R. LUDWIG.

ROLLING MILL.

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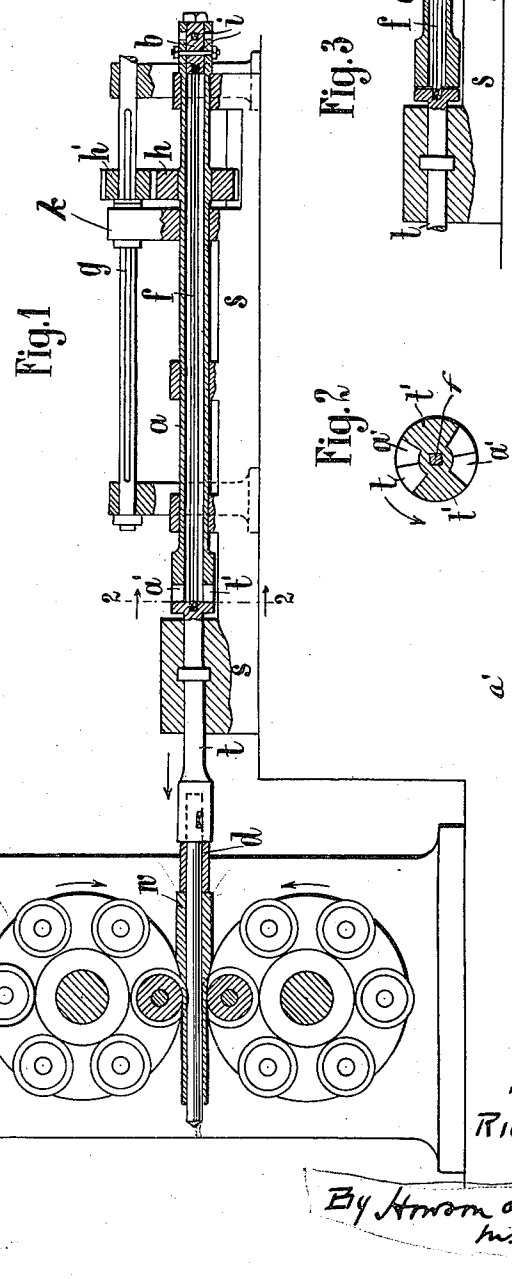
1,028,236.

Patented June 4, 1912.



WITNESSES

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ROLLING-MILL.

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To all whom it may concern:

Be it known that I, RICHARD LUDWIG, a subject of the Emperor of Austria-Hungary, residing at Bous-on-the-Saar, Germany, have invented certain new and useful Improvements in Rolling-Mills; and I do hereby declare the following to be a full, clear, and exact description of the invention.

My invention relates to a rolling mill in which the rolls operate intermittently.

In rolling machines for forming tubes over a mandrel, in which the mandrel and tube blank must be rotated a certain degree in the exceeding short time between the successive attacks of the rolls, coil springs arranged around the mandrel-holder have heretofore been used to connect the mandrel-holder and a constantly rotating driving shaft. Inasmuch as the mandrel-holder and its tube blank are prevented from rotating during the attack of the rolls, the spring is then tensioned and serves, before the succeeding attack, to rotate the mandrel and its blank. This elastic connection between the mandrel and the constantly rotating driving shaft must be such that it can withstand cumulative tensioning. For in the exceedingly short time between the roll attacks, during which the tube blank is released by the rolls and rotated by the tensioned spring, the spring is only partially relieved, its release being interrupted by the attack of the next roll, so that the tension imparted during the preceding attack of the rolls, and only partially relieved, is now augmented, and so on for succeeding attacks until the initial tension of the spring becomes such that further tension imparted thereto during the rolling stroke is entirely relieved between the attacks of the rolls. It is therefore necessary to design the spring to withstand a multiple of the tension imparted thereto during a single attack of the rolls. To this end, according to my invention, I form the spring constituting the tensioning member as a torsion spring, or as a rod-shaped torsion spring consisting of one or more pieces, and mount it in the hollow driving shaft. I connect the one end of this spring with the mandrel-holder and the other end with a constantly rotating hollow driving shaft.

As compared with the bending or flexion springs known heretofore, I obtain the following advantages by the new construction and arrangement of the spring:—

1. In the case of the rod-shaped torsion spring any desired strength can be obtained by varying the dimensions, number or length of the rods, and the tension thereof during operation can be kept within such low limits in proportion to the strength of the spring that its long life is assured. An increase in the weight of the spring is accompanied by no disadvantage, because the spring is arranged at the center of rotation and consequently the kinetic forces occasioned by its weight do not materially affect the rotation of the mandrel and blank. In the case of a coil spring arranged around the mandrel-holder, on the contrary, every increase of the strength of the spring to lower its flexibility causes an increase in its weight and an increase of the prejudicial natural oscillations of its coil, because the mass of the spring is located at a relatively great distance from the axis of rotation.

2. In the case of the rod-shaped torsion spring, by increasing or diminishing the number of the individual rods the required strength and elasticity of the spring for the rolling process can readily be obtained, while the same adjustment can be obtained with a coil spring only by a troublesome exchange of springs.

3. The torsion spring can be changed and reset with considerably greater ease than a coil spring.

4. A further advantage is derived from the fact that owing to the torsion spring being arranged within the hollow driving shaft, the spring can be placed as near as possible to the rolls on the one hand, and the masses to be rotated can be materially lightened on the other hand.

It has heretofore been proposed to obtain a certain flexibility in the drive of the mandrel by making a part of the mandrel behind the blank of a cross-shaped section, thus weakening it, so that it is slightly elastic. But as the length of this elastic portion of the mandrel must be small, the elasticity obtained is quite insufficient and the material is subjected to such severe strains that a satisfactory life cannot be obtained.

An illustrative embodiment of my invention is shown by way of example in the accompanying drawings, wherein:—

Figure 1 is a longitudinal section of a

rolling mill provided with my improved tensioning member, the driving rolls having a planet-like motion. Fig. 2 is a cross section, enlarged taken on the line 2—2, in Fig. 1; Fig. 3 is a broken longitudinal section of a modification, and Fig. 4 is a cross section of a modification, on the same line as Fig. 2.

Referring to the drawing, the mandrel-holder t, which carries the mandrel d and the tube blank w, is mounted at the front end of the slide s. The driving shaft a adjacent the mandrel-holder t is hollow and connected with the mandrel-holder t by a torsion or rod-shaped spring f, one end of which is secured to the shaft a, and the other end of which is secured to the mandrel-holder t. As Fig. 2 shows, the ends of the shaft a and of the mandrel-holder t are provided with lugs or claws a^1, t^1, respectively, like those of a claw-clutch, which are so designed that the shaft a can be twisted relatively to the mandrel-holder for the purpose of tensioning the spring f corresponding to the duration of the attack of the rolls. The lost motion engagement of these claws prevents dangerous or excessive twisting of the spring. Assuming the shaft a to rotate constantly in the direction of the arrow shown in Fig. 2, the mandrel-holder remains stationary during the attack of the rolls and the spring f is consequently tensioned. As soon as the blank is released by the rolls, it, together with the mandrel and its holder, follow the rotation of the shaft a under the influence of the tensioned spring f. The lost motion engagement between the lugs t^1 and a^1 prevents the rotation of the shaft a in advance of the mandrel holder to an extent which may be dangerous or injurious to the spring f.

In the arrangement of Fig. 3, the claws a^1 and t^1 are omitted. In this case no means are provided for limiting the twist which may be imparted to the spring. The spring f may consist of a single rod or of a bundle of round or flat rods f^1 (Fig. 4). Its tension can be readily and conveniently adjusted by reason of the fact that it is held at its right-hand end in a block b, which is inserted in the end of the shaft a. In order to adjust the tension of the spring f, it is necessary only to rotate the block b which is held in adjusted position by one or more pins i passing through the shaft a and entering holes in the block b. This adjustment is necessary in the arrangement illustrated in Figs. 1 and 2, in order to secure the requisite initial tension of the spring f. The shaft a is constantly rotated by the pair of gears h and h^1 of which the former is fast with the hollow shaft a, while the latter h^1, slides on a feather on the shaft g which is journaled in stationary supports. A post k, on the slide s is operatively connected in any suitable manner to the gear h^1, so as to impart thereto a longitudinal movement synchronous with the advance of the slide and gear h, carried by the shaft a, so that the gears h and h^1 are maintained constantly in mesh.

The present invention is not limited to rolling machines in which the rolls have a planet-like motion, but can be utilized in all rolling mills in which the rolls attack the blank intermittently and in which the mode of operation of the rolls necessitates the rotation of the blank. The expression torsion spring is used in the present application in a sense broad enough to include a group of rods twisted on a common longitudinal axis.

I claim as my invention:—

1. In a rolling machine comprising intermittently operating rolls, the combination of a mandrel-holder, a driving shaft, and a torsion spring arranged between and connecting the mandrel-holder with the driving shaft.

2. In a rolling machine comprising intermittently operating rolls, the combination of a mandrel-holder, a hollow driving shaft, and a torsion spring arranged in and connecting the driving shaft with the mandrel-holder.

3. In a rolling machine comprising intermittently operating rolls, the combination of a mandrel-holder, a hollow driving shaft, and a torsion spring arranged in and connecting the driving shaft with the mandrel-holder, the mandrel-holder and the driving shaft being provided with claws which engage one another with predetermined lost motion.

4. In a rolling machine comprising intermittently operating rolls, the combination of a mandrel-holder, a hollow driving shaft, and a torsion spring consisting of a plurality of rods arranged in and connecting the driving shaft with the mandrel-holder.

5. In a rolling machine comprising intermittently operating rolls, the combination of a mandrel-holder, a hollow driving shaft, a block adjustable in one end of the shaft, and a torsion spring having one end attached to the head of the mandrel-holder and the other end to said block.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

RICHARD LUDWIG.

Witnesses:
KARL FINK,
KARL BERTHOLD.