Jan. 13, 1931. J. W. SMITH 1,788,550

MACHINE FOR ROLLING METALLIC DISKS

Filed April 8, 1925 2 Sheets-Sheet 1

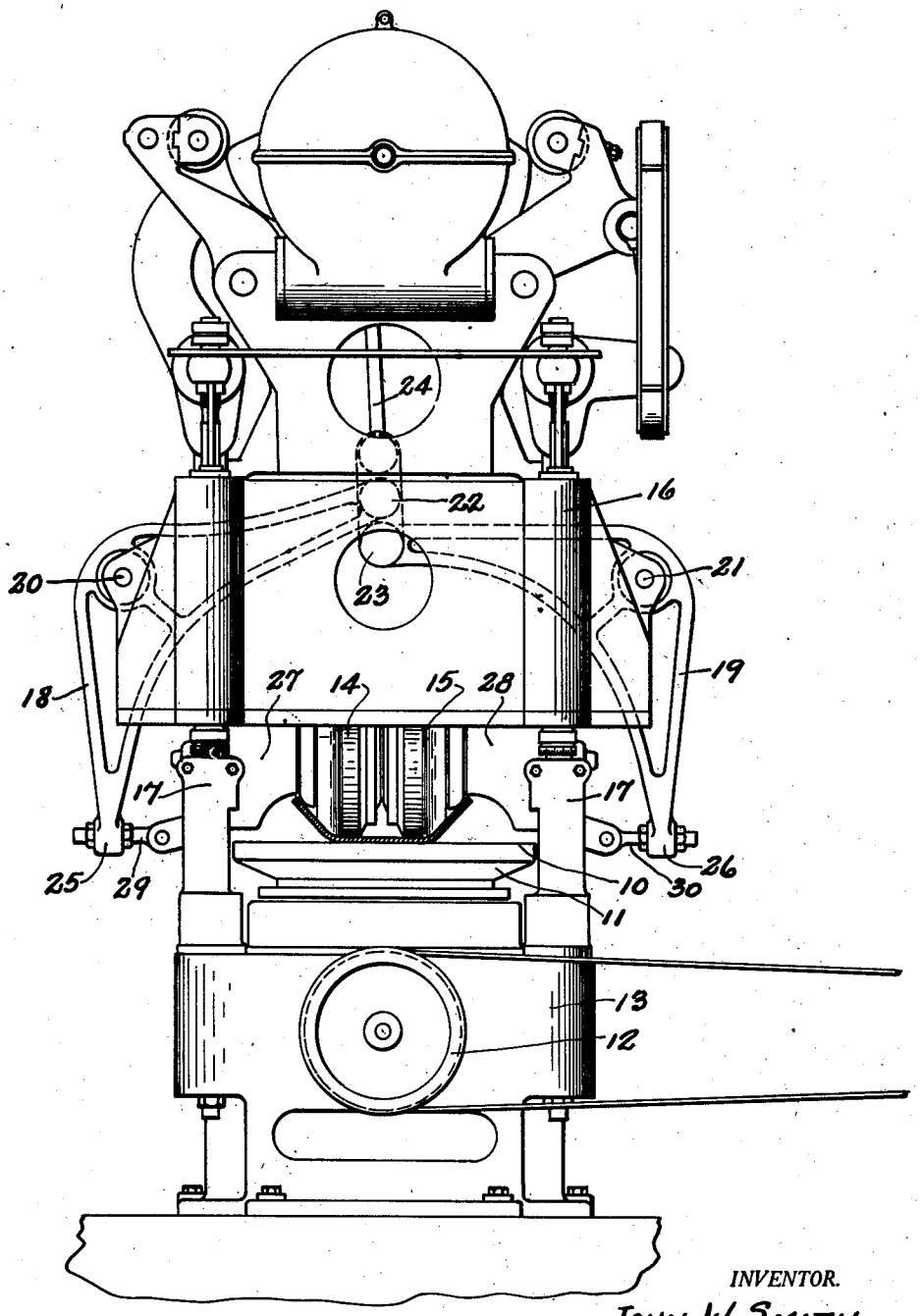


Fig 1

INVENTOR.
JOHN W. SMITH.
BY
ATTORNEY.

Jan. 13, 1931. J. W. SMITH 1,788,550

MACHINE FOR ROLLING METALLIC DISKS

Filed April 8, 1925 2 Sheets-Sheet 2

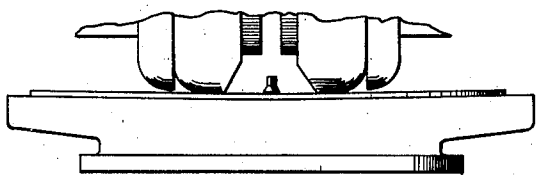


Fig 3

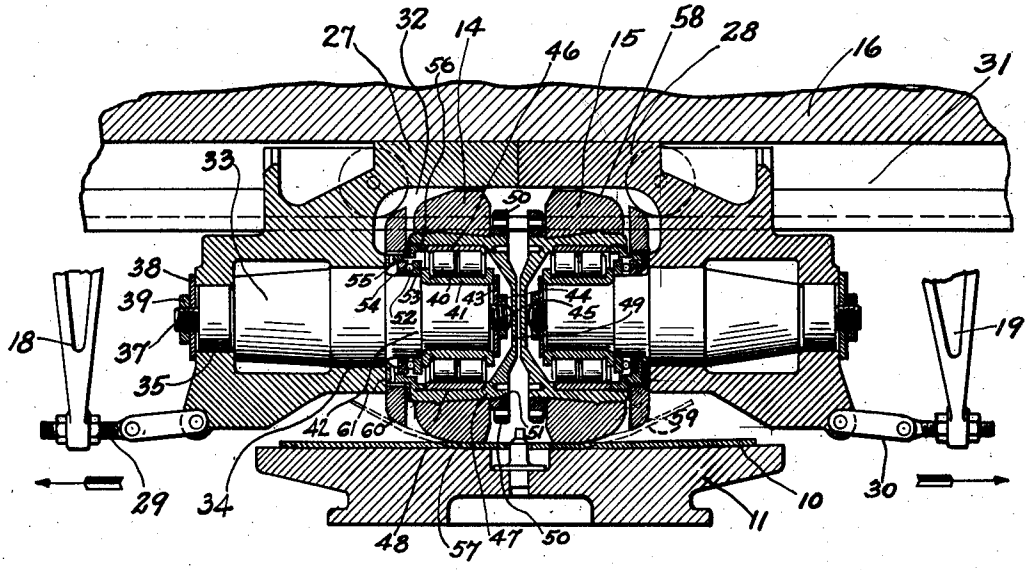


Fig 2

INVENTOR.
JOHN W. SMITH
BY John P. Laboy
ATTORNEY.

Patented Jan. 13, 1931 1,788,550

UNITED STATES PATENT OFFICE

JOHN W. SMITH, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO BUDD WHEEL COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

MACHINE FOR ROLLING METALLIC DISKS

Application filed April 8, 1925. Serial No. 21,677.

My present invention relates to improvements in machines for rolling metallic disks and, more particularly, to improvements in disk rolling machines of the type described in my co-pending applications, Serial No. 408,231, process of and apparatus for rolling metallic disks, filed September 4, 1920, Serial No. 414,848, machines for rolling disks, filed October 5, 1920, and Serial No. 641,240, machines for rolling metallic disks, filed May 24, 1923.

In my pending applications, I have described and claimed machines for rolling metallic disks in which a blank is mounted upon a rotating table and acted upon by rolls which are traversed radially of the blank as the table rotates. These rolls are of such form that they have a combined spinning and rolling action upon the blank, which reduces it in thickness and increases its diameter, bringing the finished disk to any desired cross-section, depending upon the configuration of the table or support for the blank or the line of traverse of the rolls. The combined rolling and spinning operation customarily proceeds outwardly from the center towards the periphery of the blank, and, as the rolls travel outwardly, the outer portion of the blank bends upwardly, assuming a frusto-conical shape so that the rolls have a spinning action on this portion of the blank, as will appear from my copending applications, above referred to. To facilitate such spinning and rolling action on the blank, the outer faces of the rolls are made conical, or tapered, or curved towards the axis to form a tapered leading surface and, as the rolling operation proceeds, the upwardly flaring portion of the blank is brought into contact with the conical leading surfaces of the rolls. Inasmuch as all portions of the roll surface have the same angular velocity, the linear velocity at the smaller end of the roll is much less than at the larger end.

The angular velocity of the roll is determined by the contact of its larger end with the blank. The flaring peripheral flange generated on the blank by the rolls is always outside of the zone of contact of the large ends of the rolls with the blank and, therefore, there is a considerable difference in the linear velocity of said flaring flange and the conical leading surfaces of the rolls. These portions of the rolls, accordingly, slide on the adjacent surface of the blank and, under the heavy pressures employed, this causes considerable friction and heat, with consequent damage to the surface of the disk.

An object of my present invention is to provide a machine of this type in which this friction and generation of heat may be obviated and avoided.

Another object of the invention is to provide a means by which the flaring flange generated on the blank being rolled may be supported and spaced from the end surfaces of the rolls by a freely rotatable surface.

Another object of the invention is to provide an improved mounting structure for the rolls, which is particularly suitable for use with an anti-friction guiding or spacing collar and to provide a simple and effective guide roller and bearing therefor.

Further objects, and objects relating to details and economies of construction and operation, will definitely appear from the detained description to follow. In one instance, I accomplish the objects of my invention by the devices and means set forth in the following specification. My invention is clearly defined and pointed out in the appended claims. A structure constituting a preferred embodiment of my invention is illustrated in the accompanying drawings, forming a part of this specification, in which:

Fig. 1 is a view in front elevation of a machine embodying my invention, and

Fig. 2 is a sectional elevation of a portion of the machine, taken at approximately the axis of the roll bearings.

Fig. 3 is a detail view of the blank, rolls and anti-friction collars prior to the commencement of the rolling operation.

In the drawings, the same reference numerals refer to the same parts throughout the several views.

In my said pending applications referred to above, a blank to be rolled is supported on a rotating table and acted on by rolls which

engage the blank under pressure and are moved radially of the blank, from the center outwardly, while the blank rotates, the rolls being rotatably supported and being rotated by contact with the surface of the blank on the rotating table. As the rolls move radially outwardly under heavy pressure, the metal is reduced in thickness, causing the portion of the blank beyond the zone of contact of the rolls to flare upwardly towards the axes of the rolls. The ends of the rolls are, accordingly, conical so as to form leading surfaces for the upwardly flaring blank.

In accordance with my present invention, the upwardly flaring portion of the blank is guided and spaced from the end surfaces of the rolls, near their axes, by means of a freely rotating ring or collar having a peripheral surface projecting slightly outside of the conical surface of the rolls and thus preventing contact of the blank surface with the roll surfaces at points where the greatest friction and heat would be generated. The rotating ring or collar is free to rotate with the disk surface so that there is no friction between them. In my present invention, also, the rolls are preferably not fixed to a rotating shaft but are rotatably mounted on a non-rotating shaft, thus simplifying the construction and enabling the rolls to be more easily removed from the machine, if that should be necessary.

Referring more particularly to the accompanying drawings, the invention is shown as applied to a machine similar to that disclosed in my application, Serial No. 641,240. In this machine, the blank, 10, to be rolled, is supported on a rotating table, 11, rotated by suitable driving mechanism from a driving pulley, 12, and supported on a suitable base, 13. The blank is acted on by a pair of rolls, 14 and 15, slidably supported beneath, and guided and pressed downwardly by a vertically movable carriage, 16, which is guided in its vertical movement by means of upright columns, 17, extending upwardly from the base, 13. The rolls, 14 and 15, are given a suitable movement radially of the blank and inwardly and outwardly by means of a pair of bell crank levers, 18 and 19, pivoted at, 20 and 21, respectively, on the carriage, 16, and connected at their upper ends, 22 and 23, to a vertically movable driving rod, 24, and, at their lower ends, 25 and 26, connected to roll carriers, 27 and 28, by means of connecting links, 29 and 30, respectively. The carriage, 16, is raised and lowered by suitable mechanism and the movements of the bell crank levers and carriage are so arranged that, when the carriage is lifted, the rolls are moved axially inwardly and, when the carriage is lowered, the rolls are moved axially outwardly. The roll carriers are guided in their in and out movements in a guide-way, 31, in the bottom surface of the carriage, 16, and extending in the direction of the movement of the rolls.

Each roll carrier is provided at its inner end with a recess, 32, in which the roll, 14 or 15, respectively, is disposed. But one roll carrier and roll operating mechanism will be referred to hereinafter, inasmuch as the roll carriers are substantial duplicates of each other. The roll, 14, is supported on a shaft or spindle, 33, having spaced bearing surfaces, 34 and 35, the surface, 35, being of less diameter than the bearing surface, 34, and the shaft being tapered, at 36, between said surfaces so that it may be readily inserted from the inner end of the carrier. The shaft, 33, is also provided with a threaded stem, 37, projecting outwardly beyond the surface, 35, on which a washer, 38, and nut, 39, may be secured to hold the shaft in the carrier.

The roll, 14, is mounted on the portion of the shaft extending within the recess, 32, by means of a roller bearing, 40, having an inner raceway, 41, retained between an inner shoulder, 42, of the shaft and a washer, 43, secured to the inner end of the shaft by means of a nut, 44, threaded on a projecting threaded stem, 45. The outer raceway, 46, of the roller bearing is mounted within a housing or sleeve, 47, having a wall, 48, with a cylindrical internal surface within which the raceway fits and having an end wall, 49, covering the end of the shaft, 33, and the bearing, 40. The roll, 14, is mounted directly on the external surface of the cylindrical wall, 48, the outer surface of the wall and the inner surface of the roll being tapered towards the inner end of the shaft so that the roll may be removed from the housing, 47. The roll is retained on the housing by means of an internally threaded retaining ring or nut, 50, screwed on to a threaded end portion, 51, of the housing, 47.

The end thrust between the roll and the shaft is taken by an annular ball bearing, 52, having a race, 53, abutting the adjacent end of the inner raceway, 41, and a race, 54, abutting a ring, 55, having a flange, 56, screwed to the inner surface of the housing wall, 48. The screw connection of the housing to the ring flange, 56, also serves to hold the housing in a close, unitary structure with the ball and roller bearings.

This arrangement of the apparatus and manner of mounting the rolls permits the rolls to be readily removed from the supporting shafts without removing the shafts from the carriers, all that is required for this purpose being to remove the ring or nut, 51, and slide the roll from the housing, 47. The housing may, when desired, be removed by simply unscrewing it from the ring flange, 56, thus giving access to the roller and ball bearings.

The rolls, 14 and 15, are provided with a narrow cylindrical surface, 57, through

which a rolling pressure is applied to the blank, 10. The outer end of the roll is rounded and tapered inwardly, preferably forming a conical surface, 58, thus avoiding a sharp outer edge and having a spinning action on the metal of the blank prior to its passing under the cylindrical surface, 57. As the rolls revolve, they engage the blank with a rolling pressure which causes the outer portions of the blank to flare upwardly as indicated, at 59, in Fig. 2, in dotted lines, and as the rolls continue to move outwardly, the flaring portion of the blank tends to engage the conical surface of the rolls with considerable pressure.

The rolls are given a movement of rotation around their axes by contact of the cylindrical surface, 57, with the rotating surface of the blank, 10, and, as all portions of the rolls have the same angular velocity, the conical surface, 58, has a smaller linear velocity than the cylindrical surface, 57, while the flaring portion of the blank, 10, having a greater radius, has a greater linear velocity than the portion in contact with the cylindrical surface, 57. The surfaces, 58, of the rolls and, 59, of the blank, have, therefore, a relative movement or slip which, with the considerable pressure between them, would cause a heavy friction and consequent loss of energy and generation of heat. This slip also results in a certain undesirable marring of disk surface.

To avoid this friction, a rotatable ring or anti-friction collar, 60, is mounted on the housing ring, 55, in such a manner that it projects beyond the surface, 58, of the roll and is free to rotate on the ring, 55. To provide lubrication for this collar, a number of passages, 61, are provided in the ring, 55, communicating with the raceways of the roller bearing, 40. Through this arrangement, the flaring portion, 59, of the blank, 10, is slightly spaced from the conical surfaces of the rolls, except at points near the cylindrical surfaces, 57, by the collar, 60, and, as the collar, 60, is freely rotatable, no appreciable amount of friction is generated.

As changes of construction could be made within the scope of my invention, it is desired that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent is:

1. In a machine of the type described, a roll having a leading surface tapering towards its axis, and an anti-friction collar to hold a blank from contact with the portions of said surface towards said axis.

2. In a machine of the type described, a roll having a cylindrical rolling surface and an end surface tapered towards its axis, and an anti-friction collar supported adjacent said end surface to hold a blank from contact with the portion of said end surface near its axis.

3. In a machine of the type described, a roll having a cylindrical rolling surface and a conical leading surface at one end, and an anti-friction collar at said conical end having an outer surface extending beyond said conical leading surface for holding a blank from contact with the roll.

4. In a machine of the type described, a roll having a cylindrical rolling surface and a leading end surface tapered towards the axis of the roll, and rotatable means at said leading end for guiding and spacing the surface of a blank being rolled from contact with the said end surface.

5. In a machine of the type described, a pair of rotatable rolls movable towards and from each other in the line of their axes, said rolls having cylindrical rolling surfaces and outer end surfaces tapered towards their axes, and anti-friction collars mounted at the outer ends of said rolls and each having an outer surface projecting outside the tapered end surface of the corresponding roll to prevent contact of the surface of a blank therewith.

6. In a machine of the type described, a rotatable blank supporting table, a pair of rolls movable radially towards and from each other on opposite sides of the axis of said table and on the line of their axes, said rolls having cylindrical rolling surfaces and tapered leading surfaces, and anti-friction collars mouned to prevent upturned surfaces of said blank from rubbing on the inner portions of said tapered leading surfaces.

7. In a machine of the type described, a rotatable blank supporting table, a pair of rolls movable radially towards and from each other on opposite sides of the axis of said table and on the line of their axes and having rolling surfaces pressing on and rotated by the surface of said blank, and means rotatable with said blank, independently of said rolls, for preventing the upturned surface of said blank from contacting with the outer end surfaces of said rolls.

8. In a machine of the type described, a movable roll carrier, a shaft mounted in said carrier with its axis in the line of movement of said carrier, a sleeve at one end of said shaft, a roller bearing between said sleeve and said shaft, a tapered surface on said sleeve and a roll mounted on said tapered surface.

9. In a machine of the type described, a movable roll carrier, a shaft mounted in said carrier with its axis in the line of movement of said carrier, a sleeve at one end of said shaft, a roller bearing between said sleeve and said shaft, an anti-friction thrust bearing between said sleeve and shaft, said sleeve

having a tapered outer surface, and a roll mounted on said tapered surface.

10. In a machine of the type described, a movable roll carrier, a shaft mounted in said carrier with its axis in the line of movement of said carrier, a sleeve at one end of said shaft, anti-friction supporting and thrust bearings between said shaft and said sleeve, a roll rigidly mounted on said sleeve, and an anti-friction collar mounted on said sleeve at one end of said roll.

11. In a machine of the type described, a movable roll carrier, a shaft mounted in said carrier with its axis in the line of movement of said carrier, a sleeve at one end of said shaft, anti-friction supporting and thrust bearings between said shaft and said sleeve, a roll rigidly mounted on said sleeve, an anti-friction collar mounted to rotate on said sleeve at one end of said roll and lubricant passages between said anti-friction bearings and said collar.

12. In a machine of the type described, a roll carrier having a recess at one end, a shaft mounted in said carrier and projecting into said recess, roller supporting bearings and ball thrust bearings mounted on said shaft within said recess, a sleeve mounted on said bearings and covering the end of said shaft and said bearings, a roll mounted on said sleeve, and an anti-friction collar mounted in said recess at the inner end of said sleeve.

13. In a machine of the type described, a roll carrier having a recess at one end, a shaft mounted in said carrier and projecting into said recess, a sleeve surrounding the end of said shaft within said recess, a roller supporting bearing and a ball thrust bearing between said sleeve and said shaft, said sleeve having a tapered surface, a roll mounted on said tapered surface, a nut securing said roll on said surface, and an anti-friction collar rotatably mounted on the inner end of said sleeve in position to protect the inner end of said roll from contact with an upturned surface of a blank being rolled.

14. In a machine of the class described, the combination of a roll carrier, a spindle detachably carried by said carrier, a sleeve detachably and rotatably mounted on said spindle without the roll carrier, and a readily demountable roll mounted on said sleeve.

15. In a machine of the class described, the combination of a roll carrier, a spindle carried thereby journaled within and projecting without said roll carrier, a sleeve surrounding the end of said spindle and detachably and rotatably mounted thereon, and a readily demountable roll mounted on said sleeve.

16. In a machine of the class described, the combination of a roll carrier, a spindle carried thereby, a sleeve detachably and rotatably mounted on said spindle and having a tapered external surface, a roll mounted on said sleeve and having a tapered bore fitting said external surface, and a nut screwed on said sleeve and engaging said roll to hold it rigidly mounted upon the sleeve.

17. In a machine of the class described, the combination of a roll carrier, a spindle carried thereby, a sleeve surrounding the end of said spindle, anti-friction means interposed between said spindle and sleeve, means for retaining said sleeve upon said spindle, a roll carried by said sleeve, and a collar rotatable with respect to said sleeve and mounted at one end of said roll.

18. In a machine of the type described, a plurality of independently rotatable members arranged longitudinally of each other, one of said members having a rolling surface and an end surface tapered toward its axis, the other of said members having a blank engaging surface which holds a blank from direct contact with the portions of said end surface of the first-named member which are toward its axis.

In testimony whereof, I affix my signature.

JOHN W. SMITH.