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J. W. SMITH

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ROLL FOR MAKING TAPERED DISKS

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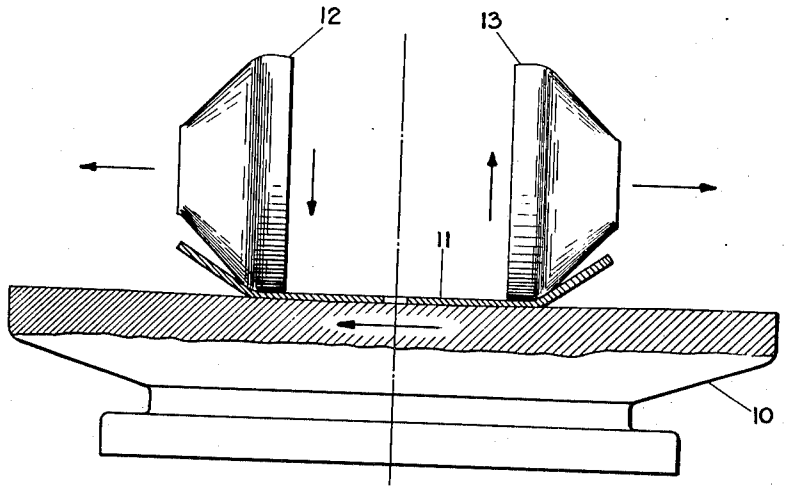


Fig. 1.

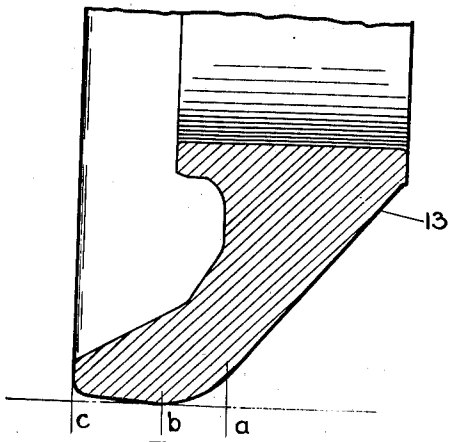


Fig. 2.

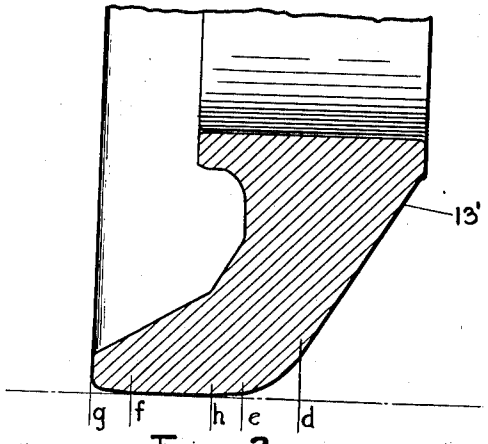


Fig. 3.

INVENTOR.

JOHN W. SMITH

BY John P. Tarbox

ATTORNEY.

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UNITED STATES PATENT OFFICE.

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

ROLL FOR MAKING TAPERED DISKS.

Application filed January 29, 1926. Serial No. 84,593.

My invention relates generally to rolls used in rolling mills, and more particularly to rolls adapted to be used to form metallic disks according to the method and apparatus disclosed in my patent for machines for rolling metallic disks, Number 1,606,906, November 16, 1926.

According to the method and apparatus disclosed in my patent above referred to, the metallic disk to be formed, either a circular blank of uniform thickness or one that has already been given a taper from its center to its periphery, is placed upon a rapidly rotating platen whose face is complemental to the form it is desired to impart to the disk. A conical roll, or preferably two rolls diametrically arranged on opposite sides of the center of the platen into position to cause the peripheral working faces of the rolls to engage under working pressure with the disk adjacent the center of the same. The rolls are then progressively moved outwardly, and in this outward movement, the disk is formed by a combined rolling and spinning action due to the spiral path of the rolls on the disk, to the desired taper. After the rolls have been traversed outwardly to the extent desired, a separating movement between the rolls and platen is initiated, and the rolls are then moved inwardly to the starting point. In this movement the formed disk may be removed and replaced by a fresh disk and the operation thereupon repeated. Sometimes, if desired, the rolls are passed several times over the same disk to improve its surface, and also to further decrease its thickness and increase its diameter.

This rolling operation may be carried out with either hot or cold blanks. However, with cold blanks, it is usually desirable that the blanks have already been given substantially their desired form by hot rolling so that only a relatively small deformation of the metal of the blank is required in the cold rolling operation, the rolling operation, in this case, being also for the purpose of improving the surface of the disk, as well as to reduce its thickness and increase its diameter, to the desired extent.

A difficulty frequently experienced in making disks with machines of this kind heretofore has been the formation under certain circumstances of objectionable waves or spiral ridges or furrows in a portion of a formed disk, and sometimes in the whole of it. Whether or not this difficulty has been encountered is dependent upon a variety of conditions, such for example, as the ratio of traverse of the rolls to the peripheral velocity of the zone of the disk being rolled, the depth of the reduction of the rolling operation, the width of the roll, etc. But it is not necessary to go into these underlying causes here. Suffice it to say that I have found that, whether due to one of the underlying causes or any number of them, this difficulty can be avoided entirely and the main object of my invention thereby attained by a proper shaping of the working face of the traversing rolls.

Heretofore the traversing rolls have been of an axial cross section at the working face curved at the leading edge to a zone of maximum working diameter of the roll, and thence rearwardly to the trailing edge of the working face and of uniform diameter equal to the maximum diameter. The roll of my invention is likewise curved at the leading edge of the working face to a zone of maximum diameter, but from the trailing edge of the working face toward the zone of maximum diameter the roll is tapered a few thousandths of an inch. This taper is of rectilinear form and may or may not extend forward to a zone of maximum diameter where it meets the curved leading edge of the working face. In one form of the invention this taper does not extend to the curved leading edge of the working face but extends from the trailing edge only part way to that line, the remaining or intermediate portions of the working face of the roll comprising a zone of rectilinear cross section of uniform diameter. Thus the new roll of my invention may be said to have a trailing portion of its working face frustro-conical in form with the base of the cone either constituting or merging into the zone of maximum diameter. The corner of the trailing edge itself is slightly rounded.

Such a roll works the metal throughout its working face just as do the rolls heretofore used, but, in the working of it, under none of the adverse conditions generally in-

dicated above does it permit the mal-forming of the face of the disk heretofore experienced.

In the accompanying drawings, I have shown several preferred forms of rolls embodying my invention:

Figure 1 represents more or less diagrammatically the relative positions of the platen, the blank supported thereby and the rolls in one phase of the working operation.

Fig. 2 represents a partial section through the axis of a roll having a working face according to the invention, more particularly adapted for rolling hot blanks.

Fig. 3 represents a similar partial section through a roll having a working face according to the invention particularly adapted for finish rolling cold blanks.

Referring to Fig. 1, the numeral 10 designates the rotating platen upon which is supported the disk 11 to be rolled. In the production of tapered disks the surface of this platen is slightly dished to conform to the taper which it is desired to impart to the finished disks. Numerals 12 and 13 indicate the conical rolls, which are first brought into working contact with the disk 11 near its center and are then moved axially outwardly to spin and roll the disk. Under the heavy rolling pressure the disk is automatically flared upwardly in the zone outside the rolls as shown in Fig. 1.

The rotation of the platen 10 is effected from a suitable source of power (not shown) and takes place in the direction indicated by the arrow. The horizontally pointing arrows in the axis of the rolls indicate the outward traverse of the rolls and other arrows adjacent the rear faces of the rolls indicate the direction in which the rolls are rotated by their working contact with the rotating disk and platen. It will be obvious then that the path of the rolls over the disk is a spiral one extending from the central portion of the disk to the periphery.

The improved roll of my invention shown in Fig. 2 is formed, as usual, with a front face tapering rearwardly and outwardly toward the working face of the roll, but the working face of the roll differs in several important respects from the prior construction hereinbefore described. In order to avoid the extreme upward flaring of the disk around its outer portion during the rolling operation, according to my invention, as shown in this figure, I form the leading in portion of the working face of the roll in a zone located between the vertical lines *a*, *b* with a curved surface of substantial radius, which merges at the front into the conical front face of the roll and at the rear, in the region indicated by the line *b*, into a zone extending between the lines *b* and *c*, which has a gradual taper toward the rear face of the roll away from the work. This tapered surface is frustro conical in form and the taper is relatively slight, ranging for different depths of roll from approximately between thirty thousandths down to a few thousandths of an inch per inch. This contour of the working face of the roll results in a very narrow intermediate portion of maximum diameter in the region of the line *b*, which bears with the maximum pressure upon the work, and hence controls the speed of rotation of the roll. A roll with this contour of working face has been found particularly applicable in connection with the hot rolling of disks, where the pressure of the roll against the work is calculated to cause a relatively great flow of the metal outwardly toward the periphery of the disk. The curve of relatively great radius leading into the work effects a turning down of the upturned flange on the disk by a relatively easy rolling and spinning action and with a metal flowage which does not put an undue strain upon the metal. The rearwardly and inwardly tapering zone extending between the line *b*, and *c*, brings about a gradual back off from the work, while yet in working contact therewith leaves the surface of the work remarkably free of ridges and irregularities. The rounded edge connecting the working surface with the rear face of the roll also is a factor contributing to this end.

The improved roll of Fig. 3 which has a working face particularly adapted for cold rolling operations such as reducing to final form and finished disks already formed to a thickness and diameter approaching their final form by previous hot rolling or otherwise, also has incorporated therein the desirable features of the working face of the roll shown in Fig. 2 with a similar desirable result. Reference is had here to the leading in zone of relatively large radius between the vertical lines *d* and *e* and the zone of gradual rearward and inward taper at the rear of the working face extending between the lines *f* and *g*. It is desirable, however, in the cold rolling operation to provide a working face leading into the work very gradually, and to this end I may provide, as shown, although in view of the large radius of the leading in zone this is not in all cases essential, a zone of straight taper indicated as extending from the line *e* to the line *h*. Between the end of this outwardly tapered portion, or portion tapering toward the work, and the rear inwardly tapering portion extending from the line *f* to line *g*, I preferably form the working face of the roll with a zone *h*—*f* having a maximum and uniform diameter and therefore, bearing upon the work with substantially uniform pressure throughout its width. As respects the width of the entire working face of the roll, this zone is relatively narrow, yet at the usual ratio of traverse of the roll and

rotation of the platen, this portion may be of sufficient width to overlap a substantial portion of the spiral zone of the work traversed thereby immediately preceding rotation of the work.

Actual practice has demonstrated that rolls having the contour of working face herein disclosed or approximating the same are particularly adapted for a high rate of production, while at the same time insuring a smoothness of surface not heretofore attained.

While I have herein disclosed two embodiments of the invention which are at present considered by me as the preferred embodiments for practicing my invention, I do not wish to be limited to this precise construction but only as is required by the spirit and scope of the appended claims.

What I claim is:—

1. A traversing roll for machines for rolling metal blanks into thin disks by rotating said blanks and moving a rotating roll radially from the center of rotation of said blank, said roll having a working face of maximum diameter and having a portion uniformly tapering away from the blank in the direction of movement of the roll relatively to the center of rotation of said blank.

2. A traversing roll for machines for rolling metal blanks into thin disks by rotating said blanks and moving a rotating roll radially from the center of rotation of said blank, said roll having a working face comprising a tapered leading in zone, a zone presented substantially flatwise to the work and a rear zone tapered away from the work.

3. A traversing roll for machines for rolling metal blanks into thin disks by rotating said blanks and moving a rotating roll radially from the center of rotation of said blank, said roll having a working face comprising a front zone curved on a substantial radius and a rear zone tapered but gradually away from the work.

4. A traversing roll for machines for rolling metal blanks into thin disks, by rotating said blanks and moving a rotating roll radially from the center of rotation of said blank, said roll having a working face whose rear portion from a point of maximum diameter of the roll to the trailing edge of the roll has a uniform taper away from the work.

In testimony whereof he hereunto affixes his signature.

JOHN W. SMITH.