Jan. 8, 1935. F. A. WARD 1,987,222

APPARATUS FOR GRINDING DISCONTINUOUS SEGMENTAL SURFACES

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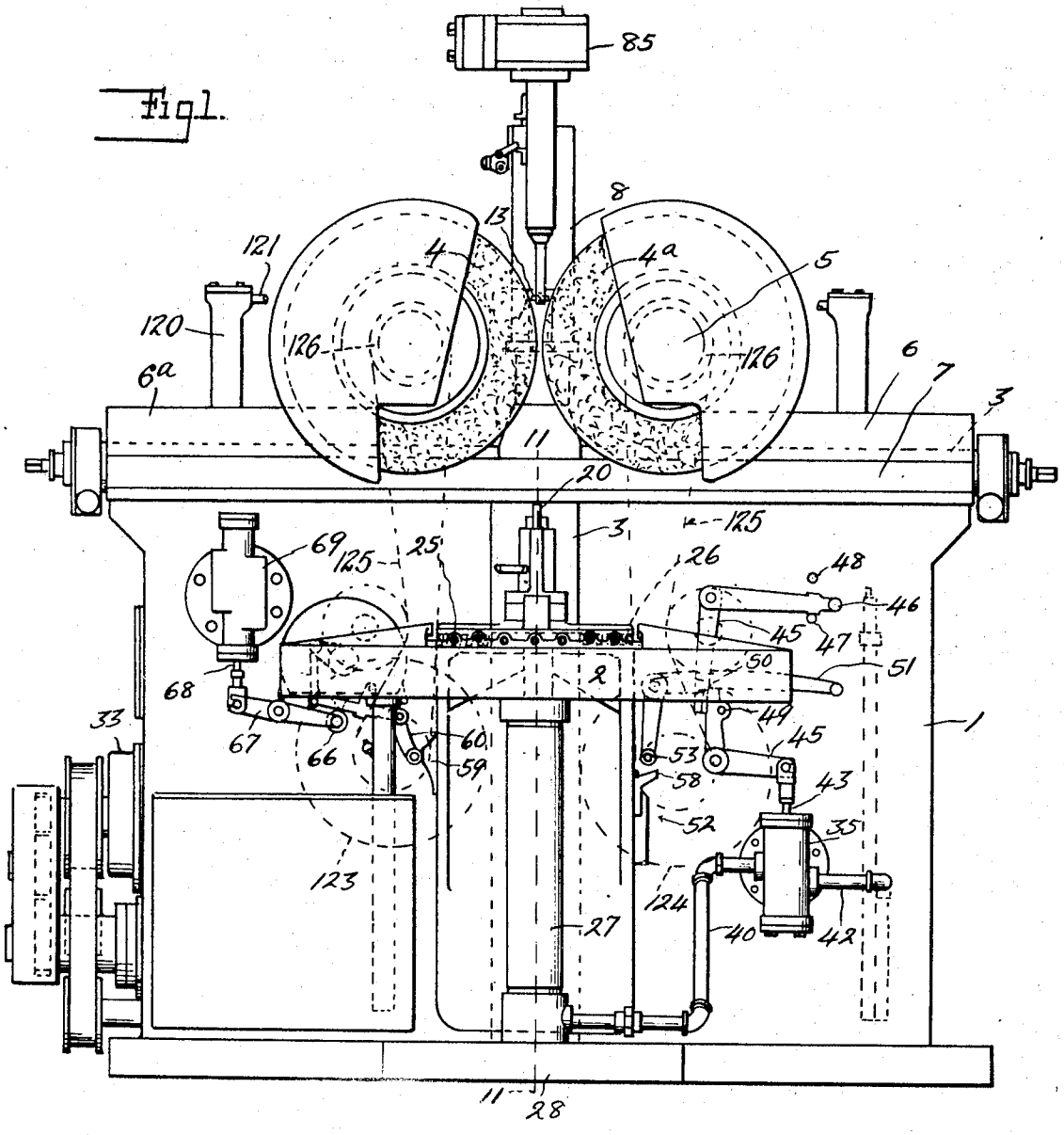
Fig 1.



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APPARATUS FOR GRINDING DISCONTINUOUS SEGMENTAL SURFACES

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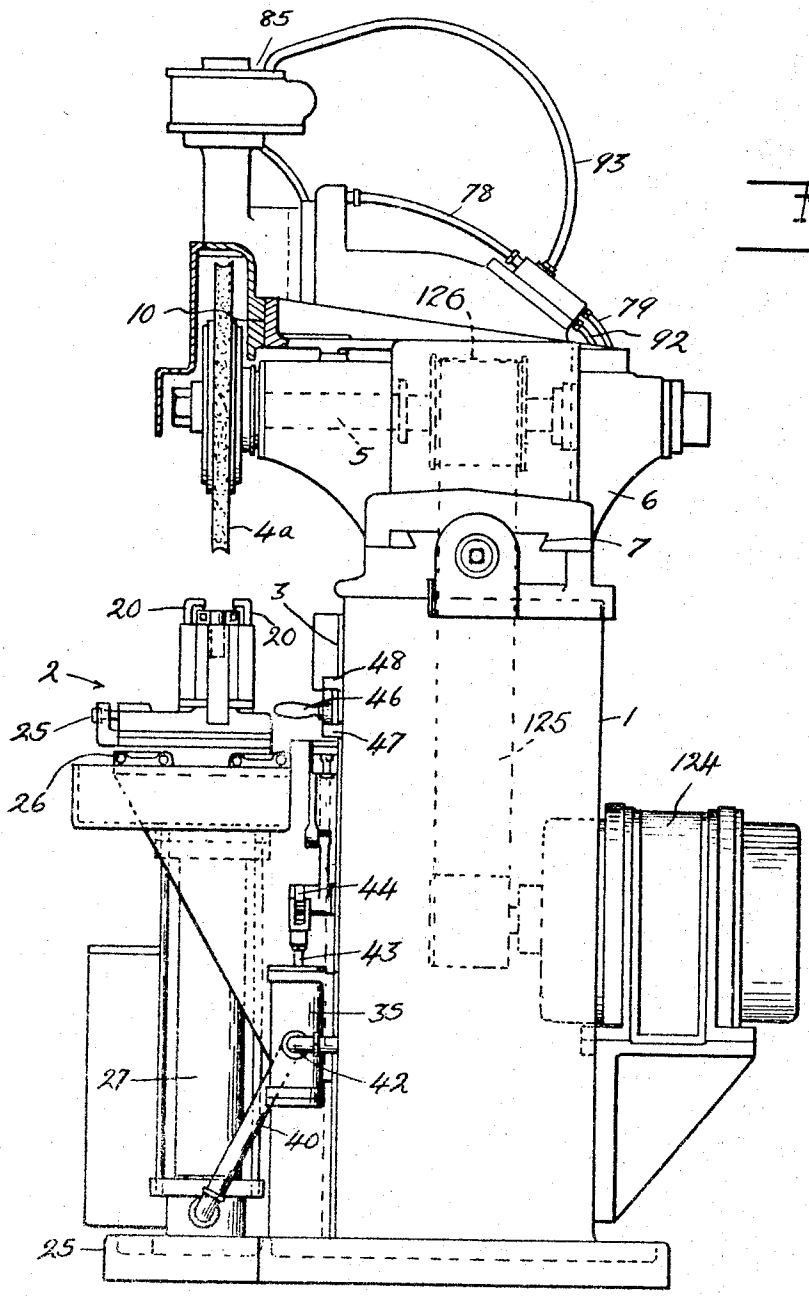

Fig. 2.

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APPARATUS FOR GRINDING DISCONTINUOUS SEGMENTAL SURFACES

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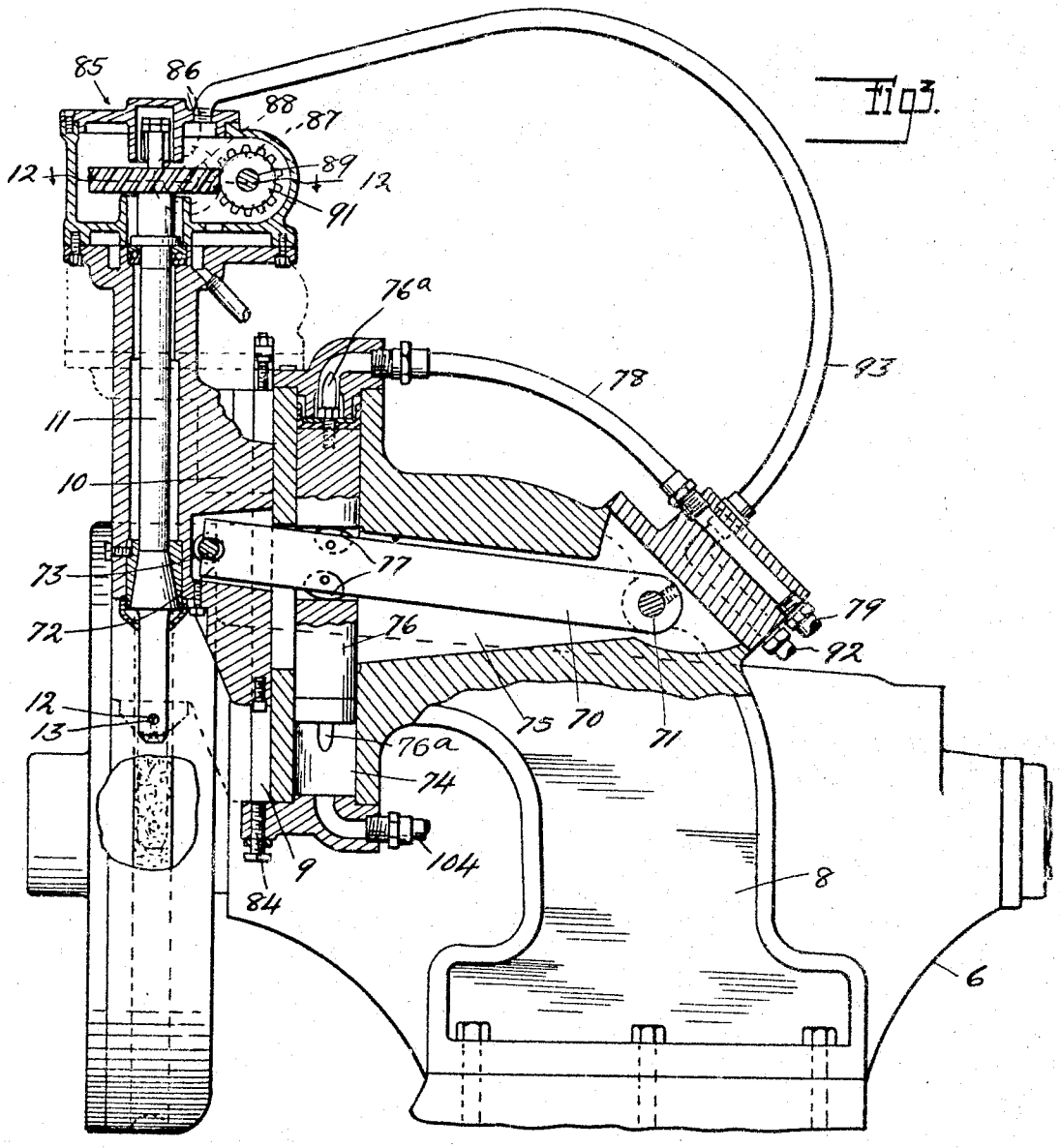
Fig 3.



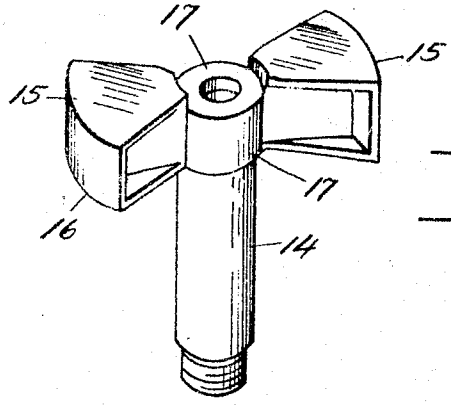


Fig 4

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Fig. 6.

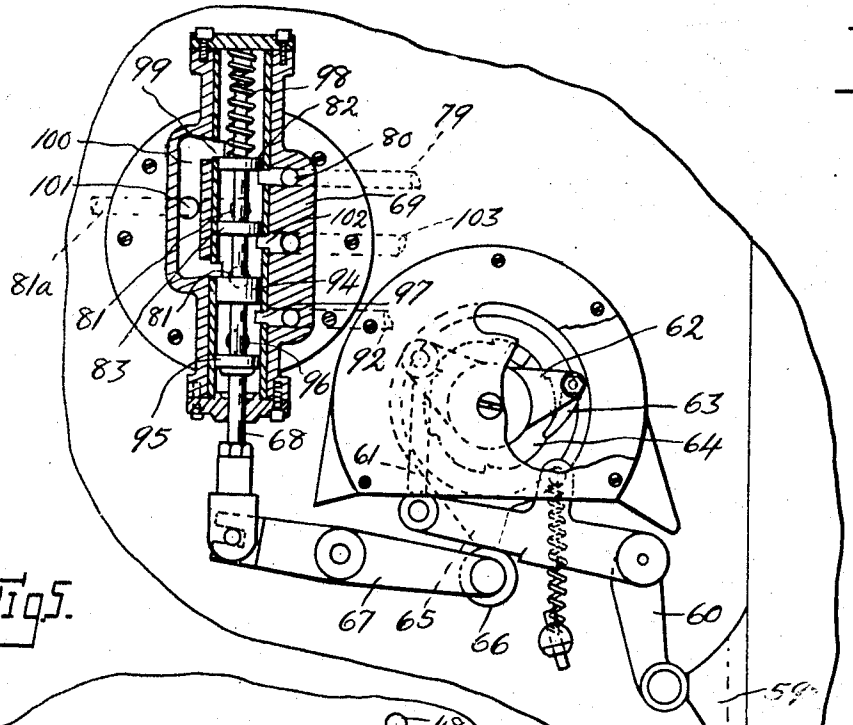


Fig. 5.

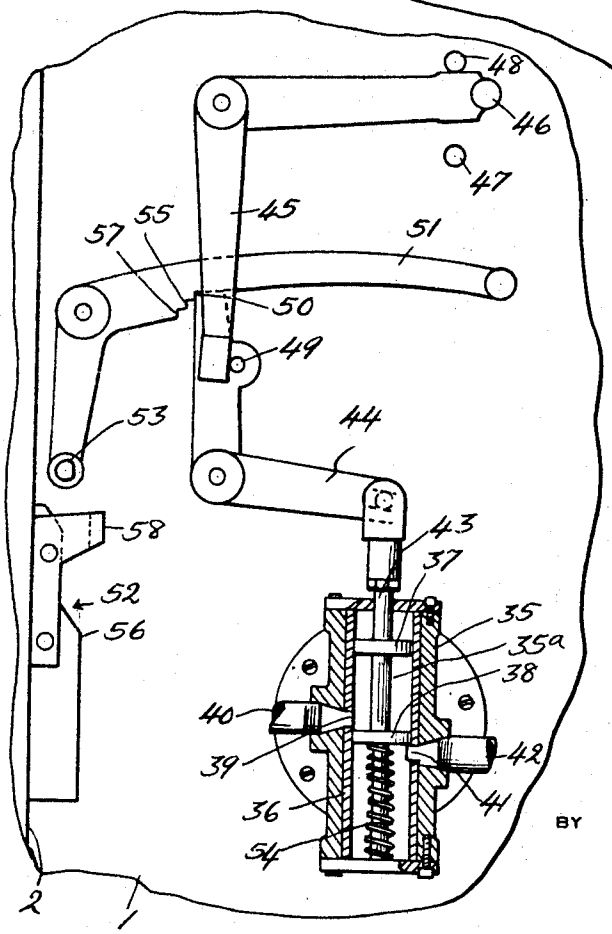


Fig. 14.

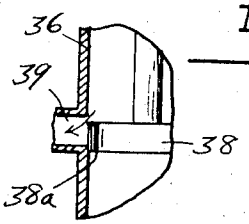
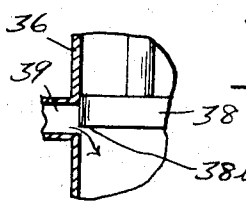


Fig. 15.



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APPARATUS FOR GRINDING DISCONTINUOUS SEGMENTAL SURFACES

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Fig. 7.

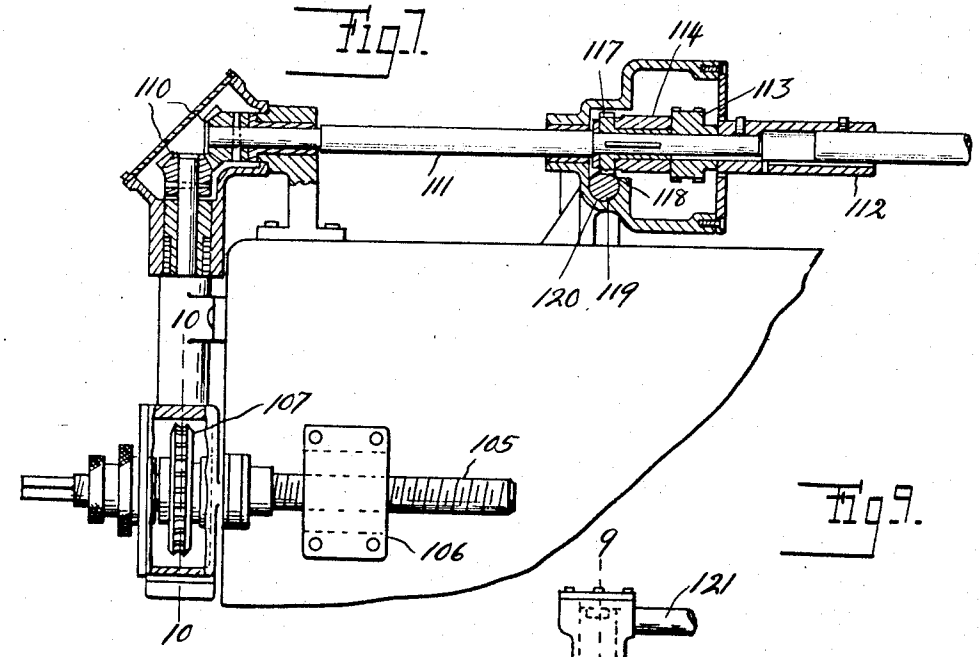

Fig. 8.

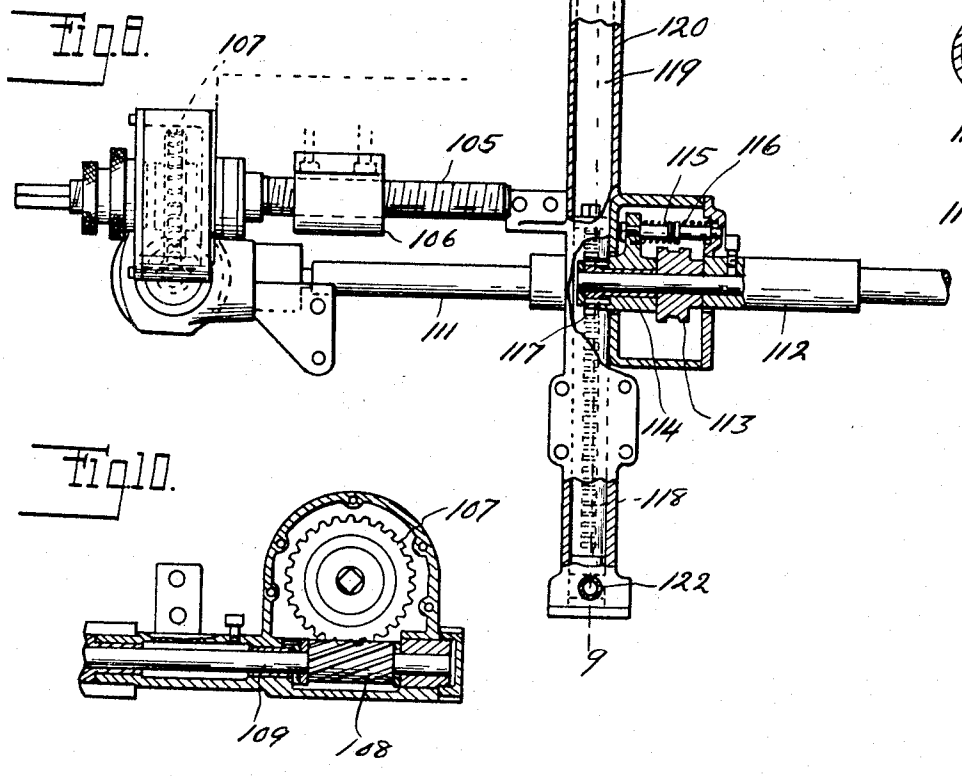

Fig. 9.

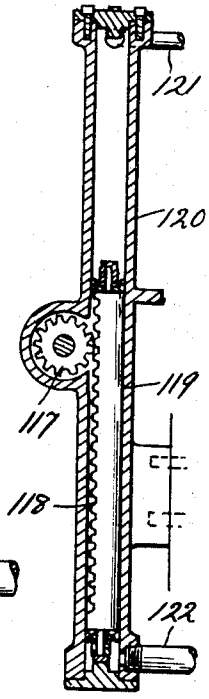

Fig. 10.

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APPARATUS FOR GRINDING DISCONTINUOUS SEGMENTAL SURFACES

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Fig. 11.

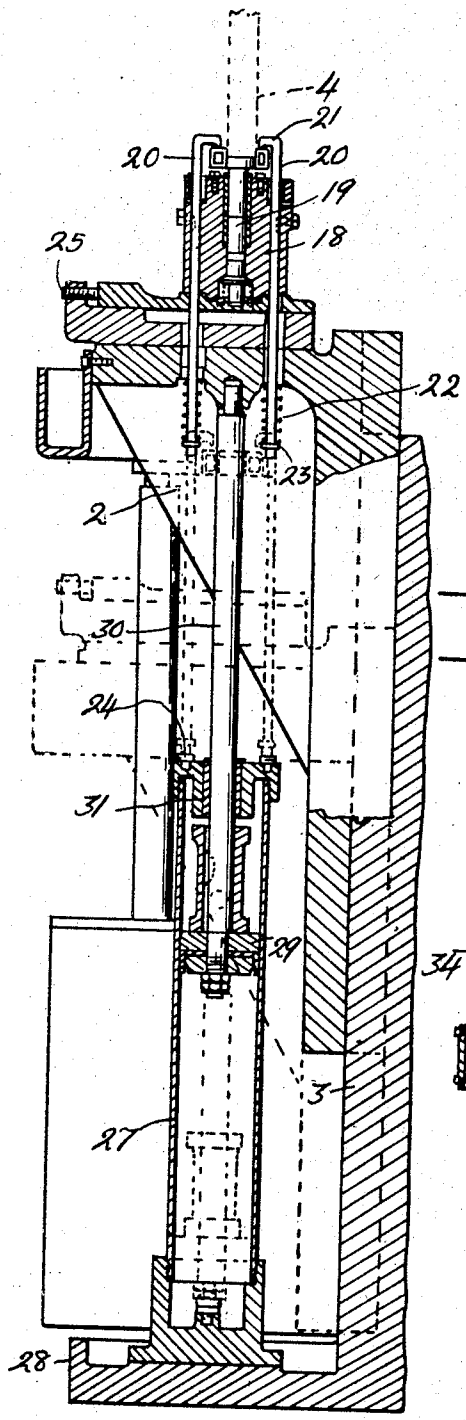


Fig. 12.

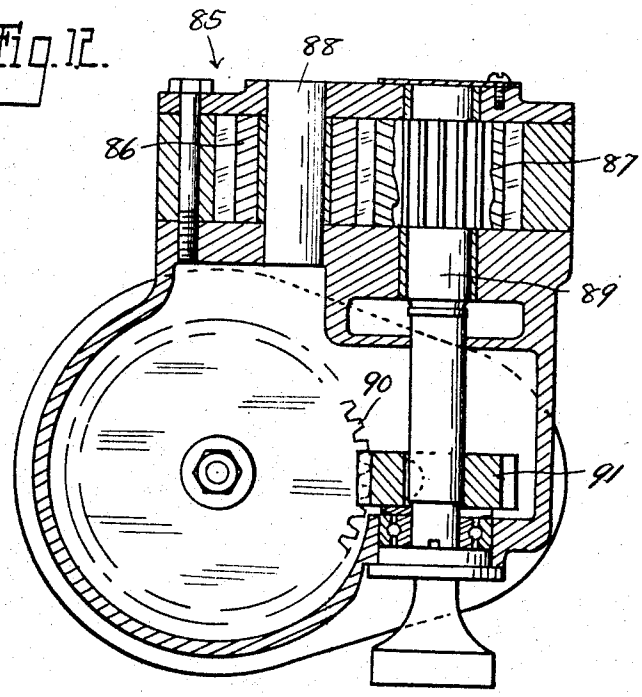
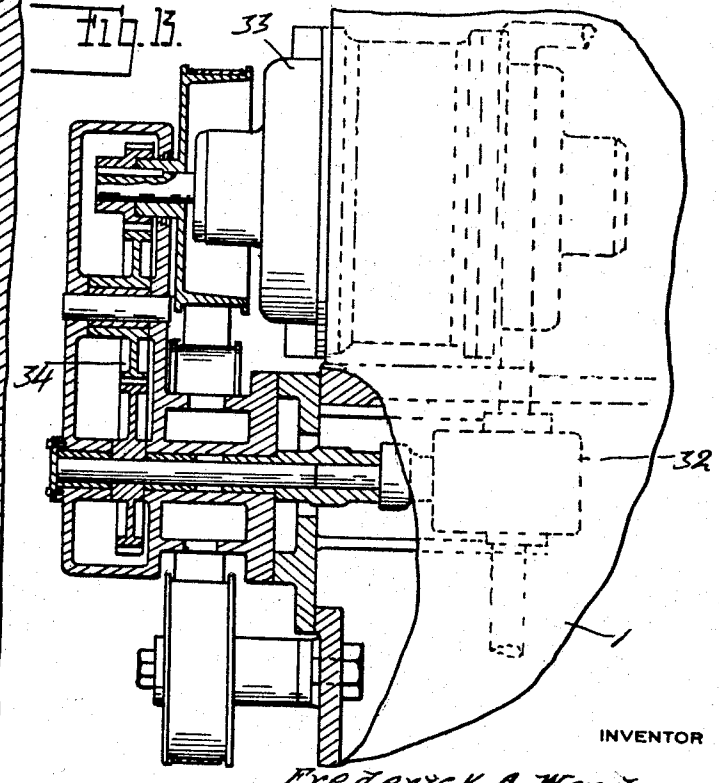


Fig. 13.



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APPARATUS FOR GRINDING DISCONTINUOUS SEGMENTAL SURFACES

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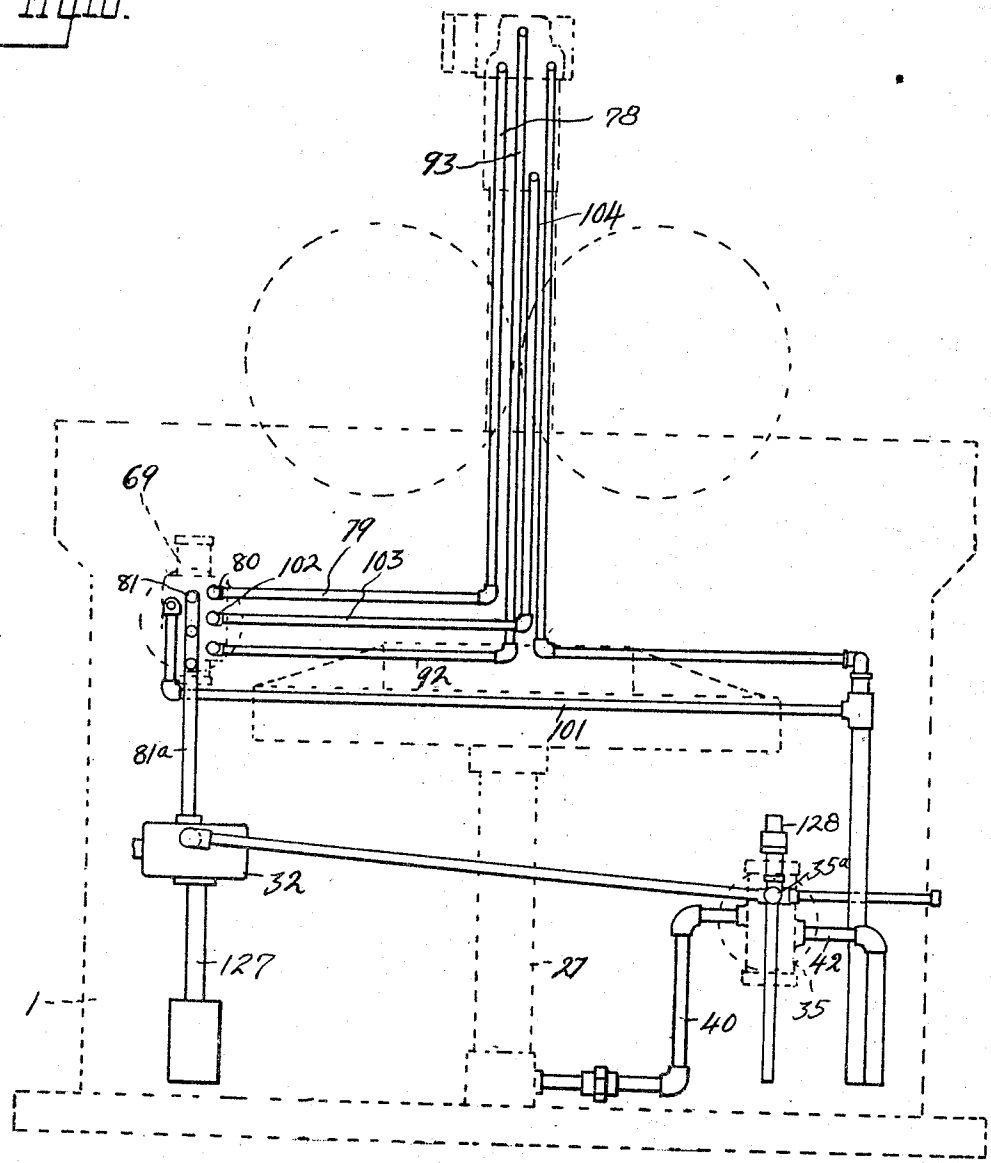
Fig 16.



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UNITED STATES PATENT OFFICE

1,987,222

APPARATUS FOR GRINDING DISCONTINUOUS SEGMENTAL SURFACES

Frederick A. Ward, Detroit, Mich., assignor to The Gear Grinding Machine Company, Detroit, Mich., a corporation of Michigan

Application June 23, 1930, Serial No. 463,180

11 Claims. (Cl. 51—84)

The invention relates to the grinding of articles having discontinuous segmental surfaces arranged about a common axis and with intermediate obstructions. It is the primary object of the invention to facilitate the rapid grinding of the articles and at the same time to secure a high degree of accuracy both in the ground surfaces and their relation to a predetermined axis in the article. It is a further object to obtain a machine so constructed and organized that its functions are automatically performed with little attention from the operator other than to place the articles in the machine and to remove them after completion of the work.

My improvements are applicable to the grinding of a large variety of articles but I shall specifically describe a single use, viz.: the grinding of an article having cylindrical segments interrupted by projecting wings and axially concentric with a cylindrical shaft. The said structure is designed for use in a hydraulic shock absorber where it is highly essential that the shank, the peripheral surfaces of the wings and the segmental surfaces intermediate the wings should all be concentric with a common axis.

In my prior patents, Nos. 1,271,495 and 1,155,532 I have described a method and apparatus for grinding interrupted segmental surfaces such for instance as spline shafts, this consisting essentially in the trimming of a grinder wheel to the desired cross sectional contour and the feeding of the work axially in operative relation to said grinder together with an indexing mechanism for successively registering the segments to be ground with such apparatus. The grinding of the different segments is necessarily successive which limits the output while the necessity of an indexing mechanism complicates the construction. It is therefore an object of the present invention to obtain a construction in which the grinding of a plurality of segments arranged about a common axis is simultaneously performed without any interference or loss in accuracy.

Generally described, my improved machine comprises a plurality of grinder wheels rotating in planes which intersect a common axis transverse to the axes of said grinder wheels. A work holder and a trimmer are arranged concentric with this axis and are moved along the same into operative relation with said grinder wheels from opposite sides thereof. There is also provided means for periodically feeding the grinder wheels towards each other and in simultaneously feeding the trimmer into operative relation thereto and rotating the same to trim the grinding surfaces. Thus in the operation of the machine after the wheels have been trimmed the articles to be ground are successively placed in the holder and moved past the grinders while periodically the wheels are fed towards each other and are retrimmed.

To perform the functions just described I have designed and organized a machine which after each article of work is placed therein will automatically perform the successive functions. These include the rapid movement of the work from position of engagement with its holder to the point of engagement with the grinder wheels, the slow feeding of the work during the grinding operation, the slow return movement of the work past the grinder wheels and the rapid return to the position for disengagement of the finished product and the engagement of the new article to be ground. The mechanism also includes automatic means operating only occasionally or once for a predetermined number of work cycles which feeds the grinder wheels inward or towards each other for a predetermined amount and then advances the trimmer into operative relation to the grinder wheels and rotates the trimmer in this position to effect the trimming. The trimmer is then retracted to be out of the way of the work in the subsequent operation of the machine.

The detailed construction of the machine is preferably as shown in the accompanying drawings in which:

Figure 1 is a front elevation;

Figure 2 is an end elevation thereof;

Figure 3 is a cross section in the plane of the axis of the trimmer shaft;

Figure 4 is a perspective view of the work to be ground;

Figure 5 is a sectional elevation of the trip mechanism and controlling valve;

Figure 6 is a sectional elevation of the trimmer controlling mechanism and timing means therefor;

Figure 7 is a horizontal section showing the adjusting mechanism for the grinder wheels;

Figure 8 is a sectional elevation thereof;

Figure 9 is a section on line 9—9 of Figure 8;

Figure 10 is a section on line 10—10 of Figure 7;

Figure 11 is a vertical cross section on line 11—11 of Figure 1;

Figure 12 is a horizontal section on line 12—12 of Figure 3; Figure 13 is a sectional elevation of the fluid pumping mechanism;

Figures 14 and 15 are detailed sections of portions of Figure 5 showing the parts in different positions of adjustment;

Figure 16 is an elevation of the fluid conduit system showing the frame of a machine in dotted lines in relation thereto.

As illustrated, 1 is a frame upon which the various operating parts of the machine are mounted. 2 is a work supporting head which is in the form of a shelf or bracket vertically slidable upon a guideway 3 on the front face of the frame 1. 4 and 4*a* are grinder wheels which are mounted upon arbors 5 journalled in heads 6 which are slidably mounted on a horizontal guideway 7 on top of the frame 1. The grinder wheels 4 and 4*a* revolve in a common plane which is parallel to the plane of the guideway 3 which latter is also perpendicular to the common axial plane of the arbors 5. Mounted on the top of the frame 1 centrally between the heads 6 is a bracket arm 8 which extends outward and is provided on its outer face with a vertical guideway 9 for a slidable head 10. The head 10 is provided with a journal bearing for the trimmer shaft 11, the axis of which lies in a plane which is centrally between the axes of the grinders 4 and 4*a*. At the lower end of the shaft 11 is a transversely adjustable holder 12 for the diamond trimmer point 13, the arrangement being such that as will be hereinafter described in detail, the lowering of the head 10 will bring said diamond point in trimming relation to the grinder wheels.

Work to be ground

The specific article to be ground is illustrated in Figure 4 and comprises a shank or shaft portion 14 with a pair of diametrically opposite projecting wings 15 having outer segmental cylindrical surfaces 16 which are concentric with the axis of the shaft. Intermediate the wings 15 are segments 17 which are of a larger radius than the shaft 14 but which must be finished to be exactly concentric with the axis of said shaft and of the peripheral segments 16. The shaft 14 and the segments 16 may be finished in a lathe or other similar tool and it is only the finishing of the segments 17 which is performed by my grinding machine.

Work holder

Upon the bracket head 2 is a work holder 18 which is provided with a socket 19 for receiving and exactly fitting the shank or shaft 14 of the work. Upon opposite sides of this socket 19 are clamping bars 20 provided with hooks 21 at their upper ends for engaging the wings 15 of the work. The hooks 21 are spaced from each other by a distance which is greater than the diameter of the segments 17 so that the shank 14 may be readily inserted in the socket 19 after which it may be revolved through a quarter revolution to bring the wings 15 beneath the hooks 21. The bars 20 extend through the base of the holder 18 and through the shelf of the bracket 2 having sleeved on their lower ends springs 22 engaging collars 23 which act to draw the bars downward and to clamp the hooks 21 upon the wings 15. However, in the normal position of the bracket head 2 the lower ends of the rods 20 engage stationary stops 24 so as to compress the springs 22 and to raise the hooks 21 a sufficient distance to clear the wings 15. This permits of engaging the work with the holder but upon the initial upward movement of the head 2 the springs 22 will clamp the hooks 21 upon the wings thereby holding the article from displacement.

Work setting means

It is absolutely essential that the axis of the ground segments 17 should coincide with the axis of the shaft 14 and of the segments 16. I have therefore provided adjustment means for the holder 18 comprising an adjusting screw 25 for moving said holder upon the bracket head 2 in one direction and adjustment screws 26 for moving the holder 18 upon the bracket head 2 in a transverse direction. By means of these two adjustments the axis of the shaft 14 may be adjusted to be coincident with the axis of the trimmer shaft 11 above referred to.

Work feeding means

To raise the bracket head 2 so as to bring the work into operative relation to the grinders I have provided a hydraulic motor comprising a cylinder 27 mounted on a projecting base portion 28 of the frame 1. Within this cylinder is a piston 29 which is connected by a piston rod 30 passing through a bearing 31 with the shelf portion of the bracket head 2. Thus if hydraulic fluid is admitted to the lower end of the cylinder 27 it will force the piston 29 upward carrying with it the bracket head 2 which slides on the guide bearing 3 and lifting the work holder 18.

Feed control

The fluid, preferably oil, which is used as the motive agent is placed under pressure by the operation of a hydraulic pump 32 of any suitable construction. As shown, this pump is driven from an electric motor 33 through the medium of a gear train 34 and delivers the oil under the desired pressure to the controlling valve 35. This valve is preferably of the piston type and includes a cylinder 36 containing a piston having balancing heads 37 and 38 between which the pressure oil is admitted to the cylinder as indicated at 35*a*. 39 is a port in the cylinder connected to a conduit 40 which leads to the base of the cylinder 27 and 41 is a port connected to an exhaust conduit 42 for the return of the oil to the storage tank.

The valve has a stem 43 extending out of the cylinder and connected to a bell crank lever 44 which is actuated by a second bell crank lever 45 having on one of its arms the trip handle 46. The arrangement is such that the handle 46 will move the bell crank lever between the stop pins 47 and 48 and through the medium of a pin 49 on the lever 44 will actuate the latter to depress the valve stem 43. This will shift the heads 37 and 38 so as to connect the port 39 with the pressure oil which is thus admitted to the cylinder 27 to raise the piston 29. The initial actuation of the valve will open an unrestricted passage through the port 39 so that the piston 29 in the cylinder 27 is rapidly raised to carry the work holder and the work into proximity to the grinder wheels. The valve is temporarily held in this position by a latch or detent 50 on a bell crank lever 51 and which engages with the upper end of the bell crank lever 44. Before, however, the work comes into actual contact with the grinders a trip lug 52 on the bracket head 2 contacts with a pin 53 on the bell crank lever 51 actuating the same so as to withdraw the detent 50 and permit a spring 54 to raise the valve in its cylinder until a second stop 55 on the bell crank lever 51 again arrests movement. The latter stop is so positioned that the head 38 of the

valve will cover the greater portion of the area of the port 39 as indicated at 39a but will leave a sufficient opening in communication with the pressure oil to continue the upward movement of the piston at a slow speed. When the travel of the piston is sufficient to pass the work beyond the grinder wheels a trip lug 56 again actuates the bell crank lever 51 to release the lever 44 and to permit it to contact with a third detent 57. This is so positioned that the head 38 of the valve will completely close connection between the pressure oil and the port 39 but will leave a restricted opening in said port which communicates with the cylinder below the head 38 and with the exhaust conduit 42 as indicated at 38b. Thus the weight of the bracket head 2 will force the oil slowly from the cylinder 27 while the work in the holder is again passing the grinder wheels. Finally, after the work has passed the grinder wheels, a trip lug 58 actuates the bell crank lever 51 to release the bell crank lever 44 from the stop or detent 57 and to permit the valve to resume its normal position. Here the port 39 is unrestricted so that the oil in the cylinder 27 may be rapidly exhausted with a correspondingly quick movement downward of the head 2 and the work holder.

Trimmer operating mechanism

As has been stated, it is only necessary to trim the grinder wheels occasionally as they will maintain their true form during the grinding of a number of successive articles. I have further provided a timing mechanism which once in a predetermined number of work cycles will set into operation the trimming mechanism. This comprises a lug 59 on the head 2 preferably on the reverse side or to the left in Figure 1. This lug during each upward movement of the head 2 will actuate a bell crank lever 60 which is connected by a link 61 with a ratchet lever 62 having a pawl 63 engaging a notched ratchet wheel 64. This ratchet wheel is connected to a rotary cam 65 which once in each revolution will contact with a roller 66 on a lever arm 67, which latter is connected to the stem 68 of a piston control valve 69. This valve performs several distinct functions, viz: First, the lowering of the trimmer shaft to bring the diamond trimmer point in the axial plane of the grinder wheels; second, the imparting of rotary motion to the trimmer shaft so as to revolve the diamond point between the grinder wheels; third, the feeding of the heads 6 and 6a toward each other on the guideway 7 so as to adjust the grinder wheels 4 and 4a slightly nearer to each other. These several functions are all performed by the valve in co-operation with mechanism of the following construction.

Trimmer shaft raising and lowering mechanism

As previously described, the trimmer shaft 11 is journalled in bearings in a vertically slidable head 10 engaging a guideway 9 on the bracket arm 8. The slidable head 10 is actuated by a lever 70 which is pivoted at 71 in a recess in the bracket arm 8 and extends into a recess in the slidable head 10 having a forked end 72 engaging a cross pin 73. Extending vertically and transverse to the direction of the lever 70 is a cylinder 74 which intersects with the recess 75 in which the lever 70 is located. 76 is a piston in the cylinder 74 which in the portion in the recess 75 is slotted for the passage of a lever 70 therethrough and segmental bearings 77 on said lever 70 maintain contact with the walls of the slot while permitting angular movement of the lever. The upper end of the cylinder 74 is connected by a conduit 78 and an extension conduit 79 with a port 80 in the cylindrical valve casing 69. The valve cylinder is also supplied with oil under pressure through a port 81 which is connected by a conduit 81a leading from the pump or oil pressure chamber. This port is so located as to lie between the heads 82 and 83 of the valve piston and in the normal position of the latter is out of communication with the port 80. When, however, the cam 65 depresses the roller 66 and rocks the lever 67, this through the stem 68 will raise the valve piston, moving the head 82 above the port 80 and establishing communication between the pressure port 81 and said port 80 as shown in Fig. 6. This permits the fluid under pressure to travel through the conduits 79 and 78 into the upper end of the cylinder 74 and to move the piston 76 downward carrying with it the lever 70 and the slide 10. Downward movement of the slide 10 is arrested by an adjustable stop 84 which is so positioned that the diamond point 13 will lie in the axial plane of the grinder wheel arbors 5. Movement of the piston 76 is retarded before contact of the slide 10 with the stop 84 by tapering pins 76a at opposite ends of the piston which engage with the ports and restrict flow of fluid exhausted from the cylinder 74 to produce a cushioning effect.

Trimmer rotating means

Mounted at the upper end of the slide 10 is a casing 85 of a rotary hydraulic motor for revolving the trimmer shaft 11. This motor is preferably of the gear type comprising the intermeshing gear wheels 86 and 87 respectively journalled on the shaft 88 and mounted on the shaft 89. The shaft 89 is connected by spiral reduction gears 90 and 91 with the trimmer shaft 11, the arrangement being such that the rotary motion generated by the gear pump is transmitted at low angular speed to the shaft 11. The gear pump is supplied with motive fluid through a conduit 92 leading from the valve 69 and coupled by a flexible conduit 93 with the gear motor housing 85. The valve is provided with two additional piston heads 94 and 95 between which is located an inlet port 96 for the fluid under pressure. A port 97 in the valve cylinder communicates with the conduit 92 so that when the valve is in the position for supplying fluid to the port 80 it will also supply fluid through the port 97 to the conduits 92 and 93, thereby actuating the gear motor and revolving the trimmer shaft 11. This motion continues as long as the valve remains in such position but whenever the cam 65 disengages from the roller 66 the valve piston will be moved downward by the actuation of a spring 98 which will simultaneously cut off the pressure fluid from the ports 80 and 97, thereby stopping revolution of the trimmer shaft 11. At the same time the valve will establish connection between the port 80 and an exhaust port 99 which through the channel 100 connects with the exhaust conduit 101 returning to the oil storage. In this same position of the valve the pressure port 81 will be in communication with a port 102 in between the heads 82 and 83 which port connects through the conduit 103 and extension 104 with the lower end of the cylinder 74 admitting fluid under pressure to said cylinder and lifting the piston 76, slide 10 and trimmer shaft mounted thereon.

Grinder wheel adjustment

In order that the trimming of the worn grinder wheels may be effected, it is necessary to adjust these wheels towards each other. This is accomplished by feed screws 105 which are journaled in end thrust bearings on opposite ends of the main frame and extend parallel to the guide 7 engaging nuts 106 on the heads 6 and 6a. The screws 105 are rotated through the medium of a reduction worm gearing comprising the worm wheel 107 on the shank of the screw and a worm 108 on a transversely extending shaft 109. The shafts 109 are coupled through miter gear wheels 110 with aligned shafts 111 extending longitudinally of the frame of the machine. The shafts 111 are connected with each other by the coupling 112 and a ratchet wheel 113 is mounted on one of these shafts. 114 is an oscillatory arm sleeved upon the shaft 11 adjacent to the ratchet wheel 113 and carrying a pawl 115 for engaging said ratchet wheel, while a second stationary pawl 116 also engaging the ratchet wheel serves to hold the latter from reverse movement. The member 114 is coupled with a pinion 117 which is in mesh with a rack 118 formed in a piston 119 slidable in a cylinder 120. The opposite ends of this cylinder have connected thereto the conduits 121 and 122 which lead to the valve 69 and are so connected that in each actuation of said valve fluid under pressure is first admitted to one end of the cylinder 120 and then to the other end thereof, the first end being coupled with the exhaust. As a consequence the piston 119 will be caused to reciprocate and when moved in one direction will through the medium of the oscillatory arm 114 and pawl 115 communicate rotary motion to the ratchet wheel 113 and shafts 111. This in turn will be transmitted through the miter gear wheels 110, shafts 109 and worm gearing 107 and 108 to the screw shafts 105. By reason of the great reduction in angular speed through the worm gearing the amount of rotary movement imparted to the shafts 105 is very slight but is enough to adjust the grinder wheels the required amount for trimming.

General operation of the machine

The grinder wheels 4 and 4a are driven at the proper speed preferably by independent electric motors located as indicated at 123 and 124 and connected by belts 125 with the pulleys 126 on the grinder arbors. The pump 32 for the hydraulic fluid is driven by a third electric motor 33 as before described, the supply of fluid being contained in a chamber within the frame of the machine from which it is drawn to the pump through a suction conduit 127. The desired pressure is maintained on the line by the operation of a pressure relief valve 128 which permits the surplus fluid to be returned to the storage.

The motors being set in operation, the operator takes an article to be ground and inserts the shank or shaft portion 14 thereof between the hooks 21 into engagement with the socket 19. The wings 15 are then turned to a quarter of a revolution to be beneath the hooks 21 which latter are raised by the engagement of the lower ends of the bars 20 with the stops 24. The operator then moves upward the handle 46 which rocks the bell crank lever 44 depressing the stem 43 of the valve against the tension of the spring 54. The successive functions are then automatically performed as has been previously described in detail, effecting first the rapid upward movement of the work into proximity to the grinder wheel; second, the slow movement of the work upward between the grinder wheels, the peripheral surfaces of which have been preformed to produce the exact form and dimensions in the ground surfaces. The work is then slowly moved downward past the grinder wheels and then rapidly returned to its initial position. In this position the rods 20 re-engage the stops 24, lifting the hooks 21 and releasing the work so that it may be removed by first rotating through a quarter revolution and then lifting out of the socket 19. A second article is then placed in the socket and operation is repeated by again drawing upward the operating handle 46.

After a predetermined number of work cycles, the successive actuations of the bell crank arm 60 by the lug 59 on the member 2 will turn the ratchet wheel 64 and cam 65 into a position for contact with the roller 66. The parts are so timed that the roller 66 is actuated downward by the downward movement of the member 2 and lug 59, it being understood that said lug will actuate the bell crank 60 twice in each cycle, first in the upward movement and second, in the downward movement. Thus at the completion of the work cycle and after the work has been withdrawn from contact with the grinder wheels, the valve 69 is operated to effect the trimming. This as previously described consists in first lowering the head 10 and trimmer shaft 11 to bring the diamond trimming point 13 into the common axial plane of the grinder wheels; second, to impart a rotary motion to the shaft 11 and the diamond 13 and third, to feed the grinder wheels towards each other a sufficient amount for the trimming. The next actuation of the handle 46 will upon the initial upward movement of the member 2 again actuate the bell crank 60 by the lug 59 which releases the roller 66 from the cam 65 permitting the return movement of the valve 69 by the spring 98 and the consequent restoration of the trimmer shaft to its normal position where it will not interfere with the work.

What I claim as my invention is:

1. A grinding machine comprising a frame, a plurality of grinder wheels mounted thereon with peripheral portions thereof in proximity, a trimmer and a work holder mounted on said frame and adjustable along a common axis passing between the peripheral portions of said grinder wheels, means for moving said trimmer between and in the axial plane of said grinder wheels and for rotating the same in this plane to fashion the cross sectional contours of said wheels and means for moving said work holder to feed the work between said grinder wheels.

2. In a grinding machine, the combination with a frame, of a pair of grinder wheels mounted on said frame to rotate in the same plane with peripheral portions thereof in proximity, means for periodically adjusting the axes of said wheels towards each other, a trimmer movable periodically between said wheels into the axial plane thereof and rotatable to trim said wheels to a predetermined cross sectional contour, a work holder in axial alignment with said trimmer and means for reciprocating said work holder along said axis to carry successive pieces of work between said grinder wheels to grind the same.

3. In a grinding machine, the combination with a frame, of a pair of grinder wheels mounted on said frame to rotate in the same plane with peripheral portions thereof in proximity, a work holder mounted on said frame to reciprocate along an axis passing between said grinder wheels, a

trimmer for fashioning the peripheral portion of said wheels to a predetermined cross sectional contour, and means operating periodically after a predetermined number of reciprocations of said work holder for operating said trimmer.

4. In a grinding machine, the combination with a frame, of a pair of grinder wheels mounted on said frame to rotate in the same plane and with peripheral portions thereof in proximity, a work holder movable along an axis extending between the adjacent peripheral portions of said grinder wheels, a hydraulic motor for reciprocating said work holder, a trimming mechanism for fashioning the cross sectional contour of said grinder wheels, hydraulic means for operating said trimmer and means operating after a predetermined number of reciprocations of said work holder for operating said hydraulic actuating means for said trimmer.

5. In a grinding machine, the combination with a frame, of a pair of grinder wheels mounted on said frame to rotate in a common plane and with peripheral portions thereof in proximity, a work holder movable along an axis passing between the adjacent peripheral portions of said grinder wheels, a hydraulic piston motor for reciprocating said work holder, a valve for admitting fluid under pressure to said motor on one side of the piston and for exhausting fluid on the other side of said piston, manual means for actuating said valve to a position for admitting fluid unrestrictedly to move said work holder rapidly towards said grinder wheel, automatic means controlled by the position of said work holder during the movement thereof for restricting the flow of fluid and retarding movement while the work is in engagement with the grinder wheels in its forward and return movements and for then opening the valve for rapid return of the work holder to its initial position.

6. In a grinding machine, the combination with a frame, of a pair of grinder wheels mounted thereon to rotate in a common plane, and with peripheral portions thereof in proximity, a work holder movable along an axis passing between the adjacent peripheries of said wheels, hydraulic means for reciprocating said work holder, a trimmer in axial alignment with said work holder on the opposite side of said grinder wheels, and means automatically actuated after a predetermined number of reciprocations of said work holder for actuating said trimmer to move the same between said grinder wheels in the common axial plane thereof for rotating said trimmer while thus positioned to trim the peripheries of said wheels to a predetermined cross sectional contour and for withdrawing the trimmer out of the path of the work.

7. In a grinding machine, the combination with a frame, of a pair of grinder wheels mounted thereon to rotate in a common plane with peripheral portions thereof in proximity, a work holder movable along an axis passing between the adjacent peripheries of said wheels, means for automatically reciprocating said work holder to carry the work between said wheels, and a work clamp released in the normal position of said work holder and automatically engaging upon the movement thereof to hold the work clamped during the grinding operation.

8. In a grinding machine, the combination with a frame and a grinder wheel mounted thereon, of a reciprocating member for carrying the work in operative relation to said grinder wheel, a work holder carried by said reciprocatory member including a socket for receiving a shank of the work, a spring actuated clamping member for holding the work in said socket while in operative relation to said grinder wheel, and a shank for said clamping member engageable with a stop in the normal position of said work holder to release the clamp and permit of engaging the work with and disengaging it from said socket.

9. In a grinding machine, the combination with a frame, a pair of grinder wheels mounted thereon to rotate in a common plane with peripheral portions thereof in proximity, a trimmer for said grinder wheels and hydraulic actuating mechanism for said trimmer comprising a piston motor for moving said trimmer axially of the trimming position between said grinder wheels, a rotary motor for revolving said trimmer while in trimming position and including a fluid actuated gear motor and a step-down transmission, a valve for controlling said hydraulic actuating mechanism adapted to successively admit fluid to said piston motor and to said gear motor, a reciprocating work holder for carrying the work to and from operative relation to said grinder wheel, and timing means automatically operated by said reciprocating work holder for periodically operating said valve to effect the trimming of the grinder wheel.

10. In a grinding machine, the combination with a frame, of grinder wheels mounted thereon to rotate in a common plane with peripheral portions thereof in proximity, a work holder movable along an axis extending between the peripheries of said wheels, means for successively reciprocating said work holder to carry the work between said wheels, a trimmer for fashioning the peripheral portions of said wheels to a predetermined cross sectional contour, means for moving said trimmer in alignment with the axis of said work holder into trimming position between said grinder wheels, means for rotating said trimmer while thus positioned to effect the trimming of the wheels, means for adjusting the axes of said grinder wheels towards each other and mechanism automatically operating after a predetermined number of reciprocations of said work holder for positioning said trimmer, rotating the same and for feeding the axes of the grinder wheels towards each other.

11. In a grinding machine, the combination with a frame, and a pair of grinder wheels mounted to rotate in a common plane having peripheral portions thereof in proximity and a trimmer for said grinder wheels comprising a slide movable towards and from said grinder wheels, a rotary trimmer shaft carried by said slide and moved axially thereby in between said grinder wheels, a hydraulic motor for rotating said shaft, a rockable lever for reciprocating said slide, a piston slotted for the passage of said rockable lever, cylinders in which the opposite ends of said piston operate and means periodically operating for admitting fluid to said cylinders to actuate said rockable lever and slide carrying said trimmer shaft into operative position and for also admitting fluid to said hydraulic motor for rotating said shaft whereby the trimming of said grinder wheels is effected.

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