June 6, 1944. W. S. REYNOLDS 2,350,569

MACHINE

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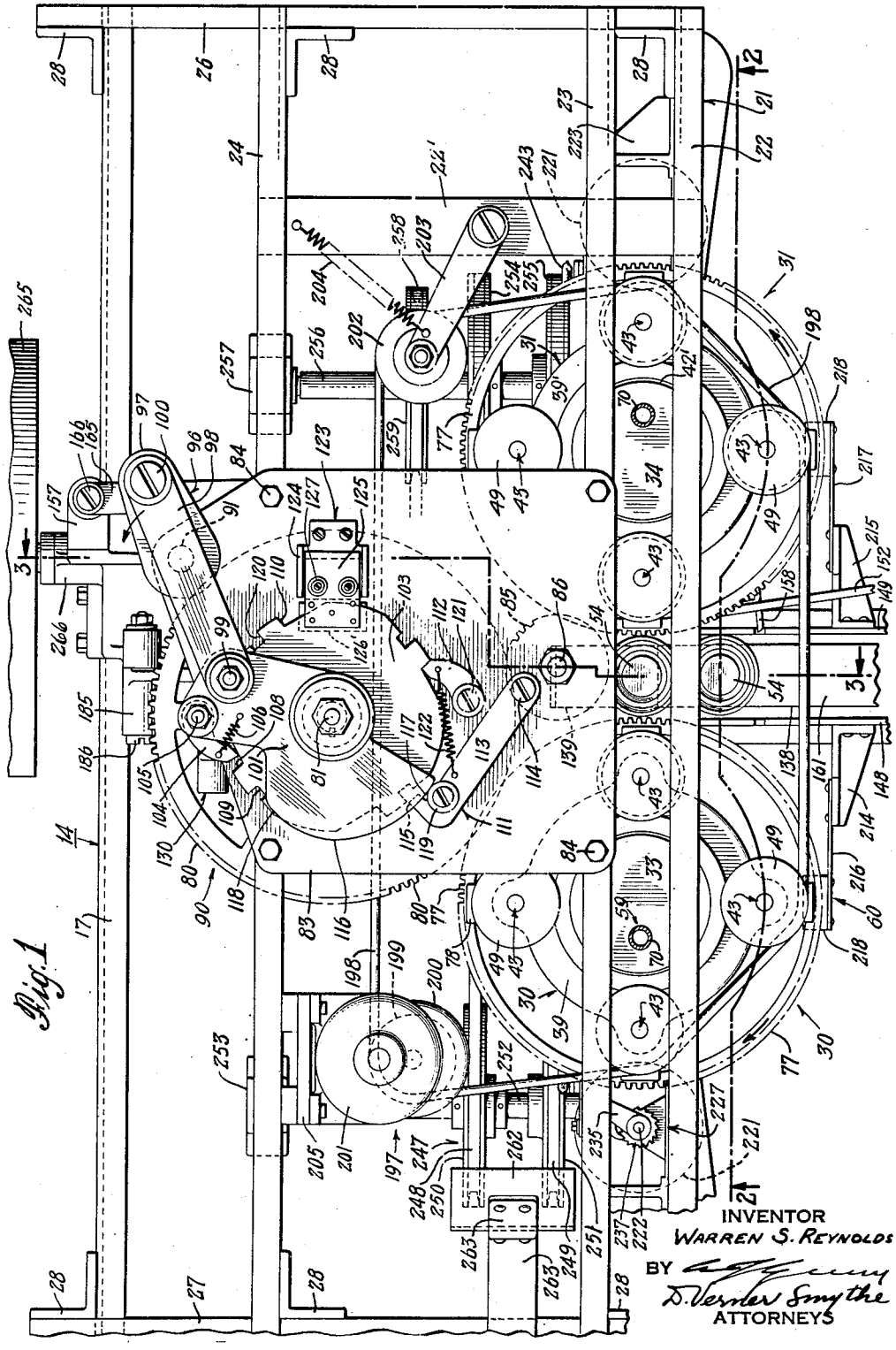


Fig. 1

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MACHINE

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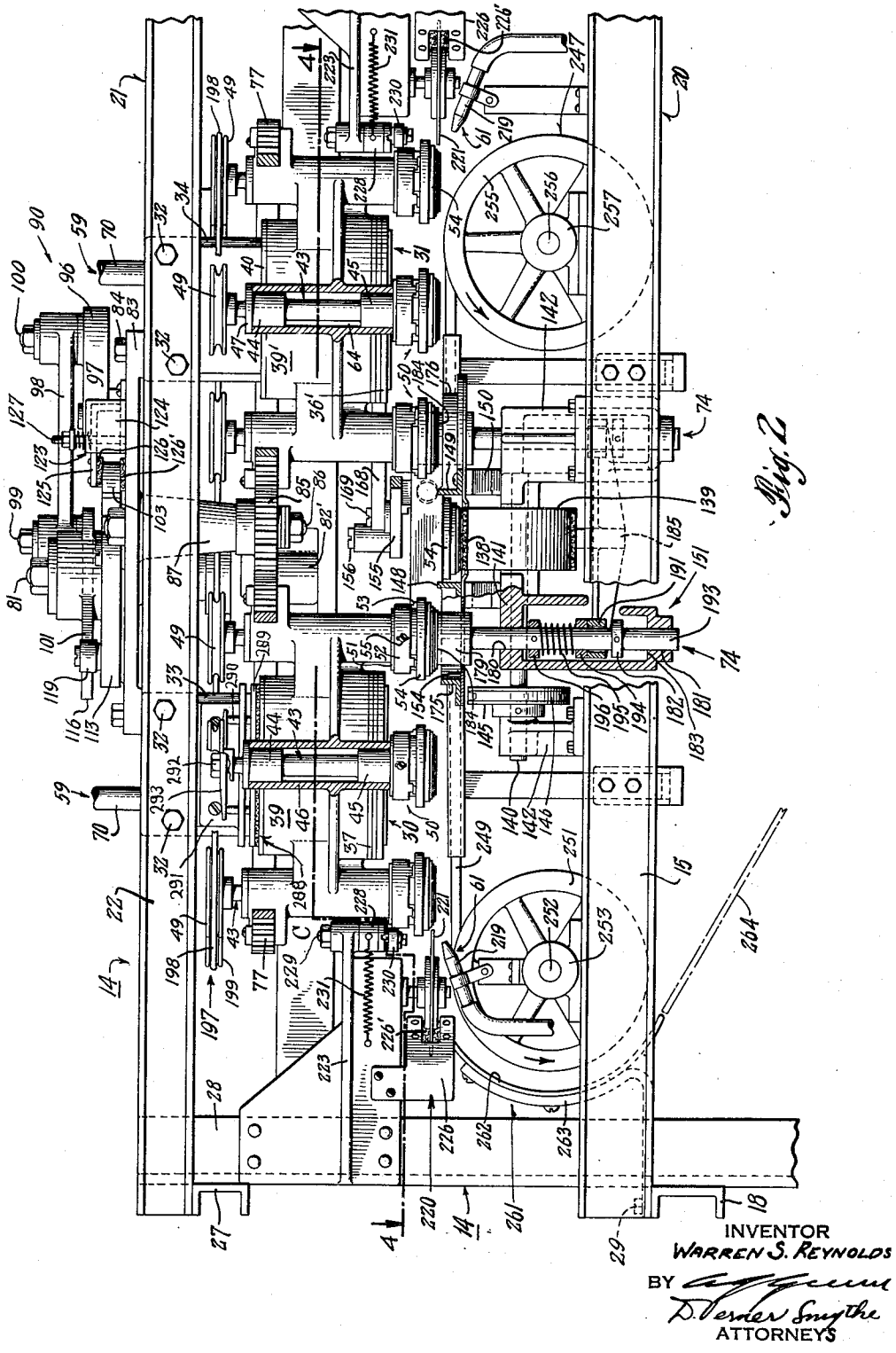


Fig. 2

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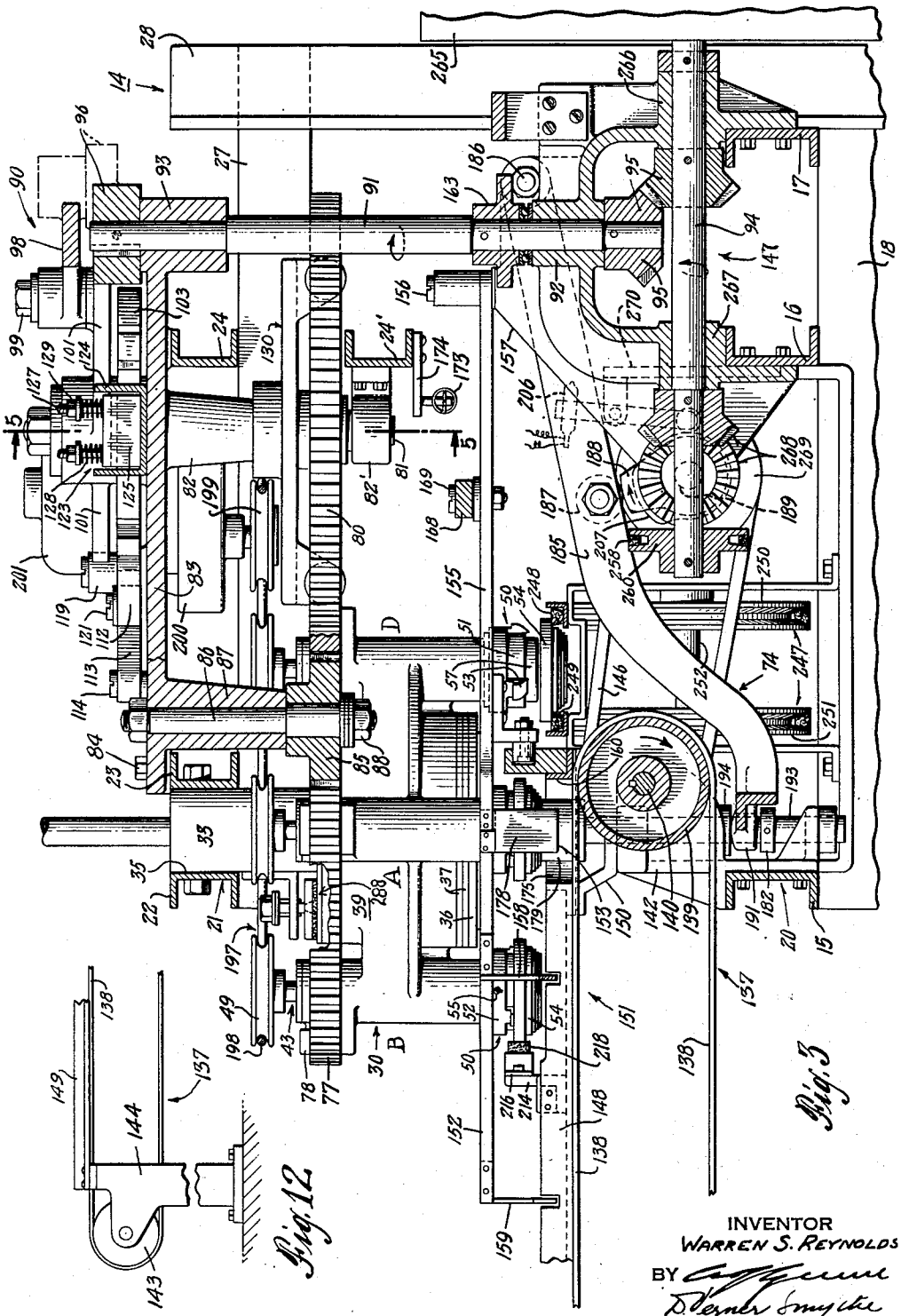


Fig. 3

Fig. 12

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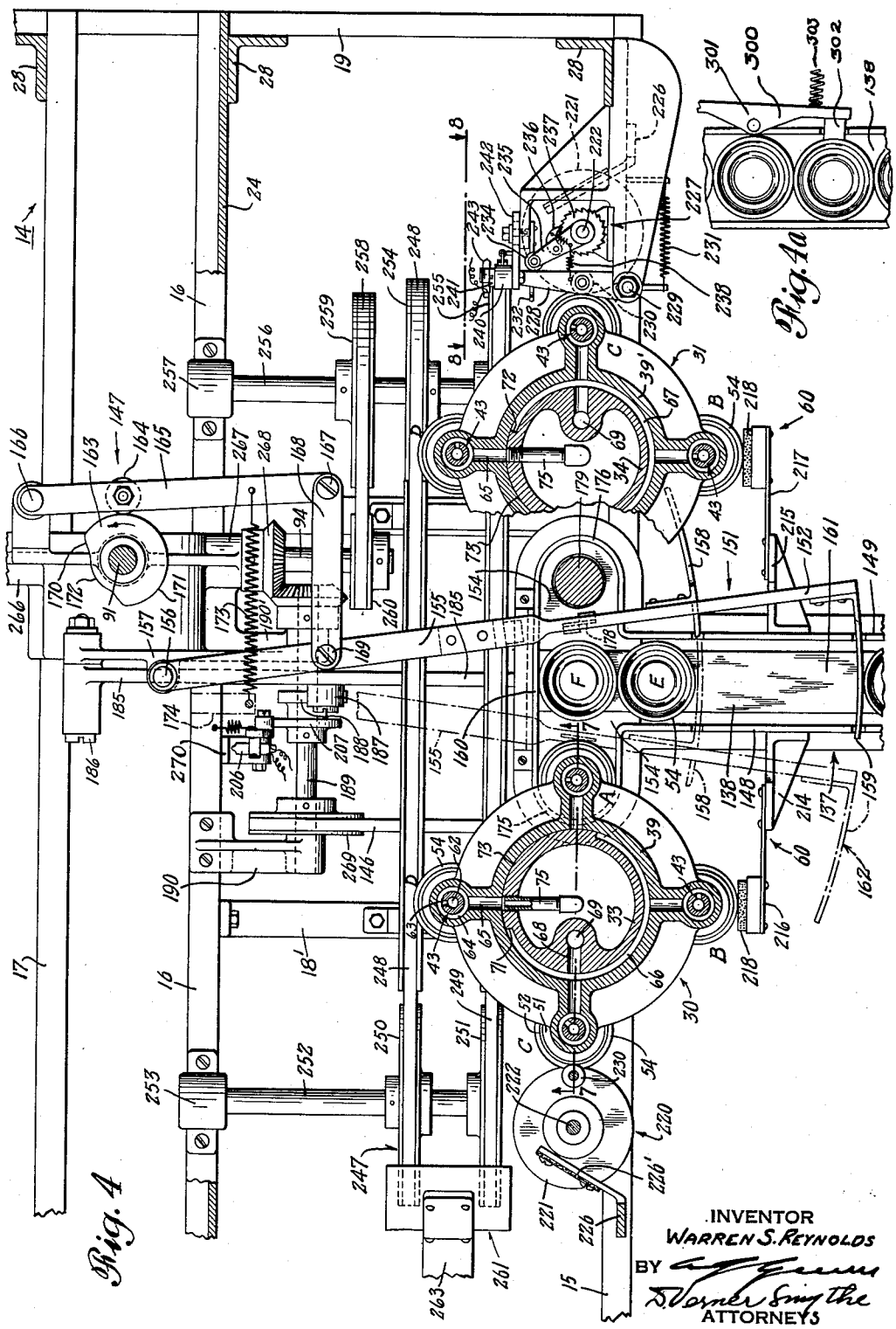


Fig. 4

Fig. 4a

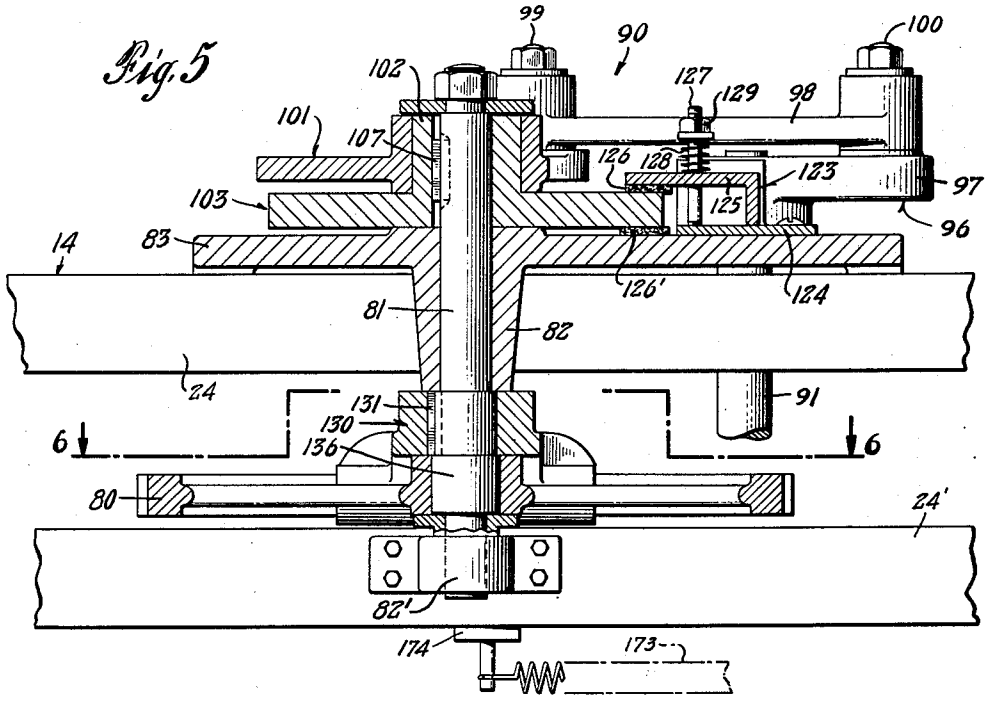
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MACHINE

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Fig. 5



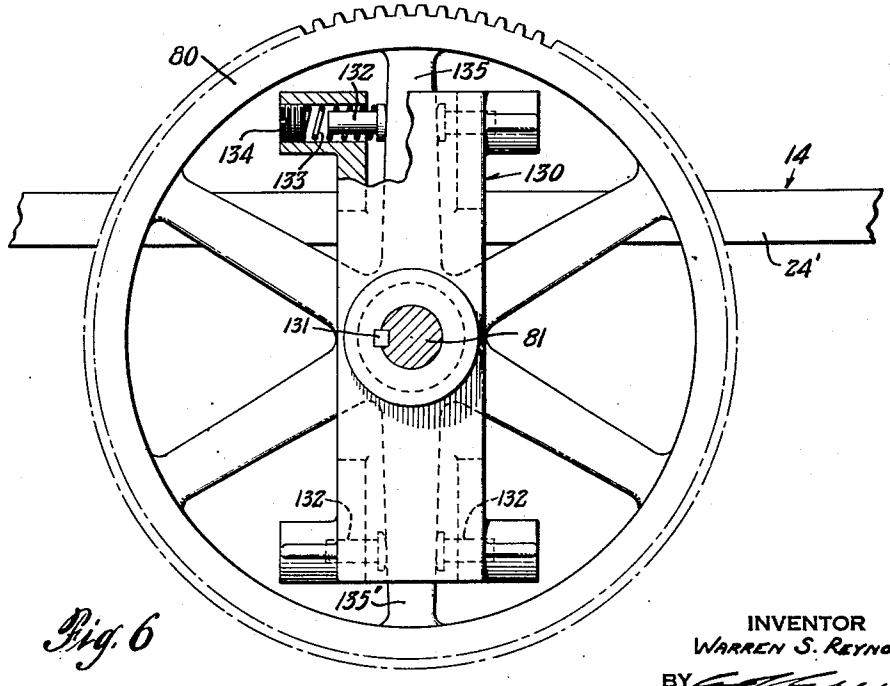


Fig. 6

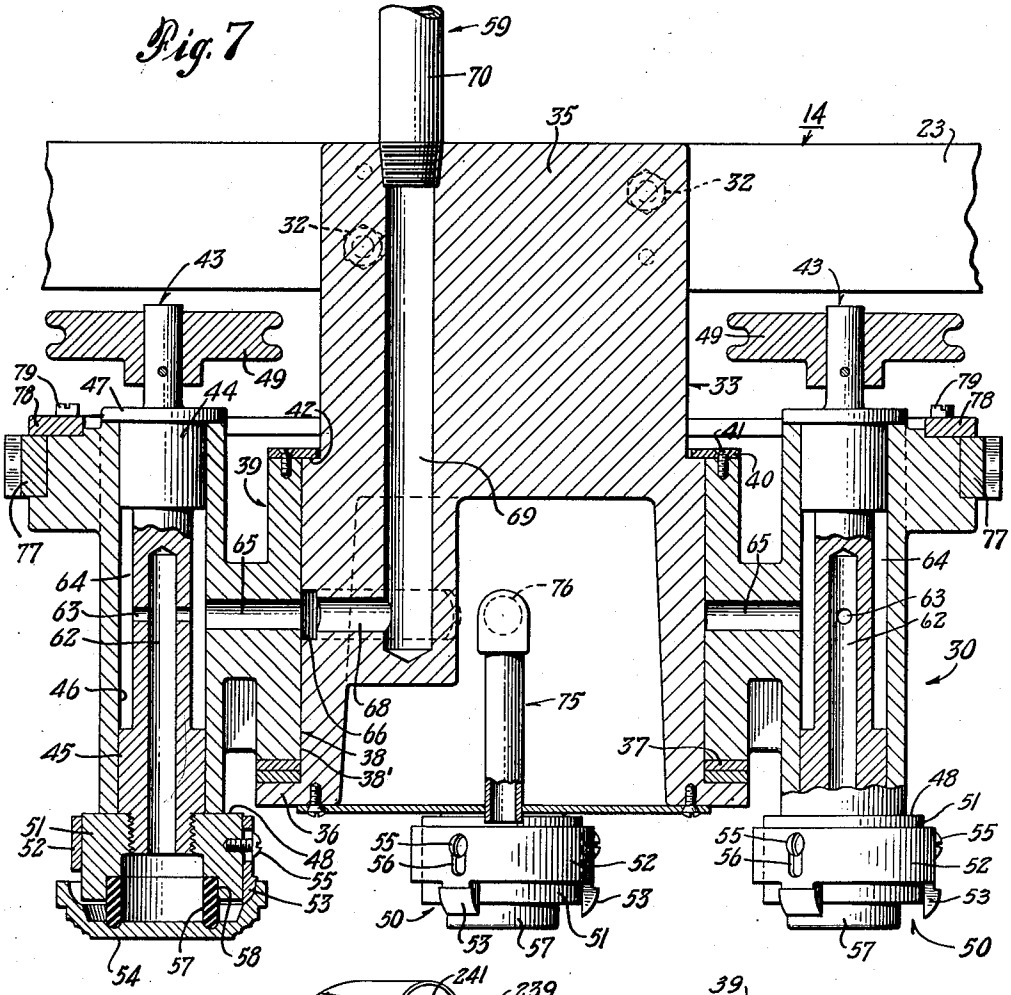
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MACHINE

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Fig. 7



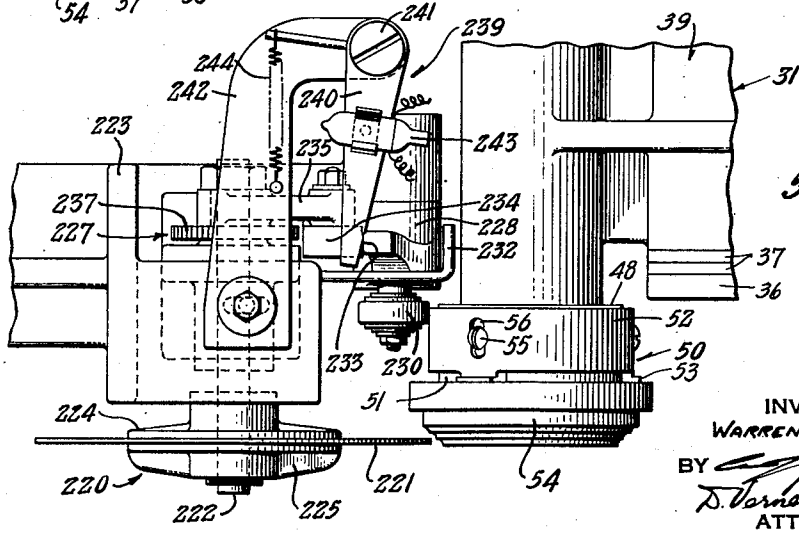


Fig. 8

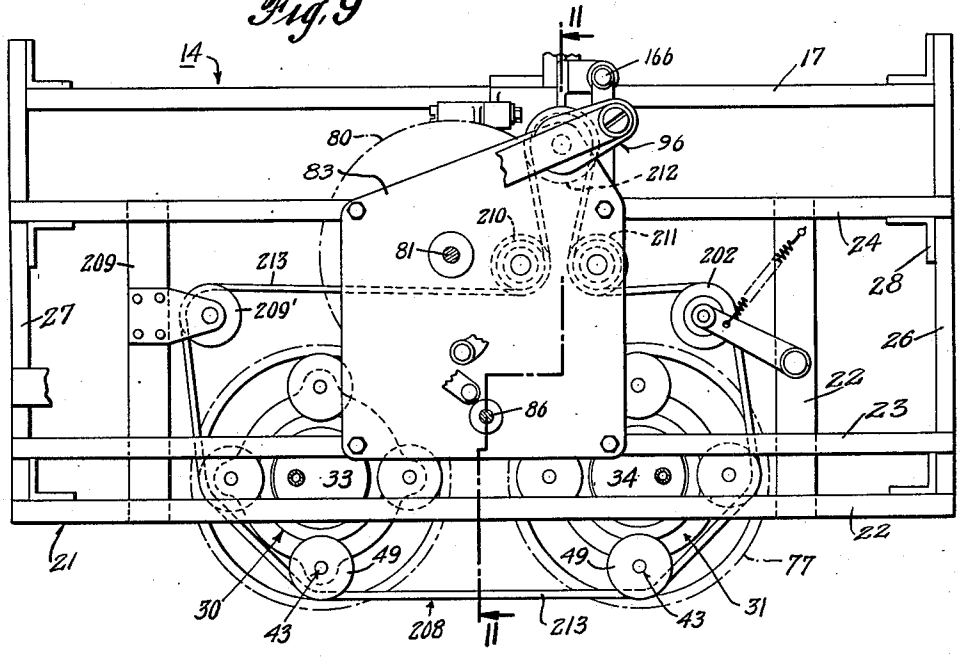
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MACHINE

Filed Dec. 23, 1940 7 Sheets-Sheet 7

Fig. 9



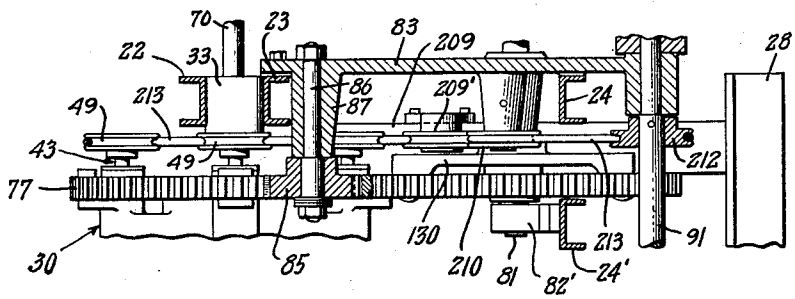
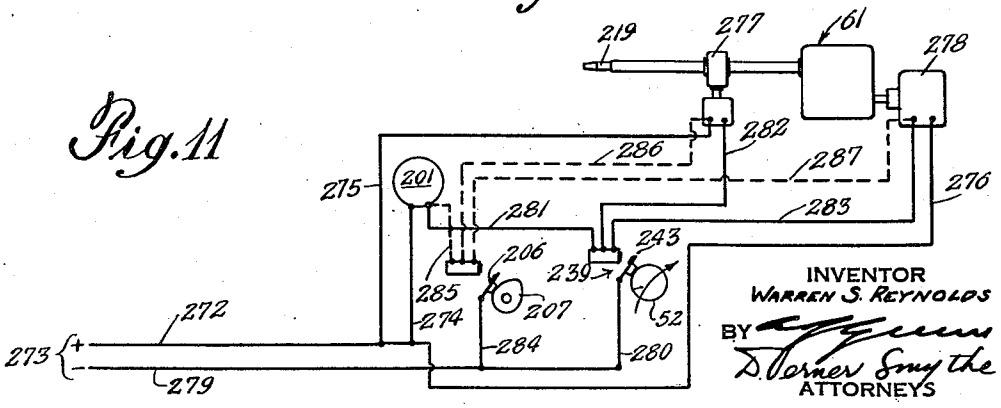


Fig. 10

Fig. 11



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Patented June 6, 1944 2,350,569

UNITED STATES PATENT OFFICE

2,350,569

MACHINE

Warren S. Reynolds, Stratford, Conn., assignor to Remington Arms Company, Inc., a corporation of Delaware

Application December 23, 1940, Serial No. 371,288

9 Claims. (Cl. 91—45)

This invention relates to automatic machines and particularly to automatic machines of the turret type.

The automatic machine, provided by the present invention, is particularly effective and advantageous for defining and painting clay targets, and for convenience of understanding is described herein only in this form. However, it should be understood that it is capable of many other embodiments and uses, and that certain of the instrumentalities, such as the tools for performing operations on the work, can be changed without departing from the spirit and scope of the invention.

Objects of the invention include the provision of an automatic machine capable of: performing one or more operations on pieces of work in an economical and high-speed manner; performing operations on fragile work without breaking the same; feeding work into and/or out of the machine, and to the operation instrumentalities, in a particularly effective manner; initiating and controlling operation instrumentalities in the machine coordinately with the general operation of the machine; definning clay targets and painting certain sections of the same.

Features of the present invention, resulting from attaining the above objectives, include the provision of an automatic machine having novel: feeding mechanism; loading mechanism adapted to move successive pieces of work into a predetermined station, or stations, in the machine; selecting mechanism which allows only a predetermined quantity of work to pass into the machine, in a step-by-step manner from the feeding mechanism; transferring mechanism, which is extremely simple, for moving work into divers nesting sections in the machine; lifting mechanism for moving work from a loading platform onto work spindles; work holders with cushioned nosepieces; locator rings for easily and accurately positioning work on the work spindles; a plurality of work turrets concurrently operable with or upon a plurality of "runs" of product; suction means for holding work upon work spindles at predetermined points and times; mechanism to rotate work spindles only when they are at predetermined stations in the machine; automatically controlled and/or operable painting and masking apparatus; means for dropping work from the work spindles, at certain stations in the machine, and complemental means which may optionally be used for expelling the work from the spindles, at a certain station, or stations, in the machine; device for turning over pieces of work as they are unloaded or fed out of the machine; driving mechanism, with comparatively few yet effective parts, for concurrently operating the aforementioned mechanisms and instrumentalities; devices for braking or otherwise minimizing shocks to divers parts of the machine.

Other objects, features and improvements will appear hereinafter.

In the drawings:

Figure 1 is a top plane view of a machine embodying the present invention.

Fig. 2 is a front view of the machine, partly in section.

Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a top sectional view taken on line 4—4 of Fig. 2.

Fig. 4A is a fragmentary view showing a modification of the escapement of Fig. 4.

Fig. 5 is a fragmentary and cross-sectional detail of a part of the indexing and driving mechanism.

Fig. 6 is a detail, partially in section, of a part of the main drive mechanism.

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

Fig. 8 is a sectional view taken on line 8—8 of Fig. 4.

Fig. 9 is a fragmentary top view of a modified form of spindle drive.

Fig. 10 is a sectional view taken on line 10—10 of Fig. 9.

Fig. 11 is a diagrammatic showing of the painting mechanism, and of the electrical circuits.

Fig. 12 is a fragmentary view of the outer end of the feeding mechanism.

Before describing the present improvements and mode of operation thereof in detail it should be understood that the invention is not limited to the details of construction and arrangement of parts shown in the accompanying drawings, which are merely illustrative of the present preferred embodiment, since the invention is capable of other embodiments, and the phraseology employed is for the purpose of description and not of limitation.

For convenience, the present machine is described for use in painting and defining clay targets. However, it should be appreciated that it may be used for similar or divers other operations on pieces of work other than clay targets.

Broadly, or in the briefest possible manner, to facilitate a comprehension of the detailed description immediately following, the invention

may be described as an automatic machine with a feeding mechanism for carrying a stream of work, such as clay targets, to a loading mechanism. This loading mechanism includes selecting means for allowing only certain pieces of work to intermittently and successively pass to a loading platform, and to transferring and lifting means for moving these pieces of work to sets of work-holding spindles on a pair of turrets. Next, these pieces of work are held on the spindles by novel suction means throughout certain parts of the rotation of the turrets. Mechanism and instrumentalities are provided to rotate the spindles to perform certain operations upon the work when the turrets are in divers stations. Unloading is accomplished with a simple yet very effective associated mechanism. A simple driving mechanism is also provided for concurrently effecting a conjoint operation of all the foregoing mechanism and instrumentalities.

Main Frame

Referring in detail to the drawings, which show the now preferred embodiment, the present invention includes a main frame 14 which is in large part made of angle irons welded or otherwise suitably secured together. In general, the present main frame includes lower bars 15, 16 and 17 extending transversely of the machine and suitably secured to rearwardly extending bars 18, 18' and 19, herein referred to as a bottom support 20. Similarly, the main frame includes a top support 21 with transverse bars 22, 23 and 24 suitably secured to rearwardly extending bars 26 and 27 as by welding. The top and bottom supports are located and supported relative to each other and relative to a bench or floor by a plurality of upright standards 28. Preferably, four or more of these are provided. Assembly and connection of the various bars relative to each other and to the upright standards may be effected by screws 29, shown at the lower left-hand corner of Fig. 2, or, by welding the various parts together. For economy and to inure a sturdy permanent connection, welding is preferred.

Turret and Work Heads

In its now preferred form the present invention includes a pair of turrets 30 and 31 (Figs. 1–4 and 7) which are alike except for slightly different stationary inner members 33 and 34 each preferably in the form of a casting having an upper center projection 35 adapted to fit closely between the bars 22 and 23 and to be secured thereto by screws 32. Each inner member 33 and 34 is provided with a lower shoulder 36 and 36' respectively (Fig. 7) adapted to form a support for suitable washers 37, and each has a main cylindrical section 38 adapted to receive and rotatably support turret heads 39 and 39'. The turret heads merely rest upon the washers 37 so that they may be rotated readily. Alternatively, or additionally, to lighten and remove load of the turret heads 39 and 39' on the shoulders 36 and 36', a ring 40 may be secured to the turret heads 39 and 39' by screws 41 and overlie upper shoulders 42 and 42'.

The turret heads 39 and 39' (Fig. 7) are exactly alike, and each includes four spindles 43 suitably supported for rotation by sections 44 and 45 on the spindles engaging bores 46 and shoulders 47 and 48 preventing adverse vertical movement. Each spindle has a suitable sheave 49 secured to its upper end, and a suitable work head 50 at its lower end including a nose-piece 51 and a locator ring 52. The locator rings 52 have a plurality of integral guide fingers 53 of comparatively narrow width and widely spaced apart so that there is no danger of the same cracking a clay target 54 if a target thereon happens to be warped or nonconcentric. The locator rings are supported for easy vertical movement and against adverse dropping from the machine, as by a plurality of screws 55 secured in each nosepiece 51 entering suitable elongated apertures 56 at several points about the locator ring 52.

Further, each work head 50 at its lower end is preferably provided with a sleevelike gasket 57 fitted into a suitable recess 58. Thus, a clay target 54 (or other piece of work) may be pushed against the locator ring 52 while the latter lifts or rises until the inside of the clay target is in engagement with the face of the rubber gasket, whereupon suitable suction means 59 may be used to retain the same in this position.

The heads 39 and 39' are adapted to be moved into loading stations A, definning stations B, painting stations C and unloading stations D. At the loading stations A new pieces of work are moved against nosepieces 51 of work spindles 43 and are subsequently maintained against the same until suction is fully "cut in" to hold work in the gaskets 57 and work spindles 43. At stations B suitable definning mechanisms 60 are yieldingly maintained against the clay targets to remove any fins or the like remaining thereon after the molding operation. At stations C suitable painting mechanisms 61 are provided to automatically paint or spray a predetermined section of such targets in order, for example, to provide a bull's-eye effect upon the same. At the unloading stations D the suction is discontinued to allow work to drop from the spindles, and optionally pressure may be directed to the work heads for forcing pieces of work from the work head if any such pieces are stuck thereon. As described in greater detail hereinafter, these spindles 43 and work heads 50 are rotated at stations B and C and are not rotated in stations A and D.

Of particular interest, the present invention provides a very effective vacuum or suction means 59 for maintaining successive pieces of work against each work head 50 a predetermined length of time. To this end, and as may be seen best in Fig. 7, each spindle 43 includes a bore 62 extending from the hollow work head 50 and from within the gasket 57 upwardly to a nearly central portion thereof, where it is provided with suitable transverse holes 63 merging with a peripheral channel 64. Thence, radial bores 65 adjacent each spindle 43 extend through the turret head 39 to an inner wall 38' thereof. The peripheral channel 64 insures suction from the radial bore 65 to the bore 62 of each spindle 43, even though the spindle is rotating. Of importance, the radial bores 65 in the turret heads 39 and 39' become associated with grooves 66 and 67 extending approximately 250 degrees about the face 38 of the inner members 33 and 34, respectively, while these grooves, in turn, are through ducts 68 and 69 connected to a suitable pipe 70 or the like to a regular exhaust pump (not shown). These grooves 66 and 67 (see Fig. 4) represent the only main structural differences between the turrets 30 and 31, and are discontinuously arranged so that suction is directed to the spindles only while they leave station A and thence until they leave station C.

For releasing or dropping pieces of work from the spindles 43 and work heads 50, and for discontinuing the suction to the work heads, the grooves 66 and 67 terminate at walls 71 and 72. Thus, as the radial bores 65 sweep from the grooves 66 and 67 over the coextensive non-grooved sections 73 of the section 38 suction is discontinued whereupon work drops from the work heads. To insure a strong suction at stations B and C the discontinued sections 73 of the grooves 66 and 67 extend adjacent radial bores 65 when the spindles are at stations A, whereby suction is not lost as the spindles initially move into stations A and while they are in this station until new pieces of work are added thereto.

The grooves 66 and 67 start again approximately 10 degrees from station A. Thus, when spindles 43 or work heads 50 initially leave stations A, suction is transmitted through ducts 68 and 69 to grooves 66 and 67, thence through radial bores 65, peripheral channels 64, transverse holes 63 and bores 62 to securely suck and hold clay targets against the gaskets 57 on work heads 50. Lifting mechanism 74, hereinafter described, is provided to maintain clay targets against the work holders 50 at stations A until the radial bores 65 of the turret heads 39 and 39' move into the path of the grooves 66 and 67.

It should also be particularly noted that the present invention contemplates the provision of means for forcing loaded work from the machine (Figs. 4 and 7). To this end, the present invention provides a compression line duct 75 which in turn has a radial bore 76 extending rearwardly of the machine for association with radial bores 65 and associated spindle ducts for transmitting air pressure, and thereby expel clay targets from the spindles whenever such spindles are at stations D. The turret heads 39 and 39' and the work heads 50 at the left- and right-hand sides of the machine are exactly alike; the only difference (Figs. 1 and 4) is that the left-hand turret head 39 is rotated in a clockwise direction, while the right-hand turret head 39' is rotated in a counterclockwise direction. Also, in view thereof grooves 66 and 67 and associated ducts 68 and 69 are slightly differently arranged (see Fig. 4 in particular). These grooves, however, function generally in exactly the same manner in both turrets.

Turret Driving Mechanism

In order to effect a coordinate and equal extent of step-by-step arcuate movement of the left- and right-hand turret heads 39 and 39' (see Figs. 1, 2, 3 and 7), the present invention provides a gear 77 at the upper end of each turret head. Preferably, and as shown in Fig. 7, this gear is in the form of a ring forced upon and/or clamped upon the turret heads as by an annular disc 78 and screws 79. A driver gear 80 suitably secured to the lower end of a shaft 81 vertically disposed in suitable bearings 82 and 82' at the underside of a top plate 83 which is secured to the top support 21 as by screws 84 has a direct connection with the gear 77 on the turret head 39, as may be seen best in Fig. 1. This same driver gear 80 meshes with an intermediate gear 85 suitably supported upon a shaft 86 secured in a boss 87 as by a nut 88, and this intermediate gear in turn meshes and rotates the large gear 77 at the upper end of the right-hand turret head 39'. Thus, as the main driver gear 80 is rotated in a counterclockwise direction, as viewed in Fig. 1, it engages gear 77 and head 39 to effect simultaneous and concurrent clockwise arcuate movement of the latter. Similarly, said driver gear 80, through the intermediate gear 85 and large gear 77, effects a simultaneous and concurrent counterclockwise arcuate movement of the turret head 39.

Indexing Mechanism

In order to achieve a high rate of production and thereby manufacture or finish clay targets 54 (or other work) in an inexpensive manner, and in view of the large size of the moving parts of the machine, special problems might be involved in accurately indexing the work heads 50 of the turret heads 39 and 39' into the successive stations A through D. The present invention provides a novel indexing mechanism 90 (Figs. 1, 2 and 3 particularly) which performs this work very successfully, including a vertical shaft 91 supported in bearings 92 and 93 and driven by a main drive shaft 94 through a suitable bevel gear connection 95. At its upper end the vertical shaft has a pitman 96 including an arm 97 secured to the upper end of shaft 91, which arm in turn, through a link 98 and studs 99 and 100, is adapted to oscillate a driver plate 101 each time the shaft 91 and arm 97 thereon is given one complete rotation.

The driver plate 101 is freely rotatable upon a vertically disposed sleeve 102 on an index plate 103 and carries a feed dog 104 mounted for pivotal movement upon a suitable stud 105, with the dog normally urged toward the plate 103 as by tension spring 106 (see Fig. 1). The index plate 103 is suitably secured to the shaft 81 as by a conventional spline key 107 or the like, and is provided with feeding and locking notches 108 and 109 respectively. In the present instance, four sets of these notches are provided because the associated turret heads 39 and 39' are each provided with four spindles 43 and work heads 50. As the pitman 96 goes through one complete movement it moves the driver plate 101 from the position shown in Fig. 1 in a counterclockwise direction, whereupon the feed dog 104 engages with a wall 110 of the feed notch 108 in the index plate 103 to move the latter 90 degrees. Retraction of the driver plate 101 by the pitman 96 results in a repositioning of the feed pawl from the feed notch of the advanced station into the next succeeding feed notch of the index plate 103.

Complemental to the main feed dog 104 and associated indexing mechanism just described in detail, the present invention provides a locking dog 111 and a backlash pawl 112, as may be seen best in Fig. 1. The locking dog 111 includes a stop arm 113 suitably pivoted upon the top plate 83 as with a stud 114 and is provided with a finger 115 adapted to be pulled into successive locking notches 109 in the index plate. The driver plate 101 is provided with a camming section 116 including a high lobe 117 which normally engages a roller 119 to maintain the locking dog 111 free or out of the path of the index plate, as shown in Fig. 1, but also includes a drop lobe 118 upon which the roller 119 part on the arm 113 rides and allows the finger 115 to move into the path of a wall 120 in each locking notch 109 to limit counterclockwise rotation of the index plate 103 and associated mechanism each time the feed dog 104 goes through its cycle of operation. Thus, there is no danger of the index plate 103 and associated mechanism being subjected to an overthrow or excessive movement.

The backlash pawl 112 is suitably mounted upon the top plate 83 as by a stud 121 and is

proportioned to fall into the feeding notches 108 and engage with the wall 110 of successive feeding notches, to thereby prevent any adverse return or clockwise rotation of the index plate 103 and associated mechanism; for example, when the feed pawl 112 on the driver plate 101 is retracted from its most advanced to the starting position, or to prevent such an adverse occurrence due to vibration or improper manipulation of the machine. A coil spring 122 is suitably connected, upon the stop arm 113 and backlash pawl 112, as may be seen best in Fig. 1, to pull both the pawl 112 and arm 113 constantly toward the center of the index plate.

To further prevent any adverse retraction or advance of the index plate 103 and its associated parts, the present invention optionally provides a brake mechanism 123 (Figs. 1, 2 and 3) including a bracket 124, in the form of a U-shaped channel suitably secured to the top plate 83 within which there is provided a spring-backed braking member 125, of a generally L shape, having a leather, fiber or like friction plate 126 suitably secured on the underside thereof, riding upon the index plate 103. To further hold this braking member 125 within the bracket 124 and to yieldingly or frictionally maintain the friction plate 126 on the index plate, the present invention provides a pair of upstanding studs 127 which are fixed in the top plate 83, project upwardly through the braking member 125, and each is provided with a coil spring 128 under nuts 129. Greater or less compression is effected by merely screwing the nut 129 down or up respectively on the studs 127. Cooperating with the foregoing is an underlying friction plate 126' (Fig. 5).

A driver dog 130 is secured to the lower end of the shaft 81 as by a spline key 131 and is provided with two pairs of plungers 132 backed by coil springs 133 and adjustment screws 134 (Fig. 6). One pair of these plungers 132 engages opposite sides of a spoke 135 on the driver gear 80 while the other pair engages a similar spoke 135' at the opposite side of the gear. The driver dog 130 and the driver gear 80 are supported against vertical displacement by bearings 82 and 82'. Although the driver gear 80 is free or rotatable upon section 136 of shaft 81 it is rotated concurrently with the shaft 81 by the drive dog 130. However, the plungers 132 serve to give the gear 80 and associated parts a cushioned start and stop as the feed pawl 104 engages wall 110 of feeding notch 108 to start arcuate movement of the index plate 103, and also give the gear and associated parts a cushioned stop when the stop finger 111 engages with wall 120 of the locking notch 109 to limit or stop arcuate movement of the index plate.

Association of the driver gear 80 with the pair of heads 39 and its function in rotating said heads in a step-by-step manner has been described in detail hereinbefore. Braking mechanism 123 and the spring-backed plungers 132 of the driver dog 130 all tend to cut down or eliminate shock which might otherwise be transmitted to the gear teeth, feed dogs and other parts of the indexing and driving mechanism, as will be readily appreciated. The spring-backed plungers 132 of the driver dog 130 also allow a slightly greater than 90-degree movement of the driver plate 101 without overdriving the index plate 103 so that movement of the latter is sufficient for the stop finger 111 to enter successive notches 109 and for the spindles 43 to properly reach successive work stations A, B, C and D.

Work-Feeding Mechanism

A simple work-feeding mechanism 137 (Figs. 1, 2, 3 and 4) is preferably provided for automatically transporting the clay targets 54, or other work, to the machine from a remote point therefrom. In its present preferred form, this feeding mechanism includes an endless belt 138 extending around a driver pulley 139 at the machine which is secured to a shaft 140 rotatably mounted in suitable standards 141 and 142 affixed to the bar 15 (or lower support 14) as by suitable bolts. A similar pulley 143 on similar supports may be mounted upon a simple bar extending forwardly of the main frame for supporting the outer end of the belt 138 and allowing its rotation, or separate long standards 144 may be merely secured to the floor at a desired point in front of the machine. The pulley 139 at the machine is driven through the provision of a sheave 145 suitably secured to the shaft 140, and the sheave has a suitable connection 146 with a main driving mechanism 147 still to be described.

The feeding mechanism also includes guide plates 148 and 149 extending along the sides of the belt 138 and of sufficient height above the belt to maintain clay targets or other work on the belt and to guide them properly toward the machine. These guide plates are secured to and supported by a bracket 150 suitably secured to the top of the bearing and bracket block 142 (Figs. 2 and 3). When only short guide plates are used this support is sufficient. However, when long guide plates are used it is preferable to provide the outer extremities thereof with suitable supports extending to the floor or suitably secured to the standards 144 for the outer or driven pulley 143 of the feed belt.

Loading Mechanism

A novel loading mechanism 151 (Figs. 1, 2, 3 and 4) is provided by the present invention, for automatically moving work onto the work heads, including selecting mechanism 152, transferring mechanism 153 and lifting mechanism 74. Broadly, these mechanisms function as follows: The selecting mechanism 152 intermittently allows only two or some other predetermined number of pieces of work to be moved by the feeding mechanism 137 to a loading platform 154 so that there will not be any undue pressure of the line of work on the feeding mechanism against the two pieces of work which are to be loaded upon the work heads 50 of the turret heads 39 and 39', and so that the instrumentalities for use in moving such pieces of work are not strained; the transferring mechanism 153 functions to alternately move successive pieces of work first to the left-hand turret head 39 and then the next one to the right-hand turret head from a central position on the loading platform; and, the lifting mechanism 74 serves to move pieces of work from the outer ends of the loading platform upwardly into engagement with locator rings 52 and then to the gaskets 57 on the work spindles 43 and to maintain them there until the suction is cut in and/or passes, for example, from the groove 66 through the radial bore 65 to the work heads 50, to thoroughly hold them upon the work spindles.

Selecting mechanism

Preferably, the selecting mechanism 152 (Figs.

3 and 4) includes an arcuately movable arm 155 pivoted upon a stud 156 in a bracket plate 157 which is secured to the bottom support 20 with inner and outer gates 158 and 159 respectively at the outer end of the arm, as shown in Figs. 3 and 4, which are adapted to pass through suitable slots in guide plates 148 and 149. When the arm 155 is in its most counterclockwise position, as shown in Fig. 4, the inner gate is clear of the work channel intermediate the guide plates 148 and 149 so that pieces of work at the inner end of the belt 138 are moved by the latter successively against a rear or stop wall 160 of the loading platform 154. However, only two such pieces of work may be moved onto the platform because the outer gate 159 at this time extends across a work channel 161 between plates 148 and 149 to intercept movement of any other pieces of work beyond the same, as shown in Fig. 4.

When the arm 155 is moved into its most clockwire position, as shown by dot-and-dash lines 162 in Fig. 4, the outer gate 159 is concurrently moved free of the work channel 161 while the inner gate 158 is concurrently moved into the work channel 161, whereupon two new pieces of work may be moved by the feeding mechanism 137 from a position forwardly of the outer gate 159 against the inner gate 158. As the arm 155 is again moved into the counterclockwise position shown by solid lines in Fig. 4, the inner gate 158 is moved clear of these two new pieces of work and the outer gate 159 is again moved within the work channel 161 to intercept or prevent further movement of work on the feed belt 138. As will be readily appreciated by a mechanic, the inner and outer gates may be of divers lengths and may be placed rearwardly and relatively on the arm 155 the equivalent of one target, whereupon this arm would serve to feed pieces of work one by one to the machine; or, the gates may be placed outwardly and relatively on the arm 155 a greater extent proportionately in order to effect a feeding of more than two pieces of work to the loading platform 154 with each reciprocation or oscillation of the arm 155.

Automatic oscillation of the selector and pusher arm 155 is preferably effected by a cam 163 secured to the vertical shaft 91 engaging with and pushing a roller 164 on a lever 165 suitably pivoted by a stud 166 on bracket 157 at the rear of the machine while a pivot connection 167 at the front of this lever 165 serves, through a link 168 and pivot 169, to arcuately move the arm 155 in a counterclockwise direction each time a high lobe 171 on the cam serves to push and maintain the lever 165, link 168 and arm 155 in the most counterclockwise position, shown with solid lines in Fig. 4; whereas, a low section 172 on the cam allows the arm 155 and associated parts to move into its clockwise position, shown by dot-and-dash lines in Fig. 4. Movement of these parts into the clockwise position is accomplished by a tension spring 173 having a connection to the lever 165 and bracket 174 as by suitable pins.

A modification of the gate or escapement mechanism is shown in Fig. 4A which may be used in place of gates 158 and 159. The lever 300 is pivoted at 301 and has a block 302 of suitable material, such as rubber, adapted to contact a target. The spring 303 serves to bias the lever 300 to target holding position. At an appropriate time, an end of lever of 155 contacts a portion of lever 300 and releases the target so that the belt 138 will carry them to the positions E and F of Fig. 4. As the lever 155 oscillates, the spring 303 again returns lever 300 to target holding position to thereby relieve the pressure on the targets that have moved past the escapement point. It is evident, however, that the machine will function without an escapement means.

The loading platform 154 is preferably provided near the front center of the machine, with a stop wall 160 with associated nesting sections 175 and 176 which may be coextensive with the guide plates 148 and 149 forming the work channel 161. The stop wall 160 serves as a stop to prevent further rearward movement of pieces of work in the machine, and to initially guide pieces of work laterally of the machine toward the loading stations A. Similarly the nesting sections 175 and 176 thereof serve to limit lateral movement of pieces of work to the left and to the right respectively, and to centralize pieces of work in a position directly and axially underlying work spindles 43 which are in the loading stations A. This loading platform 154, with the integral stop and nesting sections, is preferably substantially integral with the guide plates 148 and 149 and is preferably supported upon brackets 150 secured to the bearing and bracket block 142.

Transferring mechanism

Transferring mechanism 153 provided by the present invention serves the important function of automatically moving successive pieces of work into the loading stations A of the left-hand and right-hand turrets 30 and 31, respectively, preferably, and as shown in Fig. 4, moving a piece of work at the center position F of the loading platform 154 to the left and moving the next succeeding piece of work to the right. This transferring mechanism 153 includes a spring finger 178 (Fig. 3) suitably secured to and suspended from the selector and transfer arm 155 and movable therewith whenever said arm is oscillated. Thus, when the arm 155 is moved in a clockwise direction, from the position shown by solid lines to the position shown in dot-and-dash lines 162 in Fig. 4, it engages the adjacent section of the piece of work at the center station of the loading platform 154 and pushes it from this station into the nesting section 175, and while it is in this station the feeding mechanism 137 moves the next succeeding target from the position E to the center position F (Fig. 4) on the platform 154, whereupon the spring finger 178 engages the adjacent side thereof and pushes it from the central station F into the nesting section 176 as the arm 155 is moved from the dot-and-dash position 162 to the solid line position shown in Fig. 4. It remains in the latter position until the next successive two pieces which were in the work channel 161 between the inner and outer gates 158 and 159, respectively, are moved toward the loading platform 154, or into the positions E and F shown by the two central targets in Fig. 4.

Lifting mechanism

A simple lifting mechanism 74 is provided by the present invention for moving pieces of work from the left-hand and right-hand loading stations within the nesting sections 175 and 176 respectively upwardly against the underside of the nose-piece 51. It includes a pair of plungers 179 suitably supported in bearings 180 and 181 in the bracket 142, as may be seen best in Figs. 2

and 3. When these plungers are in the lowermost position a collar 182 at the lower end thereof rests upon a stop surface 183 in the bracket 142 maintaining top faces 184 of the plungers 179 flush with the top face of the loading platform 154. Simultaneous lifting of the pair of plungers 179 is effected by a lifter arm 185 having a pivot connection 186 on bracket 157 at the rear of the machine (see Figs. 1, 3 and 4), said arm having a roller 187 near the center thereof riding upon a cam 188 carried upon a lateral shaft 189 which is supported by suitable brackets 190 on the bottom support 20. This arm is substantially T-shaped at its forward end and has U-shaped fingers 191 straddling plunger shafts 193 underlying a slidable collar 194, coil springs 195 and fixed collars 196, as may be seen clearly near the lower center of Fig. 2. As a high lobe on the cam 188 lifts the roller 187 and lever 185 into the position shown in Fig. 3 the fingers 191 serve to lift and push against the slidable collars 194 which in turn push against coil springs 195 and against collars 196 secured to the shafts 193, and thereby lift the pieces of work from the nesting sections 175 and 176 upwardly against the nosepieces 51 and maintain them in this position until the turret heads 39 and 39' are rotated approximately 10 degrees, whereupon grooves 66 and 67 engage with radial bores 65 to effect a thorough suction and holding of the pieces of work against the nosepieces 51. The springs 195 act so that adverse pressure will not be exerted against the pieces of work as they are moved to and held against the nosepieces. Further, when the lifter arm 185 is permitted to drop, as by a suitable low section on the cam 188 coming into engagement with the roller 187, the plungers 179 are dropped into the lowermost position again. This is accomplished partly by the discontinuance of the fingers 191 pushing upwardly against the springs 195 and plungers 179 and partially by the fingers 191 engaging and pushing downwardly against the lower collars 182. The weight of the arm 185 as it extends forwardly and away from the rear pivot 186 is sufficient to cause the same to drop downwardly and remain in engagement with the cam 188.

From the foregoing it will be appreciated that the present invention provides a comparatively simple loading mechanism 151 which accomplishes the manifold functions of: selecting or passing only a predetermined quantity of work from the feeding mechanism 137 to a loading platform 154; pushing successive pieces of work into different predetermined locations in the machine; and, lifting and maintaining said pieces of work against nosepieces 51 of the work spindles 43 for a predetermined length of time. After pieces of work are moved into position on nosepieces 51 of the turret heads 39 and 39' at the loading stations A they are successively moved into definning stations B, painting stations C and unloading stations D by the indexing mechanism 98 hereinbefore described in detail.

Spindle-driving Mechanisms

At the definning and painting stations B and C, respectively, it is desirable to rotate the work spindles 43, and to this end the present invention provides a simple spindle-driving mechanism 197, shown particularly in Fig. 1 and to a lesser degree in Figs. 2 and 3. This driving mechanism includes sheaves 49 secured to the upper end of each of the spindles 43 for receiving an endless belt 198 which extends to a driver pulley 199 at the lower end of a reduction unit 200 and associated electric motor 201, thence to an idler pulley 202 mounted upon an arm 203 pivotally secured to the rearwardly extending bar 22 with a spring 204 secured to the arm and bar for yieldingly pulling the idler pulley in a clockwise direction, as viewed in Fig. 1, and thereby continually maintain the belt in a taut driving condition. The entire arrangement is such that the belt 198 serves to drive only two spindles 43 in each of the heads 39 and 39' at the definning and painting stations B and C, respectively; and, such that the belt is out of engagement with and does not drive the spindles whenever the same are in the loading or in the unloading stations A and D, respectively. The motor and reduction units 201 and 200, respectively, may be standard units suitably secured to the frame 14 as by bracket 205 and may be connected to any suitable source of current in the usual manner with a conventional switch which will cause the motor 201 and belt 198 to run continuously while the machine is in operation.

Alternatively, the motor 201 may be initiated periodically in properly timed relation with the operation of the other parts of the machine, by a switch unit 206 actuated by suitably shaped cam 207 on the shaft 189.

A simplified and more economical driving mechanism 208 (Figs. 9 and 10) for the spindles 43 includes merely adding another rearwardly extending arm 209 to the left of the turret 30, similar to the arm 22' with a freely rotatable sheave 209' suitably supported thereon (replacing the pulley 199, electric motor 201 and reduction unit 200), merely securing the two freely rotatable pulleys 210 and 211 to the lower side of the top plate 83, and providing an extra sheave 212 on the upper part of shaft 91. With this modified form of driving mechanism it is desirable to use a longer belt 213 which will extend over the sheaves 49 of the four spindles 43 in much the same manner as the belt 198 shown in Fig. 1, over the sheave 209', thence around sheaves 210 and 211 and to the driver and idler sheaves 212 and 202, respectively. This form of the invention has the advantage of displacing the costly motor 201 and reduction unit 200, eliminating the need for electric current to said motor (or disadvantage of any breakdown thereof), and assures concurrent rotation of the work spindles with and whenever the machine is regularly placed in operation.

Operation Mechanisms

Definning mechanism

The present invention provides a simple mechanism for automatically removing molding fins or other imperfections from the clay targets or the like while spindles 43 and pieces of work of both heads 39 and 39' are in the stations B. For this purpose, the present invention provides brackets 214 and 215 suitably secured to and extending to the left and right of guide plates 148 and 149. Spring arms 216 and 217 are suitably secured to the brackets 214 and 215 and each has an abrasive 218 secured at the outer end thereof. The structure just described is located in such a manner that the blocks of abrasive 218 are yieldingly urged against the pieces of work whenever the same are in the stations B so that fins and like imperfections are removed by the abrasive as the spindles 43 and pieces of work are rotated by the belt 198 (or 213).

Painting mechanism

Various standard and well-known paint guns may be used with the present machine, and therefore no effort to show one in detail is included herein. A nozzle 219, shown in Fig. 2, is included to diagrammatically or schematically represent any standard painting mechanism 61. The well-known Paasche paint gun No. F600 has been used and performs very satisfactorily in this connection. The special additional mechanisms provided by the present invention to make possible the use of such standard paint guns automatically and advantageously with the present machine include a masking device 220 (Figs. 2, 4 and 8), one at each station C, with a large disc 221 carried by a vertically extending shaft 222 in a bracket 223 which is suitably secured to the main frame 14 (one of these will be described in detail but it should be understood that substantially duplicate units are provided at opposite sides of the machine, one for each of the heads 39 and 39'). The disc 221 serves to insure paint spray from the paint gun reaching only predetermined parts of the clay target or the like.

Figs. 2, 4 and 8 include the best showing of the painting mechanism 61. The disc 221 which is suitably secured as by flanges 224 and 225 to the lower end of a spindle 222 is of a diameter and is located in such a position that it protects sections of the piece of work which are not to be reached by the paint spray; for example, the outer peripheries thereof (see Figs. 2 and 8). The spray of paint from the nozzle 219 is directed upwardly against the underside of the clay target 54 on the spindle in such a manner that the bulk of the spray hits the bottom central section of the target, while the disc 221 functions to mask or prevent any stray spray from reaching the periphery of the target immediately overlying it.

Preferably, the disc 221 is rotated and cleaned by a scraper or wiper 226, including bladelike sections 226', suitably supported on the main frame 14, to prevent an adverse accumulation of paint immediately adjacent the work which might otherwise adversely affect or obstruct a proper amount of the paint reaching the center of the work. A ratchet mechanism 227 arcuately moves the disc 221 step by step each time a loaded spindle 43 is moved into the painting station C, said mechanism including an arm 228 pivotally mounted on a suitable stud 229 at the outer extremity of the bracket 223 with a roller 230 adapted to engage locator rings 52 whenever a spindle is in the station C. A tension spring 231 extending between suitable studs on the bracket 223 and on the forward part of the lever or arm 228 serves to move the lever 228 with the roller 230 toward the locator ring 52, normally until the outer end of the lever 228 engages a stop 232. As a spindle moves into the painting station C, the ring 52 engages roller 230 to pivotally move the lever 228 about the stud 229 in a direction away from the station C, whereupon side 233 thereof engages a roller 234 on the ratchet arm 235 which has a loose pivotal connection to the top of the spindle 222, and this latter arm in its clockwise movement (Fig. 4) moves a conventional pawl 236 thereon to move an associated ratchet plate 237 arcuately, and the latter moves the conventionally interconnected spindle 222. A coil spring 238 connected to the two arms 228 and and 235 (see Fig. 4) serves to maintain the ratchet arm 235 in engagement with the lever 228 and serves to hold the ratchet arm in a counterclockwise direction whenever rings 52 on spindles 43 move from station C toward station D and when the lever 228 is moved to stop 232 by spring 231. A conventional pawl spring allows the pawl 236 to merely ride over the ratchet teeth during this return movement.

It is desirable that the painting occur only for short intervals of time during operation of the machine; for example, only part of the time while successive spindles 43 are in stations C and not while the spindles are moving from stations B to stations C or from stations C to stations D. Accordingly, an electrical control 239 is provided on the bracket 223 for automatically conditioning the painting unit for only a predetermined extent of time, while spindles 43 are in stations C. In its present preferred form this electrical control 239 includes a vertically extending arm 240 pivotally mounted upon a stud 241 in a bracket finger 242 with a mercury switch 243 in a suitable clamp at the upper end thereof. The lower end of the vertically extending lever is yieldingly urged against side 233 of lever 228 by tension spring connection 244 (Fig. 8). The mercury switch 243 including leads may be of conventional type.

As a spindle 43 moves into station C ring 52 thereon engages roller 230 on the lever 228 to kick the latter in a clockwise direction (Fig. 4), whereupon side 233 of lever 228 actuates the ratchet arm 235 to index or move the disc 221 a predetermined extent arcuately, and concurrently the outer end of the lever 228 moves the lower end of the lever 240 in a clockwise direction as viewed in Fig. 8 in order to close the circuit between the contacts in the mercury switch 243 whereupon leads 245 and 246, through suitable wiring (circuit to source of power and to paint gun) actuate the paint gun. However, the mercury switch and the circuit to the paint gun are again opened the moment the spindle moves from station C toward station D and as the roller 230 on the lever 228 rides off the locator ring 52. This mercury switch may be used to temporarily actuate the electrical driving mechanism for the complete painting unit or may be used to open and close a standard solenoid valve which will open and close the regular line of air and/or paint to the nozzle 219, in those instances where the air and/or paint is continually supplied to the paint gun in a conventional manner.

Referring particularly to Figs. 7 and 8, it will be noted that in order to contact the roller 230, and thereby actuate the paint delivery and the paint scraper, ring 52 must be elevated, to the position shown in section at the left of Fig. 7, by the presence of a target or other work piece thereon. It will be remembered that such a work piece engages and is sealed against the end of rubber ring 57 and is thus held in place, elevating ring 52, by the suction apparatus heretofore described. Thus, paint is delivered only if there is a work piece in position to receive it. If the delivery mechanism heretofore described has failed to place a work piece on any spindle 43 and its ring 52 such unloaded spindle will pass through the painting station without actuating the paint delivery. It will also be noted that the depending fingers 53, preferably three in number, act to center work pieces on the spindles.

UNLOADING MECHANISM

A simple yet effective unloading mechanism 247 is provided by the present invention, for receiving and removing finished work from the machine, including a pair of endless belts 248 and 249 extending respectively around driven sheaves

250 and 251 on a shaft 252 in suitable bearings 253, thence to driver sheaves 254 and 255 on a shaft 256 in bearings 257 on the frame 14. An endless belt 258 extending from a sheave 259 on the shaft 256 to a sheave 260 on the main drive shaft 94 insures continuous rotation of the belts 248 and 249 whenever the main drive shaft is operated.

The unloading belts are driven from right to left as viewed in Figs. 1, 2 and 4, and serve with a turning plate 261 to reverse the work. This turning plate has a large concave face 262 spaced a slight extent from the sheaves 250 and 251 and of slightly larger contour than the sheaves. It is held in place by an arm 263 thereon suitably secured to the frame 14 in such a way that pieces of work carried by the endless belts move to the plate and are gradually turned approximately 180 degrees so that the painted side thereof, which is facing down in the work spindles and as the pieces are initially dropped onto the belts, are faced up when expelled from the machine down a slide 264.

With this mechanism there is no danger of brushing off some of the wet paint, because the endless belts 248 and 249 are spaced apart enough so that only the painted sections of the clay targets are down within the two belts and the unpainted sections thereof rest upon the belts, and because the pieces of work as they are shunted from the conveyor and turning plate 261 down the inclined surface 264 are turned face up.

Pieces of work are released from the spindles 43 as they move into the unloading stations D through a cutting-off of the suction to the spindles as axial bores 65 move out of registry with the suction grooves 66 and 67 in the central members of the turret heads 39 and 39' (see Figs. 4 and 7 particularly). Complemental thereto, in case the cut-off suction is not enough to allow the pieces of work to drop from the spindle, the present invention provides a duct 76 extending to a suitable source of compression which registers with the axial bores 65 to force work from the spindles to cause a flow of compressed air or the like to the work holders whenever the latter are in the stations C.

Main Driving Mechanism

In its present preferred form the invention provides a driving mechanism 147 including a main drive shaft 94 extending from a main drive pulley 265 at the rear of the machine horizontally inwardly of the machine through suitable bearings 266 and 267. At its innermost end this main drive shaft is provided with a sheave 260 and belt connection 258 for continuously operating the unloading mechanism 247 in the manner hereinbefore described.

Also, near the center of the machine this main drive shaft 94 is provided with a bevelled gear connection 268 to a horizontally and laterally extending shaft 189 suitably supported in brackets 190 and 190'. This shaft, through a sheave 269 affixed thereto and belt 146 thereon, serves to continuously rotate the feeding mechanism 137 continuously. Also, through a cam 188 it actuates the lifter lever 185, as may be seen best in Fig. 3, operable as described in detail hereinbefore. Concurrently, also it may rotate a cam plate 207 on the shaft 189 to oscillate a mercury switch 157 carried upon a bracket plate 270 to control a conventional electric circuit to the standard paint gun apparatus, to operate a conventional solenoid controlling a valve of the paint line of a conventional painting apparatus, and/or to operate the motor 200 for the spindle-driving mechanism 197 briefly only at predetermined points in the operation of the machine (e. g., in place of the switch 243).

Another bevelled gear connection 95 is provided near the outer or rear end of the shaft 94 to rotate the vertically extending shaft 91 which in turn operates the indexing mechanism 90, optionally through sheave 212 (Figs. 9 and 10) rotates the spindles 43, and which through the cam 163 serves to operate the selector and transfer arm 155, as described in detail hereinbefore.

The driving mechanism 147 and associated indexing mechanism 90 is arranged to move the heads 39 and 39' arcuately in a step-by-step manner, 90 degrees each time, and to allow the spindles and work heads to remain in the A, B, C and D positions for a predetermined length of time (about the same length of time as it takes to move spindles from one station to the next station).

Cam 163 is proportioned to oscillate the selector and transfer arm 155 to the clockwise or dot-and-dash-line position and back into the solid-line position shown in Fig. 4, as and while spindles 43 are being moved from position C to position D, and, concurrently moves one target into the nesting section 175 and the other target into the nesting section 176. The gates 158 and 159 are located, proportioned and moved, concurrently with said arm 155 to allow a new set of work to move from a point forwardly of the outer gate 159 to a point against inner gate 158.

The lifter arm 185 and the cam 188 therefor are proportioned to lift the set of clay targets from the left-hand and right-hand nesting sections 175 and 176 up against the locator rings 57 and nosepieces 51 of the work spindles 43 immediately after a new set of unloaded spindles has been moved into the loading station A, and to maintain them in the raised position against the nosepiece until the turret heads are again moved at least a slight extent (approximately 10 degrees), until the ducts 66 and 67 register with the suction channel 65 to thereby enable the suction to maintain the clay target against the nosepiece.

Electrical Circuits

Since the electrical circuits used with the present machine are in the main conventional, detailed description is omitted. However, by referring to Fig. 11 it will be seen that lead 272 of one "leg" of source of current 273 may, through leads 274, 275 and/or 276, respectively, be directly connected to motor 201, conventional solenoid valve 277 and/or conventional painting mechanism motor 278, while the other lead 279 of the other "leg" of the source of current 273 may, through lead 280, be connected to switch 243 operated by ring 52 as hereinbefore described, said switch when closed, through leads 281, 282 and/or 283, respectively, completing the circuit to the motor 201, valve 277 and/or painting mechanism motor 278.

Similarly, the switch 206 connected to lead 279, by lead 284, and operated by cam 207, may, through leads 285, 286 and/or 287, be used alternatively, and additionally, to operate said motor 201, valve 277 and/or painting mechanism motor 278.

As just described, it will be appreciated that either of said switches 243 or 206 may be utilized for controlling current to motor 201, valve 277

and/or motor 278 by alternatively omitting leads 288 or 284, respectively; or, both switches may be used each to operate certain of said motor 281, valve 277 and/or motor 278, by alternatively omitting leads 281 or 285, 282 or 286, 283 or 287.

Switch 243 has the advantage of being near the top of the machine, in a readily accessible location for adjustment, repairs and the like; whereas, switch 286 which is in a less accessible place has the advantage of making possible a greater control over timing of the circuit since a lobe or lobes may be formed thereon to actuate the switch at any point in the operation of the machine.

Operation

Briefly (in view of the detailed description of divers parts of the machine hereinbefore), operation of the machine is as follows:

The main driving mechanism 147 is operated by any suitable prime mover connected to pulley 265 whereupon the main drive shaft 94, through its associated driving connections, cams and the like, concurrently: operates the indexing mechanism 90 to move the turret heads 39 and 39' in a step-by-step manner into stations A, B, C and D; drives feeding mechanism 137 to move work thereon toward and into the machine; oscillates selector and transfer arm 155 once each time one of the spindles 43 on each head 39 and 39' is moved into station A to push work from the center of loading platform 154 into nesting sections 175 and 176, and concurrently allows a predetermined new supply of work to move to the platform for the next successive loading of the spindles; oscillates arm 185 to lift the pair of plungers 179 with work thereon against spindles 43 on heads 39 and 39' and maintains the same there until radial bores 65 on said heads are moved into registry with suction grooves 66 and 67; conditions suction means 59 to maintain said work upon the spindles 43 in stations B and C; rotates successive spindles 43, with work thereon, in stations B and C; fabricates or acts upon the work in stations B and C, with operation means, such as the definning mechanism 60 or painting mechanism 61; cuts off the suction to radial bores 65 as successive spindles of heads 39 and 39' are moved from stations C to stations D to drop work from the spindles; (optionally) forces work from the spindles 43 at stations D; conveys work from the machine on the unloading mechanism 247; and turns the work with a turning plate 262.

Alternatively to the braking mechanism 123, or additionally thereto, to restrain excessive indexing movement the present invention provides a second braking mechanism 288 (Figs. 2 and 3), including a brake shoe 289 frictionally engaging ring 40 on head 39. Said shoe is provided and located with substantially integral upstanding lugs 290 extending through a bracket 291 suitably secured to tongue 35 on inner member 33. Pressure of the brake shoe is regulated by adjusting a screw 292 relative to a plate 293 which rests upon the lugs 290.

Oiling arrangements, painting mechanism, guards, etc., throughout the machine may conform with usual practice and be of conventional design. For brevity and clarity they have, therefore, not been shown in the drawings or described in the specification. It should be appreciated that the automatic machine features described herein can be used for other than clay targets and for other than definning and/or painting operations. The electrical circuits disclosed may be used to operate or control other types of electrical apparatus. Also, it will be readily appreciated that more or fewer than four spindles and/or four stations may be provided and utilized. A plurality of turrets 30 and 31 may be provided and utilized, as shown; or, only one turret may be provided and utilized by merely omitting the head 31 or regulating the selecting mechanism 152 to feed one piece of work each time, as described hereinbefore.

Likewise, for brevity and clarity of the unusual main inventive features of the present invention, and because the painting apparatus, solenoid valve and mercury switches may be of conventional commercial type, no detailed showing has been included herein.

It will be apparent that the complete machine comprises many parts and performs many functions, any of which might be performed separately or in conjunction with operation mechanisms differing from those herein described. For example: the feeding mechanism 137 and loading mechanism 151 may be eliminated and the work heads 50 loaded by hand; the unloading mechanism 247 may also be eliminated and the work unloaded by hand. However, such eliminations make the machine less advantageous.

The description and drawings throughout are directed to representative embodiments of the invention susceptible to many modifications, and since many apparently widely different embodiments of the invention may be made without departing from the spirit and scope thereof it is to be understood that the invention is not limited to the specific embodiments thereof, except as defined in the appended claims, which claims are to be broadly construed.

Having thus described the invention, what is claimed as new is:

1. A multiple-spindle turret machine comprising a fixed central support, a turret rotatably mounted on said support, means for indexing said turret, means for driving said spindles, means for loading a spindle in loading position comprising a plunger adapted to transfer and yieldably hold a work piece in contact with said spindle, suction means for retaining said work piece on said spindle comprising passages through said spindle and said turret, and a peripheral channel in said fixed central support adapted to communicate with said turret and spindle passages as said spindle is withdrawn from loading position in the indexing movement of said turret.

2. In a machine of the character described, fixed central support, a turret rotatably mounted on said support, a plurality of individually rotatable work holding spindles carried by said turret, means for indexing said turret to move said spindles successively to a loading station, a plurality of operating stations and an unloading station, suction means for retaining work pieces on said spindles comprising passages through said spindles and said turret and a peripheral channel in said fixed central support extending from a point adjacent said loading station to a point adjacent said unloading station, whereby suction applied to each spindle as it moves from the loading station is withdrawn as each spindle enters the unloading station, and means for applying fluid pressure to the passages of said spindles and turret at the unloading station.

3. A work-holding spindle for a multiple-spindle turret machine comprising passages for communication with a suction device, a work-holding head, a collar surrounding said head and having a pin-and-slot connection thereto, and

a plurality of work engaging devices depending from said collar and adapted to engage and center a work piece in a position closing said passage.

4. A work-holding spindle for a multiple-spindle turret machine comprising passages communicating with a suction device, and a work-holding head comprising a ring member adapted for displacement by a work piece and provided with work piece engaging and centering devices adapted to hold a work piece in a position closing said passage.

5. A work-holding spindle for a multiple-spindle turret machine comprising passages communicating with a suction device, and a work-holding head comprising a ring member displaceable by a work piece adapted to hold a workpiece in a position closing said passage, and a sealing gasket adapted to be engaged by a work piece when said ring is thus displaced and said passage is closed by said work piece.

6. In a machine for the finishing of targets, a rotatable turret, a plurality of rotatable spindles mounted on said turret, means for indexing said turret to move each of said spindles successively through a loading station, a plurality of operating stations, and an unloading station, means for centering and holding work pieces on said spindles comprising a ring member movably mounted on each spindle and displaceable by a work piece thereon, and means for controlling an operation at an operating station actuated by said ring members when in displaced position.

7. In a machine for the painting of clay targets, a rotatable spindle, means for moving said spindle to a painting station, a control member on said spindle adapted for displacement by a target thereon, painting means, and means at said painting station adapted for actuation by said control member when in displaced position for actuating said painting means.

8. In a machine for the painting of limited areas of a clay target comprising a target holding spindle, means for moving said spindle to a painting station, control means on said spindle movable from a normal position to a displaced position by the presence of a target on said spindle, paint spraying means, movable means for shielding a portion of the target from said paint spray, and means actuated by said control means for governing the movement of said shield and the operation of said paint spraying means.

9. In an indexible turret machine for the finishing of targets; a fixed central support; a turret rotatably mounted on said support; a plurality of spindles carried by said turret; means for indexing said turret to move each of said spindles successively to a loading station; a plurality of operating stations and a loading station; suction means for holding work-pieces on said spindles at certain stations only including a peripheral channel in said fixed central support, means for exhausting the air from said channel, and passages through said spindles and said turret adapted to communicate with said channel; means for centering and holding work-pieces on said spindles comprising a ring member movably mounted on each spindle and displaceable thereon; and means for controlling an operation at an operating station actuated by said ring members in displaced position.

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