Feb. 21, 1933. P. THORSEN ET AL. 1,898,648

AUTOMATIC GRINDING MACHINE

Filed March 22, 1928 3 Sheets-Sheet 1

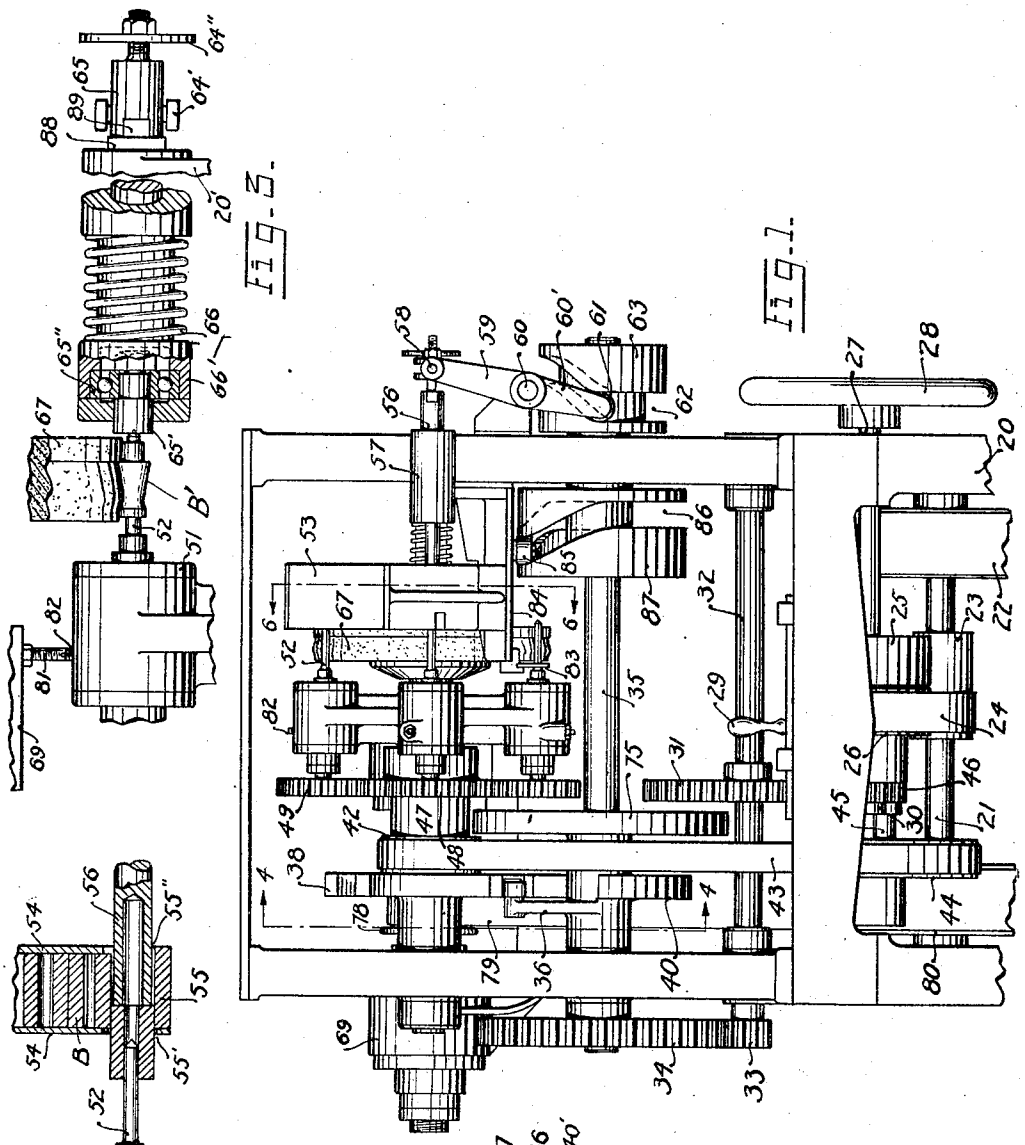


Fig. 3.

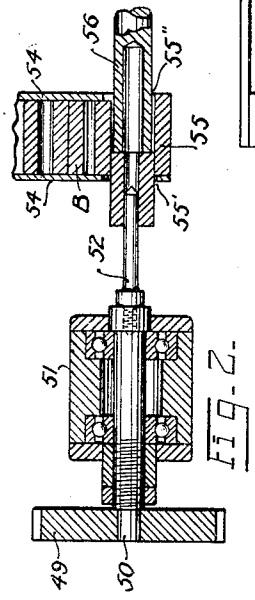


Fig. 2.

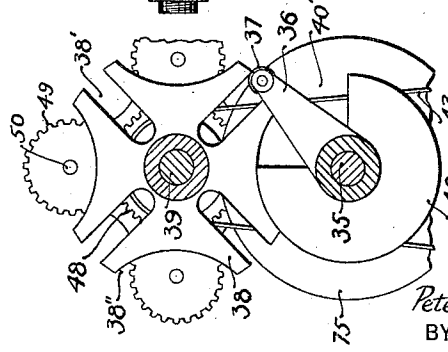


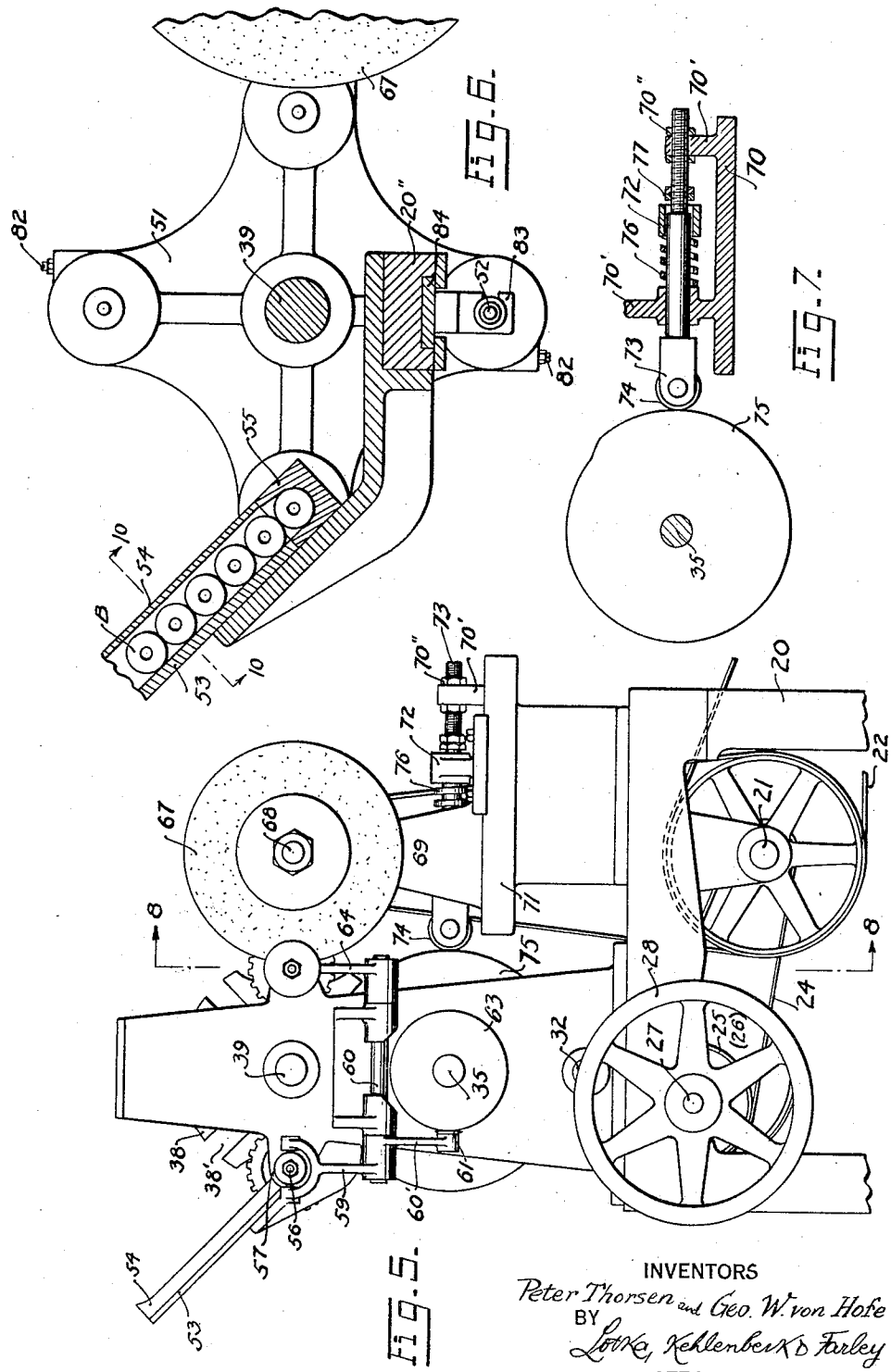
Fig. 4.

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AUTOMATIC GRINDING MACHINE

Filed March 22, 1928 3 Sheets-Sheet 2



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AUTOMATIC GRINDING MACHINE

Filed March 22, 1928 3 Sheets-Sheet 3

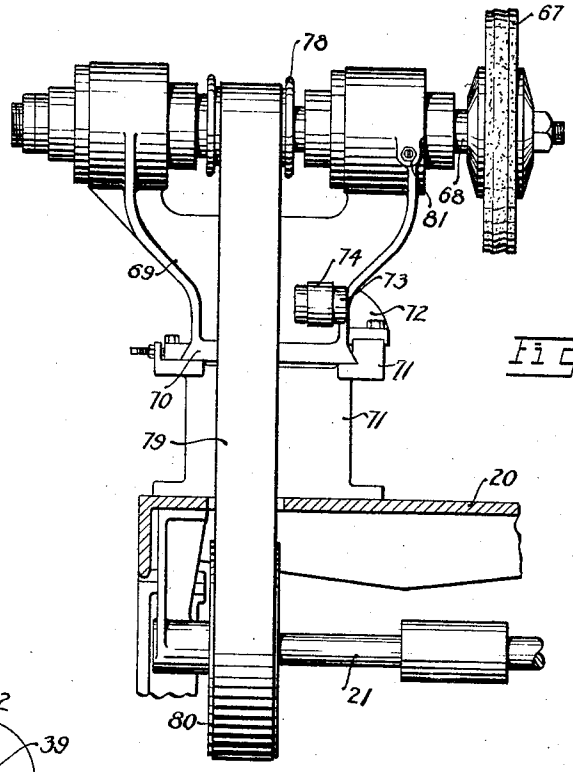
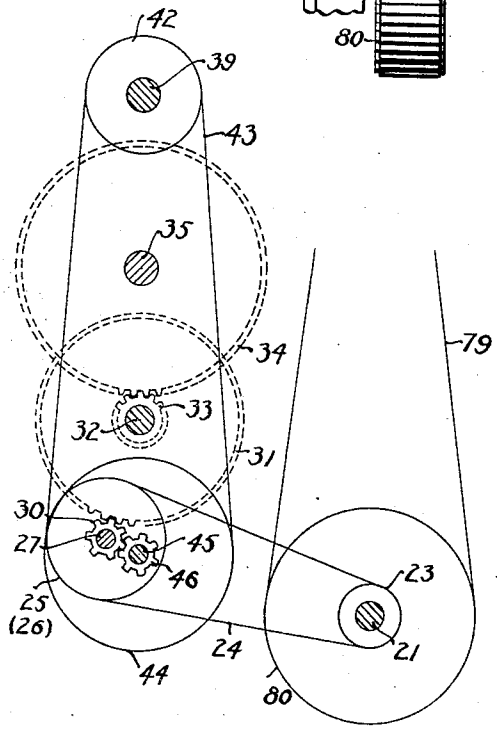


Fig. 8.

Fig. 9.



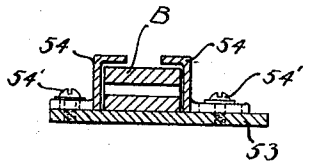


Fig. 10.

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UNITED STATES PATENT OFFICE

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AUTOMATIC GRINDING MACHINE

Application filed March 22, 1928. Serial No. 263,657.

Our invention relates to a machine for grinding various articles, for instance, the cylindrical parts of fountain pens or other elements of like shape. The object of the present invention is to provide a machine capable of grinding articles of the character set forth above very rapidly and accurately.

Another object is to eliminate all hand work and handling of the articles during the grinding operation. Still another object is to provide a machine that can be readily adapted or changed to work on articles of different sizes, without any great delay in time or the expenditure of considerable sums of money for change parts. A machine having these desirable characteristics will be available for continuous work in the production of large numbers of identical articles, and still will be flexible enough to be used on short runs in the production of somewhat different articles.

A brief description of the operation of the machine is as follows: The articles to be ground are placed in a magazine and are taken from the lower end of this magazine and transferred to a mandrel which is rotated permanently about its axis. In addition to its continuous rotary movement, the mandrel has an intermittent movement causing it to advance from station to station. At one of the stations the article carried by the mandrel is brought into operative relation to a grinding wheel, and at a subsequent station the mandrel with the ground article thereon is brought into operative relation to an ejector. The above description gives an outline of the operation as conducted by means of the embodiment of our invention illustrated in the accompanying drawings, but we desire it to be understood that the invention is not restricted to this specific embodiment, and that various modifications may be made without departing from the nature of the invention as set forth in the appended claims.

In the drawings Fig. 1 is a partial end elevation of the improved machine; Fig. 2 is a detail vertical section showing a portion of the magazine, one of the mandrels, and the mechanism for transferring an article from the magazine to the mandrel; Fig. 3 is a partial plan view showing the grinding wheel in conjunction with the article under treatment, the mandrel and the mechanism which holds the mandrel during the grinding operation; Fig. 4 is a vertical section on the line 4—4 of Fig. 1; Fig. 5 is a side elevation of the machine; Fig. 6 is a partial section on the line 6—6 of Fig. 1; Fig. 7 is a detail sectional view illustrating the mechanism for moving the grinding wheel from and toward the work; Fig. 8 is an elevation with parts in section on the line 8—8 of Fig. 5, illustrating the mechanism for operating the grinding wheel; Fig. 9 is a diagrammatic vertical section illustrating the drive of various parts and Fig. 10 is a cross section on the line 10—10 of Fig. 6.

In the frame 20 is journalled the main shaft 21 driven in any suitable manner as by a power belt 22 on said shaft. On said shaft is secured rigidly a drive pulley 23 engaged by a shift belt 24 adapted to be brought into engagement either with a fast pulley 25 or with a loose pulley 26 mounted on a shaft 27 provided with a hand wheel 28. At 29 we have indicated a belt shifting mechanism which may be of any customary or approved construction. On the shaft 27 is mounted to turn therewith a pinion 30 in mesh with a gear wheel 31 on a counter shaft 32. On this counter shaft is secured rigidly a pinion 33, in mesh with a gear 34 on an actuating shaft 35. To this shaft is secured rigidly an arm 36 carrying a roller 37 adapted to enter slots 38′ in a Geneva wheel 38. This wheel is secured rigidly to a shaft 39 and is provided with concaved surfaces 38″, between the radial slots 38′, said surfaces being of proper curvature to fit the periphery of a disk 40 secured rigidly to the shaft 35. The disk 40 has an open quadrant 40′ to permit the Geneva wheel 38 to turn at the proper time as will be readily understood. The shaft 39 is mounted loosely within a sleeve 47 carrying rigidly, at one end, a pulley 42 which receives a continuous motion through a belt 43 from a pulley 44 on a shaft 45, on which

is also mounted rigidly a pinion 46 in mesh with the pinion 30.

On the other end of the sleeve 47 is mounted rigidly a gear 48. On the latter are adapted to roll gears 49 secured to shafts 50 which are journalled in a carrier 51 fast on the shaft 39, said shafts 50 and 39 being parallel to each other. Each of the shafts 50 is provided with a mandrel 52 at the end opposite to the gear 49.

As the carrier 51 is rotated intermittently, the mandrels 52 are brought successively into registry with the discharge portion of a magazine which comprises an inclined bottom 53 and side walls 54 together with an end member 55 having a substantially semi-cylindrical socket. The side walls 54 are preferably adjustable toward and from each other, as by means of slots through which the fastening screws 54′ extend, see Fig. 10. The blanks B which are generally of cylindrical tubular shape as shown, are fitted loosely between the side walls 54 of the magazine so as to roll down into the socket member 55. It will be obvious that by making the distance between the side walls 54 adjustable, the magazine will be adapted to hold and feed blanks of different lengths. The socket member 55 is provided with lateral openings 55′, 55″ respectively, one of which, 55′, is large enough to allow the blank to pass therethrough as illustrated in Fig. 2, while the other opening, 55″, need not be so large, but should be large enough to allow the entrance of a plunger 56 movable in line with the mandrel 52 as indicated in Fig. 2.

The plunger 56 is arranged to slide in a stationary guide 57, and by means of a suitable operating connection 58 of the pin-and-slot or pin-and-groove type, said plunger is adapted to be operated from a lever 59 mounted on a rock shaft 60. On this rock shaft is also mounted an arm 60′ provided with a roller 61 extending into a cam groove 62 on a cam or disk 63 rigidly secured to the shaft 35.

The rock shaft 60 is further provided with an arm 64 having a forked end 64′. A sliding rod 65 is guided in a portion or hub 20′ of the frame and provided at one end with a bearing portion or holder 65′ which is rotatably mounted in the bearing 65″ secured in the enlarged end of the rod 65. The said holder 65′ has a central recess of proper shape to receive the pointed end of the mandrel 52. Against the enlarged end 66′ of the rod 65 bears one end of a spring 66, the other end of said spring being in engagement with the frame portion 20′, so that the spring tends to move the rod 65 toward the mandrel carrier 51. Adjustably secured to the outer end of the rod 65 is a plate 64″. This plate 64″ is adapted to engage the forked end 64′ of the lever 64 as the rock shaft 60 is actuated by the cam 63. A plate 88 secured to the hub 20′ engages a flat 89 on the rod 65 to prevent rotation of said rod.

A grinding disk 67, the periphery of which is profiled in accordance with the nature of the work to be done (see Fig. 3) is secured rigidly on a shaft 68 journalled in a carrier 69 which is integral or rigid with a slide 70 movable horizontally in a direction transverse to the shafts 39 and 68, in a suitable guide 71, here shown as of dovetail shape. At 72 we have indicated a stationary guide for a rod 73, the latter being parallel to the path of the slide 70 and normally rigid with said slide. The rod extends through guide portions 70′ on the slide and is held fast against one of said guide portions adjustably by means of nuts 70″ screwed on a threaded portion of the rod 73, it being understood that said threaded portion passes loosely through the said guide portion. The rod 73 carries a roller 74 in engagement with a cam disk 75 rigid on the shaft 35. A spring 76 is coiled around the rod 73 between the stationary guide 72 and one of the guide portions 70′, in such a manner as to have a tendency to throw the rod 73 toward the cam 75. At 77 we have indicated a pair of lock nuts on the threaded portion of the rod 73 to limit the motion thereof in the direction toward the cam 75.

In order to drive the grinding disk 67, its shaft 68 carries a pulley 78 operated from the shaft 21 by means of a belt 79 engaging a pulley 80 on said shaft 21. The grinding wheel carrier 69 is provided with a stop 81 adapted, when the said wheel is in its operative position, to engage one of four stops 82 located on the mandrel carrier 51. Preferably the stops 81 and 82 are adjustable as indicated, in the direction in which the grinding wheel carrier 69 moves, and as there is a separate stop 82 on the mandrel carrier 51 adjacent to each of the four mandrels 52, proper individual adjustments can be made so that the grinding wheel 67 will be stopped in its forward or feed movement, in correct relation to the respective mandrel 52 and the blank thereon.

An ejector 83, preferably of the slotted or forked shape shown best in Fig. 6, is adapted to fit laterally on the mandrel 52 which has reached its lowermost position as shown in Fig. 6, between the blank and a shoulder on said mandrel as indicated in Fig. 1. This ejector is movable in a direction lengthwise of the shaft 39 and of the mandrel 52, at the side of the latter, for which purpose the ejector is secured to a slide 84 movable in a guide 20″ which may be the same part of the machine that holds the bottom 53 of the feed magazine. On this slide is secured a roller 85 projecting into a cam groove 86 on a cam 87 rigidly secured to the shaft 35.

The operation of our improved machine is as follows: The blanks B (of cylindrical tubular shape, in the particular case illustrated) are stacked in the magazine, rolling down on the inclined bottom 53 thereof, between the side walls 54, which have been adjusted to a distance corresponding to the length of the said blanks. The lowermost blank comes to rest in the socket at the lower end 55 of the magazine. Such lowermost blank is in line with the plunger 56, and also, when the carrier 51 comes to a rest, with one of the mandrels 52. It will be noted that these mandrels are detachable from their shafts 50, so that it is easy to substitute different mandrels if blanks of another internal diameter are to be ground. While the carrier 51 is temporarily stationary, the plunger 56 is operated by the cam 63 and lever 59, so as to cause said plunger to pass through the opening 55'' of the magazine and force the lowermost blank B out of said magazine through the opening 55' and onto the mandrel 52 which is in alignment with the plunger 56 at that time. The plunger 56 then moves back until it is clear of the magazine, the blank which has been pushed out of the magazine remaining on the mandrel, and another blank dropping to the lowermost position as soon as the plunger is withdrawn entirely from the magazine.

The Geneva mechanism then gives the carrier 51 one-fourth of a revolution, whereby the mandrel 52 carrying the blank B is brought to the uppermost position or station. No operation is performed on the blank at that station, in the particular embodiment of our invention disclosed herein; the construction of the Geneva mechanism and other instrumentalities is simpler when four stations or dwells are employed than when three are used, hence we prefer to construct the machine with four stations, even though only three of them are utilized. Besides, the fourth or upper station, although not used in the specific instance illustrated, might be utilized for some preliminary operation to be performed on the blank before it is ground.

After another quarter-revolution the blank B is brought into operative relation to the grinding disc 67. The holder 65', which during the movement of the mandrel-carrier 51 has been withdrawn, by the action of the cam 63, from the path of the mandrel, is brought, by the spring 66, into engagement with the free end of the mandrel carrying the blank, so as to hold said mandrel steady during the grinding operation. It will be understood that all the mandrels 52 are rotated continuously by means of the belt 43 and gearing 48, 49, and when a mandrel is engaged with the holder 65' at the grinding station as described, said holder will rotate in unison with the mandrel, on the bearing balls, thus reducing friction. The mandrel fits into the blank tightly enough to compel them to rotate in unison, in a direction opposite to the rotation of the grinding disk or wheel 67. The latter is profiled in accordance with the shape it is desired to give to the outer surface of the blank. Normally, the grinding disc clears the path of the blank carried by the mandrel, but after the mandrel has been engaged by the holder 65', the grinding disc is moved inwardly, against the blank, by the action of the cam 75 and rod 73, the spring 76 affording the required yielding connection.

When the grinding operation has been completed, the holder 65' is withdrawn again by the cam 63, to leave the carrier 51 to be rotated by the Geneva mechanism. It will be noted that as the bearing 65' is withdrawn from engagement with the mandrel 52, the stop 81 is withdrawn from engagement with the corresponding stop 82 on the mandrel-carrier 51. During the grinding operation, the stop 81 engages one of the stops 82, thus assisting in keeping the grinding-wheel carrier 69 in the proper position during such operation.

After the next quarter-revolution of the carrier 51, the mandrel 52 with the ground blank B' thereon comes to a stop at the lowermost station in which the fork of the ejector 83 straddles the mandrel, between the shaft 50 and the adjacent end of the blank. While the carrier 51 is stationary in this position, the ejector 83 is moved lengthwise of the mandrel 52, away from the shaft 50, and thus strips the ground blank B' off the mandrel, such blank dropping onto a table, a chute, a receptacle or other element provided for its reception. This completes the operation of our machine, so far as the blank is concerned. It will be understood that the next quarter-revolution will bring the mandrel 52 from which the blank B' has just been stripped off, back to its initial position, in line with the plunger 56 and in readiness to receive another blank B from the magazine.

Of course, with the arrangement shown, the three steps or operations are being performed simultaneously on three different blanks; that is to say, at the same time that one blank is transferred by the plunger 56 from the magazine onto one of the mandrels 52, another blank, carried by another mandrel, is being ground by the disc 67, and a third blank, carried by still another mandrel, is stripped off such mandrel by the ejector 83.

We claim:

1. In a grinding machine, the combination of a grinding wheel, a rotary mandrel having a free end, means for feeding said

grinding wheel toward said mandrel, and means to support the free end of said mandrel during the feeding of said grinding wheel to said mandrel.

2. In a grinding machine, the combination of a grinding wheel, a rotary mandrel having a free end, means for rotating said mandrel, means for feeding said grinding wheel toward said mandrel, means for supporting the free end of said mandrel during the forward feeding of said grinding wheel, and adjustable means to arrest the forward movement of said grinding wheel.

3. In a grinding machine, the combination of a rotatable grinding wheel, a magazine for holding a plurality of blank articles, a plurality of work carrying means mounted to rotate about their individual axes and traveling in an endless path, means for feeding a blank article to said work carrying means, means to move said work carrying means in an endless path, means to move said grinding wheel to an article carried by said work carrying means, and means to remove a ground article from said work carrying means.

4. In a grinding machine, the combination of a rotatable grinding wheel, a frame carrying a plurality of rotatable mandrels having free ends, means for moving said mandrels in an endless path with a step by step movement thereby placing one of said mandrels in operative relation to said grinding wheel at each step, means for resiliently feeding said grinding wheel toward a mandrel when in operative relation to said mandrel, and a plurality of adjustable means carried by said frame to arrest the forward movement of said grinding wheel.

5. In a grinding machine, a grinding mechanism, an article-holder adapted to present an article to said mechanism, a carrier for said holder, movable to bring said holder into and out of grinding position, and a support for engaging and steadying said holder when it is in grinding position.

6. In a grinding machine, a grinding mechanism movable into and out of operative position, an article-holder adapted to present an article to said mechanism, a carrier for said holder, movable to bring the holder into and out of grinding position, a movable support, means for bringing said support into engagement with the article-holder after the latter has been brought into grinding position, and means for moving the grinding mechanism to its operative position after said support has engaged the article-holder.

7. A grinding machine according to claim 6, in which a yielding connection is included in the means for moving the grinding mechanism to its operative position.

8. In a grinding machine, a grinding mechanism, a plurality of mandrels for holding tubular articles, a carrier for bringing said mandrels successively into operative relation to said mechanism, a magazine adapted to hold the articles to be ground, a device arranged to transfer the individual articles successively from said magazine to the several mandrels as the latter come into operative relation to the magazine, and an ejector arranged to fit laterally on the mandrels and to move lengthwise of the mandrel at the side thereof to remove the ground articles from the respective mandrels after the latter have come out of operative relation to the grinding mechanism.

9. In a grinding machine, a grinding mechanism, a plurality of parallel rotatable article-holders, a carrier for bringing said holders successively into operative relation to said mechanism, a magazine adapted to hold the articles to be ground, a device movable in a direction parallel to the article holders, to transfer the individual articles successively from said magazine to the several holders as the latter come into operative relation to the magazine, and an ejector movable in a direction parallel to the article-holders at a point reached by the individual holders successively after they have come out of operative relation to the grinding mechanism, to remove the ground articles from such holders.

10. In a grinding machine, a grinding mechanism, a plurality of article holders adapted to bring the articles into and out of operative relation to said mechanism, a carrier on which said holders are mounted, means for imparting a step-by-step movement to said carrier to bring the several article holders successively into operative relation to said grinding mechanism, means for feeding the grinding mechanism toward an article holder while the latter is in operative relation thereto, a plurality of stops mounted on said carrier, and a cooperating stop mounted on the grinding mechanism to move into engagement with a carrier stop when the grinding mechanism is fed toward the respective article holder and thus to prevent any further feeding motion of the grinding mechanism.

11. In a grinding machine, a grinding mechanism, a plurality of article holders adapted to bring the articles into and out of operative relation to said mechanism, a carrier on which said holders are mounted, means for imparting a step-by-step movement to said carrier to bring the several article holders successively into operative relation to said grinding mechanism, means for feeding the grinding mechanism toward an article holder while the latter is in operative relation thereto, a plurality of stops mounted on said carrier and adjustable relatively thereto in the direction of the movement of said mechanism when in operative

relation thereto, and a cooperating stop mounted on the grinding mechanism to move into engagement with a carrier stop when the grinding mechanisn is fed toward the respective article holder and thus to prevent any further feeding motion of the grinding mechanism.

12. In a grinding machine, a grinding mechanism, a plurality of article holders adapted to bring the articles into and out of operative relation to said mechanism, a carrier on which said holders are mounted, means for imparting a step-by-step movement to said carrier to bring the several article holders successively into operative relation to said grinding mechanism, means for feeding the grinding mechanism toward an article holder while the latter is in operative relation thereto, a plurality of stops mounted on said carrier, and a cooperating stop mounted on the grinding mechanism to move into engagement with a carrier stop when the grinding mechanism is fed toward the respective article holder and thus to prevent any further feeding motion of the grinding mechanism, said cooperating stop being adjustable relatively to the grinding mechanism in the direction of the movement of said mechanism.

In testimony whereof we have hereunto set our hands.

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GEORGE WILLIAM von HOFE.