Jan. 3, 1939. D. R. HALL 2,142,444

GRINDING MACHINE

Filed Dec. 26, 1935 2 Sheets-Sheet 1

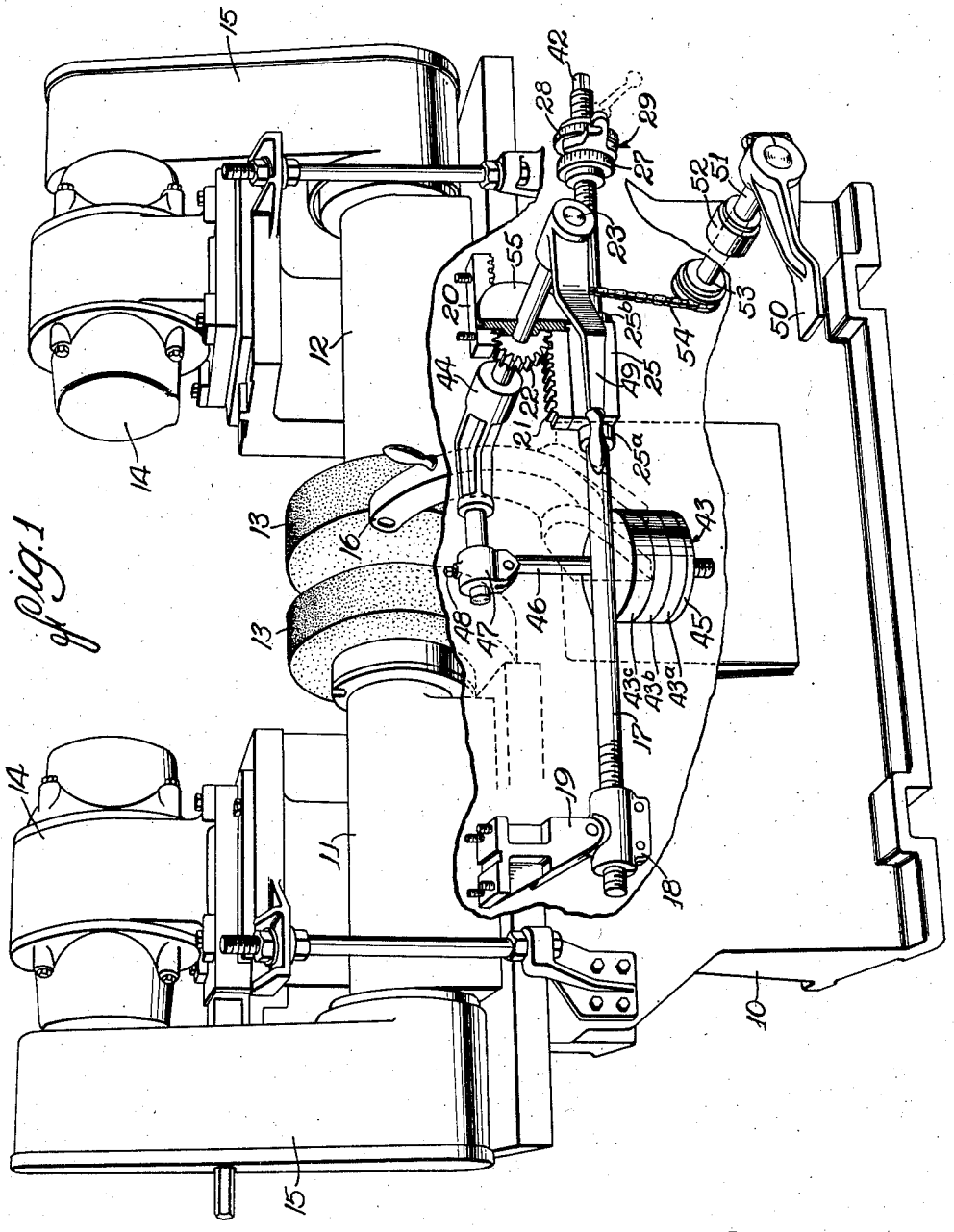



Fig. 1

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Fig. 2

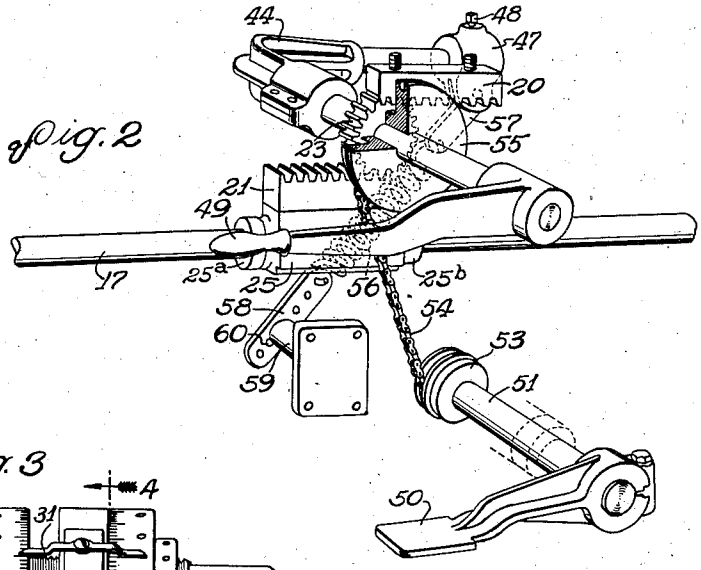



Fig. 3

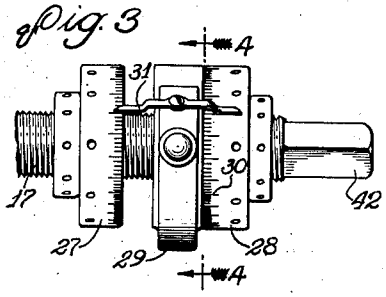



Fig. 4

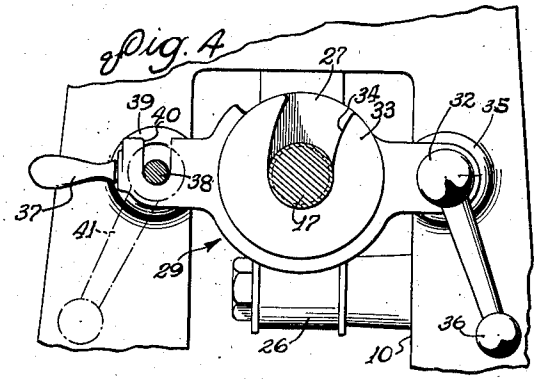
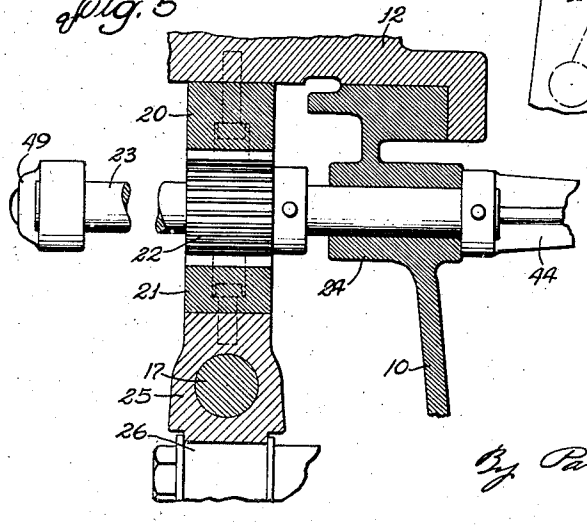



Fig. 5




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## GRINDING MACHINE

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Application December 26, 1935, Serial No. 56,136

6 Claims. (Cl. 51—111)

The invention relates to grinding machines, and more particularly to machines having opposed grinding elements adapted to operate simultaneously on opposite sides of the work.

In grinding work to predetermined dimensions on machines of the above general character, the grinding operation may be carried out in either of two ways, depending upon the character of the work and the particular type of surface finish desired. In one case, the grinding heads are held stationary with the grinding elements adjusted into predetermined spaced relation, and the work is inserted between the elements to obtain what is commonly termed a "shear cut". In the other case, the work is inserted between the grinding elements while the heads are in open position, and, after the work is in place, the heads are closed together to a predetermined point to grind the two surfaces of the work in what may be termed a face grinding operation. In either operation, accurate positioning of the grinding elements is essential to the proper finishing of the work to exact dimensions. With this in view, it is an object of the present invention to provide improved adjusting means of simple and sturdy construction by which the grinding elements of the machine may be quickly and accurately set for grinding work to exact dimensions by either type of grinding operation.

Another object is to provide improved grinding element adjusting means for a grinding machine of the above general character whereby the machine is enabled to operate accurately with high efficiency and a large productive capacity.

Another object is to provide improved means for adjusting the relative positions of the grinding elements of the machine to compensate for uneven wear of the elements.

Another object is to provide improved means for locking the grinding heads of the machine in set position and embodying means of an advantageous character whereby the heads may be quickly released and opened to provide convenient access to the grinding elements for dressing the same.

Another object is to provide improved means for automatically shifting the grinding heads of the machine which means is readily adjustable either to close the heads together on the work or to retract them from the work, and by which the pressure exerted by the grinding elements upon the work or the speed at which they are retracted therefrom may be conveniently regulated to suit the requirements of any particular work involved.

Other objects and advantages will appear from the following detailed description of a preferred embodiment which has been selected for illustration in the accompanying drawings. It will be understood, however, that many changes in form, construction and arrangement of parts may be made by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims.

In the drawings:

Figure 1 is a perspective view of a machine embodying the features of the invention.

Fig. 2 is a fragmentary perspective view of a modified form of the mechanism for automatically shifting the grinding heads of the machine.

Fig. 3 is a front view of a portion of the adjusting mechanism showing the adjusting nuts and the stop member with which they cooperate.

Fig. 4 is a fragmentary elevational view of one end of the machine showing the stop member and the arrangement whereby it may be actuated to release the grinding heads from locked position.

Fig. 5 is a transverse sectional view through the rack and pinion mechanism of the adjusting means.

Referring now to Fig. 1, the invention is shown as embodied in a conventional double spindle grinding machine having a hollow base 10 carrying horizontally reciprocable grinding heads 11 and 12 mounted for movement toward and from each other. Each head carries a grinding wheel 13 adapted to be driven by an electric motor 14 through the medium of a drive mechanism indicated at 15. The grinding wheels 13 are disposed in opposingly faced relation to enable them to operate simultaneously upon opposite sides of the work which may be held in operative relation with the faces of the wheels in any suitable manner as by a retractable work support 16.

Coordinated movement of the grinding heads and proper spacing of the wheels 13 is provided by connecting means of an advantageous character associated with the heads. In its preferred form, the connecting means comprises a connecting bar 17 having one end threaded into an anchoring member 18 pivotally carried by a bracket 19 depending from and rigidly secured to the head 11, and having the other end connected with the head 12 through the medium of a rack and pinion mechanism. As shown herein, this mechanism comprises opposingly faced racks 20 and 21 which extend parallel to the direction of movement of the heads 11 and 12 and between which is interposed a pinion 22

carried by a shaft 23. The shaft 23 may be journaled in suitable bearings formed in the base 10, such as the bearing 24 shown in Fig. 5, the ends of the shaft preferably projecting through the base on opposite sides to provide for the mounting thereon of actuating means to be described hereinafter. The rack 20 may be rigidly secured to the head 12 in any suitable manner and the rack 21 is carried by a supporting member 25 to which the bar 17 is rotatably anchored by means of collars 25a and 25b fast on the bar and disposed so as to abut against opposite ends of the member 25. To maintain the rack 21 in engagement with the pinion 22, the member 25 is slidably supported by a guide 26 as shown in Fig. 5. With the above arrangement, movement of the grinding head 11 will effect a corresponding movement of the connecting bar 17 which carries the rack 21 with it and through the medium of the pinion 22 and rack 20, effects an oppositely directed movement of the other head. Likewise, movement of the grinding head 12 will result in a longitudinal shifting of the bar 17 and a corresponding movement of the grinding head 11.

The various elements of the connecting means above described may be conveniently disposed within the hollow base 10 of the machine. To provide for convenient access for adjustment, however, one end of the bar 17 preferably extends through a suitable aperture in the end of the base and on this end of the bar is mounted suitable adjusting mechanism.

When work is to be ground to predetermined dimensions, accurate spacing of the grinding wheels 13 is essential. In taking a shear cut, the wheels must, of course, be locked in set position, while in face grinding, the limit of their closing movement must be accurately determined. With this end in view, I provide stop means of an advantageous character whereby the heads 11 and 12 may be held immovable in any desired position or limited to movement within accurately defined limits that may be readily adjusted to meet the requirements imposed by different types of work.

In its preferred form, the stop means includes nuts 27 and 28 threaded onto the projecting end of the connecting bar 17 and disposed at opposite sides of a stop member 29 rigidly supported on the base 10 so as to coact with the member in the reciprocatory movements of the bar 17. Referring more particularly to Fig. 3, it will be apparent that the movement of the connecting bar 17 to the right as viewed in the drawings, and consequently the closing movement of the grinding heads 11 and 12, will be limited by the position of the nut 27 on the bar 17 with respect to the stop member 29. Movement of the bar and grinding heads in the opposite direction may be limited by properly positioning the nut 28 on the bar 17. To facilitate accurate positioning, the nuts may be provided with an indexing scale 30 cooperating with a pointer 31 mounted on the member 29.

In face-grinding work to a predetermined dimension, the nut 27 will be set so that the closing movement of the grinding wheels is stopped at the point necessary to give the work the desired dimension. Nut 28 may conveniently be set to permit opening of the grinding wheels just sufficient to allow insertion of the work so that unnecessary movement of the grinding heads is avoided and the grinding operations may thus be carried on with a minimum loss of time. For grinding with a shear cut, the nuts 27 and 28 first may be adjusted away from the stop 29 sufficiently to permit positioning of the grinding wheels in the desired spaced relation and then turned up tightly against the stop to hold the wheels in set position.

At times, as for example when the grinding wheels require dressing, it may be necessary to move the wheels apart a greater distance than that for which the stop nut 28 is set in order to provide sufficient clearance for a dressing tool or the like. To facilitate this operation, the stop 29 preferably is constructed so that it may be readily withdrawn from between the stop nuts 27 and 28 without disturbing the setting of these nuts. As shown in Fig. 4, the stop 29 is in the form of a lever pivotally supported at one end on a pad or shoulder 35 formed on the base of the machine by a pivot member 32 for movement transversely of the bar 17. For coacting with the stop nuts 27 and 28, the stop may be conveniently formed with an enlarged portion 33 of generally cylindrical form intermediate its ends, this enlarged portion having an upwardly opening radially extending slot 34. The slot is preferably arcuate about the pivot 32 and of a width sufficient to accommodate the bar 17 and thus permits the stop to be rocked into the position shown in the drawings wherein it is operatively engageable by the nuts 27 and 28. To provide for maintaining the stop 29 in operative relation to the stop nuts, the pivot member 32 is preferably constructed in the form of a screw threaded into the shoulder 35 and having an actuating arm 36 by which it may be readily rotated to clamp the end of the stop frictionally against the shoulder.

Manipulation of the stop 29 is facilitated by providing a hand lever 37 on the free end thereof by which it may be readily rocked on its pivot. As a further means of insuring against accidental release, additional latching means coacting with the free end of the stop 29 may be provided. This means may conveniently take the form of a clamping screw 38 similar to the screw 32, also threaded into a suitable pad or shoulder 39 formed on the base 10. An upwardly opening slot 40 is provided adjacent the free end of the stop for receiving the screw 38 when the stop is swung into operative position as shown in Fig. 4 of the drawings. Thus, by means of an actuating arm 41, the screw 38 may be turned up to clamp the free end of the stop against the shoulder 39.

With the above described construction and arrangement of the stop, the grinding heads may be quickly released for free movement within the limits imposed by the construction of the machine by simply loosening the latching screws 32 and 38, and rocking the stop 29 out of the path of the stop nuts 27 and 28.

The invention also provides a convenient means whereby the grinding wheels 13 may be quickly and accurately centered with respect to the work support in the event of uneven wearing of the wheels. To effect such centering, either or both of the stop nuts may be backed away from the stop 29 and the effective spacing of the grinding heads adjusted by rotating the connecting bar 17 about its longitudinal axis. Rotation of the bar is facilitated by squaring one end 42 to provide for gripping the same with a wrench or other suitable tool. The connecting bar on rotating acts through the medium of the threaded connection with the anchoring member 18 to shift the head 11 toward or from the head 12. The relative position of

the connecting bar with respect to the latter head is unchanged by reason of the fact that the bar is rotatably anchored to the supporting member 25. After the head 11 is shifted sufficiently to compensate for the uneven wear, the stop nuts may again be set to define the limit positions of the grinding wheels.

While any suitable means may be employed for imparting movement to the grinding heads 11 and 12, I have shown an arrangement whereby such movement may be effected by rotation of the pinion 22. To this end, the pinion is keyed to or otherwise made fast on the shaft 23 and suitable actuating means for rotating the shaft are provided.

When it is desired to move the grinding heads into open or closed position automatically, the actuating means may be arranged so that it normally tends to rotate the shaft 23 and pinion 22 in a direction such as to produce the desired movement. A simple and efficient means for accomplishing this result is shown in Fig. 1 and includes a counterweight 43 adapted to act on the shaft 23 through the medium of a lever member 44 having one end fast on the shaft. If the heads are to be automatically closed together, the lever 27 is set so that the weight tends to rotate the shaft 23 in a counter-clockwise direction. For opening the heads, the lever arm may be set to project from the shaft in the opposite direction and thus the weight 43 will tend to rotate the shaft in a clockwise direction. To facilitate such adjustment the lever 44 is preferably mounted on the end of the shaft which projects from the rear of the base, thus providing ready access thereto.

As a convenient means for adjusting the pressure exerted by the heads in opening or closing, the counterweight 43 may comprise a plurality of separate elements or weights $43^a$, $43^b$ and $43^c$ removably carried on a plate 45 threaded onto one end of a rod 46 depending from the free end of the lever 44. Further adjustment may be secured by moving the rod 46 toward or from the free end of the lever, and for this purpose, the connecting means for securing the rod to the lever may conveniently take the form of a split collar 47 having a set screw 48 for clamping the collar to the lever.

To provide for movement of the heads 11 and 12 in opposition to the automatic means above described, I have provided additional actuating members adapted to be actuated by the operator of the machine. One such member comprises a manually operable lever 49 fast on the projecting end of shaft 23 whereby the shaft may be rotated in either direction by the operator. Another member includes a foot pedal 50 fast on the projecting end of a rock shaft 51 supported transversely of the base 10 by a bearing 52. The shaft 51 carries a drum 53 to which is anchored one end of a flexible connecting member such as a chain 54, the arrangement being such that the chain is wound on the drum when the pedal 50 is depressed and unwound when the pedal is permitted to rise. The other end of the chain passes over and is anchored to a pulley 55 fast on the shaft 23 in a manner such that the counterweight tends to unwind the chain on the drum. Accordingly, the drum 55 and shaft 23 may be rotated against the action of the counterweight 43 and the heads may be moved to open position by depressing the foot pedal 50.

Fig. 2 shows a modified form of the mechanism in which a spring actuator is used in place of the counterweight. In this instance, the lever 44 is shown positioned for automatically moving the grinding heads to open position and the foot operated mechanism is arranged for closing the heads together. As shown herein, the spring actuator includes a coiled spring 56 connected at one end to the lever 44 by means of a link 57 secured to the adjustable collar 47. The other end of the spring 56 is anchored to the base of the machine by means of a link 58 pivotally secured to a pin carried by an anchoring post 59 adapted to be bolted or otherwise rigidly secured to the base 10. To provide for adjusting the tension of the spring, the link 58 is provided with a plurality of spaced apertures adapted to receive the anchor post pin so that the effective length of the link and thus the tension of the spring, may be varied by changing from one aperture to another as required.

In view of the foregoing, it will be apparent that I have provided improved means whereby the grinding elements of a double spindle grinding machine may be quickly and accurately adjusted for grinding work to predetermined dimensions. The machine when so equipped may be readily set for grinding with a shear cut or for face grinding as required and is adapted to operate accurately with high efficiency and large productive capacity. Moreover, the relative position of the grinding elements may be readily adjusted to compensate for uneven wear and they may be quickly and easily released from set position to facilitate dressing. I have also provided means of an advantageous character for effecting movement of the grinding heads of the machine whereby the grinding elements may be closed together on the work or retracted therefrom with a minimum effort on the part of the operator and with substantially no lost time.

I claim as my invention:

1. A grinding machine having, in combination, a base, a pair of grinding heads mounted on said base for movement toward and from each other, grinding elements supported on adjacent ends of said heads, means for supporting work in operative relation to said elements, a bar secured to one of said heads and extending toward the other head, means operatively connecting the bar with said other head whereby movement of that head in one direction results in the movement of the first mentioned head in the opposite direction to close the grinding elements together on the work or to retract them from the work, a stop stationarily supported on the base, and a stop engaging member adjustably carried by said bar for limiting the closing movement of said heads to determine the finished dimension of the work.

2. A grinding machine having, in combination, a base, a pair of grinding heads mounted on said base for movement toward and from each other, grinding elements supported on adjacent ends of said heads, a bar secured to one of said heads and extending toward the other head, means operatively connecting the bar with said other head whereby movement of that head in one direction effects a movement of said first mentioned head in the opposite direction, a stop supported on the base, and a pair of stop engaging members carried by said bar, said members being disposed on opposite sides of said stop and adjustable relative to the stop to lock the heads stationary in a predetermined set position.

3. A grinding machine having, in combination,

a base, a pair of grinding heads mounted on said base for movement toward and from each other, grinding elements supported on adjacent ends of said heads, a bar secured to one of said heads and extending toward the other head, means operatively connecting the bar with said other head whereby movement of that head in one direction results in a substantially equal movement of the other head in the opposite direction, a stop supported on the base, and a pair of stop engaging members carried by said bar, said members being disposed on opposite sides of said stop and adjustable relative to the stop to lock the heads stationarily in a predetermined set position or to permit movement of the heads within predetermined limits.

4. A grinding machine having, in combination, a base, a pair of grinding heads mounted on said base for movement toward and from each other, grinding elements supported on adjacent ends of said heads, a bar rigidly secured to one of said heads and extending toward the other head, means operatively connecting the bar with said other head whereby movement of the bar in one direction is effective to move the heads toward each other to close the grinding elements together and movement of the bar in the opposite direction is effective to move the heads away from each other to open the grinding elements, said connecting means including a pair of opposed racks carried respectively by the bar and by said other head and a pinion journaled in said base and engaging said racks, means tending to rotate said pinion to move the heads towards each other, manually operable means for rotating said pinion to move the heads away from each other, and adjustable means for limiting the extent of movement of the heads.

5. A grinding machine having, in combination, a base, a pair of grinding heads mounted on said base for movement toward and from each other, grinding elements supported on adjacent ends of said heads, a bar rigidly secured to one of said heads and extending toward the other head, means operatively connecting the bar with said other head whereby movement of the bar in one direction is effective to move the heads toward each other to close the grinding elements together and movement of the bar in the opposite direction is effective to move the heads away from each other to open the grinding elements, said connecting means including a pair of opposed racks carried respectively by the bar and by said other head and a pinion journaled in said base and engaging said racks, means tending to rotate said pinion to move the heads, and adjustable means for limiting the extent of movement of the heads.

6. In a machine of the class described, in combination, a base, a pair of tool heads movably supported on said base, and a connecting member having a threaded connection with one tool head and a rotatable connection with a rack and pinion mechanism operatively associated with the other head, said member operating through said connections to move the head simultaneously toward and from each other when the member is moved longitudinally and to move one head independently of the other when the member is rotated.

DONALD R. HALL.