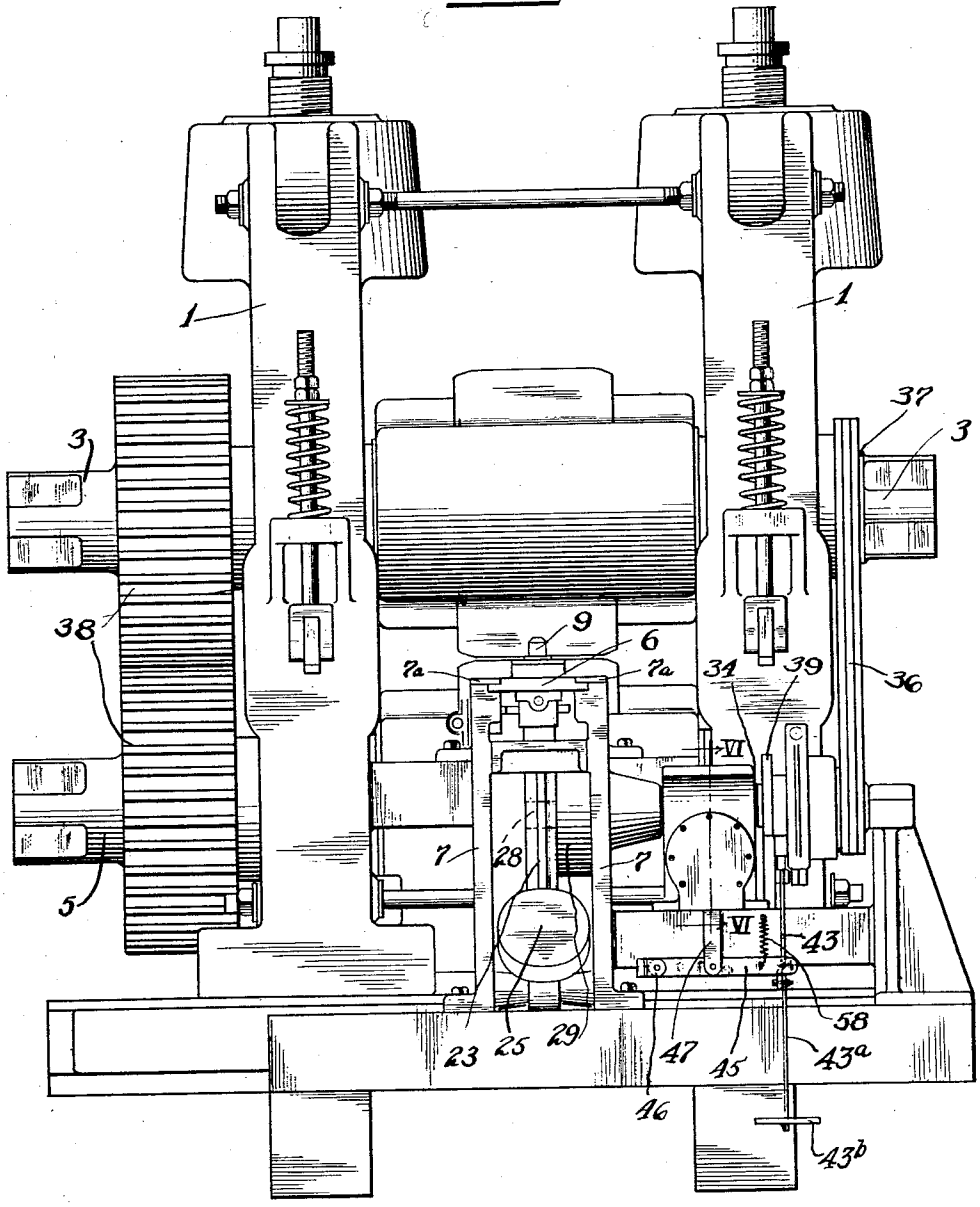
Jan. 17, 1933. R. C. INGERSOLL 1,894,689

METHOD OF AND APPARATUS FOR ROLLING METAL ARTICLES

Filed Jan. 9, 1931 4 Sheets-Sheet 1

FIG. 1



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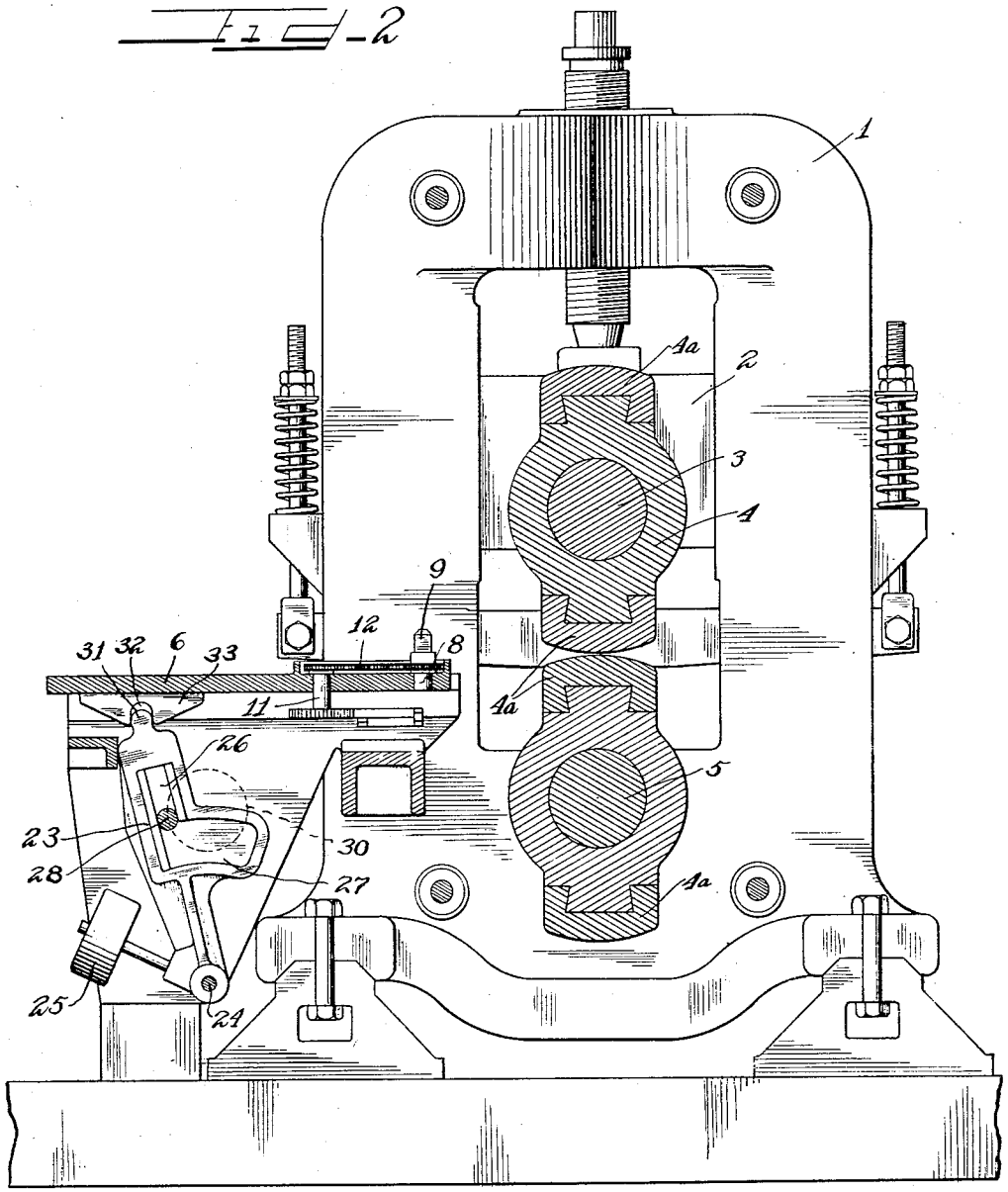
by Attys

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METHOD OF AND APPARATUS FOR ROLLING METAL ARTICLES

Filed Jan. 9, 1931 4 Sheets-Sheet 2

Fig-2



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METHOD OF AND APPARATUS FOR ROLLING METAL ARTICLES

Filed Jan. 9, 1931 4 Sheets-Sheet 3

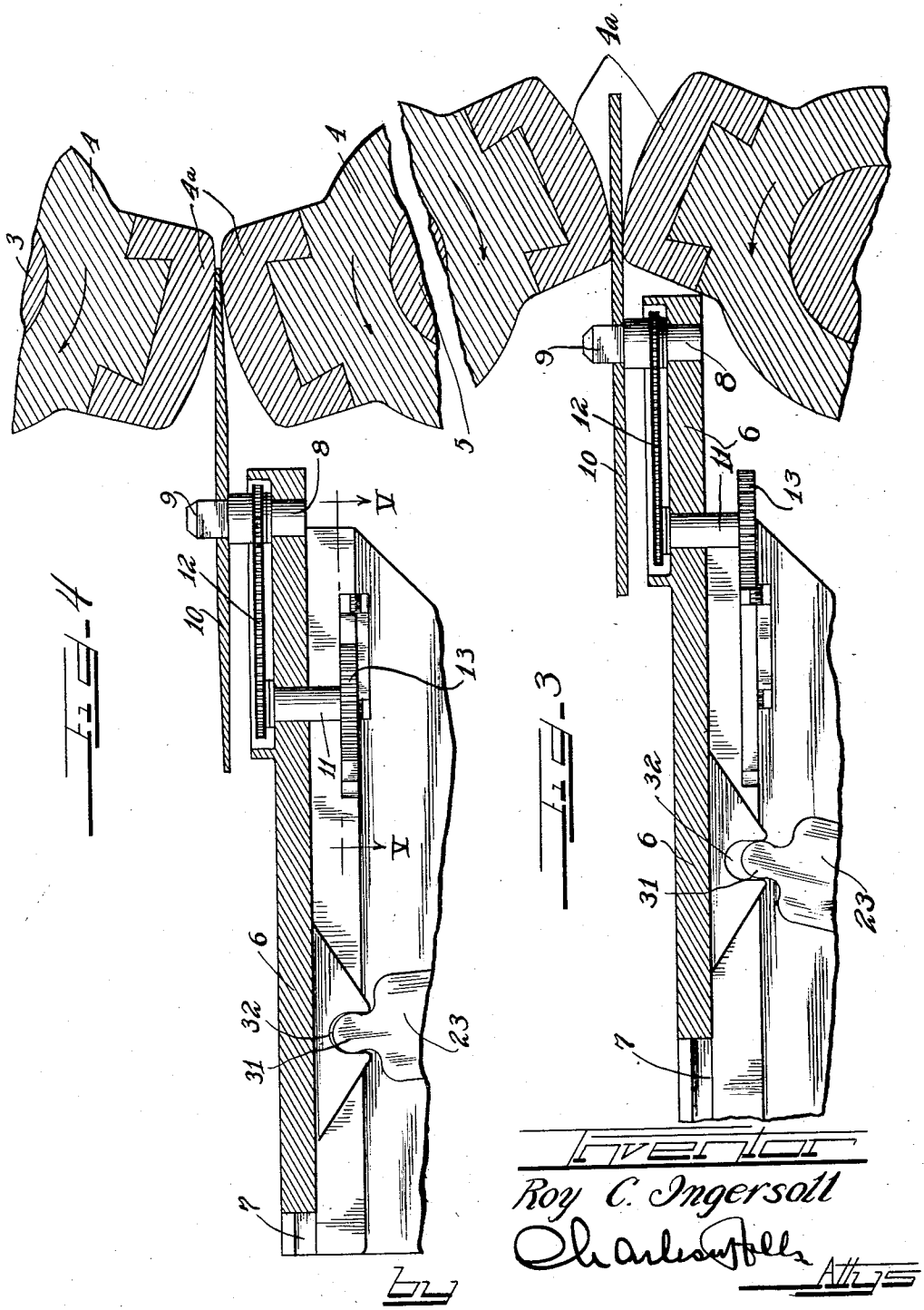


FIG. 4

FIG. 3

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METHOD OF AND APPARATUS FOR ROLLING METAL ARTICLES

Filed Jan. 9, 1931 4 Sheets-Sheet 4

FIG. 6

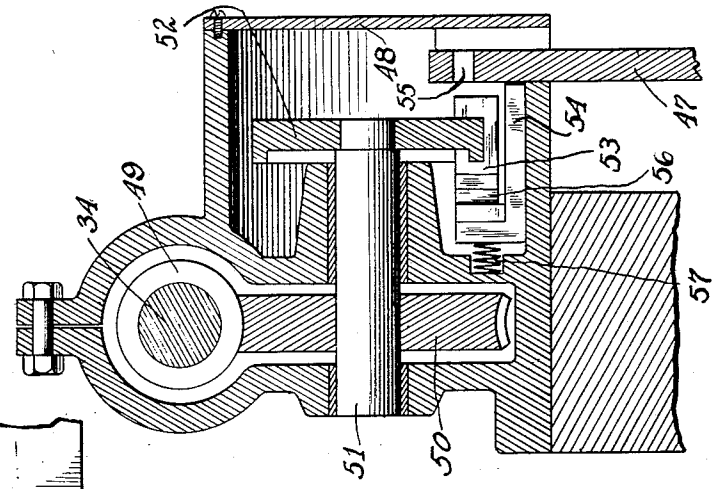


FIG. 5

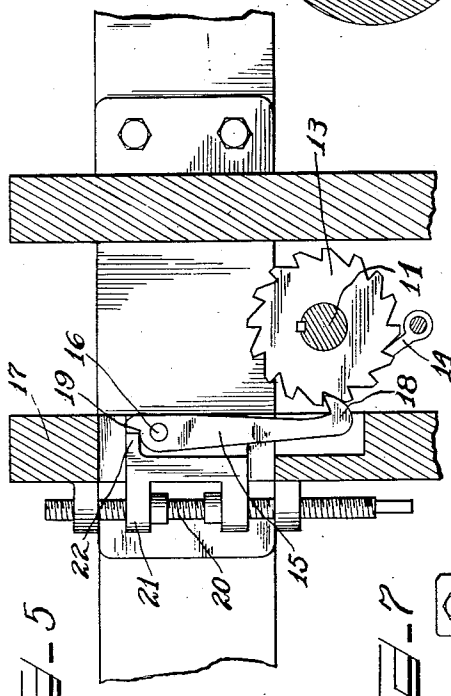
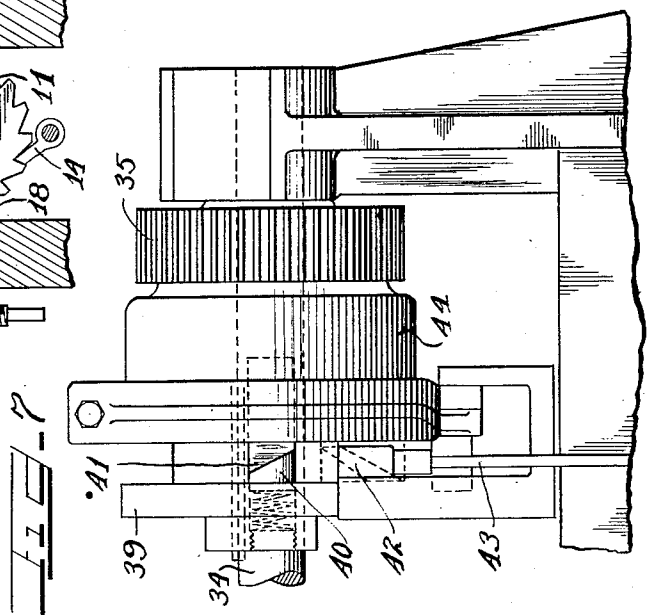


FIG. 7



Inventor

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Patented Jan. 17, 1933

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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR ROLLING METAL ARTICLES

Application filed January 9, 1931. Serial No. 507,576.

This invention relates to a method and apparatus for forming metal articles, and more especially circular plates or disks for making disk wheels.

Heretofore, it has been the common practice to cold roll such plates. This process put a limit on the carbon content that can be used in the metal, besides requiring certain ingredients in the metal that would render the same brittle. In addition, the grain of the metal is directed in a circumferential direction which weakened the structure.

This invention contemplates the use of hot metal which may have any desired carbon content or other desired ingredients, and the method is designed to produce a radial grain in the disks and the proper taper.

The invention comprises the novel method and apparatus hereinafter described and more particularly pointed out and defined in the appended claims.

In the accompanying drawings which illustrate a preferred form of this invention and in which similar reference numerals refer to similar features in the different views,

Figure 1 is an end elevational view of a machine involving this invention;

Figure 2 is a transverse sectional view of the machine showing parts in elevation;

Figure 3 is an enlarged fragmentary sectional view illustrating the initial action of the rolls upon a plate during one revolution;

Figure 4 is a view similar to Figure 3 illustrating the final action of the rolls upon the plate during one revolution thereof;

Figure 5 is a sectional view taken upon the line V—V of Figure 4, looking in the direction of the arrows;

Figure 6 is a sectional view taken upon the line VI—VI of Figure 1 looking in the direction of the arrows;

Figure 7 is an enlarged fragmentary elevational view of the driving shaft and clutch.

This invention involves a new method and apparatus for rolling and producing a taper on a metal article. While the article is illustrated in the form of a circular plate for a disk wheel, it should be understood that the invention may be applied to a wide variety of articles. As applied to a disk plate, the method consists in first heating the disk to a predetermined temperature or red hot, then compressing a radially extending portion of the plate from a point spaced somewhat from the center to the outer edge thereof with gradually increasing pressure to produce a taper; then rotating the disk a predetermined extent and repeating the operation over an adjacent radial section portion of the plate and continuing this process until the plate has been once revolved and all portions have been rolled, compressed and tapered. The method will perhaps be better understood in connection with the description of the apparatus which will now be described.

The illustrated apparatus consists of a suitable frame comprising spaced yokes 1 in which vertically adjustable bearing boxes 2 are mounted for the upper roll shaft 3 whereby the distance between the rolls may be varied as desired. A roll 4 having oppositely directed rolling portions 4*a* is mounted upon the shaft 3. Below the shaft 3 there is journalled a second shaft 5 which supports a similar roller 4 having oppositely directed rolling portions 4*a*. Such rolls are commonly called gap rolls and will be thuswise termed in this specification. It will be noted that the rolling surfaces 4*a* are convex or arcuate with the result that they define a pass therebetween of varying dimensions.

Adjacent one side of the rolls, there is a plate support or carriage 6 which is mounted for freely slidable movement toward and from the rolls. The carriage 6 is slidably mounted upon tracks cut in the uprights 7 (Figure 1) and lap pieces 7*a* secured to the uprights overhang the margins of the carriage. A vertical shaft 8 is journalled in the carriage and the upper end of this shaft has a reduced rectangular stud 9 for supporting the plate or disk 10 which rests upon the annular shoulder formed by the reduced portion. Spaced rearwardly from the shaft 8 there is a second vertical shaft 11 journalled in the carriage. The upper end of the shaft 11 is geared by means of sprocket gearing 12 to the shaft 8. The lower end of shaft 11 carries a ratchet wheel 13 which is held from rotation in one direction by a holding pawl

14 on the carriage (Figure 5). An actuating pawl 15 is supported upon the frame work in the path of the ratchet. As shown, the pawl 15 is pivoted as indicated at 16 at one end in a recess in a member 17 below the carriage. The other end of the pawl 15 has a hooked portion 18 engageable with the teeth of the ratchet wheel. The pivoted end of the pawl has a tail or lug 19 beyond the pivot 16. A screw 20 is mounted upon the member 17 and a stop member 21 is adjustably threaded upon the screw 20 and is provided with a lug 22 adapted for engagement with the lug 19 on the actuating pawl 15 for limiting or controlling the movements of the pawl with respect to the ratchet.

It will be understood that the carriage 6 is freely mounted so that it can float or slide rearwardly as the disk is being rolled in one radial section. During such movement, the ratchet travels with the carriage and the pawl rides idly thereover. Before the next radial section of the plate can be rolled, it is necessary to move the carriage forwardly to the position shown in Figure 3, and during this forward movement of the carriage the ratchet will be rotated one step as it moves relatively to the pawl 15 for rotating the disk 10 through the sprocket gearing 12 for bringing a fresh radial section of the plate in the plane of the rolls. The carriage is adapted to be moved forwardly by mechanism which is power driven but which is so designed as to allow the carriage to freely move rearwardly as a section of the disk is being rolled.

The mechanism for shifting the carriage 6 forwardly consists of a lever 23 (Figure 2) which is pivoted to the frame work at its lower end as indicated at 24. The lower end of the lever has a socket for receiving the stem of a counter weight 25 which tends to swing the lever to the left when the weight is beyond dead center. The lever 23 has a slot 26 which merges into an enlarged space or opening 27 therebelow, the lever having an offset portion for extending the space 27 to the right for the purpose of allowing the operating wrist pin 28 to idly rotate and to allow the carriage to freely move rearwardly. The pin 28 is on a driving disk 29 (Figure 1) and describes a circle 30 as shown in dotted lines in Figure 2. The upper end of the lever has a rounded tenon 31 that fits in a groove 32 in a lug 33 on the bottom of the carriage.

In the position shown in Figure 2, the wrist pin 28 is in position to shift the lever 23 to the right for moving the carriage 6 forwardly into the position shown in Figure 3. In this position the wrist pin will move into the enlarged space 27 in the lever and idly rotate.

The wrist pin disk 29 is secured upon a power driven shaft 34 journalled in suitable bearings upon the frame of the machine. The outer end of the shaft 34 loosely carries a gear 35 (Figure 7) which is connected by a chain 36 (Figure 1) with a driving gear 37 on the upper roll shaft 3. The two roll shafts 3 and 5 are geared together by the gears 38 and may be driven by any suitable source of power.

The feeding mechanism which advances the carriage after each actuation of the rolls, is designed to be automatically thrown out of action when a disk has been finished, or in other words after the gap rolls have made a predetermined number of revolutions.

To this end, a collar 39 is rigidly secured upon shaft 34 and a spring pressed slidable clutch pin 40 having a bevelled shoulder 41 is slidably mounted in this collar and is adapted for engaging a recess in a clutch drum 44 on the gear 35. The shoulder 41 of the clutch pin 41 is adapted to be engaged by a cam 42 on a rod 43 when the same is in the path of the shoulder as shown in Figure 7. It should be noted that shaft 34 rotates in a clockwise direction with reference to Figure 7 with the result that the inclined shoulder 41 will ride against the cam 42 and the pin will become disengaged from the recess whenever the cam 42 is in its operative position.

The clutch controlling mechanism is best shown in Figures 1, 6 and 7 and in referring first to Figure 1, it will be noted that the lower end of the cam rod 43 is pivoted to the end of a lever 45 which is pivoted at its other end to the frame work of the machine as indicated at 46. A foot pedal rod 43*a* is connected to the lower end of the rod 43 and this rod carries a foot pedal 43*b* whereby the clutch rod 43 may be lowered. Intermediate the ends of the lever 45 there is connected a rod 47.

Obviously the movements of the rod 43 are controlled by the foot pedal 47*a*. Referring now to Figure 6, it will be noted that the rod 47 extends into a housing 48 which is provided with a suitable aperture therefor. The shaft 34 extends through the housing 48 and within said housing rigidly supports a worm 49 which drives a worm gear 50 secured to a shaft 51 journalled in the housing and having a cam disc 52 fastened to that end which projects toward the pedal rod 47. This disk 52 embodies a cam 53 which is designed to engage a locking bolt 54 which normally extends into an aperture 55 in the pedal rod 47. This locking bolt as will be noted is substantially L-shaped and the short leg is vertically positioned in the path of the cam 53 and is preferably provided with a cam surface 56 for coaction with the cam 53. A coil spring 57 normally urges the bolt 54 outwardly into locking position. The rods 43 and 47 are normally urged upwardly by a spring 58 (Figure 1) attached to the frame

work and connected to the lever 45. In Figures 6 and 7 the rods 43 and 47 are shown in their elevated positions so that the clutch pin 40 will be retracted when it engages the cam 42. When the shaft 51 has rotated the cam 53 beyond the bolt 54, the spring 57 will project the bolt against the rod 47, whereupon the operator may depress the pedal 43*a* until the aperture 55 in the rod 47 becomes aligned with the locking bolt which will be automatically projected therein by its spring. As the pedal is depressed, the lever 45 will be swung downwardly, which in turn will lower the cam 42 beyond the orbit of the clutch pin 40. The shaft 51 is driven at such a ratio with respect to the roll shafts that a disk will be completed by the time the said shaft 51 has rotated one revolution at which time the cam 53 will retract the bolt 54 and allow the spring 58 to elevate the rods 43 and 47. As the rod 43 is thuswise elevated, it will bring the cam 42 into the orbit of the clutch pin 40.

Thus it will be seen that the lever 45 is normally locked in its depressed position by the rod 47 with the cam 42 in its inoperative position. Now when the disk has been completed and the shaft 51 has made one revolution, the rod 47 will become unlocked and spring 58 will elevate lever 45 and the rods 43 and 47 and the cam 42 on rod 43 will be elevated into the orbit of clutch pin 40 for retracting the same. The parts will then remain in such position until the operator depresses foot pedal 43*a* as previously set forth.

In the use of this machine, a hot disk 10 is placed upon the tenon 9 on the carriage which will be moved forwardly into the position shown in Figure 3 before the gap rolls strike the same when the machine is in operation. The forward portions of the gap rolls will simultaneously strike the plate 10 at a point not far from the center as shown in Figure 3. These forward portions of the gap rolls are spaced further apart than the more interior portions. As the rolls rotate onward from the positions shown in Figure 3, the pass between the rolls will gradually decrease and the compressing or squeezing action on the plate will force the same, together with the carriage to the left as shown in Figure 4. Due to the gradually decreasing pass between the rolls, the plate or disk 10 will be tapered as shown in Figure 4. When the rolls have passed over a radial section such as is passed over when the rolls travel from the position shown in Figure 3 to the position shown in Figure 4 and free the plate, the aforedescribed feeding mechanism including the lever 23 will shift the carriage 6 to the right as shown in Figure 3, and during this movement the disk 10 will be rotated one step by the pawl and ratchet mechanism to bring a fresh portion under the rolls which will be acted upon by the rolls as the first portion. Preferably the disk 10 is only rotated so that the rolls overlap a portion of the previously rolled area so as to provide a smooth surface of uniform thickness at any given distance from the center.

It will be evident that disks rolled and tapered according to this invention will have a radially extending grain and as it is a hot rolling process, no special requirement of metal is necessary so that a better metal for the purpose may be used than has heretofore been possible, and at the same time a tougher and more durable disk is obtained.

Although the machine and method of this application are particularly adapted to use with hot rolling it will be evident that cold rolling may also be accomplished thereby with a high degree of efficiency.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. In an apparatus for rolling and tapering a metal disc, a carriage freely movable in one direction, a rotatable work holder thereon, and means for shifting said carriage in the opposite direction and rotating said work holder, said means including a connection adapted to be disconnected when said work holder has been rotated a predetermined number of times.

2. In an apparatus for rolling and tapering metal disks, a carriage freely movable in one direction, a disk supporting stud rotatably mounted upon said carriage, a shaft journalled in said carriage, gearing connecting said shaft and stud and means for rotating said shaft a predetermined extent during the movement of the carriage in one direction.

3. In an apparatus for rolling and tapering metal disks, the combination with a pair of gap rolls, of a carriage movable toward and from said rolls, a rotatable disk supporting stud mounted upon said carriage, an oscillatable member pivoted at one end and connected to said carriage at the other end, said member having a wrist pin slot terminating in an enlargement at an angle thereto, driving mechanism for said carriage including a wrist pin extending into said slot and means for rotating said stud during the movement of said carriage in one direction.

4. In an apparatus for rolling and tapering a metal disk comprising a pair of gap rolls, a carriage supported for reciprocating movements toward and from said rolls, a disk supporting stud rotatably mounted upon said carriage, means for shifting said carriage toward said rolls including a con-

nection for allowing said carriage to freely move away from said rolls, and means for rotating said stud one step as said carriage is moved toward said rolls.

5. In an apparatus for rolling and tapering a metal disk comprising a pair of gap rolls, a carriage adapted for reciprocating movements toward and from said rolls, means for moving said carriage toward said rolls including a lost motion connection for allowing said carriage to freely move in a direction away from said rolls, a rotatable article supporting member upon said carriage and means for rotating said member when said carriage moves toward said rolls.

6. In an apparatus for rolling and tapering a metal disk comprising a pair of gap rolls, a carriage mounted for movement toward and from said rolls, a disk supporting stud rotatably mounted upon said carriage, a shaft journaled upon said carriage and geared to said stud, a ratchet wheel upon said shaft, a pawl engaging said ratchet wheel, and means for moving said carriage toward said rolls and causing said pawl to rotate said ratchet wheel.

7. In an apparatus for rolling and tapering a metal disk comprising a pair of gap rolls, a rotatable and shiftable work holder, mechanism for advancing said workholder toward said rolls and simultaneously rotating the same one step, said mechanism including a pair of cooperating members having a driving relation that becomes ineffective where said workholder has been advanced for allowing said workholder to freely move away from said rolls.

In testimony whereof I have hereunto subscribed my name at Chicago, Cook county, Illinois.

ROY C. INGERSOLL.