United States Patent

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[54] **APPARATUS FOR GRINDING ELONGATED ROLLING-UP MATERIAL, PARTICULARLY METAL WIRE**
4 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **51/90**
[51] **Int. Cl.** **B24b 3/00,** B24b 5/00
[50] **Field of Search** 51/43, 80, 90, 120

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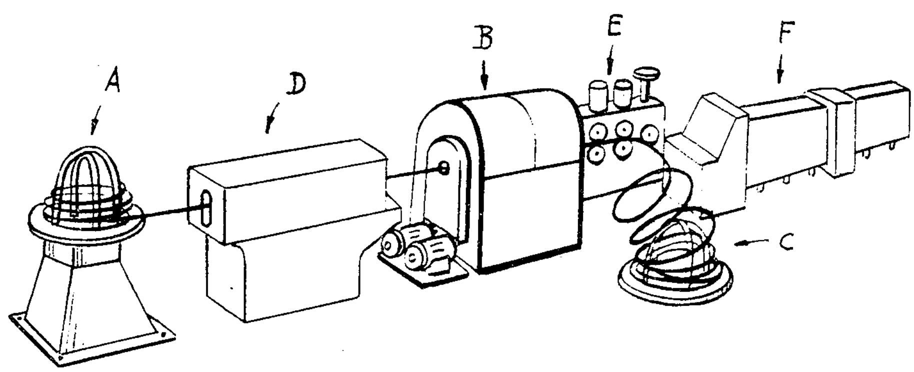
ABSTRACT: This disclosure relates to an apparatus for grinding material having a circular cross section which is wound in reels or rolls, said apparatus comprising a fixed framework, a rotating unit mounted on said framework for rotation about an axis parallel to the direction of advancement of the material to be ground, and a pair of grinding wheels rotatably supported by said rotating unit.



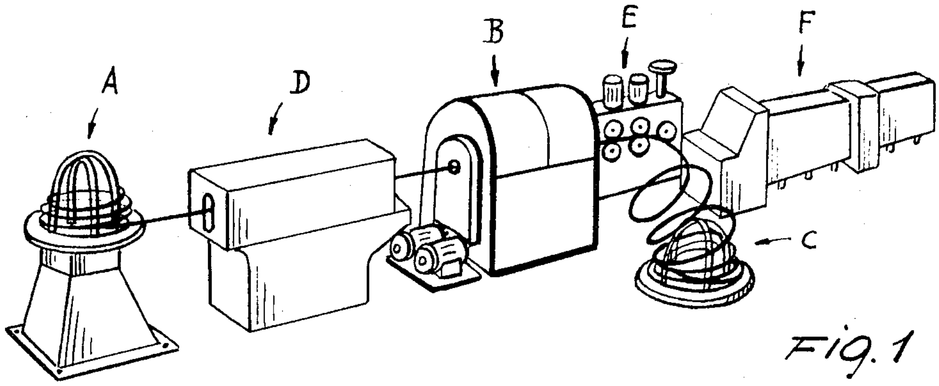
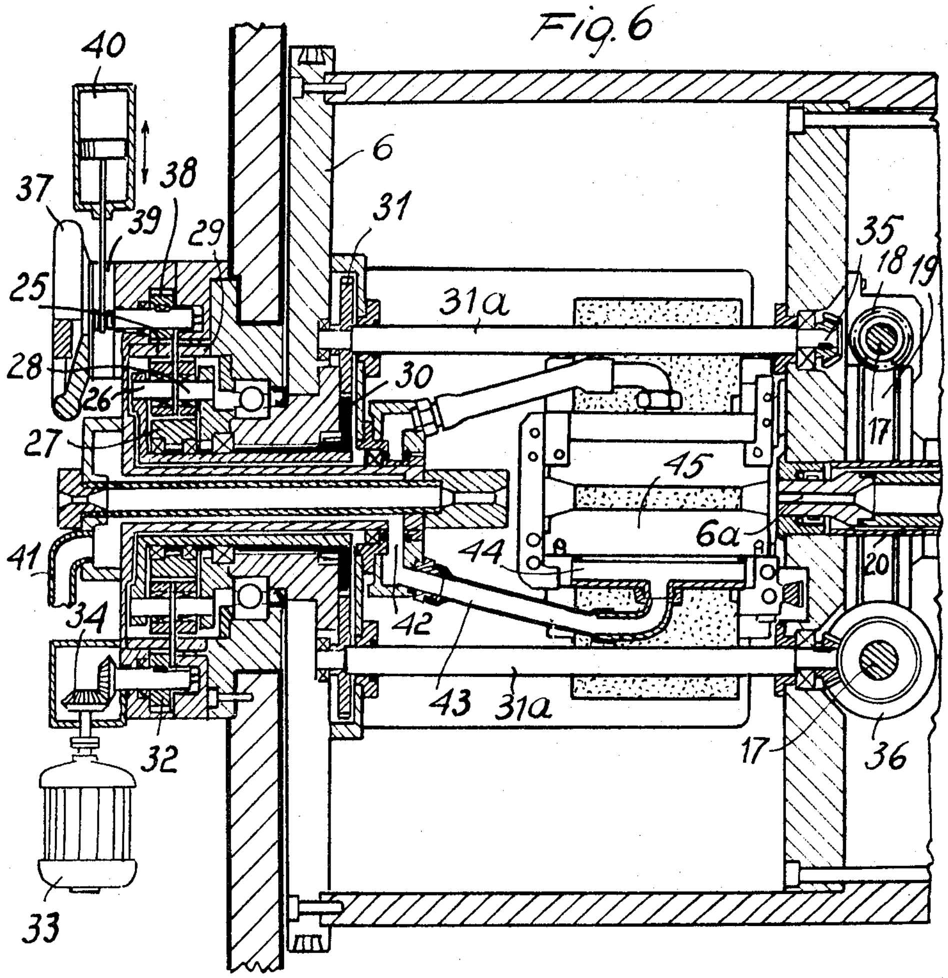


Fig. 1

Fig. 6



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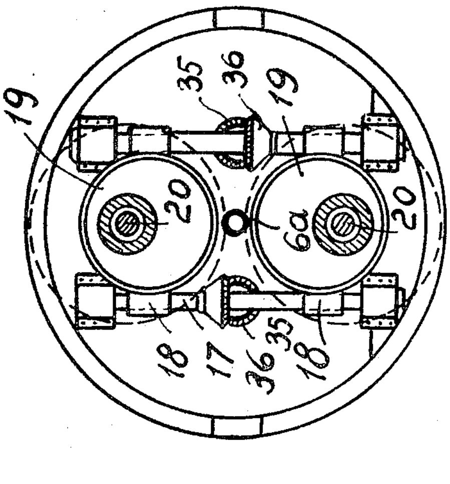

Fig. 5

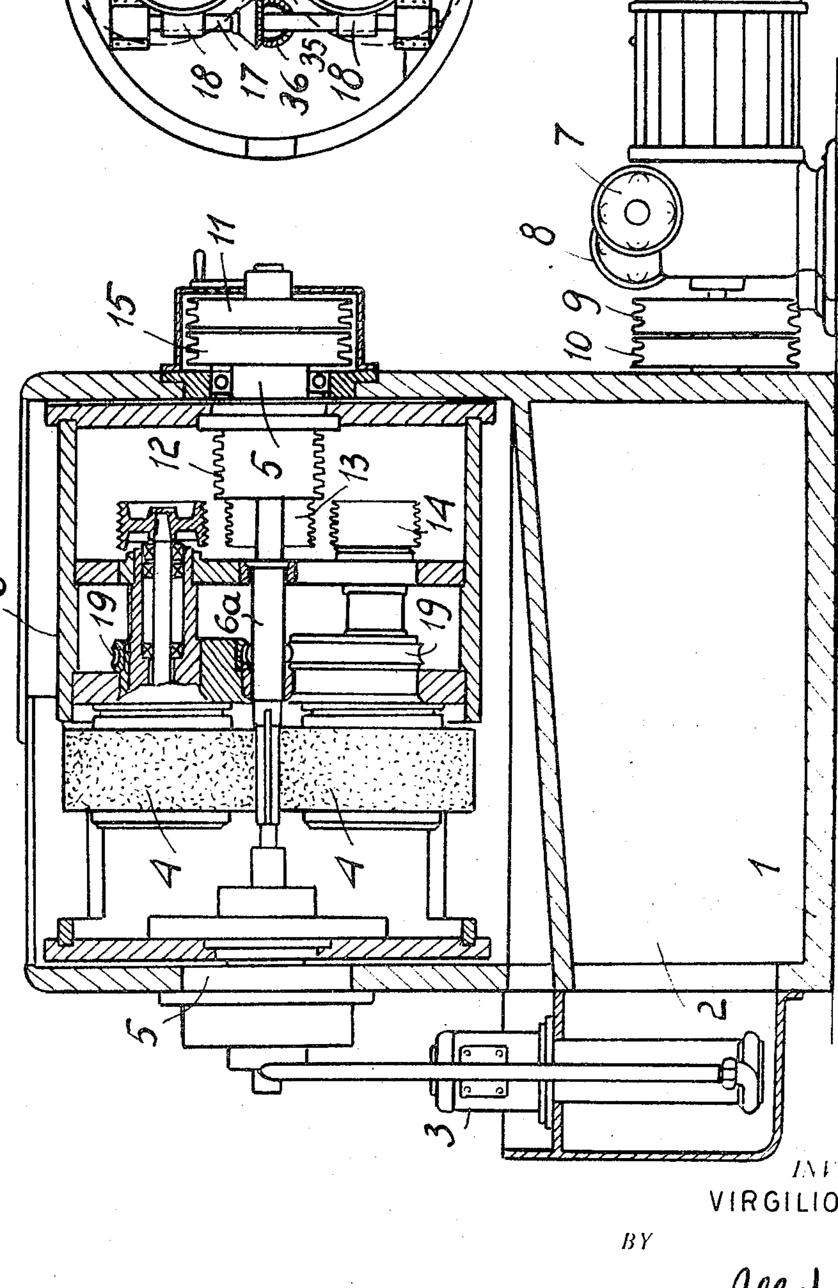

Fig. 2

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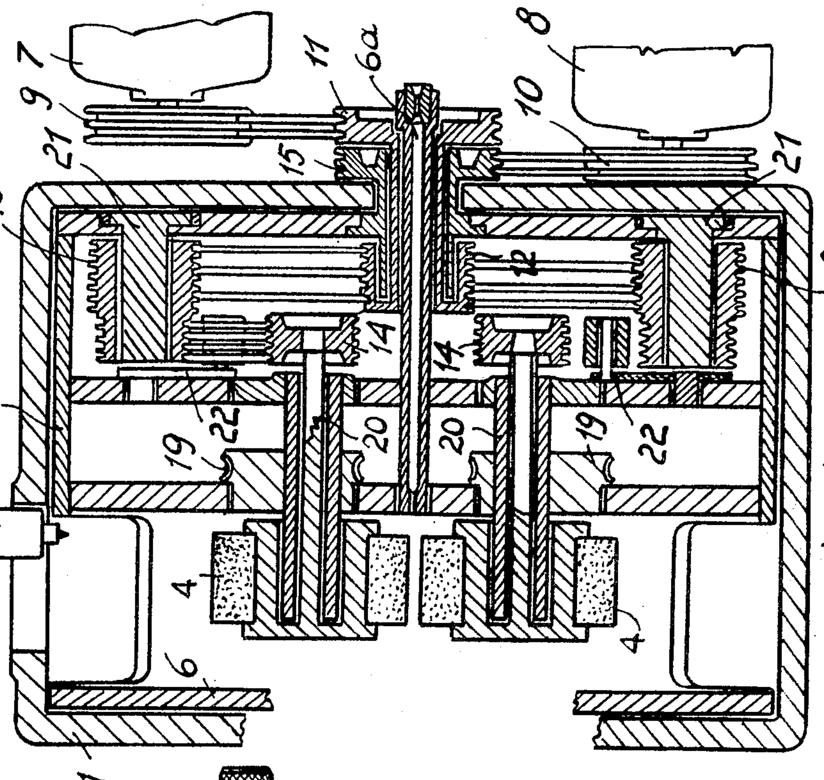

FIG. 4

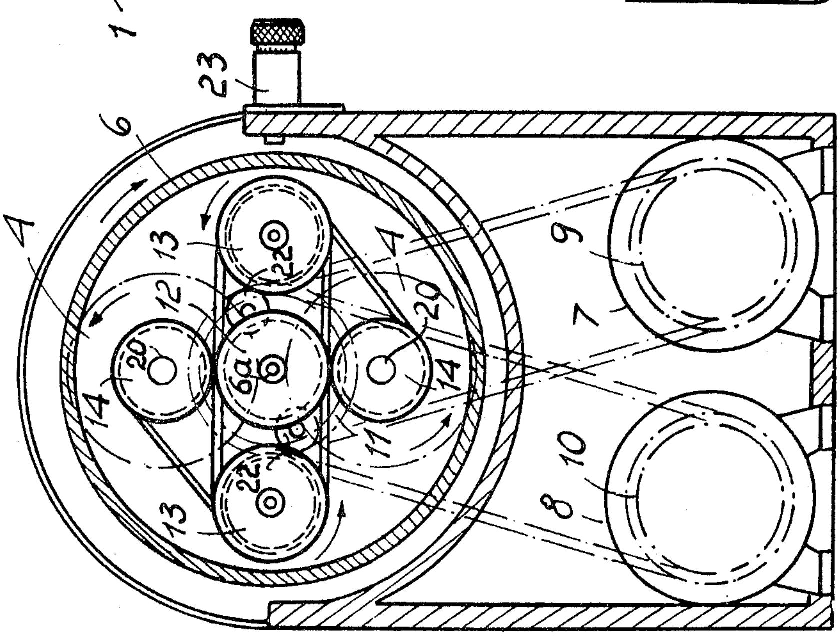

FIG. 3

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APPARATUS FOR GRINDING ELONGATED ROLLING-UP MATERIAL, PARTICULARLY METAL WIRE

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for grinding elongated rolling-up material, particularly metal wire.

Apparatus are known for grinding bars of limited length. Such grinders generally comprise two grinding wheels which rotate about fixed axes, between whose faces the material to be ground is longitudinally advanced while it rotates. It will be readily appreciated that such apparatus cannot be employed for grinding round sectioned material in rolls, and this constitutes a serious inconvenience which considerably limits the potential use of this apparatus. In fact, it is precisely the rotation of the material to be ground between the grinding wheels during its advance, which limits the use of the apparatus to bars of limited lengths and excludes work on material in rolls. It will also be readily understood that for many applications it is decidedly preferable to feed the apparatus directly with a material which is wound in rolls, so that after the material has been subjected to treatment it may once again be wound in rolls or, with suitable means, reduced into bars. In fact, this leads to a simplified working.

Apparatus are further known in which the material to be ground does not rotate about its own axis and in which the grinding wheels while rotating about their own axes rotate also around the material, thus substantially obtaining the same relative movement between the material to be ground and the grinding wheels. Material wound in rolls can therefore be supplied to these machines.

One object of this invention is that of providing an apparatus for grinding round sectioned materials in rolls with a considerably increased potential use.

Another object of the invention is that of providing a grinding machine which permits all the normally required adjustments, such as depth of cut, peripheral velocity of the grinding wheels and speed of advancement of the wire, even during the working of the machine.

SUMMARY OF THE INVENTION

According to the invention an apparatus is provided for grinding elongated rolling-up materials, characterized in that it comprises a fixed support framework, a unit mounted on said framework for rotation about an axis parallel to the direction of advancement of the material to be ground, and at least one pair of rotating grinding wheels supported by said rotating unit.

Advantageously said rotating unit comprises a drum arranged to rotate about its own axis, said drum internally supporting a pair of shafts bearing said grinding wheels parallel to the axis of the drum, kinematic means also being provided for transmitting a rotary motion to said shafts independently of the rotary motion of said drum.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will appear more clearly from the following detailed description of a preferred embodiment of an apparatus according to the invention for grinding elongated rolling-up material, illustrated by way of example in the accompanying drawings, in which:

FIG. 1 diagrammatically shows the grinding apparatus with the auxiliary units for the grinding of round sectioned material;

FIG. 2 is a longitudinal section, normal to the support plane, of the grinding apparatus according to the invention;

FIG. 3 is a diagrammatic front view of the grinding apparatus, showing the transmission means for transmitting the motion from the drive means to the grinding wheels and to the drum which carries the grinding wheels;

FIG. 4 is a sectioned plan view of the grinding apparatus;

FIG. 5 is a section taken along a vertical plane perpendicular to the axis of the drum which carries the grinding wheels;

FIG. 6 shows, in plan view, details of the means for the displacement of the grinding wheels according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, B indicates the grinding apparatus which is fed by a supply reel A which unwinds the roll, and C indicates the winding or takeup reel. Between the reel A and the grinder B a straightening and rolling unit D is interposed. E indicates the winder unit and F indicates a unit for the working of bars. With reference to said figures, reference numeral **1** indicates the fixed framework of the grinding apparatus with the cooling reservoir **2** and a pump **3** which passes the cooling liquid to the grinding wheels **4** carried by respective driving shafts **20**. Reference numeral **5** indicates two supports for a drum **6** which rotates about a horizontal axis. The driving shafts **20** are arranged diametrically opposite to said axis and parallel to the same. Outside the framework **1**, adjacent the base thereof, there are arranged two independent driving means or speed-changer units **7** and **8** which transmit movement to the grinding wheels **4** and to the drum **6**, respectively, through adequate transmission means. The speed-changer unit **7** transmits movement, through the pulley **9** fast with its shafts, to a first pair of pulleys **11**, **12** coaxial with the drum and freely rotatable thereto, the pulley **12** being arranged inside the drum **6**. The pulley **12** transmits the movement to a second pair of pulleys **13** idly supported by shafts **21** arranged on opposite sides of the axis of the drum **6**. Said pulleys **13** transmit motion, through a pair of suitable belts, to a further pair of pulleys **14** which are coaxial and each fast with one of the driving shafts of the grinding wheels **4**.

The speed-changer **8** transmits motion to a pulley **15** through a pulley **10** rigidly mounted on the shaft of said speed-changer unit **8**. Said pulley **15** is coaxial with the said pulley **11**, is independent of the latter, and is fast with the drum **6**. In this manner the transmission of a first rotational movement is obtained of the drum **6** and a second rotational movement, which is independent of the former, to the pair of grinding wheels **4** which are equidistant from the passage guide for the material to be ground (indicated with *6a*) and corresponding to the axis of the drum. The grinding wheels may therefore rotate around their own axes and around the metal wire to be ground, together with the rotatable drum, although the metal wire itself does not rotate.

Since the grinding wheels **4** are subject to wear, it is necessary to be able to change their position with respect to the axis of the drum **6** or with respect to the passage line of the material, so as to maintain them always at an equal distance from said line. For such a purpose an adjustment device comprising worm gear means is provided which will be described hereinafter.

In order to modify the position of the shafts **20** of the grinding wheels with respect to the axis of the drum **6**, said shafts are carried eccentrically by rolling members arranged in partition walls of the drum and provided with a toothed portion **19**. A pair of shafts **17** extending orthogonal to the driving shafts **20** carries two pairs of worm screws **18** which each engage said toothed wheels **19** at diametrically opposite zones. In order to balance the rotating system and increase the sturdiness thereof, a double control is provided. The toothed crowns **19** rotate in the same direction and displace the axis **20** of the grinding wheels towards or away from the center of the machine, that is towards or away from the axis of the drum **6**, so as to simultaneously approach the two grinding wheels **4** which will always be at an equal distance from the axis of said drum **6**, that is from the material to be ground. The shafts **17** are moved by means of two conical gear units **35** and **36** through a control arrangement which will be described hereinafter.

Reference numeral **22** indicates a jockey pulley which together with the eccentrically mounted shafts **21** provide for the adjustment of the series of belts described above ensuring transmissive engagement between the said pairs of pulleys even during the displacement of the grinding wheels. The jockey pulleys **22** are stretched by suitable springs which are not shown. Reference numeral **23** indicates a diamond holder which is mounted on a displaceable carriage for the dressing of one grinding wheel at a time.

With reference to FIG. 6, there will now be described the adjustment movement for the positions of the grinding wheel shafts, both with the machine stationary and during the operation of the machine. For such purposes a series of machine gears comprising a differential unit is provided which permits the rotation of the drum 6 without varying the distance of the axles of the grinding wheels from the center. The differential unit comprises a first crown wheel 25 which is internally and externally toothed and free to rotate with respect to the drum 6 and an internally toothed second crown wheel 29, rigid with the fixed framework; a first planet unit 26 connected with said adjustment device 17–19 which varies the position of the grinding wheels; a second planet unit 28 fast with the drum 6; an idle crown wheel 27 on which the two planet units 26 and 28 rotate. The external toothing of the crown wheel 25 engages two wheels 32 and 38 which transmit movement from the stationary part of the machine to the mobile part thereof.

For large displacements of the grinding wheel's unit, the transmission of external controls may be effected with a motor 33 which, through a conical wheel reduction unit 34, transmits motion to the gear 32. For micrometric displacements of the grinding wheel unit a handwheel 37 is provided which controls the gear 38. Both the gears 32 and 34 mesh with the external toothing of the planet wheel 25. Moreover, the planet wheels 25 and 29 are identical.

Coaxial with the drum 6 a toothed wheel 30 is coaxially provided which meshes with the toothed wheels 31 secured to the ends of shafts 31*a*. On the opposite ends of said shafts 31*a* toothed wheels 35 are arranged which engage the conical wheels 36.

When the crown wheels 25 and 29 are stationary and the drum 6 rotates a movement occurs of the planet unit 28, which rotates inside the crown wheel 29 and drives the gear 27. The planet unit 26 is then caused to rotate between the gear 27, which drives the unit 26 itself and the crown wheel 25 which is stationary, in the direction of the planet unit 28, with the same number of rotations as the drum 6. In this case no movement of the transmission 30–31–35–36–18–19 occurs. It will thus be seen that if the two planet units rotate with the same speed in the same direction, no radial displacements of the grinding wheels take place.

If, however, the position of the crown wheel 25 is varied by means of the gears 38 or 32 with the machine stationary, the planet unit 26 will be caused to rotate on the gear 27 fast with the drum 6. Moreover the wheel 30 and the wheels 31 will move with respect to the drum 6, and consequently also 35–36–18–19. There consequently takes place a displacement of the grinding wheel shafts towards or away from the center. Thus, by changing the position of the two planet units with respect to one another, a displacement occurs of the shafts of the grinding wheels either when the machine is in motion or when it is stationary.

By means of pneumatic control grinding wheel feeding system 40, which receives pneumatic impulses by means of an electronic comparator which carries out the measurement reading, the free wheel 39 is put in rotation and drives the gear 38.

The cooling and the lubrication of the grinding wheels and the material is carried out by the pump 3 which passes an emulsion along a tube 43 and thence to the stationary part of the machine until it arrives at the rotary joint 42. Thereafter the emulsion passes along tubes 43 which extend to the guide support 44 and which open adjacent the grinding wheels and the material being ground, so as to cool everything and simultaneously lubricate the guides 45.

It will be evident that the speed of rotation of the grinding wheels can be varied in relation to different factors. Thus, for example, if the speed changer 7 supplies 1,000 rotations per minute, the grinding wheels will also carry out 1,000 rotations per minute, with the drum stationary. If, instead, the speed changer 8 is caused to rotate at 500 rotations per minute and the speed changer 7 is maintained stationary, the drum 6 will also carry out 500 rotations per minute (pulley ratio 1:1).

The grinding wheels, which rotate as planet wheels inside the drum 6 and which are connected to the pulley 12 fast with the speed changer 7 (in this case stationary), will carry out 500 rotations per minute rotating in the opposite direction to the drum. It will therefore be appreciated that by restarting the speed changer 7 which rotates in the same direction as the grinding wheels at 1,000 rotations per minute, the latter provide 500 rotations and the grinding wheels rotate consequently at 1,500 rotations per minute. The speed of the drum may consequently be adjusted continuously by maintaining the grinding wheels at a number of revolutions such that they develop the peripheral speed desired by acting on the speed changer 7 or 8.

With the above-described apparatus a grinding is obtained in which the material passes between the grinding wheels without rotating, and the advance thereof may be varied on the basis of the power of the machine, and on the dimension of the material and on the removal of material for each cut. This, which has to form part of a combined work system, has been rendered completely automatic since, all the necessary adjustments are possible even when the machine is in motion as has been seen hereinabove, that is:

a. the guides do not scratch the material being worked because they do not support the removal stress, the latter being divided between the two grinding wheels;

b. the peripheral speed of the operating grinding wheels may be continually adjusted or maintained constant at the optimum yield;

c. the external control differential system enables the renewal of the amount of round material being worked by causing the grinding wheels to approach one another in relation to their wear.

The field of application of the apparatus is determined by its size and installed power. The apparatus according to the invention is particularly suitable for grinding stainless steel wire because the materialslides longitudinally without rotating and thus eliminates the possibility of lining.

The provision of a self-calibrating electronic device which acts on the position control mechanism of the operating grinding wheels permits the measurement of the grinding, and controls with impulses the renewal of the established tolerances. For the achievement of efficient results, it is advantageous that the two grinding wheels have the same diameter and the same composition so that the wear on each wheel is the same and, consequently, the rotating drum-grinding wheel system does not become unbalanced.

I claim:

1. An apparatus for grinding elongated rolling-up material, particularly metal wire, having a fixed supporting framework, a drum supported by said framework and rotatable around an axis, means for advancing the metal wire to be ground along said axis, two driving shafts arranged inside of said rotatable drum parallel to each other and to said axis and diametrically opposite thereto, a pair of grinding wheels supported each by one of said driving shafts for grinding said metal wire, at least two pairs of rolling members inside said drum carrying said driving shafts eccentrically, means for rotating said rolling members to cause the displacement of said grinding wheels with respect to said metal wire, and driving and transmission means for rotating said driving shafts and said drum independently from one another, wherein, according to the improvement, said means for rotating said rolling members comprise worm gear means in engagement with said rolling members, a differential unit arranged between said rotatable drum and said fixed framework to engage said worm gear means, control means on said fixed framework outwardly thereto for actuating said differential unit, thereby to cause the displacement of said driving shafts and said grinding wheels in the inoperative and operative conditions of the apparatus.

2. An apparatus according to claim 1, wherein said differential unit comprises a first internally and externally toothed crown wheel arranged coaxial to said drum and freely rotatable thereto, a second internally toothed crown wheel ar-

ranged coaxial to said first crown wheel and rigid with said fixed framework, an externally toothed crown wheel arranged coaxially and idly to said first and second crown wheels inside thereof, a first and a second planet unit having planet wheels capable of rotating between said externally toothed wheel and said first and second crown wheels, respectively, around said externally toothed wheel, said first planet unit being connected for rotation with said worm gear means and said second planet unit being fast with said drum, and wherein said control means for actuating said differential unit comprise at least a further toothed wheel engaging said externally toothed first crown wheel and means for operating said further toothed wheel from the outside of the apparatus.

3. An apparatus according to claim **1**, wherein said worm gear means comprise a toothed portion on said rolling members, two shafts parallel to each other and extending orthogonal to said driving shafts of said grinding wheels, two pairs of worm screws arranged on said shafts respectively, each pair being located diametrically opposite to said rolling members for engaging said toothed portions thereof, said shafts being connected for rotation to said differential unit.

4. An apparatus according to claim **1**, wherein said driving means are arranged outwardly of said rotatable drum on said fixed framework and said transmission means for transmitting movement to said driving shafts comprise a first pair of pulleys rigid with one another and arranged coaxial to said drum freely rotatable thereto, one of said pulleys being arranged outwardly and the other inwardly of said drum, said pair of pulleys being actuated by said driving means, a pair of shafts carried by said rotatable drum parallel to the axis thereof and diametrically opposite thereto, a second pair of pulleys equal to each other idly supported by said shafts, respectively, first belt transmission means for transmitting driving motion from said first pair of pulleys to said second pair of pulleys, a further pair of pulleys rigidly arranged on said driving shafts, respectively, second belt transmission means transmissively connecting said further pair of pulleys with said second pair of pulleys, tensioning means for allowing transmissive engagement between said first, second and further pair of pulleys even during the relative displacement of the grinding wheels.

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