Nov. 27, 1928. 1,692,833

L. R. HEIM

ROLL GRINDING APPARATUS

Filed Feb. 8, 1921 6 Sheets-Sheet 1

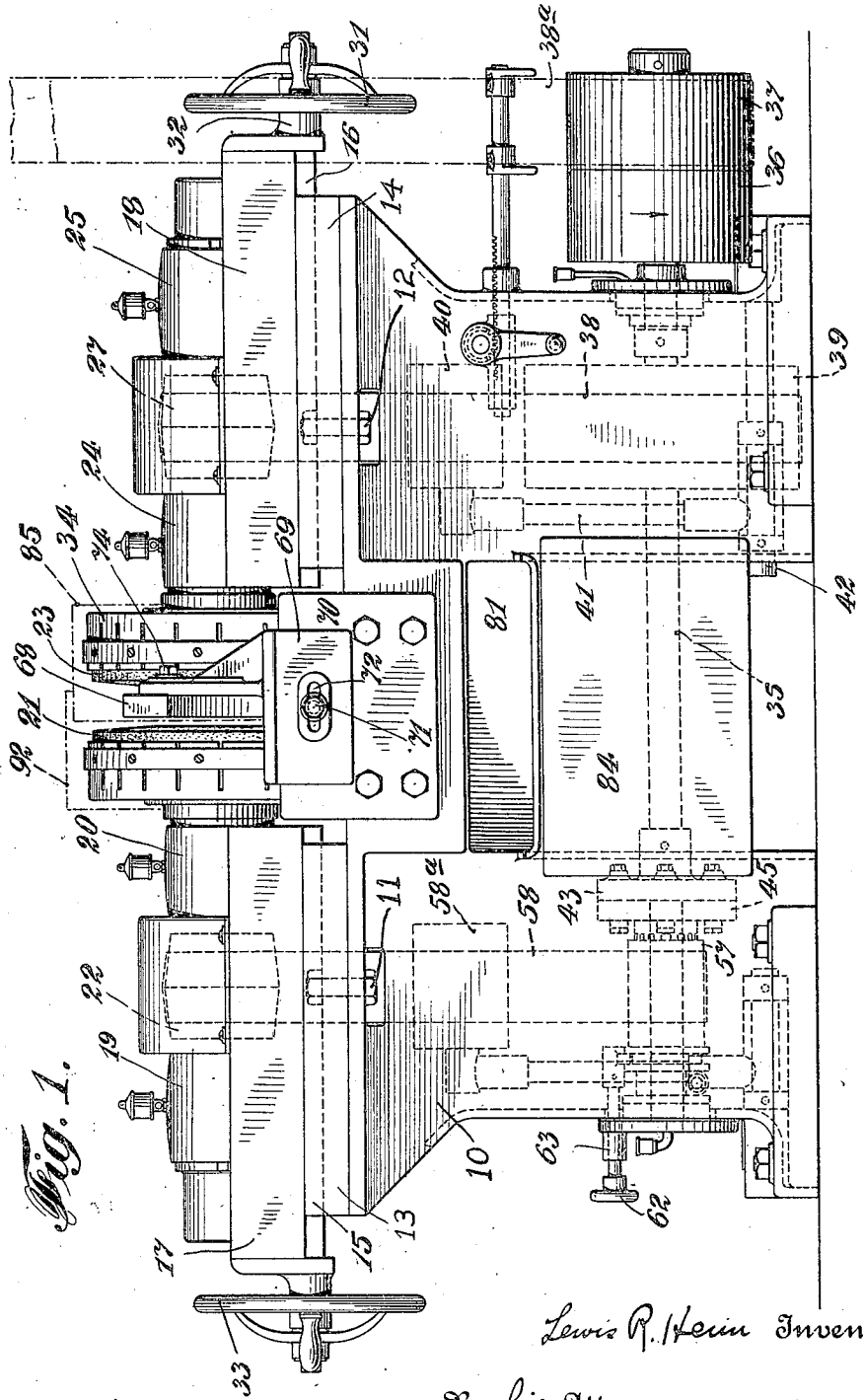

Fig. 1.

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ROLL GRINDING APPARATUS

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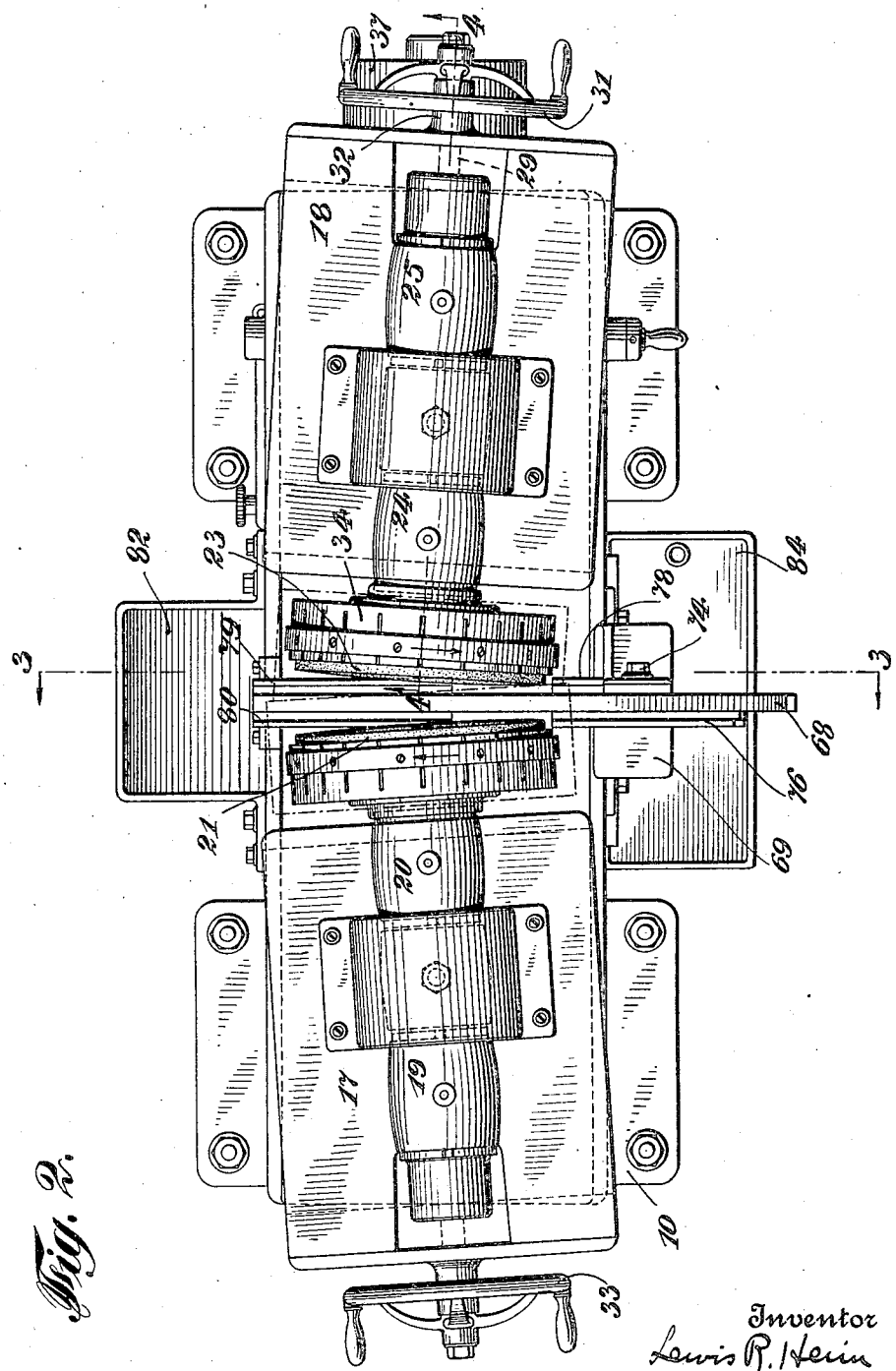

Fig. 2.

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ROLL GRINDING APPARATUS

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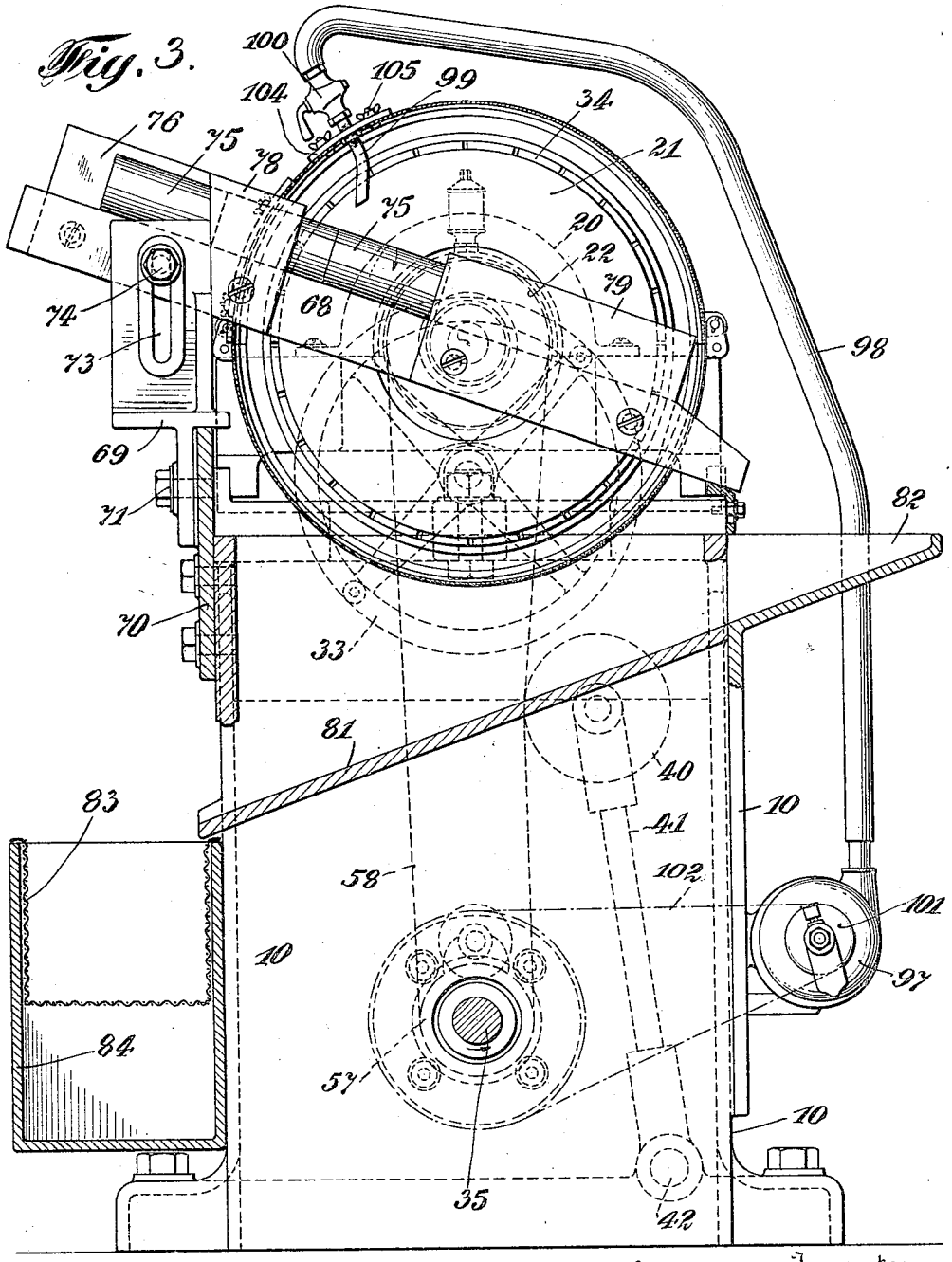
Fig. 3.



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ROLL GRINDING APPARATUS

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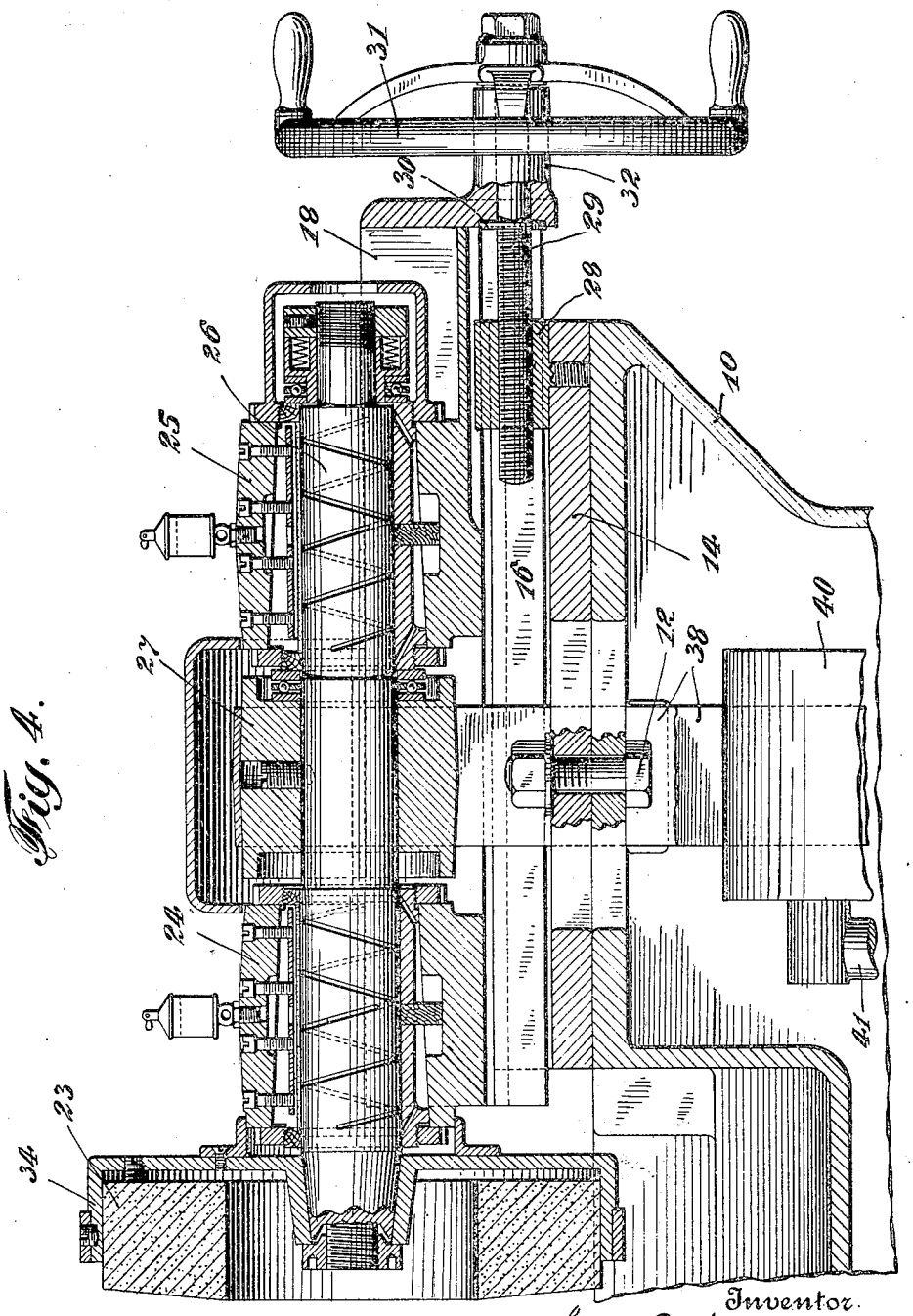

Fig. 4.

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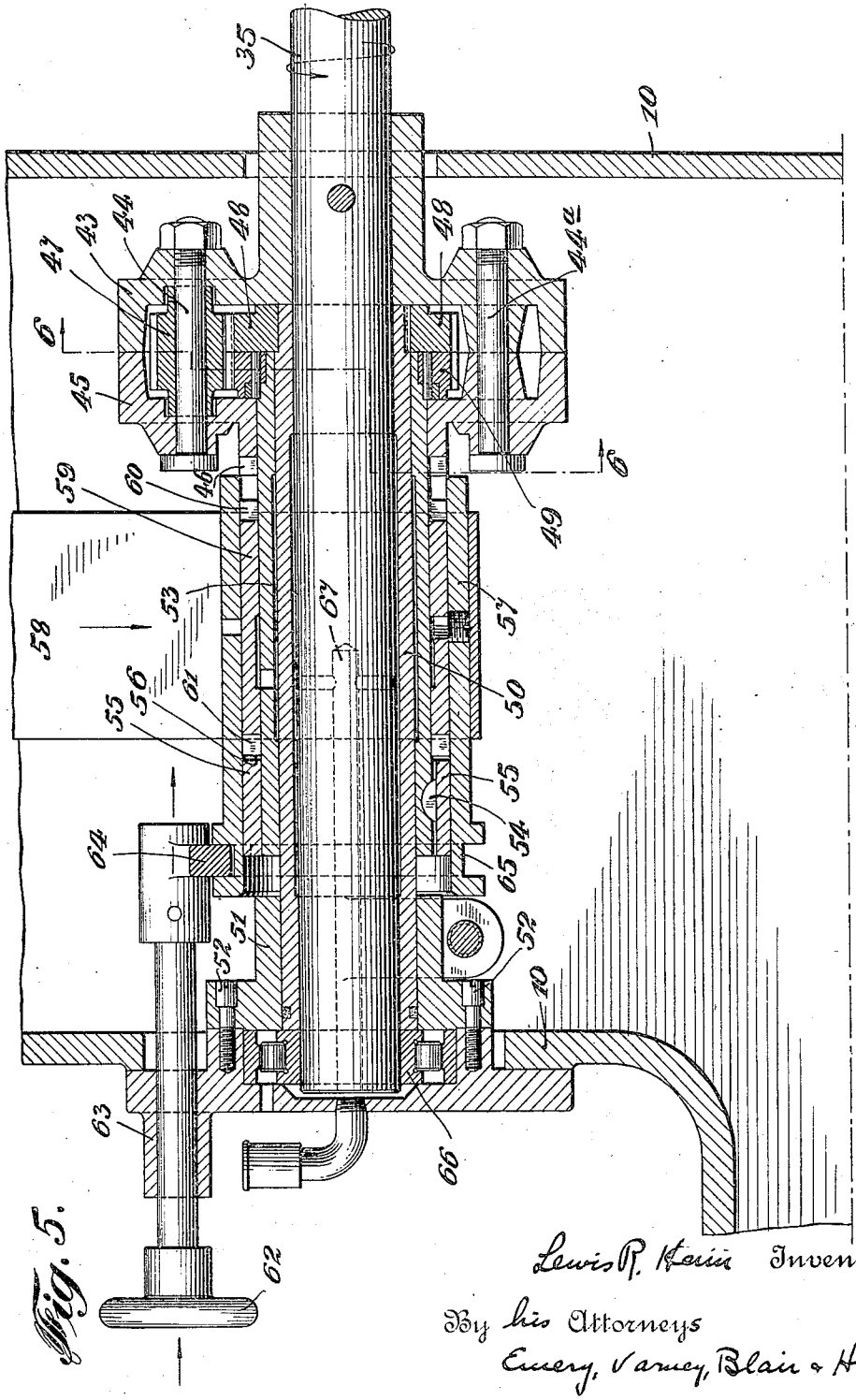

Fig. 5.

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ROLL GRINDING APPARATUS

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Fig. 6.

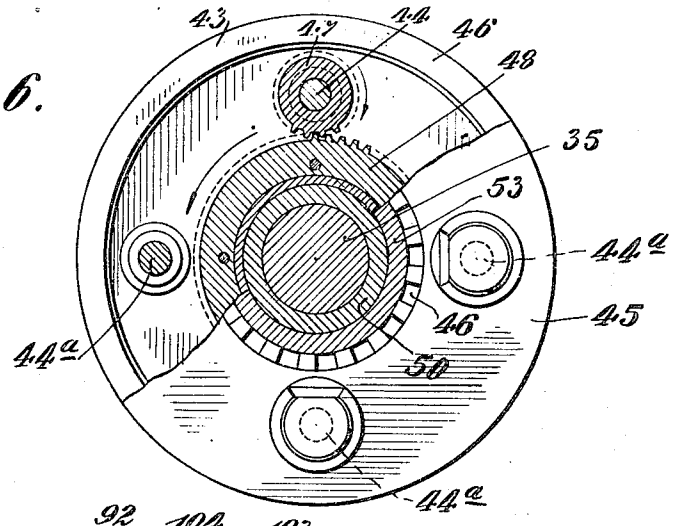
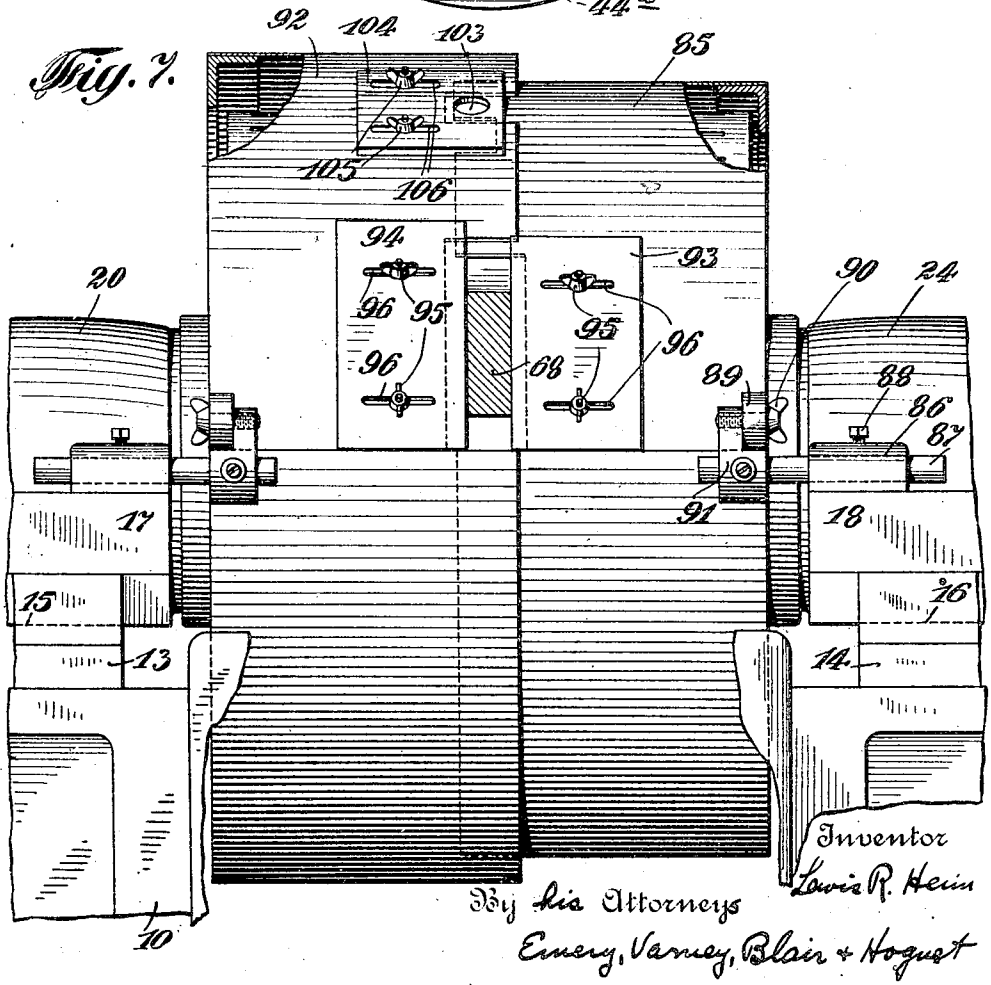


Fig. 7.



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UNITED STATES PATENT OFFICE.

LEWIS R. HEIM, OF DANBURY, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CINCINNATI GRINDERS INCORPORATED, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

ROLL-GRINDING APPARATUS.

Application filed February 8, 1921. Serial No. 443 389.

This invention relates to grinding apparatus and more particularly to apparatus of such nature for the production of rolls such as are used in roller bearings. One of the objects thereof is to provide apparatus of the above nature of strong and dependable construction and the action of which will be characterized by a high degree of accuracy and efficiency. Another object is to provide apparatus of the above nature which shall be readily adjustable to meet various conditions of use and sizes of work. Other objects are to provide apparatus of the above nature in which the drive is capable of ready adaptability to different conditions and in which the parts are so disposed as to form a compact machine without sacrifice of ready accessibility. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the structure hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which is shown one of various possible embodiments of this invention,

Figure 1 is a front elevation thereof;

Figure 2 is a plan;

Figure 3 is a sectional elevation taken substantially on the line 3—3 of Figure 2 and showing the parts on an enlarged scale;

Figure 4 is a sectional elevation taken along the line 4—4 of Figure 2, showing the parts on an enlarged scale;

Figure 5 is a sectional view taken through the axis of a speed change gear;

Figure 6 is a sectional view taken along the line 6—6 of Figure 5; and

Figure 7 is an enlarged front elevation of a portion of the machine shown in Figure 3, and showing the protective hoods mounted thereon.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now in detail to Figure 1 of the drawings, there is shown a supporting frame 10 on which are pivotally mounted by means of the bolts 11 and 12 a pair of beds 13 and 14. Slidably mounted on the beds 13 and 14 in suitable ways 15 and 16 are the wheel supporting carriages 17 and 18 respectively. The carriage 17 is provided with bearings 19 and 20 in which is supported a shaft, upon one end of which is mounted what will be termed the regulating abrasive wheel 21, and intermediate of the supporting bearings of which is mounted a driving pulley 22 to drive the regulating wheel 21 in the manner hereinafter described. A substantially similar construction is provided upon the carriage 18 for mounting an abrasive wheel 23 which will be termed the grinding wheel, the construction employed being more clearly shown in section in Fig. 4 and on an enlarged scale. Referring to Fig. 4, it will be noted that upon the carriage 18 are mounted bearings 24 and 25 for supporting the shaft 26, upon the one end of which is mounted the grinding wheel 23 and upon which is secured the driving pulley 27 positioned preferably between the two bearings 24 and 25. In this figure are also shown the means for adjusting the carriage 18, this construction being substantially identical to the construction used in connection with carriage 17.

Upon the bed 14 pivotally mounted upon the frame 10 as by the bolt 12 is provided a lug 28 in which is threaded the adjusting screw 29, the outer end of which is provided with a collar 30 and a hand wheel 31 between which the unthreaded portion of the screw 29 engages the downwardly extending boss 32 of the carriage 13. The boss 32, being thus restricted between the collar 30 and the hand wheel 31 rigidly secured to the screw 29, is thus made to partake of the axial movement of the screw 29 and is thus also made to carry the carriage 18 throughout a corresponding movement on the ways 16. The hand wheel 33 is similarly arranged to adjust the carriage 19 and its associated regulating wheel 21.

The abrasive wheels 21 and 23 are preferably of the annular or ring wheel type and are mounted on their respective shafts by means of suitable chucks 34 and are furthermore provided with beveled operative surfaces. By means of the pivotal mountings of the beds 13 and 14, the carriages 17 and 18 and their respective wheels may be adjusted so that the operative portions of their abrasive surfaces may be adjusted into substantial par-

allelism, and by means of the hand wheels 32 and 33 the operative surfaces of the wheels may be adjusted toward or away from one another for the purposes hereinafter described.

Referring more particularly to Fig. 1, it will be noted that there is provided a main driving shaft 35 suitably mounted in the lower portion of the supporting frame 10 and provided at its outer end with tight and loose pulleys 36 and 37 adapted to be connected as by means of the belt indicated at 38ª from any suitable source of power. A pulley 39 upon the shaft 35 is placed in driving connection with the pulley 27 mounted in the carriage 18 so as to transmit the driving power from the main shaft to the grinding wheel 23 as by means of the belt 38. The jockey pulley 40, journaled upon the swinging arm 41 pivotally mounted upon the stud 42, is adapted to maintain the belt 38 substantially tight and permits of the positive driving of the grinding wheel 23 throughout the extent of the adjustments of the carriage 18 hereinbefore described. The pulley 39 has, furthermore, a face of such extent that the desired extent of movement of the carriage 18 may be taken advantage of without interfering with the drive of the grinding wheel 23.

Referring to the enlarged detail view in Fig. 5, in which is shown the driving mechanism for the regulating wheel 21, it will be noted that the main driving shaft 35 has mounted upon and pinned to it a substantially cylindrical housing 43 to which is bolted, as by means of the bolts 44, a substantially similar cylindrical member 45 provided with the jaw clutch portion 46. Upon one of the bolts 44 is rotatably mounted a single pinion 47, the bolts 44ª serving to securely hold the cylindrical housing members 43 and 45 together and in proper alignment. The pinion 47 is adapted to cooperate with two gears 48 and 49. The gear 48 is keyed to the sleeve 50 which is held against rotation by means of the clamping sleeve 51 which is rigidly secured to the frame member 10 as by means of the screws 52. The gear 49, however, is rigidly secured to a sleeve 53 rotatably mounted upon the sleeve 50 and sleeve 53 has mounted upon its other end and keyed thereto, as by the key 54, an auxiliary sleeve 55 provided with the dog clutch portion 56. A sleeve 57 forming the pulley which, by means of the belt 58, held tight by jockey pulley 58ª, is in driving connection with the pulley 22 on the regulating wheel shaft, is rotatably mounted upon the sleeve 53 by means of an intermediate sleeve member 59 which is provided at its right hand portion with the teeth or jaw clutches 60 adapted to cooperate with the jaw clutches 46 on the housing member 45, and which is provided at its left hand portion with the jaw clutches 61 adapted to cooperate with the jaw clutches 56 on the sleeve member 55.

The pulley 57 with its associated clutch sleeve 59 is slidable in an axial direction upon the sleeve 53 and is manually placed in driving connection with either the jaw clutches 46 or the jaw clutches 56 by means of the handle 62 slidably mounted in the bearing 63 in the frame 10 and engaging, as by means of the hook 64, a groove 65 formed in the sleeve or pulley member 57.

The movement to the right of the pulley member 57 with its associated clutch sleeve 59 places the latter in driving connection with the jaw clutches 46 of the housing member 45 so that the pulley 57, and hence the regulating wheel 21, is placed in direct driving connection with the shaft 35 to give the regulating wheel a rotation at a relatively high speed. Movement to the left, however, of the pulley member 57 with its associated clutch sleeve 59 places the latter in connection with the jaw clutches 56 rotating with the sleeve 53 in turn in driving connection with the gear 49. The latter gear is provided with slightly less teeth than the fixed gear 48 and may, for example, have only one tooth less than the latter gear. The rotation of the pinion 47 about the axis of the main shaft 35 and in such driving connection with the fixed gear 48 and the rotatable gear 49 causes the latter to partake of a relatively slow rotation in the opposite direction so that the pulley 57, and hence the regulating wheel 21, is caused to be driven in a direction opposite from that of the main driving shaft 35 and also of the grinding wheel 23 and, furthermore, at a relatively low speed.

The main driving shaft is preferably supported at its end in roller bearing 66 and is provided with oil passages 67 by means of which the several sleeves hereinbefore described rotating relative to each other may be supplied with a suitable lubricant, the several sleeves being provided with suitable passages and grooves communicating with the main passage 67.

It will be noted that the main driving shaft 35 is mounted in the lower part of the main frame 10 so that the driving pull on the belts connecting the main shaft to the two abrasive wheels is in a downward direction, and that this downward pull insures that the wheel carriages are maintained seated on their respective beds and these in turn upon the main supporting frame.

A work carrier 68 is provided for supporting cylindrical bodies, such as rolls for example, indicated at 75 in Fig. 3, in operative relation to the operative surfaces of the regulating wheel 21 and the grinding wheel 23. Referring more particularly to Figs. 1 and 3, it will be noted that the carrier 68 is mounted upon a bracket 69 resting upon a plate 70 forming a rigid portion of the main supporting frame 10. The supporting bracket 69 is secured to the plate 70 by means of the cap

screw 71 extending through the longitudinal slot 72 in the bracket 69 so as to permit of an adjustment of the bracket 69 and also of the carrier 68 in a direction longitudinal of the machine. The upwardly extending post of the bracket 69 is provided with a slot 73 extending in a vertical direction through which extends a cap screw 74 for securing the carrier 68 in position between the wheels 21 and 23. The carrier 68 may thus be adjusted vertically with respect to the wheels and, furthermore, its inclination with the horizontal plane may be adjusted at will. In the operation of the apparatus, the grinding wheel 23 rotates at a relatively high speed in the direction indicated in Fig. 2 of the drawings and performs the grinding operation upon the cylindrical bodies supported on the carrier 68, whereas the regulating wheel 23, rotating in the opposite direction at a relatively low speed determines the rate of rotation of the cylindrical bodies on the carrier 68 during the operation thereon by the grinding wheel. The inclination of the carrier 68 is preferably such that there exists a relative inclination between the path of travel of the cylindrical bodies along the carrier and the path of travel of the operative surface of the regulating wheel 21. With this condition existing, the regulating wheel exerts a thrust upon the bodies in the direction of their axes and towards the axis of the regulating wheel so that the objects operated upon are fed forward between the operative surfaces of the wheels. It is preferred, however, to make the inclination of the carrier 68 of such an extent that the force of gravity will have a substantial effect in urging the bodies downwardly and along the carrier. The rate of feed, therefore, of the cylindrical bodies may be adjusted at will by varying the inclination of the carrier 68 so as to vary to a substantially corresponding degree the effect of gravity in urging the cylindrical bodies in a forward direction.

The carrier 68 is provided with guide plates 76 and 78 suitably secured on the sides of the carrier for guiding the bodies 75 into operative relation to the wheels 21 and 23 and at its lower end is provided with guide plates 79 and 80 for guiding the bodies along the carrier 68 after operation thereon by the wheels. As will be noted in Fig. 2, the operative portions of the beveled faces of the wheels 21 and 23 are adjusted into substantial parallelism and that, by such adjustment, a sufficient space is provided intermediate the rear portions of the wheels for accommodating the guide plates 78 and 80.

Extending substantially entirely underneath the wheels 21 and 23 is a trough or chute 81 preferably integrally formed with the supporting frame 10 and provided with a rearwardly extending portion 82 for receiving the rolls or bodies 75 from the carrier 68 and for discharging the ground bodies into the wire basket 83 suspended within the tank 84 positioned at the front of the machine. The tank 84 contains a suitable fluid which is maintained at such a level that the ground articles are cushioned in their fall from the chute 81 into the basket 83. Furthermore, the basket 83 permits of the removal of the ground articles from the tank 84 in a convenient manner and without the necessity of interfering with the liquid contained therein. It will be noted that the finished articles immediately after operation thereon are thus discharged or conducted to the front of the machine where the operator may readily inspect the results of the operations of the apparatus.

Referring now to Fig. 7 of the drawings, it will be noted that the grinding wheel is provided with a protective hood or casing 85 which is adjustably secured to the carriage 18 preferably at the bearing post 24. The latter is provided with a lug 86 which receives the rod 87 adjustably secured therein, as by the set screw 88, and the inner end of which is suitably secured to the casing or hood 85. The hood 85 is preferably provided with a lug 89 so that the hood may be detachably secured, as by means of the thumb screw 90, to the post 91 mounted upon the rod 87. A similar construction is employed for securing the rear portion of the hood 85 to the carriage 18.

It will be seen that the hood 85 may thus be readily positioned relative to the grinding wheel 23 which it encases and may readily be removed when it is necessary to gain access to the wheel or other parts.

The regulating wheel 21 is provided with a hood or casing 92 of substantially similar construction and substantially similarly mounted upon the carriage 17, as is the hood 85 encasing the grinding wheel. The hood 92 is preferably made of a slightly larger diameter than that of the hood 85 so that the two hoods are in a telescopic relation to one another in order that the wheels may be substantially entirely encased throughout the several adjustments that may be made of the wheels relative to each other and as already hereinbefore described. The difference in the diameters of the hoods 85 and 92 is preferably made of such extent that the relative angular adjustment between the axes of the two wheels may readily be made without interfering with the telescopic action of the two hoods.

Suitable apertures are provided in the front and rear portions of the hoods 85 and 92 to permit the carrier 68 with its guiding plates to extend through the hoods and between the two wheels. In order that the apertures may be made to fit snugly about the carrier 68, the hoods 85 and 92 are provided with adjustable plates 93 and 94 respectively, one on

each side of the carrier 68, so that upon the proper adjustment having been made, the plates 93 and 94 may be moved into snug contact with the carrier 68 and may be located in their adjusted position as by means of the thumb screws 95 cooperating with the slots 96 in the plates 93 and 94. The apertures in the hoods for accommodating the carrier 68 are thus made adjustable not only for the purpose of compensating for whatever adjustments may be given the two wheels with respect to one another, but also for the purpose of readily accommodating the hoods for the reception of carriers of various sizes or thicknesses corresponding to various diameters of work desired to be operated upon.

Referring to Fig. 3 of the drawings, there is mounted upon the frame 10 a suitable pump 97, preferably of the centrifugal type, the intake of the pump being suitably connected to the tank 84 hereinbefore described, and the outlet being connected by means of the pipe 98 to the nozzle 99 extending through the hoods and immediately above the work operated upon by the wheels. A suitable valve 100 is interposed in the discharge circuit for regulating the flow of cooling liquid upon the work and the abrasive surfaces. The driving pulley 101 of the pump is connected by means of the belt 102 to the main driving shaft 35 (see Fig. 1), the cylindrical housing 43 hereinbefore described functioning conveniently as the pulley for the belt 102.

The discharge nozzle 99 in the cooling liquid circuit extends through the opening 103 in a plate 104 slidably mounted upon one of the hoods, as the hood 92 for example. The plate 102, through which the nozzle 99 extends, thus permits the adjustment of the nozzle 99 within the hoods to be readily made for most effective cooling action upon the operative surfaces of the wheels, suitable thumb screws 105 cooperating in the slots 106 of the plate 104 being provided to lock the parts in adjusted position.

The hoods 85 and 92 in encasing the abrasive wheels not only form a protective guard to prevent contact with the rotating parts by an operator of the apparatus, but also prevent the dispersion by the centrifugal action of the wheels of the cooling fluid employed. The latter is discharged from the hoods into the discharge chute 81 which, as hereinbefore described, also functions to conduct the parts operated upon to the front of the machine and the fluid is thus returned to the tank 84 for further circulation by the pump 97.

It will be noted that the several operative parts of the machine are readily adjustable and readily accessible, and that the drive of the regulating wheel 21 is readily and conveniently controlled and varied as may be desired by the action intended to be performed. Thus, while the grinding operation is being performed, the regulating wheel 21 partakes of a rotation in a direction opposite from that of the grinding wheel 23 and at a relatively low speed, the adjacent operative surfaces of the wheels 21 and 23 traveling in opposite directions. The rate of drive of the regulating wheel 21 is preferably relatively low, the cylindrical objects 75 in contact therewith being of such relatively small diameter that their rate of rotation during the grinding action of the grinding wheel 23 is, nevertheless, relatively high.

When, however, it is desired to drive the regulating wheel 21 at a relatively high speed and in the same direction as the grinding wheel 23 for the purpose of truing the wheels, the reversal of the direction of rotation and the change in the rate of drive from a relatively low speed to a relatively high speed is conveniently and readily made. Furthermore, it will be noted that the several clutches through which the regulating wheel 21 is driven are positively acting jaw clutches so that the drive of the regulating wheel may at all times be positive. It will thus be seen that there is provided in this invention apparatus in which the several objects of this invention are achieved and in which many practical advantages are attained.

As various possible embodiments may be made of this invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore described and shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In apparatus of the general nature of that herein described, in combination, a grinding wheel, a regulating wheel, a pair of telescoping hoods, one for each of said wheels, for substantially enclosing said wheels, a carrier extending between said wheels for supporting cylindrical bodies in operative relation thereto, and means for adjusting one of said hoods toward or away from the other.

2. In apparatus of the general nature of that herein described, in combination, a grinding wheel, a regulating wheel, protective means substantially encasing said wheels and having an aperture therein, a carrier extending through said aperture and between said wheels for supporting cylindrical bodies in operative relation to said wheels, and a means adapted to be adjustably positioned adjacent said carrier for substantially closing said aperture through which said carrier extends.

3. In apparatus of the general nature of that herein described, in combination, a grinding wheel, a regulating wheel, protective means substantially encasing said wheels and provided with an aperture, a carrier extending through said aperture and between said wheels for supporting cylindrical bodies

in operative relation to said whels, and a pair of plates mounted upon said protective means and adjacent said aperture and each adapted to be adjustably positioned with respect to said carrier to substantially close said aperture.

4. In apparatus of the general nature of that herein described, in combination, an annular grinding wheel having a beveled operative surface, an annular regulating wheel having a beveled operative surface, a carrier extending between said wheels for supporting work of round section in operative relation thereto, means for pivotally mounting one of said wheels to permit adjustment of its operative surface into substantial parallelism with the operative surface of the other of said wheels, means for adjusting one of said wheels toward or away from the other, a main driving shaft, a driving connection between said shaft and said grinding wheel adapted to rotate said grinding wheel at a relatively high speed, a driving connection between said shaft and said regulating wheel adapted to rotate said wheel at a relatively low speed and in reverse direction from that of the grinding wheel, and means for maintaining said driving connections effective irrespective of the adjustments given said wheels.

5. In apparatus of the general nature of that herein described, in combination, a grinding wheel adapted to be rotated at a relatively high speed, a regulating wheel adapted to be rotated at a relatively low speed, said wheels being adapted to present operative surfaces traveling in opposite directions, a carrier extending between said wheels for supporting cylindrical bodies in operative relation thereto, said carrier being mounted at an inclination to permit the force of gravity to have a substantial effect in urging said bodies along said carrier, and means for adjusting the inclination of said carrier to vary the effect of gravity, thereby to vary the rate of feed of said bodies along said carrier.

6. In apparatus of the general nature of that herein described, in combination, a grinding wheel adapted to be rotated at a relatively high speed, a regulating wheel adapted to be rotated at a relatively low speed, said wheels being adapted to present operative surfaces traveling in opposite directions, a carrier extending between said wheels for supporting cylindrical bodies in operative relation thereto, the path of travel of the bodies along said carrier being at an inclination with respect to the path of travel of the operative surface of said regulating wheel, thereby to cause said regulating wheel to feed said bodies along said carrier, and means mounting said carrier at an inclination to cause the force of gravity to have a substantial effect to urge said bodies along said carrier, thereby to increase the rate of feed of said bodies along said carrier.

7. In apparatus of the general nature of that herein described, in combination, an annular grinding wheel having an operative side surface, an angular regulating wheel having an operative side surface, a main frame for rotatably supporting said two wheels with their operative surfaces in opposed operative relation to one another, a carrier for supporting work of round section in operative relation to the opposed operative surfaces of said two wheels, a main driving shaft rotatably supported by said main frame, a driving connection between said shaft and said grinding wheel adapted to rotate said grinding wheel at a relatively high speed, and a driving connection between said shaft and said regulating wheel adapted to rotate said wheel at a relatively low speed and in reverse direction from that of the grinding wheel.

8. In apparatus of the general nature of that herein described, in combination, a main frame, a grinding wheel mounted on said frame, a regulating wheel mounted on said frame and in operative relation to said grinding wheel, a carrier extending between said wheels for supporting cylindrical bodies in operative relation thereto, a main driving shaft mounted in the lower part of said frame, means on said shaft in driving connection with said grinding wheel adapted to drive said wheel at a relatively high speed, a clutch member on said shaft and driven therefrom at a relatively high speed, a second clutch member mounted on said shaft and driven therefrom at a relatively low speed and in reverse direction, means forming a driving connection with said regulating wheel, and selectively controlled means for placing said regulating wheel driving means in connection with either of said clutch members.

9. In apparatus of the general nature of that herein described, in combination, a main frame, a grinding wheel mounted on said frame, a regulating wheel mounted on said frame and in operative relation to said grinding wheel, a carrier extending between said wheels for supporting cylindrical bodies in operative relation thereto, a main driving shaft mounted in the lower part of said frame, means on said shaft in driving connection with said grinding wheel adapted to drive said wheel at a relatively high speed, a clutch member provided with jaws on said shaft and driven therefrom at relatively high speed, a second clutch member provided with jaws mounted on said shaft and driven therefrom at relatively low speed and in reverse direction, means provided with jaws in driving connection with said regulating wheel, and selectively controlled means for placing said last mentioned jaws in driving connection

with either of the jaws on said two clutch members.

10. In apparatus of the general nature of that herein described, in combination, a grinding wheel, a regulating wheel, a pair of independent and cooperating hoods, one for each of said wheels, for substantially enclosing said wheels, a carrier extending between said wheels for supporting cylindrical bodies in operative relation thereto, and means for independently adjusting said hoods toward or away from one another.

11. In apparatus of the general nature of that herein described, in combination, a grinding wheel, a regulating wheel, protective means substantially encasing said wheels and provided with adjustable apertures and a carrier extending through said adjustable apertures and between said wheels for supporting cylindrical bodies in operative relation to said wheels.

12. In apparatus of the general nature of that herein described, in combination, a grinding wheel, a regulating wheel, a carrier extending between said wheels for supporting cylindrical bodies in operative relation thereto, a pair of telescoping hoods one for each of said wheels, for substantially enclosing said wheels, and means for adjusting one of said wheels and its hood toward or away from the other.

13. In apparatus of the general nature of that herein described, in combination, a grinding wheel, a regulating wheel, a pair of telescoping hoods, one for each of said wheels, for substantially enclosing said wheels, means for adjusting one of said wheels and its hood toward or away from the other, an adjustable aperture in said hood, and a carrier extending through said adjustable aperture and between said wheels for supporting cylindrical bodies in operative relation to said wheels.

14. In apparatus of the general nature of that herein described, in combination, a main frame; a grinding wheel supported by said frame; a regulating wheel supported by said frame and operatively related to said grinding wheel; means extending between said wheels for holding work of round section in operative relation to said two wheels; a main driving shaft rotatably supported by said frame and adapted to be connected to a source of power; a pair of members rotatable coaxially with said shaft and each connected to one of said wheels for driving the latter; and driving connections between one of said members and said driving shaft including speed-change gearing.

15. In apparatus of the general nature of that herein described, in combination, a grinding wheel; a regulating wheel; means extending between said wheels for holding work in operative relation to said two wheels, a main driving shaft adapted to be connected to a source of power; means connecting said grinding wheel to said driving shaft and arranged to drive said wheel at a relatively high speed; a plurality of toothed members rotatable coaxially with said shaft and adapted to be driven therefrom at different peripheral speeds; and driving means for said regulating wheel adapted selectively to be placed in driving connection with one of said toothed members.

16. In apparatus of the general nature of that herein described, a grinding wheel; a regulating wheel; means extending between said wheels for holding work in operative relation thereto; a driving shaft adapted to be connected to a source of power; means connecting said grinding wheel to said driving shaft and arranged to drive said wheel at a relatively high speed; a pair of toothed members driven from said shaft, one at a relatively low speed and another at a relatively high speed, and driving means for said regulating wheel adapted to be placed in driving connection with either one of said toothed members.

In testimony whereof, I have signed my name to this specification this 31st day of January, 1921.

LEWIS R. HEIM.