July 1, 1930. T. JACOBSON 1,769,839

AIR CLEANING MACHINE

Filed June 7, 1929 4 Sheets-Sheet 1

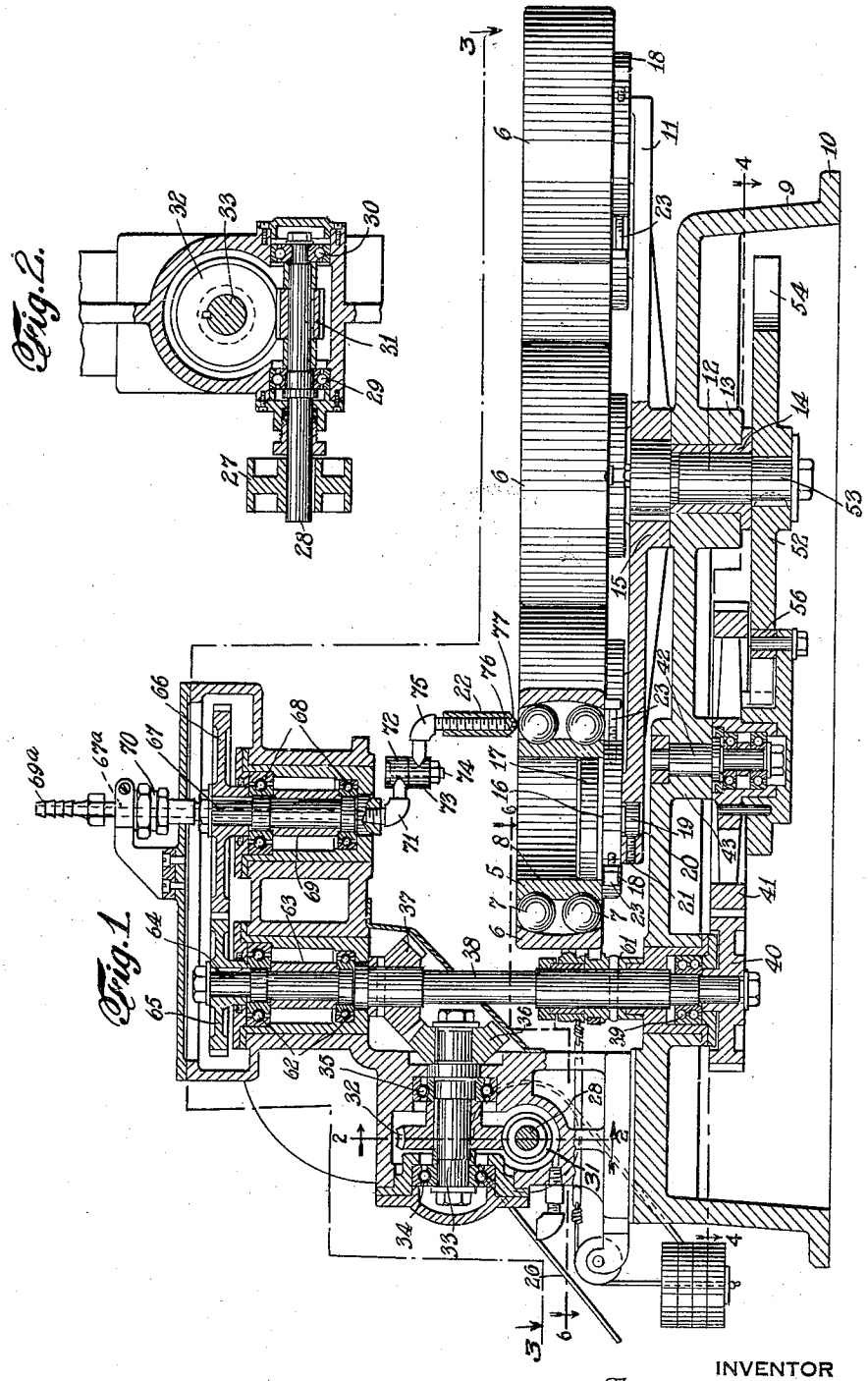


Fig. 2.

Fig. 1.

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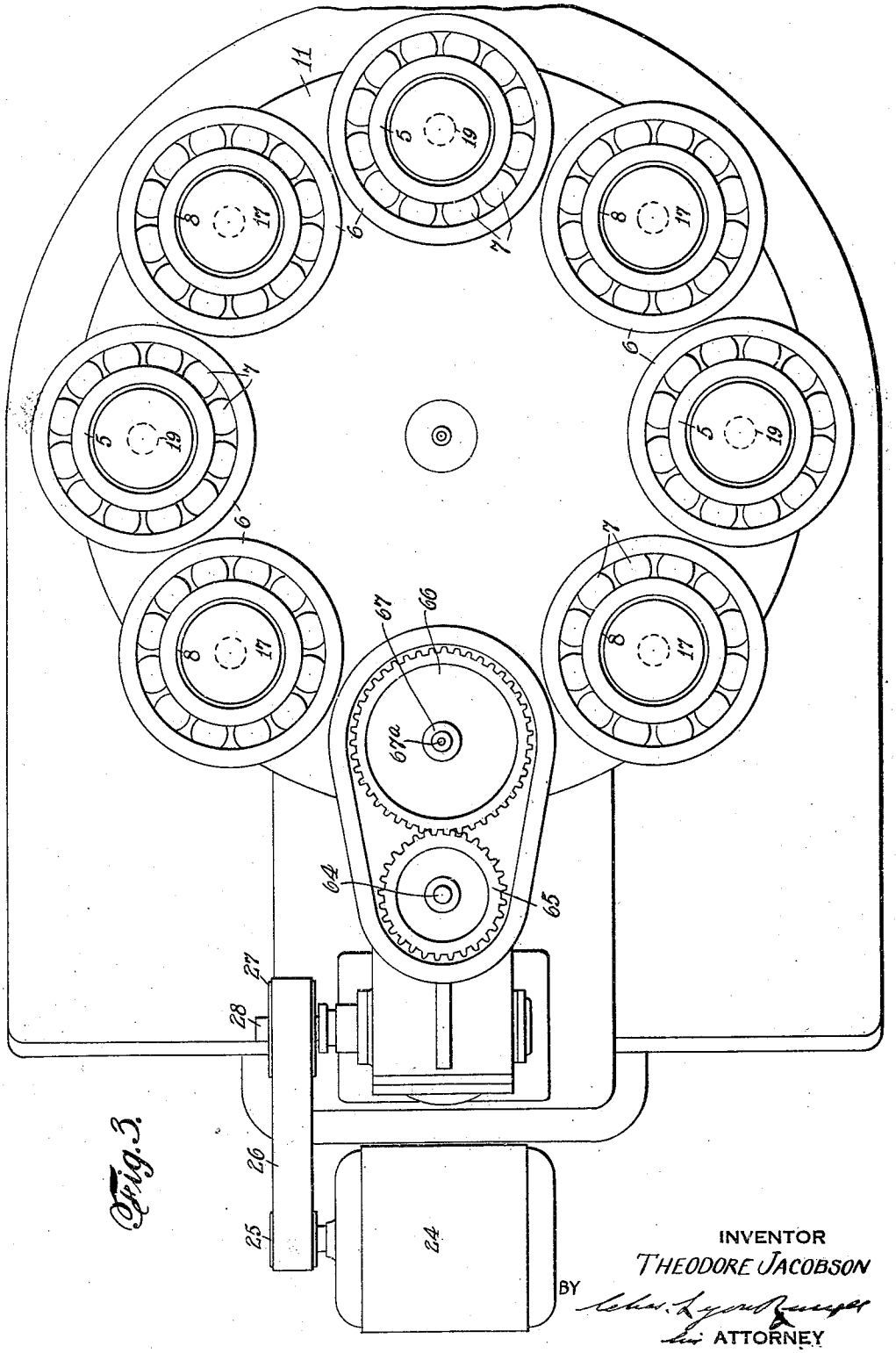


Fig. 3.

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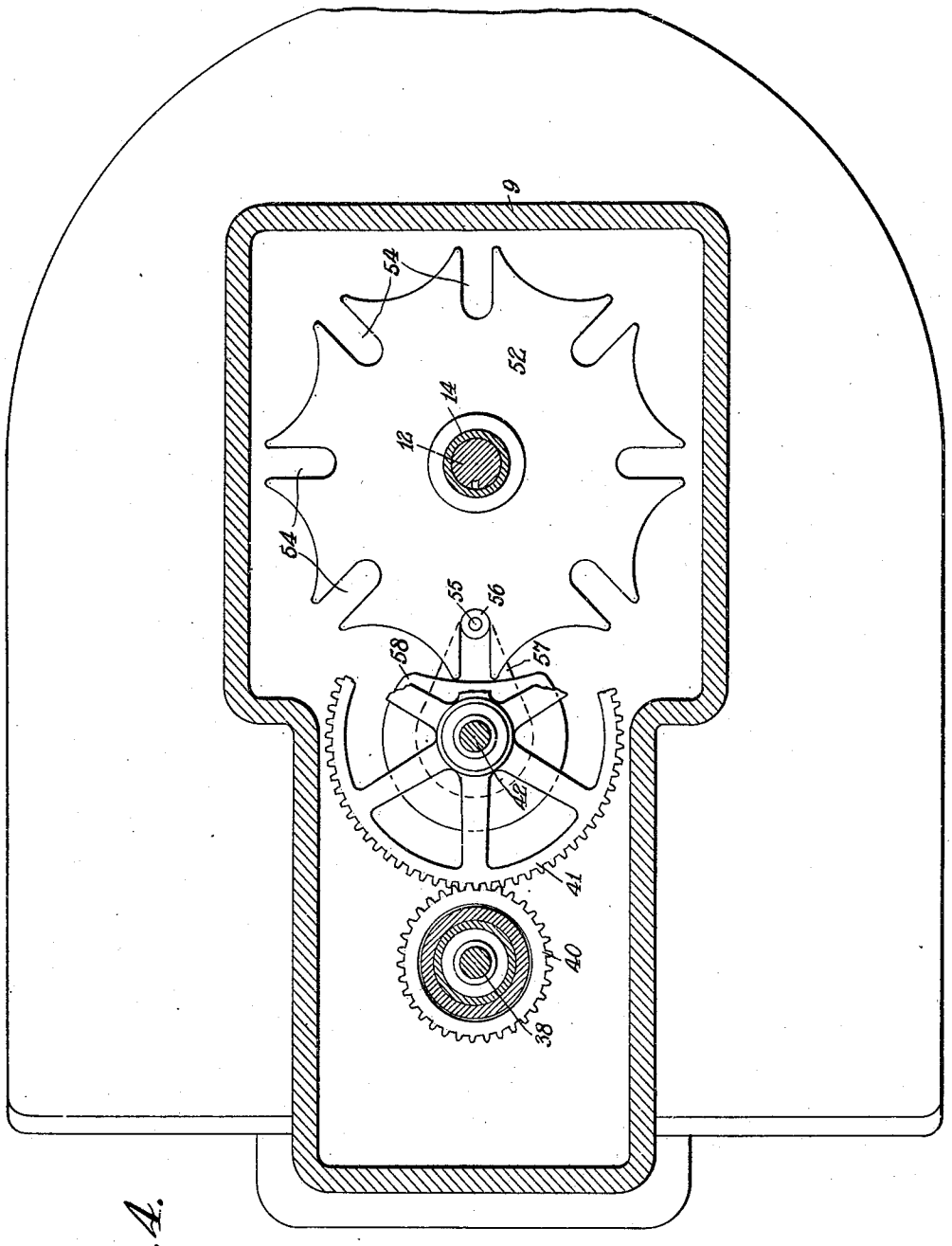


Fig. 4.

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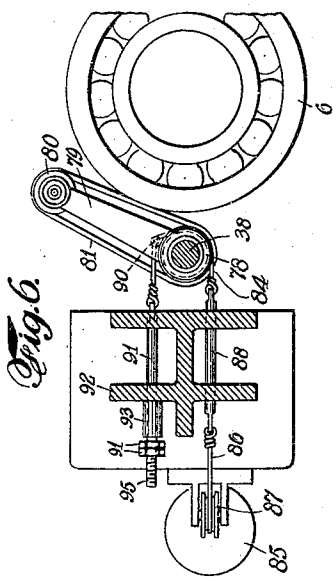


Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE

THEODORE JACOBSON, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE SKAYEF BALL BEARING COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT

AIR CLEANING MACHINE

Application filed June 7, 1929. Serial No. 369,182.

The object of this invention is to provide a machine for consecutively indexing work pieces into and out of the range of activity of an air jet, preferably a rotatable air jet nozzle.

One application of the invention is the drying by means of an air jet of self-contained unit handling ball bearings, the mechanism for use on such bearings preferably including a turned table having plugs upon which a plurality of bearings may be mounted, and mechanism for rotating the nozzle of an air jet device so that it will direct its discharge around the entire circumference of the ball occupied space between the rings of each bearing as it is indexed into the region of activity of the nozzle.

According to prevailing practice, after ball bearings have been assembled they are washed for permitting accurate inspection and are also washed prior to being finally packed or packaged, or rather just prior to being immersed in oil or melted grease, which is generally the step immediately preceding the wrapping. The washing is done with various liquids, frequently kerosene, gasoline, or some other volatile material. The prevailing practice has been to subject the washed rings to the action of an air jet sometimes while the rings were held in the hand of the operator and sometimes while lying on a table, but so far as I am aware no effort has been made to cause an air jet nozzle to traverse a path which directs it through the entire circuit of the balls. Nor am I aware of any device in which a work table is provided which is constructed and adapted for receiving a plurality of bearings or other work pieces, which work table is indexed to bring the bearings into the region of activity of an air jet nozzle.

When my improved machine is in operation a continuous supply of air under a sufficient amount of compression is brought to the nozzle. This nozzle rotates continuously and is adjusted to move in an orbit corresponding with the pitch circle of the balls in the bearings which are to be treated. The work table is furnished with a plurality of plugs for holding the bearings so that free passage of the air will be had between the rings and about the balls. These plugs are in such positions that as the table is indexed about by a continuous intermittent motion, each bearing is subjected to at least one continuous rotation of the air jet nozzle. I have also found it desirable to rotate the outer ring of the bearing and the plug holding the inner ring, so that the balls may roll between the rings thereby exposing the entire cracked surfaces of the rings and the rolling circumferences of the balls to the action of the jet. The operator preferably stands at the side of the machine opposite the working position, and removes the bearings from the plugs as they approach his position, and places other washed bearings in the places from which he removes those which have been dried.

In the drawings accompanying this specification one practicable embodiment of my invention is illustrated which may be regarded as the preferred form, in which drawings

Figure 1 is a central vertical section of the machine showing one of the bearings also in central section.

Fig. 2 is a detail of the driving mechanism taken on a plane at about the line 2—2 of Figure 1.

Fig. 3 is a top view showing in part a horizontal section on about the plane of the line 3—3 of Figure 1.

Fig. 4 is a top view taken at about the plane of the line 4—4 of Figure 1 for the purpose of showing the indexing mechanism for the work table.

Fig. 5 is an enlargement of the lower central portion of Figure 1, and

Fig. 6 is a partial top view taken at about the plane of the line 6—6 of Figure 1 and shows the mechanism for permitting the bearing while being indexed to pass the raised rotating device.

The work pieces which this machine is especially designed to handle are self-contained ball bearings, one of these being illustrated in section in Figure 1, and others in elevation in Fig. 3.

The bearing is shown comprising an inner

ring 5, and an outer ring 6, which rings are held together by two rows of balls 7. The inner ring 5 has a bore 8, which in the illustration is shown as cylindrical, which is the shape a large percentage of such bearings have, although other shapes are used in practice. The manufacturing tolerances for this bore 8 in the finished bearing are very small, so that a rather close fit may be had between the bore of the inner ring and whatever plug is employed for insertion into it.

It will be seen that in the work piece, the bearing in the illustrative example, there is an annular space between the rings 5 and 6, in which balls are located, and with the exception of these balls such space is clear for the passage of a fluid from side to side of the bearing.

The problem solved by this invention is the removal of whatever liquid has been used in washing the bearing either partially or to effect the complete drying of the balls and the opposed faces of the rings.

The mechanical elements of the device will be described by starting at the base of the machine, which is illustrated in the form of a casting 9 having feet 10 adapted to rest upon some suitable support such as a table or bench. The work table 11 is shown having its top face disposed on a horizontal plane and carried by a vertical shaft 12 mounted in a hub 13 formed on the base plate 9. In the illustration an anti-friction bushing 14 is located between the shaft 12 and the bore of the hub 13. The work table is shown having a hub 15 which rests upon a suitably prepared upper face of the hub 13 and in which the enlarged upper end of the shaft 12 is keyed.

The work table 11 in the illustration is furnished with eight work piece positions. The work piece holding or positioning devices in the present illustration comprise interchangeable blocks 16, each having a plug portion 16 of suitable dimensions and tolerances to accommodate the bores 8 of the bearings which it is intended to carry. The block 16 has a base 18 below the plug which is adapted to form a rest or support for the inner ring 5 of the bearing. the radius of the base 18 being preferably less than the outer radius of the inner ring 5 so that the free passage of air and the escape of liquid which is driven off will not be impeded. Each block is furnished with a pin 19 which pins are adapted to enter suitable sockets 20 formed in the work table 11.

Each machine is provided with several sets of blocks 16 having their plug portions 17 and supporting portions 18 adapted to conform to various size bearings. These blocks are interchangeable because the pins 19 are of uniform size. When the block is mounted on the machine a set screw 21 engages the pin 19 and holds this in position.

The sockets 20 are located on a circle concentric with the axis of rotation of the work plate 20, and such circle is adapted to pass under the center of the orbit of travel of the air jet nozzle 22 which will be described later.

Each of the blocks 16 in its supporting base 18 is shown furnished with a plurality of set screws 23, preferably three in number, for lightly engaging the outer races of self-aligning bearings, when these are being operated upon, and for preventing tilting of such rings, especially when subjected to the pressure of the air jet.

The power will be supplied from some suitable source, in the present illustration an electric motor 24, having a pulley 25 over which runs a belt 26 driving the pulley 27 mounted on a shaft 28, which shaft is supported in suitable bearings 29 and 30 between which it carries a worm 31 meshing with a worm wheel 32 keyed to a shaft 33 mounted in suitable bearings 34, 35, and upon which shaft is mounted a bevel gear wheel 36 meshing with a bevel gear wheel 37 fast with a vertically disposed shaft 38.

The lower end of the shaft 38 is shown mounted in a suitable bearing 39 carried by the bed plate or frame 9, and below which frame the shaft 38 carries a spur wheel 40 which meshes with a larger spur wheel 41, the ratio of such wheels being 2 to 1. The shaft 42 on which the gear wheel 41 is mounted is shown seated in a hub 43 dependent from the bed plate. The shaft 42 below the hub 43 is provided with a flange 44 which is tightly clamped against the lower face of the hub 43 by means of a nut 45 which engages the upper screw end 46 of the shaft. This nut 45 is provided with suitable spanner engaging sockets 47. The gear wheel 41 is mounted for rotation about the dependent portion 48 of the shaft 42. The gear wheel has an enlarged hub 49 in the center of which are a pair of suitable bearings 50—50 engaging the inner walls of the chamber of the hub 49 and mounted upon the shaft portion 48, the bearings being spaced apart at the shaft portion by means of a spacing ring 51.

The index wheel 52 is keyed on a depending portion 53 of the shaft 12. The indexing wheel 52 has a plurality of radially disposed slots 54 corresponding in number to the number of work positions, in the present illustration eight. These indexing slots 54 are engaged by a forwarding device which effects the intermittent movement of it and the work table.

In the present illustration a stud 55 is carried by the gear wheel 41 and is furnished with a roller 56 for reducing friction. This stud 55 is upstanding from an indexing arm 57 which is securely fastened to the lower side of the gear wheel 41. This arm has a hub portion 58 adapted to surround a suitably formed surface on the hub 49 of the

gear wheel, and also to act as a closure for the bearing housing formed by the chamber within the hub 49. The lower portion of the arm is shown secured to the hub by means of suitable screws 59, and as an additional means for preventing rotation a dowel pin 60 is shown passing into the body of the gear wheel from the body of the indexing arm.

The shaft 38 is shown provided above its lower bearings with a dust cap or a guard 61.

The upper end of the shaft 38 is shown supported by a pair of bearings 62—62 spaced apart by a suitable sleeve 63. To the extreme upper end 64 of this shaft is keyed and secured a gear wheel 65 meshing with a gear wheel 66 keyed and secured to the upper end 67 of a short shaft mounted in a pair of suitable bearings 68—68 also spaced apart by a suitable sleeve 69. The shaft 67 is centrally bored at 67^a forming an air passage from the hose nipple 69^a to the air jet nozzle 22.

A hose not shown will lead to the nipple 69 from some suitable source of compressed air supply or to the common air line if compressed air is generally used throughout the plant.

The ratio between the gear wheels 40 and 41 is 1 to 2, so that the shaft 38 makes two complete rotations to every revolution of the indexing pin 55, and consequently to the indexing movement of the work table 11.

The ratio of gearing between the gear wheel 65 at the upper end of the shaft 38 and the gear wheel 66 which rotates the jet nozzle is 2 to 3 so that the air jet nozzle will make one and one-half revolutions during each complete indexing movement of the table. This additional half revolution is consumed during the shifting of the work pieces out of and into the working zone of the nozzle. It of course can be so arranged that the nozzle will be at about the position of the shortest distance between the centers of work positions when the shifting takes place, so that very little if any air will be wasted during the indexing movement in the passage from work piece to work piece.

Suitable packing devices are furnished between the upper end of the shaft 69 for adapting its bore 67^a to communicate with the bore of the nipple 69^a. The devices illustrated are stock articles and do not need a special description except to say that the shaft rotates and the nipple is held from rotation. A flexible coupling 70 permits this movement.

The communication between the shaft 67, which in reality is a tube, and the nozzle 22 is an L 71 communicating with a pair of swivel members 72, 73 adapted to be clamped together by means of a screw 74. From the lower swivel 73 there extends an L 75.

When the L's are located in approximately the same plane, the nozzle 22 will have an orbit of the largest radius. When these L's are bent into an angle one to the other by adjustment about the swivel screw 74, the radius of the orbit will be shortened. After the adjustment has been made to bring the nozzle 22 at the correct position from its center of rotation for supplying the air to the bearings under treatment at the right location, the swivel screw 74 is tightened and the parts are held in their adjusted positions.

In the illustration the nozzle is shown provided with two discharge holes or openings 76, 77, one of which is preferably directed to pass a jet of air toward the inner surface of the outer ring, and the other of which, 77, is directed to pass a jet of air toward the outer surface of the inner ring. Of course when the nozzle is directly over one of the balls of the bearing being treated its influence will be exerted upon the entire surface of the ball except where the ball is in direct contact with the race surfaces of the rings.

During the application of the jet of air if the balls remain stationary, some of the liquid which it is desired to expel by the nozzle may remain in the small spaces adjacent the point of contact between the balls and the races. To overcome this difficulty a mechanism is shown, see particularly Figs. 1, 5 and 6, for rotating the outer ring of the bearing which is at the working point, while the inner ring is held from rotation by means of the plug 17 of the supporting member.

A convenient means for effecting this rotation is a belt moving in contact with the outer race of the bearing when this comes into the indexed position, and which belt is so yieldably held that it engages such race prior to its coming into the exact working position and which will yield to permit the treated ring to move on with the work table.

On the vertical shaft 38 there is shown mounted a small pulley 78. A rocker arm 79 is mounted free on the shaft 38 and carries at its free end a pulley 80 over which pulley there passes an endless belt 81.

A weight is illustrated as a convenient means for holding the belt 81 against the outer ring 6 of a bearing which is at the working point. A circumferential groove 82 is shown formed in the hub 83 of the arm 79, a flexible member 84 lies in this groove, passing partly around the hub, and having a turn about a stud 90, shown in the form of a screw, carried by the arm 79. One end of the flexible member 84 is connected to a suitable weight 85 through the instrumentality of a flexible member 86 passing over a pulley 87 and connected to a slide bar 88 which is connected to one end of the flexible member 84.

For the purpose of limiting the idle movement of the arm 79 and for adjusting the range of such movement, the other end 89 of the flexible member 84 extending beyond the stud 90 is connected to a slide bar 91. An in-

terchangeable sleeve 92 surrounds the slide bar, one end of the sleeve abutting the frame member 93 through which the slide bars 91 and 88 pass, the other end of the sleeve being engaged by a pair of nuts 94 on the screw threaded end 95 of the slide bar 91.

The weight 85 is sufficiently strong to press the belt 81 against the outer ring of the bearing and rotate it causing the balls to roll on their raceways.

It will be obvious that as the finished article is moved from the working position to make room for another, that it can readily roll by the belt 81 moving the arm 79 upon the axis of the shaft 38 and slightly raising the weight 85. After the bearing which has been treated has gotten beyond the pulley 80, the weight will of course bring the arm back into its operative position and even beyond, so that it will engage the oncoming bearing and start the outer race of this rotating as it is coming into the indexed working position.

The adjusting device and the weight also permit the use of the device upon the bearings or other work pieces of different diameters.

Although but one form of the invention has been illustrated and particularly described, yet it is to be understood that various changes may be made as occasion demands within the scope of the claims without departing from the spirit of my invention.

Having thus described my invention, I claim and desire to secure by Letters Patent:

1. In a device of the character specified, the combination with an air jet nozzle, of means for moving the nozzle through a circular path, a work table provided with a series of work holding and positioning devices, and means for indexing the work table for shifting the work positioning means and the work held thereby into and out of the working zone of the nozzle.

2. The combination with a work holding table, of means for indexing the table, the table being provided with a number of sockets equal in number to the index positions, interchangeable work holding blocks having portions adapted to be mounted in the sockets, each block having a plug adapted to fit the bore of an antifriction bearing and a base capable of supporting the inner ring of the bearing.

3. The combination with a work holding table, of means for indexing the table, the table being provided with a number of sockets equal in number to the index positions, interchangeable work holding blocks capable of being mounted in the sockets, each block having a plug adapted to fit the bore of an antifriction bearing and a base capable of supporting the inner ring of the bearing, such base being of less radius than the radius of the outer dimension of the inner ring at its point of contact therewith.

4. The combination with a machine having a work suporting block and means for positioning this at a definite working point, of a rotatable air jet device adapted to rotate on an axis corresponding with the axial position of the work supporting block when at the working point of the machine, the mechanism carrying the jet device being adjustable for regulating the radius of the orbital movement of the jet.

5. The combination with a work table for presenting work pieces to the influence of an air jet, each of the work pieces being formed with an annular opening to which the jet is to be applied, of work positioning means having a support constructed and adapted to hold a work piece in such manner that its annular opening lies in the path of nozzle movement and freely permits the passage of the jet of air through it, an air nozzle, and means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the work piece.

6. An air supplying device comprising a rotary tubular shaft, of an L carried by the shaft, a swivel member fast with the L, a second swivel member rotatably connected with the first swivel member, a nozzle, and an L connecting the nozzle to the second swivel member, and a clamping device for holding the swivel members in adjusted position, the whole being organized and adapted for adjustably varying the radius of the orbital movement of the nozzle incident to the rotation of the tubular shaft.

7. The combination with a work table for passing work pieces under the influence of an air jet, each of the work pieces being formed with an annular opening to which the jet is to be applied, and a number of work positioning means carried by the holder each having a support constructed and adapted to hold a work piece in such manner that the annular opening lies in the path of nozzle movement and freely permits the passage of the jet of air through it, an air nozzle, and means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the work piece.

8. The combination with a work table for presenting work pieces to the influence of an air jet, each of the work pieces being formed with an annular opening to which the jet is to be applied, of work positioning means having a support constructed and adapted to hold a work piece in such manner that its annular opening lies in the path of nozzle movement and freely permits the passage of the jet of air through it, an air nozzle, and means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the work piece.

9. The combination with a work table for passing work pieces under the influence of an air jet, each of the work pieces being formed with an annular opening to which the jet is to

be applied, and a number of work positioning means carried by the holder each having a support constructed and adapted to hold a work piece in such manner that the annular opening lies in the path of nozzle movement and freely permits the passage of the jet of air through it, an air nozzle, and means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the work.

10. In a device of the character specified, the combination with a work table, of means for indexing this, work positioning means carried by the table, an air jet located in position to direct a jet of air upon a work piece properly positioned at each indexed position of the work table, and means for rotating the work piece when so positioned.

11. In a device of the character specified, the combination with an air jet nozzle, of a work table provided with a series of work holding and positioning devices, means for indexing the work table for shifting the work positioning means and the work held thereby into and out of the working point of the nozzle, and means for rotating the work while at the working point.

12. In a device of the character specified, the combination with an air jet nozzle, of means for moving the nozzle through a circular path, a work table provided with a series of work holding and positioning devices, means for indexing the work table for shifting the work positioning means and the work held thereby into and out of the working point of the nozzle, and means for rotating the work while at the working point.

13. The combination with a work table for presenting antifriction bearings to the influence of an air jet, each of the bearings being formed with an annular opening occupied by a series of rolling elements to which opening the jet is to be applied, of work positioning means having a support constructed and adapted to hold a bearing in such manner that its annular opening lies in the path of nozzle movement and permits the passage of the jet of air through it, an air nozzle, and means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the bearing.

14. The combination with a work table for passing antifriction bearings under the influence of an air jet, each of the bearings being formed with an annular opening occupied by a series of rolling elements to which opening the jet is to be applied, and a number of work positioning means carried by the holder each having a support constructed and adapted to hold a bearing in such manner that its annular opening lies in the path of nozzle movement and permits the passage of the jet of air through it, an air nozzle, and means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the bearing.

15. The combination with a work table for presenting antifriction bearings to the influence of an air jet, each of the bearings being formed with an annular opening occupied by a series of rolling elements to which opening the jet is to be applied, of work positioning means having a support constructed and adapted to hold a bearing in such manner that its annular opening lies in the path of nozzle movement and permits the passage of the jet of air through it, an air nozzle, means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the bearing, and means for rotating one of the rings of the bearing.

16. The combination with a work table for passing antifriction bearings under the influence of an air jet, each of the bearings being formed with a central bore and an annular opening occupied by a series of rolling elements to which opening the jet is to be applied, and a number of work positioning means carried by the holder each having a plug constructed and adapted to enter the bore of a bearing and hold its annular opening in the path of nozzle movement and permit the passage of the jet of air through it, an air nozzle, means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the bearing, and means for rotating the outer ring of the bearing.

17. The combination with a work table for passing antifriction bearings under the influence of an air jet, each of the bearings being formed with a central bore in the inner ring and an annular opening between the rings occupied by a series of rolling elements, a number of work positioning means carried by the holder each having a plug constructed and adapted to enter the bore of the inner ring of a bearing and support it in such manner that the annular opening of the bearing lies in the path of nozzle movement and freely permits the passage of the jet of air through it, an air nozzle, means for so moving the nozzle that its jet describes a path corresponding with the annular opening of the bearing, and means for concurrently rotating the outer ring of the bearing for causing the balls to roll during the application of the jet.

Signed at Hartford, Conn., this first day of June, 1929.

THEODORE JACOBSON.