Sept. 29, 1953 J. R. TINSMAN ET AL 2,653,562

AUTOMATIC METAL SPINNING APPARATUS

Filed Sept. 14 1949 4 Sheets-Sheet 1

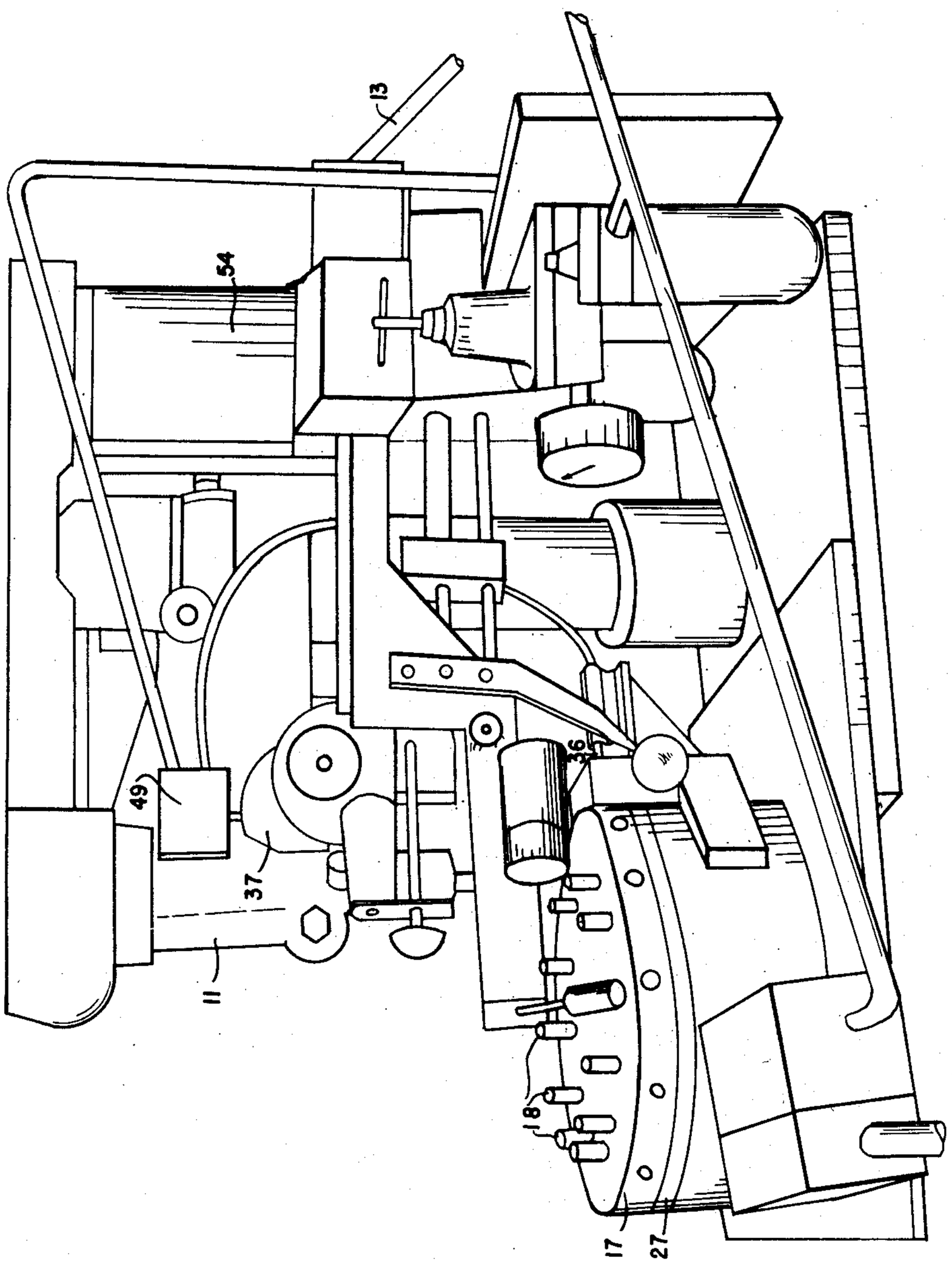

FIG. 1

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FIG. 2

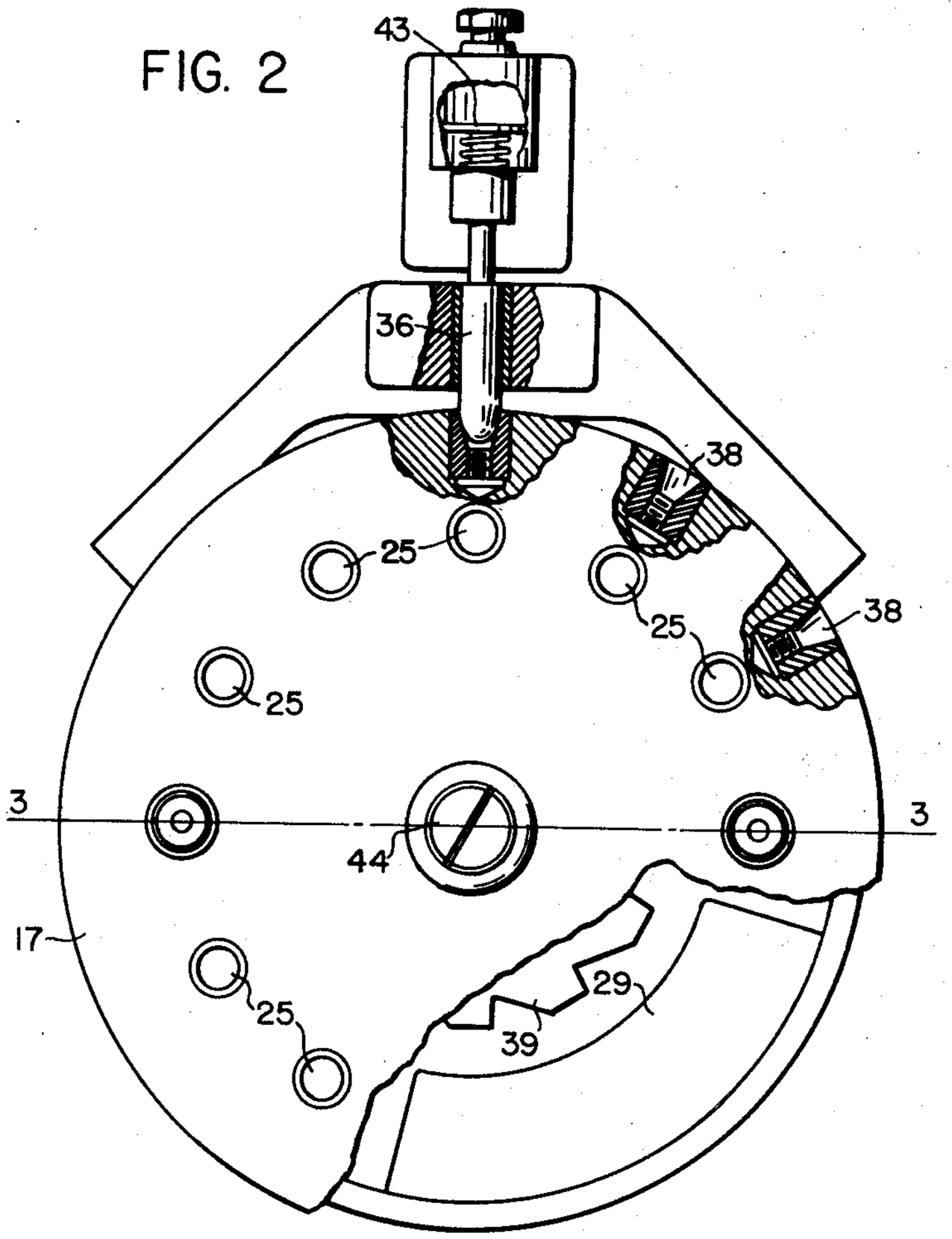

FIG. 3

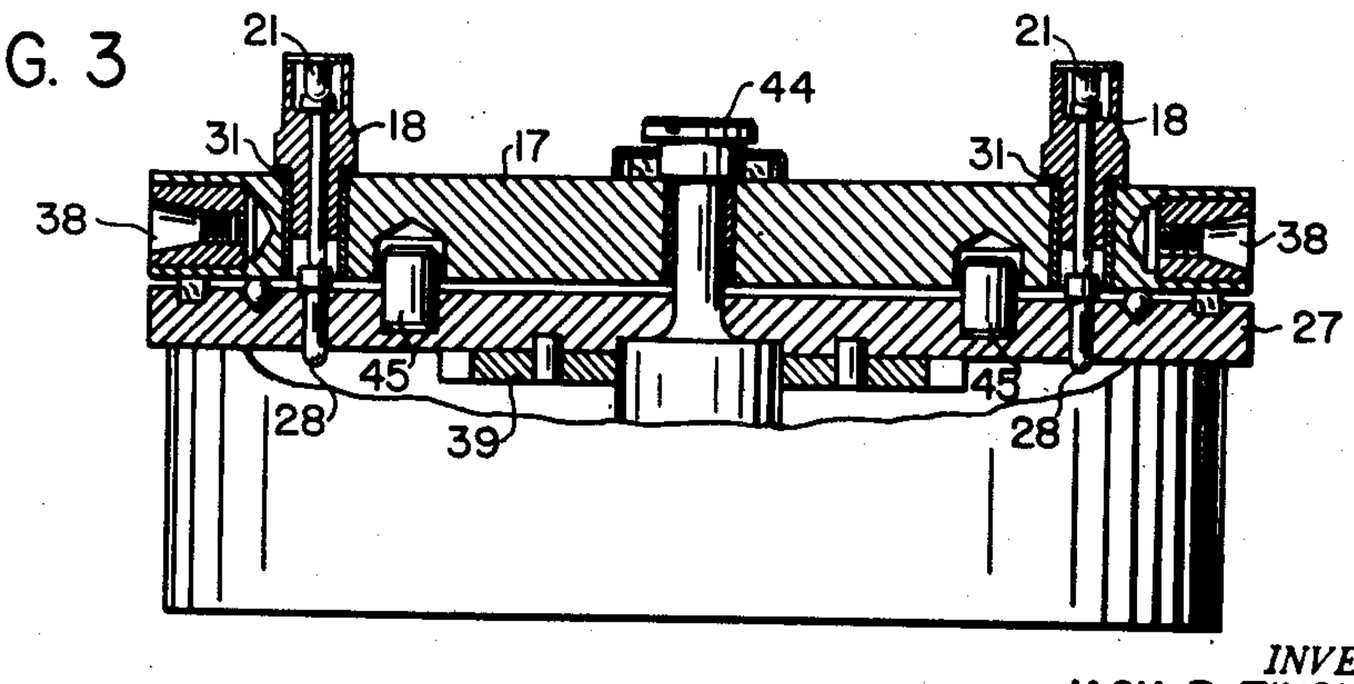

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FIG. 4

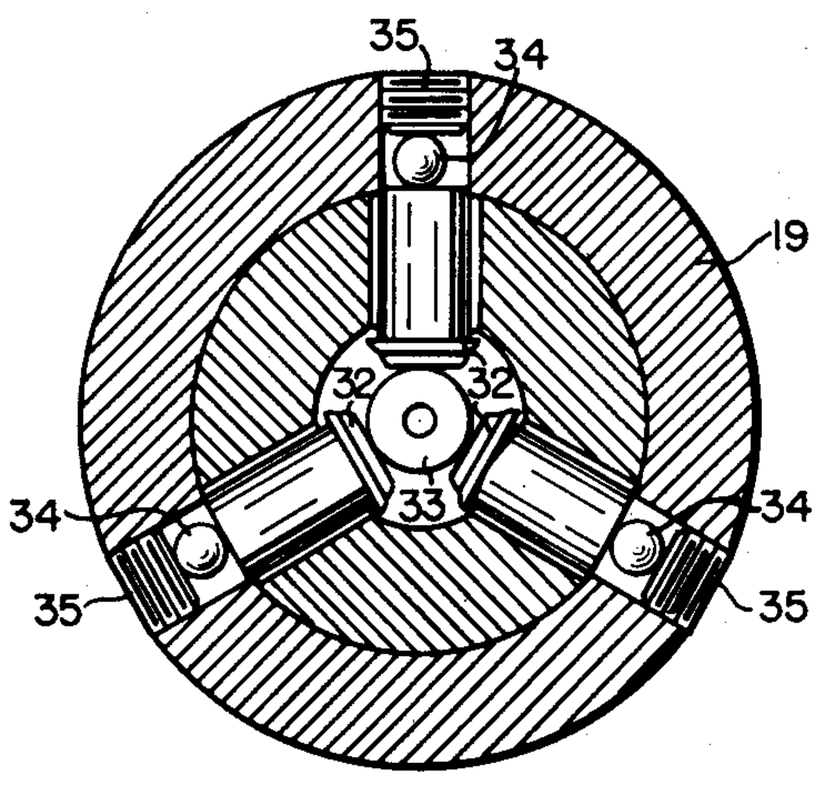

FIG. 5

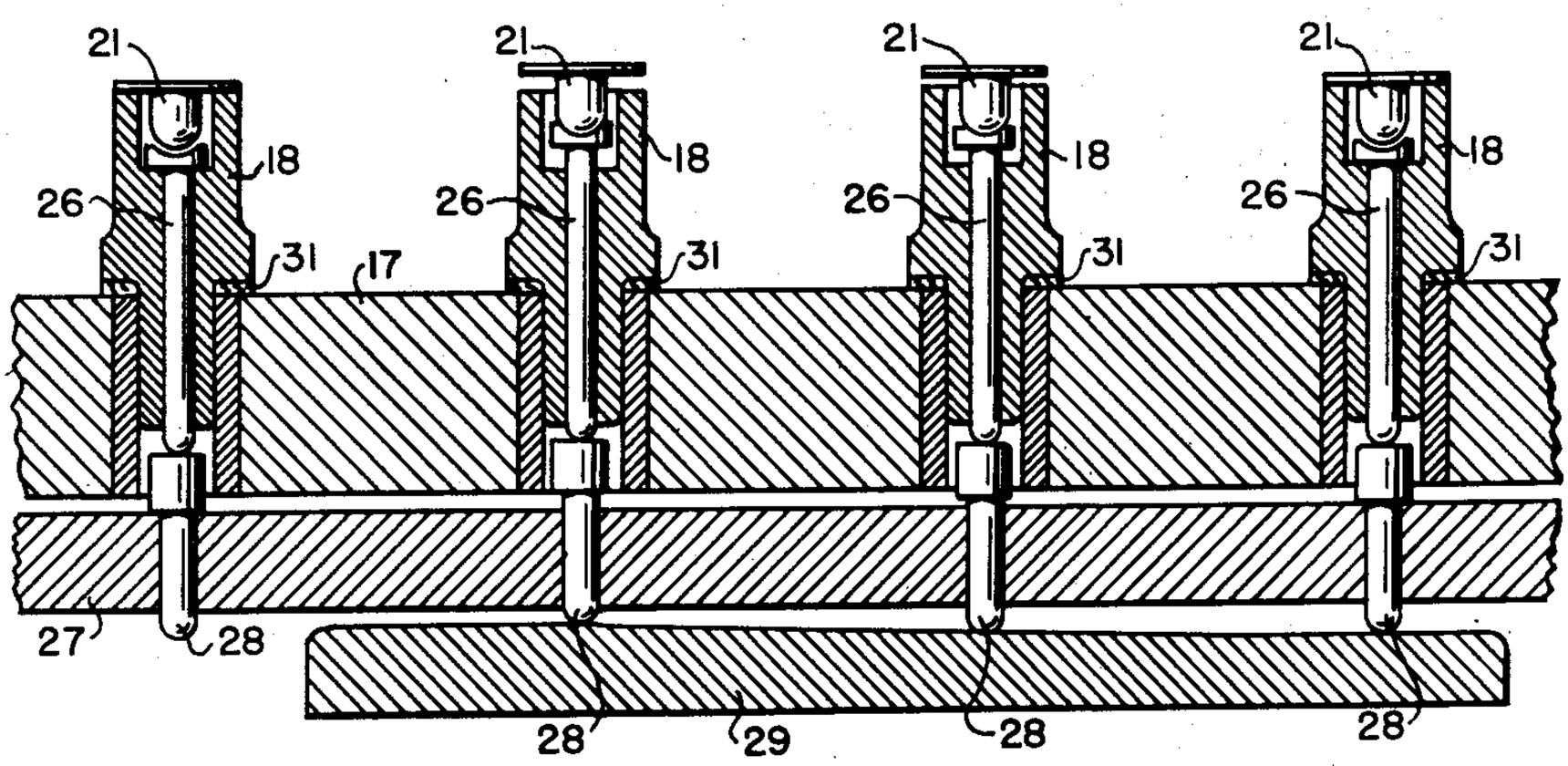

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FIG. 6

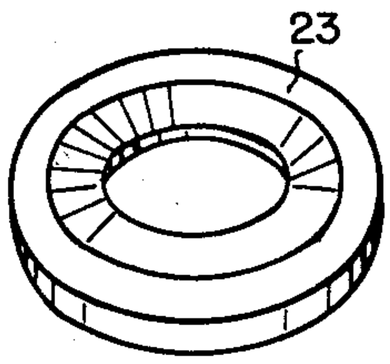


FIG. 7

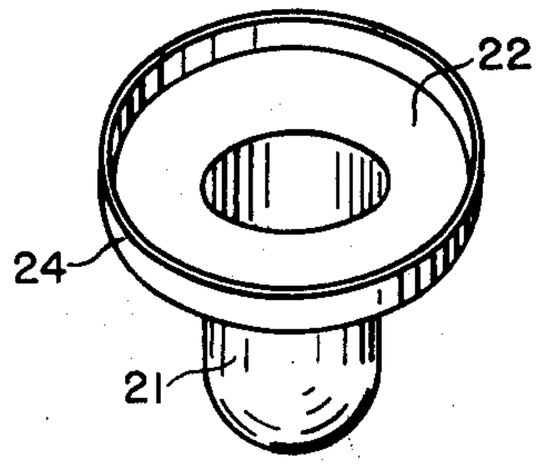
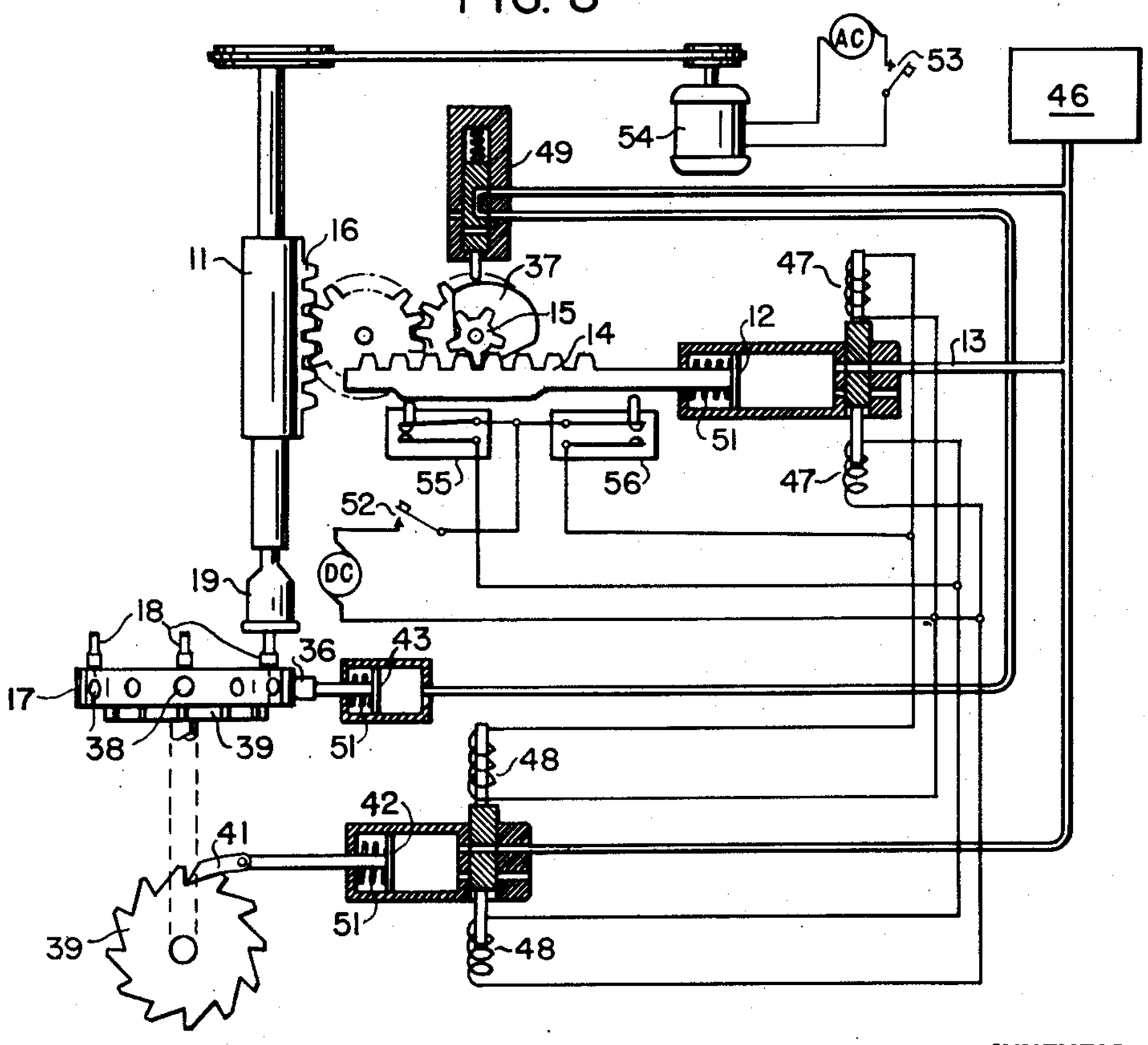


FIG. 8



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AUTOMATIC METAL SPINNING APPARATUS

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Application September 14, 1949, Serial No. 115,714

4 Claims. (Cl. 113—52)

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This invention relates to an automatic metal spinning machine in which a work piece is centered under a spinning head which is then automatically fed to a position from which it may act upon the work piece to alter its shape.

An automatic machine of this description is of particular advantage in the production of carbon cup units such as are used in telephone transmitters. In the past, these carbon cup elements have been produced on a lathe. The carbon disk was inserted in a metal cup; this assembly was then turned in a lathe while a spinning tool was manually held against the rim of the metal cup until the rim was curved over the carbon disk sufficiently to maintain it in place in the cup.

It is an object of this invention to provide an apparatus which will automatically feed a work piece into a position where it may be spun into a desired shape.

Another object of the invention is to produce a spinning apparatus which will automatically spin a work piece within very narrow tolerance limits.

A further object of the invention is to provide a spinning apparatus with a rotary feed table in which work piece holders have cam operated plungers which lift work pieces a slight distance above the holders in order to insure easy removal of the work pieces.

A feature of the invention is an automatic electric control which maintains the apparatus in constant operation after it is once started.

A further feature is the inclusion of an adjustable cam for timing the reciprocating motion of a plunger for centering the rotary table.

Other objects and features will become apparent from reference to the drawings in connection with the following detailed explanation.

As shown on the drawings, Figure 1 is a perspective view of the assembled device illustrating a number of standard parts which coact to produce an automatic spinning mechanism.

Figure 2 is a plan view partially in section of the rotary feed table and indexing plunger which will center the rotary feed table in position.

Figure 3 is a vertical cross sectional view of the rotary feed table taken along the line 3—3 of Figure 2 and showing two work piece holders with work pieces in position thereon.

Figure 4 is a sectional view of the spinning head showing the forming wheels as they would appear looking upward from underneath.

Figure 5 is a sectional view of a portion of the rotary feed table and four work piece holders with work pieces in position. In this view a circular construction has been straightened out for purposes of illustration in order to show the cam and plunger action whereby the work pieces are lifted slightly from the work piece holders in order to afford ease of handling.

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Figure 6 is a perspective view of a carbon disk such as is used in a telephone transmitter.

Figure 7 is a perspective view of a metal cup into which the carbon disk of Figure 6 is locked by spinning.

Figure 8 is a schematic diagram showing the electric control system and the air operated piston control mechanisms of the device.

Referring to Figure 1, it may be seen that a number of standard parts may be adapted for use in this invention. For example, a spinning head press 11 may be adapted from a standard drill press. Instead of a hand feed, however, an automatic air control feed such as that manufactured by The Bellows Company of Akron, Ohio, under number DFE–120 may be used. A piston 12 (Figure 8) is actuated by air entering through hose 13 to operate a rack 14 and pinion 15. The horizontal movement of the rack 14 is translated to vertical movement in the drill press rack 16.

A rotary indexing table 17 may be adapted from rotary table number BRT–10E manufactured by The Bellows Company. The Bellows units are operated by compressed air at a pressure of about 35 pounds per square inch. During operation, the rotary table advances to a position where a work piece holder 18 is directly under a spinning head 19 (Figure 8). While the work piece holder is being centered under the spinning head the piston 12 is advancing to lower the spinning head into contact with the work piece in holder 18. Upon the return of the piston 12 the spinning head travels upward out of contact with the work piece and the rotary table 17 advances the next work piece holder 18 into position.

A detailed explanation will now be given with reference to Figures 2 to 8. Figures 6 and 7 show one type of work piece which may be satisfactorily fabricated in the machine. The metal cup 21 of Figure 7 may be a thin metal stamping. The metal cup 21 has a flat circular surface 22 which serves to seat a carbon disk 23. The top portion of the rim 24 of cup 21 may be folded over the carbon 23 by a spinning operation performed by spinning head 19.

The design of the work piece holders 18 is best illustrated in Figures 3 and 5. The work piece holders fit snugly in apertures 25 spaced uniformly on a circumference near the perimeter of the rotary table 17. The center of each of work piece holders 18 has a plunger 26 freely

movable therein. The top of the plunger **26** is made concave to conform with the convex portion of metal cup **21**. An under plate **27** of rotary table **17** has apertures disposed concentric with work piece holders **18** in which plungers **28** are freely movable. The plungers **28** impinge at their upper surfaces upon the plungers **26** and at their bottom surfaces impinge upon a cam **29** during a portion of their circular movement around the rotary table. During their passage over the cam **29** the plungers **28** are raised slightly and in so doing raise the plungers **26** which in turn raise the metal cup **21** a slight distance off the work piece **18** thereby facilitating removal of the finished cup.

Work piece holders **18** are seated upon plastic or latex washers **31** which are compressed slightly during the time of contact between the work piece **21** and spining head **19** thereby insuring uniform pressure between the work piece and spinning head wheels.

The spinning head illustrated in Figure 4 consists of three forming wheels **32** which are free to rotate between a retaining stud **33** and a thrust bearing **34**. Pressure on the forming wheels **32** may be controlled by set screws **35**. The forming wheels **32** have surfaces rounded slightly in order to give the proper curvature to the upper part of the rim **24** during the time the parts are in engagement.

As best illustrated in Figure 2 an air operated indexing plunger **36** is utilized to center the rotary table within very narrow tolerances. The plunger **36** must operate only after the rotary table **17** has positioned a work piece holder **18** under the spinning head **19**. Movement of the plunger **36** is therefore controlled by a cam **37** (Figure 8) which may be adjusted to a particular seating on the shaft of pinion **15**. There is a horizontal aperture **38** lined up in rotary table **17** with each of vertical apertures **25**. Since there is a certain amount of wear upon the sides of apertures **38** during operation these apertures are located in a removable metal piece so that they may be replaced after excessive wear.

The rotary table **17** is rotated by a ratchet wheel **39** integrally concentric with under plate **27**. The ratchet **39** is actuated by a pawl **41** (Figure 8) on piston **42**. As an influx of air moves the piston **42** the pawl **41** actuates the ratchet **39** which in turn forwards another of work piece holders **18** into position under the spinning head **19**. A piston **43** then moves plunger **36** into one of the apertures **38** in order to insure that the work piece holder **18** is precisely centered.

The rotary table **17** is held in position by means of a pawl **41**. Rotary table **17** and under plate **27** rotate together. Bosses **45** prevent slippage between the two parts.

The operation of the apparatus may best be described with reference to Figure 8. Numeral **46** designates a source of compressed air for operation of the pistons **12**, **42** and **43**. This compressed air may be supplied from any source of about 35 pounds per square inch. The return of the pistons is accomplished by means of compression springs **51**. The admission of air into the cylinder chamber is controlled by solenoid valves **47** and **48** in the case of pistons **12** and **42**, respectively, and by a cam operated valve **49** in the case of piston **43**. Pistons **12**, **42**, and **43** may be double acting air pistons instead of spring return pistons.

A single starting switch could be used to place the device in operation but it is convenient to

have a pair of starting switches **52** and **53** so that the spinning head may be rotated independently by closing switch **53** while the various piston control parts may be held stationary. In the position shown in Fig. 8 the pistons are shown at the limit of their travel. Their motion will now be described through a complete cycle.

The switch **53** is closed to complete a circuit for the operation of press motor **54** which rotates spinning head **19**. The switch **52** is closed to complete a circuit through a microswitch **55** for the energization of solenoids **47** and **48** to the exhaust position. The piston **12** is restored by its spring **51** as the compressed air is exhausted through the solenoid valve **47**. This motion raises the spinning head **19** and brings cam **37** into a position to move the valve **49** into exhaust position. When the valve **49** is in exhaust position the piston **43** is acted upon by its spring **51** to pull the plunger **36** out of its aperture **38**. At the same time the restoration of the piston **42** by its spring **51** disengages the pawl **41** which then engages the succeeding tooth in ratchet **39**.

The motion of rack **14** opened microswitch **55** and toward the end of its stroke closed microswitch **56**. The closure of microswitch **56** prepared solenoid valves **47** and **48** for the intake of compressed air. When the intake valve **48** is in position to pass compressed air to piston **42**, piston **42** rotates ratchet **39** through the agency of pawl **41** to line up the succeeding work piece holder **18** under the spinning head **19**. With the solenoid valve **47** in position to pass compressed air to piston **12**, piston **12** started the travel of rack **14** which lowered the spinning head **19**. Just before spinning head **19** engaged the work piece cam **37** opened the intake of valve **49** to move piston **43** which in turn forced index plunger **36** into engagement with rotary table **17** through aperture **38**. The index plunger **36** thus locked the rotary table **17** into position during the spinning interval.

In the meantime the movement of rack **14** had opened microswitch **56** and closed microswitch **55** so that all moving parts were one again in the position shown in Figure 8.

In production operations the operator of the machine receives the cups **21** with the carbon disks **23** seated therein. After the machine is started it continues to operate and the operator places the cups **21** into the work piece holders **18** before they reach the spinning head **19**. After the carbon disk **23** has been spun into place further rotation of rotary table **17** brings the cups **21** to a point where the cam **29** raises the work pieces slightly above the holders **18** to enable the operator to remove them quickly and easily.

While the invention has been described with reference to a single embodiment it is not the intention to limit the scope thereof other than as necessitated by the appended claims.

What is claimed is:

1. An automatic machine for spinning metal comprising a spinning head press, a spinning head connected to said press, an air-operated piston means for raising and lowering said head, a rotary work table for said press, the axes of said head and said rotary table being substantially parallel and displaced a short distance from each other, an air-operated piston means for rotating said rotary table in short steps, a plurality of work piece holders in spaced relation around a circumference near the perimeter of

said rotary table, said circumference passing through the axis of said spinning head, a plurality of circular apertures in spaced relation around the periphery of said rotary table, the axes of said apertures being at right angles to the rotary table axis, an indexing plunger integral with said press and coaxial with a particular position said apertures assume during rotation of said rotary table, an air-operated piston means for moving said indexing plunger into said apertures, solenoid valves to control the air intake and exhaust of said first and second air-operated, piston means, two switches, means operating responsive to the raising of said head for operating one of said switches and operating responsive to the lowering of said head for operating the other of said switches, a power source for said solenoid valves, a circuit including said one of said switches, said power source, and said solenoid valves, said one of said switches connected in said circuit so that said circuit is completed when said head is raised to cause said first and second air-operated piston means to lower said head and to rotate said table one step, a second circuit including said other of said switches, said power source, and said solenoid valves, said other of said switches connected in said second circuit so that said second circuit is completed when said head is lowered to cause said first and second air-operated piston means to raise said head and to condition said table for further rotation, and means operated responsive to the lowering of said head for operating said third air-operated piston means and operated responsive to the raising of said head for restoring said third air-operated piston means.

2. An automatic metal spinning machine comprising a spinning head press, a spinning head on said press in position to be rotated, a rack and pinion and a piston connected thereto for raising and lowering said head, a rotary work table for said press, a pawl and ratchet and a piston connected thereto for rotating said work table in short steps, a plurality of work piece holders in spaced relation around a circumference near the perimeter of said rotary table, said circumference passing through the axis of said spinning head, a freely movable concentric plunger in each work piece holder, a stationary cam mounted below said table and engaged by said plungers as said table is rotated when said plungers are in a position other than in vertical alignment with said head, to raise work pieces a short distance above said work holders, cone shaped apertures in spaced relation around the peripheral surface of said rotary table, the axes of said apertures being at right angles to the rotary table axis and extending radially outward therefrom, a cone shaped indexing plunger integral with said press and coaxial with a particular position said apertures assume during rotation of said rotary table, an air-operated piston for moving said indexing plunger into said apertures to index said table, a cam operated in association with said rack and pinion, a valve operated by said cam to permit air to enter said indexing plunger piston when said head is lowered and to permit air to exhaust from said indexing plunger piston when said head is raised, solenoid valves to control the air intake and exhaust of said rack and pinion and said pawl and ratchet pistons, a source of compressed air connected to said valves, two switches, a second cam mounted on said rack for operating said switches, said switches so mounted that one is operated when said head is raised and the other is operated when said head is lowered, a power source for said solenoid valves, a circuit including said one of said switches, said power source and said solenoid valves, said circuit completed when said head is raised to operate said one of said switches to cause air to enter said rack and pinion piston and said pawl and ratchet piston, a second circuit including said other of said switches, said power source and said solenoid valves, said second circuit completed when said head is lowered to operate said other of said switches to cause air to be exhausted from said rack and pinion piston and said pawl and ratchet piston.

3. Means for controlling the operation of a metal spinning machine having a spinning head, and having a rack and a series of gears co-operating with said spinning head for raising and lowering said spinning head, and having a rotatable work table having a ratchet mounted on the underside thereof and a pawl for co-operation with said ratchet, and having an indexing piston for co-operation with said work table to accurately index each work piece mounted upon said work table, comprising a solenoid controlled air valve connected to said pawl, a cam controlled air valve connected to said indexing piston, a solenoid air valve connected to said rack, a cam mounted on one of said series of gears and associated with said cam controlled air valve, two switches, a cam on said rack associated with said two switches, a power source for said solenoid controlled air valves, and a source of air connected to said valves, a circuit including one of said switches, said power source and each of said solenoids of said solenoid controlled air valves, said one of said switches so mounted as to be closed by said cam mounted on said rack when said rack is in the restored position thereby completing said circuit, said solenoids so connected in said circuit that the completion of said circuit operates said solenoids to cause air from said air source to enter said solenoid controlled air valves, whereby said solenoid controlled air valves are operated by said air from said air source to cause said pawl to operate against said ratchet to rotate said work table and to cause said rack to operate against said series of gears to cause said spinning head to be lowered toward said work table, said cam on one of said gears so shaped that said cam controlled air valve is operated by said cam before said spinning head is completely lowered whereby said air source is caused to enter said cam controlled air valve thereby causing said indexing piston to index said work table, a second circuit including the other of said switches, said power source and each of said solenoids of said solenoid controlled air valves, said other of said switches so mounted as to be closed by said cam mounted on said rack when said rack is in the operated position thereby completing said second circuit, said solenoids so connected in said second circuit that the completion of said second circuit restores said solenoid controlled air valves whereby said pawl and said rack are restored, said cam on said one of said gears so shaped that said cam controlled air valve is restored by said cam as said rack is restored.

4. In a metal spinning machine, a spinning head, a rack, a series of gears, said gears co-operating with said rack and said spinning head so that as said rack is operated and restored said spinning head is respectively lowered and raised, a rotatable work table, a ratchet mounted on the

underside of said table, a pawl mounted to co-operate with said ratchet, a series of holes in said work table, an indexing piston mounted to co-operate with any one of said holes in any rotated position of said table, a series of work holders mounted on said table and associated respectively with each of said indexing holes, an air operated spring restored motor connected to said pawl for operating and restoring said pawl, a second air operated spring restored motor connected to said rack for operating and restoring said rack, a third air operated spring restored motor connected to said indexing piston for operating and restoring said piston, two solenoid valves, one of said valves connected to said first motor, the other of said valves connected to said second motor, a cam mounted on one of said gears, a third valve so mounted as to be operated by said cam on one of said gears, said third valve connected to said third motor, said valves operable to admit air to said motors and restorable to release air from said motors, a source of air connected to said first, second and third valves, a cam mounted on said rack, two switches, a power source for said solenoid valves, a circuit including one of said switches, said power source and said solenoid valves, a second circuit including the other of said switches, said power source and said solenoid valves, said cam mounted on

said rack shaped to cause said one of said switches to be closed when said rack is restored and to open said one of said switches and to close said other of said switches when said rack is in the operated position, whereby the completion of said first circuit causes the operation of said solenoid valves to cause said pawl to operate against said ratchet to rotate said table and to cause said indexing piston to index said table and to cause said spinning head to be lowered, and whereby the completion of said second circuit causes said spinning head to be raised and causes said pawl and said piston to be restored.

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