view of the machine showing one of the chucks and a screw feed device for shifting it to and away from the other chuck,

Fig. 10 is a plan view of Fig. 9,

Fig. 11 is a longitudinal detail of a quick release mechanism for the carriage feed screw of the shiftable chuck, and

Fig. 12 is a perspective detail of the quick release plate for the feed screw.

Referring to the drawings by reference numerals, the machine preferably comprises a pair of co-acting chucks 14, 14', for jointly holding a workpiece 15, such as a standard wooden ball B, of the five pin type which it is desired to treat in a re-surfacing process. The process may comprise the grinding of the ball as an initial step, after which it may be buffed and polished, etc. The chucks co-act to rotate the ball with a compound motion while it is worked on by a grinding wheel 16.

The chucks are gapped, or in other words, spaced apart, and the grinding wheel is disposed between them to contact the supported ball in a diametrical plane at right angles to the aligned axes of the chucks about which the ball is caused to spin by rotation of the chucks. Said grinding wheel is carried by a shaft 17 journalled in a bracket 18 and independently driven by a belt drive 19 from an electric motor 20. This motor is mounted on the bracket 18 and this bracket is pivoted on a stationary rod 21 at the far side of the machine bed 22. The electric motor 20 is switch controlled. The bracket is movable on its pivotal connection to bring the grinding wheel into contact with the ball B. The required movement of the grinding wheel is brought about by a conventional handwheel 23 having a shaft 24 connected to the bracket 18 to turn freely and supported in a bearing plate 25 with which it has a screw threaded connection 26. There is of course no novelty in the specific structure of the grinder; and it will be gathered that the grinding wheel can be shifted to and away from the

ball B according to the direction in which the handwheel 23 is turned.

The chucks 14, 14' jointly hold the ball while it is being acted on by the grinding wheel. Said chucks are axially aligned and are rotated unidirectionally at uniform speeds. Each chuck comprises a body 27 having a hub portion 28 by which it is mounted upon a spindle to turn therewith.

The spindle 29 that carries the chuck 14' is journalled in a headstock 30 comprising the bearing members 31. Said headstock is supported upon the frame rods 21 and 32 of the bed by means of said bearing members 31 which are slidable on the rods 21 and 32, but are normally locked against sliding movement as by collars or the like. The headstock is adjusted positionally with respect to the grinding wheel when balls of a different size are to be re-surfaced.

Extending longitudinally of the bed 22 is a drive shaft 33 which is disposed medially of the width of the bed and journalled in suitable bearings provided thereon. This shaft is driven by a source of power such as the electric motor 34 attached to the bed. The spindle 29 belonging to the chuck 14' is driven by the spur gearing 35 which is connected to the shaft 33.

The spindle 29' belonging to the chuck 14 is journalled in a carriage 36 comprising the bearing plates 37 and 38. The carriage 36 is slidably mounted on the rods 21 and 32 to enable the chuck 14 to be shifted to and away from the chuck 14' for insertion and removal of a ball as required in the operation of the machine. Rods 21 and 32 constitute ways for the carriage. The spindle 29' is driven from the drive shaft 33 by means of spur gears 39 similar to gearing 35. The spur gearing 39 includes a gear 40 which is free to slide on the drive shaft 33 but is held against rotating independently of this shaft. To this end the gear 40 is provided with a hub 41 journalled in the bearing plate 38 of the carriage and shouldered against endwise movement with respect to the carriage. A screw 42 in the hub 41 has an inner end engaged in an elongated keyway 43 in shaft 33 to form a driving connection. This arrangement may be modified within the spirit of the invention.

A handwheel 44 is employed to shift the carriage 36 along the ways 21 and 32 as required in the operation of the machine. The handwheel 44 has the usual screw rod 45 fixed to it. This screw rod has threaded engagement with an element 46 on the bed 22 and extends parallelly to the said ways 21 and 32 with its inner end connected at 47 to the carriage to turn freely for a feeding action. It will be clearly understood that with this arrangement the handwheel 44 is turned in one direction to slide the carriage inwardly and is turned in the opposite direction to feed the carriage outwardly. The chuck 14 is moved accordingly.

Desirably the hand feed for the carriage is provided with a quick release device so that the carriage can be pulled back quickly by hand when the handwheel has been given a few turns to release the grip on a ball held by the chucks. The quick release device may be of any known type but that shown in the drawings comprises a round bar 48 which is apertured to allow the feed screw 45 to slide freely therethrough. The element 46 is a nut which is located outwardly of the bar 48 in close proximity thereto. Swingable on the bar 48 by means of U-members 49 is a locking plate

50 which is swung downwardly over the nut at the outside thereof to prevent it from shifting away from the bar 48 and to prevent it from turning. The locking plate has an aperture 51 in the form of an open-ended slot through which the feed screw 45 extends. The U-members have their legs extending through holes in the locking plate and they are encircled by coil springs 52 shouldered thereon and backed by nuts to allow the locking plate to yield outwardly under stress. Accordingly in turning the feed screw in a feeding movement the nut 46 is held by the locking plate and consequently the carriage is advanced to bring the chuck 14 into gripping engagement with a ball. The springs 52 are placed under tension in the advanced movement of the carriage as the ball is gripped by the chucks, and therefore these springs act to automatically take up any slack in the grip of the chucks due to grinding down of the ball which is being processed. Upon completion of the grinding operation the handwheel is given a few backing off turns to loosen the grip of the chucks on the ball and then the locking plate 50 is swung upwardly by hand, as shown in Fig. 11, to release the nut 46 so that the carriage can be pulled back with a quick releasing movement for removal of the ball.

The chucks 14, 14' are of identical construction, hence a description of one will suffice. The chuck comprises a recess 53 formed in its body 27. The recess is open to the face of the chuck and it contains a set of four friction wheels 54. These wheels are arranged in pairs and each pair is supported upon a shaft, denoted at 55. The two shafts are disposed in a plane at right angles to the chuck axis and are spaced apart in parallel relation on opposite sides of this axis. Said shafts are journalled in the body 27 and held against endwise movement. The wheels of each shaft are spaced thereon and held against turning independently as by the nuts 56 which have screw engagement with the shaft and thus enable the spacing of the wheels to be varied to accommodate balls of different diameters. The wheels have friction faces 57 for peripheral engagement with a ball. The friction faces may be afforded by the rubber discs 58 (Fig. 8) which are clamped in place.

The two shafts of the chuck are driven in unison in the same direction as by gearing comprising worm wheels 58 keyed on the shafts and in mesh with worms 59 keyed on a stub shaft 60 which is journalled in the body 27 and supplied with a driving gear 61 of the spur type which is in mesh with a similar gear 62. Gear 62 is journalled on the body and this gear protrudes through an opening in the case portion 63 of the body at the rear thereof.

Gear 62 is driven at a uniform speed during rotation of the chuck. The means for driving this gear preferably comprises a scroll cam 64 which is stationary and secured at 65 concentrically of the chuck axis. Said cam is a disc-like member having eccentric camming blades 66 on the inner side thereof for interdental engagement with the gear 62. Two such camming blades are desirably employed. These are semicircular elements of a spiral or scroll pattern such that each in its turn acts to rotate the gear 62 a distance of about one tooth in a half-turn of the chuck. As a result this gear is turned unidirectionally at slow speed compared to the speed of the respective chuck. When a ball is placed in the chuck it is jointly engaged by the four friction wheels thereof.

In the use of the machine a ball is placed between the two chucks and then they are advanced toward each other by movement of the carriage to firmly grip the ball. The chucks are rotated in the same direction and thus spin the ball about their own axes. During rotation of the chucks the friction wheels are turned in unison by the cam mechanism and gearing in order to slowly rotate the ball in a direction at right angles to the axis about which it is spinning. This compound movement progressively brings different surface areas of the ball in contact with the grinding wheel in a re-surfacing process. In this way the entire surface of the ball is ground uniformly and accurately. In the grinding operation it is desirable to support the ball at the opposite side of the grinding wheel by means of a steady rest, such as that indicated at **67**, but this element per se does not form a part of the present invention.

It will be understood that my invention provides a machine for revolving a wooden ball or the like about its own centre with a compound motion such as to bring different surface areas into contact with an operating tool or equivalent object. The invention is not confined to the use of two chucks of the kind described. For some purpose a single chuck may be used, in which case a device, such as a steady rest, would be used to bear on the ball oppositely to the chuck to retain the ball in engagement with the friction wheels. It will also be understood that a chuck could be constructed to employ three friction wheels, if desired, one or more of which could be driven. It is also conceivable that a single friction wheel could be employed provided the ball were supported at spaced points by idler rollers or the like. These and other modifications may be resorted to as coming within the scope of the invention.

What I claim is:

1. In a mechanism of the kind described, a rotary member, means for supporting a ball on said rotary member with its centre coinciding with the axis thereof, said supporting means including a friction wheel journalled on said rotary member transversely thereof for engaging said ball to turn it about an axis transversely of the axis of said rotary member, and driving means for turning said friction wheel with respect to said rotary member while the rotary member is rotating.

2. In a mechanism of the kind described, a rotary member, means for supporting a ball on said rotary member with its centre coinciding with the axis thereof, said supporting means including friction wheels at opposite sides of said rotary member and journalled transversely thereon for engaging said ball to turn it about an axis at right angles to the axis of said rotary member, and means for turning said friction wheels with respect to said rotary member while the rotary member is rotating.

3. In a mechanism of the kind described, a rotary member, revoluble means on said rotary member for supporting a ball with its centre coinciding with the axis thereof, said supporting means including friction wheels at opposite sides of said rotary member and journalled transversely thereon for engaging said ball to turn it about an axis at right angles to the axis of said rotary member, and means for turning said friction wheels with respect to said rotary member while the rotary member is rotating.

4. In a mechanism of the kind described, a rotary member, means for supporting a ball on said rotary member with its centre coinciding with the axis thereof, said supporting means including friction wheels at opposite sides of said rotary member, said friction wheels being journalled on said rotary member for rotation in parallel planes and spaced for engaging said ball at different points to turn it about an axis at right angles to the axis of said rotary member, and gearing for driving said friction wheels with respect to said rotary member while the rotary member is rotating.

5. In a machine of the kind described, means for rotating a ball with a compound motion, said means including a chuck comprising a body element rotatable about its own axis, a pair of parallel wheels journalled in said body element on an axis parallel to a plane containing said axis, said wheels having friction faces for driving engagement with said ball, and means for rotating said wheels during rotation of said body element.

6. A structure as defined in claim 5, and in which means are employed to hold the ball in engagement with the wheels.

7. A structure as defined in claim 5, and in which wheels are employed to hold the ball in engagement with the pair of parallel wheels.

8. A structure as defined in claim 5, and in which the pair of parallel wheels is journalled in the body element by means of a shaft on which they are adjustable longitudinally thereof.

9. In a machine of the kind described, means for rotating a ball with a compound motion, said means including a chuck comprising a body element rotatable about a longitudinal axis, sets of wheels including two pairs of parallel wheels, each pair being fixed on a shaft journalled on said body element, said wheels having friction faces for driving engagement with said ball, said shafts being disposed in parallel relation at right angles to the longitudinal axis of the body element, and means for rotating said shafts during rotation of said body element.

10. In a mechanism of the kind described, a rotary member, means for supporting a ball on said rotary member with its centre coinciding with the axis thereof, said supporting means including a friction wheel journalled on said rotary member transversely thereof for engaging said ball to turn it about an axis transversely of the axis of said rotary member, and means motivated by rotation of said rotary member for imparting rotational movement to said friction wheel.

11. In a mechanism of the kind described, a rotary member, means for supporting a ball on said rotary member with its centre coinciding with the axis thereof, said supporting means including a friction wheel journalled on said rotary member transversely thereof for engaging said ball to turn it about an axis transversely of the axis of said rotary member, and driving means for turning said friction wheel with respect to said rotary member while the rotary member is rotating, said driving means including gearing and a cam device.

12. In a mechanism of the kind described, a rotary member, means for supporting a ball on said rotary member with its centre coinciding with the axis thereof, said supporting means including a friction wheel journalled on said rotary member transversely thereof for engaging said ball to turn it about an axis transversely of the axis of said rotary member, and driving means for turning said friction wheel with respect to said rotary member while the rotary member is

rotating, said driving means including a cam device.

13. In a mechanism of the kind described, a rotary member, means for supporting a ball on said rotary member with its centre coinciding with the axis thereof, said supporting means including a friction wheel journalled on said rotary member transversely thereof for engaging said ball to turn it about an axis transversely of the axis of said rotary member, and driving means for turning said friction wheel with respect to said rotary member while the rotary member is rotating, said driving means including a scroll cam device supported in fixed relation to said rotary member.

14. In a mechanism of the kind described, a rotary member, means for supporting a ball on said rotary member with its centre coinciding with the axis thereof, said supporting means including a friction wheel journalled on said rotary member transversely thereof for engaging said ball to turn it about an axis transversely of the axis of said rotary member, and driving means for turning said friction wheel with respect to said rotary member while the rotary member is rotating, said driving means including a spur

gear journalled on the rotary member, and a stationary disc cam supported concentrically of said rotary member and having a spiral-like element engaged interdentally with said spur gear.

15. In a machine of the kind described, means for rotating a ball with a compound motion, said means comprising a pair of confronting chucks having aligned axes, friction wheels journalled in said chucks and spaced to grip the ball, and means for rotating said friction wheels during rotation of said chucks.

16. A machine as defined in claim 15, and in which a carriage is provided to support one of the chucks for movement to and away from the other.

17. A machine as defined in claim 15, in which one of the chucks is mounted on a carriage provided with a quick release mechanism.

18. A machine as defined in claim 15, in which a headstock supports one of the chucks, and a carriage supports the other chuck, and in which the carriage is mounted on ways and moved by a handwheel.

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No references cited.