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O. BRIEDE.

ROLLING MILL.

APPLICATION FILED MAY 4, 1903.

Fig. 2.

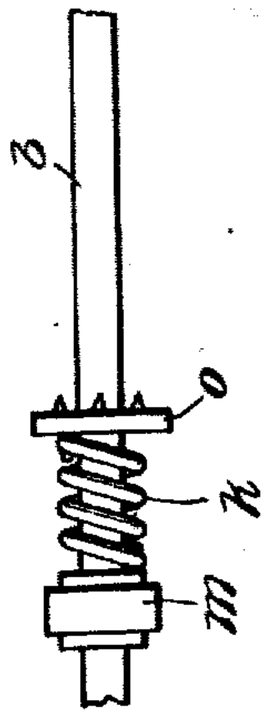
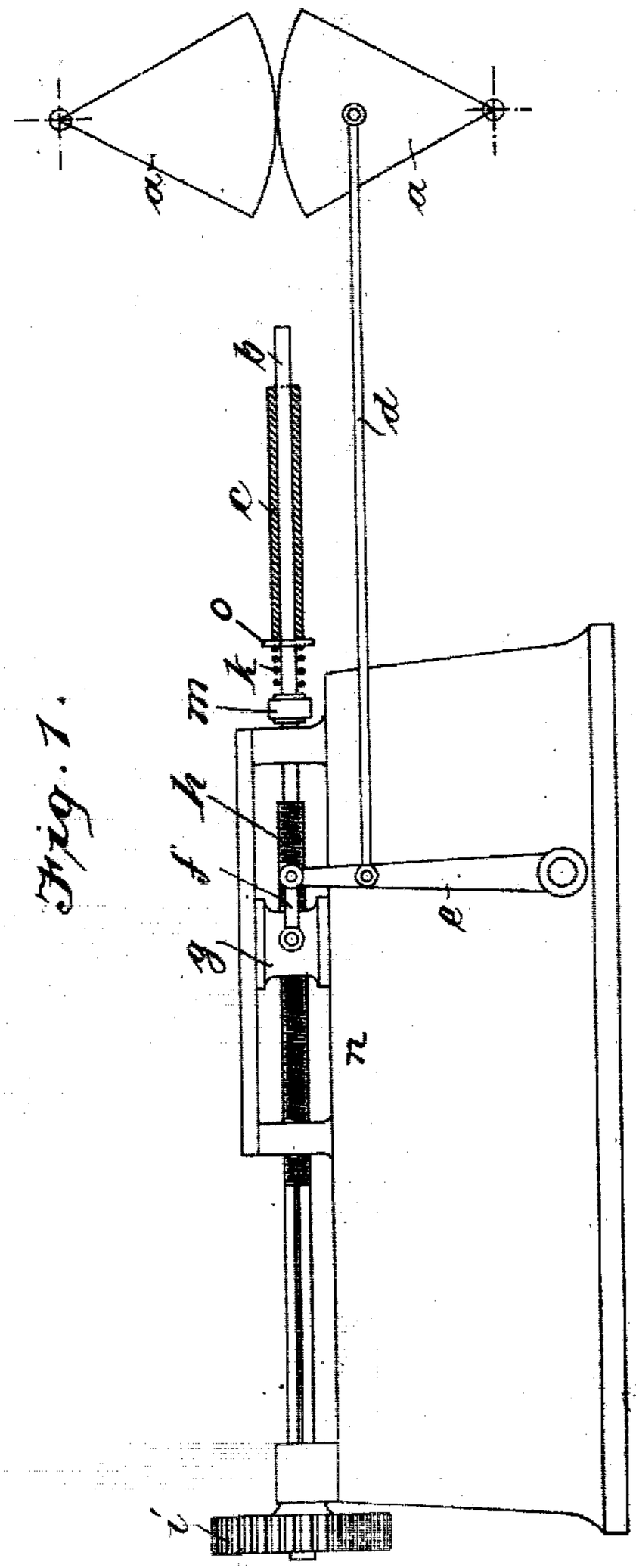


Fig. 1.



Witnesses:
Emil Kayser.
Max Wescher.

Inventor.
Otto Briede.
by Burridge & Burridge
Attorneys.

UNITED STATES PATENT OFFICE.

OTTO BRIEDE, OF BENRATH, NEAR DUSSELDORF, GERMANY.

ROLLING-MILL.

No. 822,879. Specification of Letters Patent. Patented June 5, 1906.

Application filed May 4, 1903. Serial No. 155,599.

To all whom it may concern:

Be it known that I, OTTO BRIEDE, a subject of the King of Prussia, German Emperor, and a resident of Benrath, near Dusseldorf, in the Province of the Rhine, German Empire, have invented certain new and useful Improvements in Rolling-Mills, of which the following is an exact specification.

The invention described herein relates to certain improvements in mills employing oscillating swages or dies for reducing billets, the invention being especially applicable to the production of seamless tubes.

In such mills the billet or ingot to be reduced should follow the movement of the swages or dies, except for a forward feed proportional to the reduction to be effected at each oscillation of the swages or dies. The synchronous movements of the dies or swages and the ingot or billet have been effected by the employment of springs which tend to hold the billet in normal position, but permitting it to be moved by the dies or swages when they bite or operate on the billet. As soon as the dies release the billet it is returned to normal position by the springs. For mechanical reasons it is sometimes desirable to employ means positively connecting the feed mechanism with the swages or dies, so that the latter will be moved positively with the swages. This mechanical connection is generally used in connection with buffing-springs to prevent injury or shock to the mechanism.

The present invention has for its object the provision of means for positively reciprocating the billet, such reciprocation being synchronous with and preferably effected by the oscillating dies or swages. The invention is hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is an elevation of my improved mechanism for feeding the billet to the dies or swages which are represented diagrammatically, and Fig. 2 is a detail view illustrating the manner of connecting the driving-head to the feed-rod.

In the practice of the invention the billet or ingot *c* is held or supported by any suitable means adapted to the article to be operated on and the product desired. In reducing billets or ingots to tubes the holder or support consists of the mandrel *b*, which is secured to the feed-rod *h* by a suitable coupling *m*. The feed-rod is carried by the slide-block or cross-head *g*, and provision is made for giving to the feed-rod a longitudinal movement independent of the sliding block. This can be effected in many ways—as, for example, by forming a threaded portion on the rod adapted to pass through an internally-threaded opening through the sliding block or cross-head *g*, which is movably mounted in suitable guideways on the bed *n* of the mill. The sliding block or cross-head is given a back-and-forth movement synchronous with and equal in amount to the movements of the dies or swages *a*. These ends or results are preferably obtained by connecting the sliding block to one of the dies or swages, as shown, the sliding block being connected by a link *f* to a lever *e*, which in turn is connected by a rod *d* to one of the swages or dies *a*. By this construction the billet or ingot is given a back-and-forth movement equal to and synchronous with the movements of the dies or swages.

Provision is made for imparting a forward or feed movement of the feed-rod independent of the sliding block proportional to the reduction to be effected by the swages during each oscillation. This feed movement can be produced in many ways—as, for example, the feed-rod may be formed with a threaded portion engaging an internally-threaded opening through the sliding block, as described. By the rotation of this feed-rod it, with the holder and ingot, will be advanced without any change in the back-and-forth movement of the sliding block and feed-rod. This forward feed of the billet or ingot should occur at the time the latter is released from the bite of the swages or dies. In other words, the feed of the billets is step by step, or intermittent. Such feed can be effected in many ways without departing from the spirit of my improvement. A convenient means to this end consists in so mounting a power-driven wheel *i* on the feed-rod *h* that the latter will rotate with the wheel, but is free to move longitudinally through the same. If the wheel *i* is driven continuously, a spring *k* is interposed between an abutment on the feed-rod and a head *o*, movably mounted on the billet-holder as the mandrel *b* and serving as a bearing for the billet or ingot. While the billet is gripped by the dies or swages it cannot be fed through between, and hence the forward movement of the feed-rod during such gripping by the dies will result only in the compression of the spring *k*; but as soon

as the billet is released the spring will expand and force the billet forward between the dies or swages. In other words, the feed of the billet or ingot is intermittent.

As heretofore stated, the billet-holder should move back and forth with the dies or swages. In this case means supplementing the operation of the dies or swages in producing these movements are employed and are especially desirable for returning the billet-holder after the swaging action of the dies to the position where feed occurs. During the swaging movement of the dies the latter have such a grip on the billet that there is little liability of slip; but on the return swing when the grip is less effective there may be some slip of the dies on the billet, and hence it is desirable to employ means which will insure the return of the billet and holder to feed position. In the present case this means consists of the connection from the dies or swages to the sliding cross-head.

It is desirable that the ingot or billet should be partially rotated during reduction and preferably at each forward feed. Many ways will readily suggest themselves to those skilled in the art for effecting this rotation, and hence I do not limit myself as regards the terms of the broader claims to the particular construction herein shown and described, although I have found the same well adapted for the purpose. This construction consists in connecting the respective ends of spring *k* to the abutment on the feed-rod and to the head *o*, which is constructed to engage the rear end of the billet, as by prongs or other suitable means. When the feed-rod is rotated in the manner described, while the billet is gripped by the dies or swages, the spring will be placed under a torsional strain, which when the billet is released will become effective to rotate the billet.

It is characteristic of my improvement that by imparting a feed movement to the mandrel just prior to or during each swing of the swages a reduction of the ingot can be effected during both the back and forward oscillations of the swages—as, for example, if when the swages are in the extreme right-hand position and begin to move to the left the shaft *h* is rotated, the swages, as well as the guide-block, will move to the left; but a slight movement of the mandrel and billet to the right will be given, or, in other words, by reason of the rotation of the shaft *h* through the guide-block the ingot will not move as quickly to the right as the swages, the mandrel being advanced by the rotation of the shaft *h* to the right, so that during this movement a rolling out of the ingot will take place. If when the swages are in extreme left position and they commence their return movement to the right the shaft *h* is rotated at the beginning of or during such return movement, the ingot will move with somewhat higher velocity than the swages, so that during this back stroke a rolling out or reduction will occur.

It will be noted that in the swaging apparatus herein described the oscillatory swaging-dies engage or have a bite on the ingot or billet, which except at the brief moment of feed is practically continuous, as a result of which the dies at the time when a feed is desired put the billet in position for such feed and also determine or fix a limit to the amount of feed. In other words, the feed movement of the billet is determined and controlled by the operative faces of the oscillating swages. Although the feed mechanism may be ready for operation at any time, it does not become practically operative to shift the billet forward until the swages reach a position in their oscillation where their bite is relaxed or entirely loosened. When the grip of the swages is relaxed, the billet is moved forward until a portion thereof abuts against the operative faces of the swages. This forward or feed movement will be dependent to a large extent on the reduction previously effected and will be largely independent of the movement of the feed mechanism itself.

The term "feed position" as used herein is used purely for convenience of description. The work of this machine when in operation goes on with a cycle or series of movements which must take place in a certain order, though the order may be varied somewhat in different machines. There must be a feeding movement of the billet, also a reducing stroke or movement of the dies, also a reverse stroke, and at or before the beginning of each feed movement the billet must be brought by die or by conjoint action of the die or other mechanism operating on the billet to a proper position for such feed. In a general way this position is the one I refer to by the term "feed position," and this without reference to its particular place in the cycle of movements except that it must immediately precede the feeding movement; but in practical operation the work usually goes on with such rapidity that the billet rarely, if ever, occupies such feed position for more than an inappreciable time.

I claim herein as my invention—

1. In a swaging apparatus the combination of oscillatory reducing-dies, feed mechanism having a longitudinally-movable member, and means for imparting a reciprocation to the longitudinally-movable member of the feed mechanism equal to and synchronous with the peripheral movement of the swages, substantially as set forth.

2. In a swaging apparatus the combination of oscillatory reducing-dies, a holder for the billet or other article, means for imparting a reciprocatory movement to the holder equal to and synchronous with the periph-

eral movement of the dies, and means for feeding the holder forward step by step, substantially as set forth.

3. In a swaging apparatus the combination of oscillatory reducing-dies, a holder for the billet or other article, means for causing the holder to have a movement equal to and synchronous with the peripheral movement of the dies, means for feeding the holder forward step by step, and means for rotating the article, substantially as set forth.

4. In a swaging apparatus the combination of oscillatory reducing-dies, a reciprocatory cross-head operated by said dies, a feed-rod carried by the cross-head, and means for adjusting the feed-rod relative to the cross-head, substantially as set forth.

5. In a swaging apparatus the combination of oscillatory reducing-dies, a reciprocatory cross-head operated by and synchronously with said dies, a feed-rod carried by the cross-head, and provided with means for engaging the article, and means for rotating the feed-rod, substantially as set forth.

6. In a swaging apparatus the combination of oscillatory reducing or swaging dies, a reciprocatory cross-head connected to said dies, a feed-rod carried by the cross-head, and a head having a longitudinally-yielding connection to the feed-rod, substantially as set forth.

7. In a swaging apparatus the combination of oscillatory swaging or reducing dies, a feed-rod movable synchronously with the dies, means for rotating the feed-rod, a head adapted to engage the article operated on, and a rotary yielding connection between said head and feed-rod, substantially as set forth.

8. In a swaging apparatus the combination of oscillatory reducing dies or swages, a longitudinally-movable mandrel carrying the ingot, means for causing the mandrel to move synchronously with the oscillatory dies or swages, and means for feeding forward the mandrel on each swing of the swages, substantially as set forth.

9. In a rolling-mill for rolling seamless metal tubes the combination of oscillatory swages and a longitudinally-movable mandrel carrying the ingot, means for positively connecting the mandrel to the oscillatory swages so as to compel the mandrel to positively follow the movement of the swages, and means for feeding the mandrel.

10. In a rolling-mill for rolling seamless metal tubes, the combination of oscillating swages and a longitudinally-movable mandrel carrying the ingot, means for causing the mandrel to move synchronously with the oscillatory swages and means for feeding the mandrel.

11. In a forging-machine the combination of oscillatory dies or swages, an ingot or billet holder movable by the dies or swages, means for returning the holder to feed position when released from the dies or swages, means for feeding the holder toward the dies or swages, and resilient means for rotating the holder, substantially as set forth.

12. In a forging-machine the combination of oscillatory dies or swages, means for causing the billet or other article to reciprocate synchronously with the dies or swages and means for exerting a constant feeding pressure on the billet or other article, substantially as set forth.

13. In a swaging apparatus, the combination of oscillating rolls carrying swaging-dies, a cross-head operated by and synchronous with said rolls, a feed-rod carried by the cross-head and provided with means for engaging the article, and means for rotating the feed-rod, substantially as set forth.

14. In a swaging apparatus, the combination of oscillating rolls carrying swaging-dies, a cross-head operated by said rolls, a feed-rod carried by the cross-head, and a head yieldingly connected to the feed-rod, substantially as set forth.

15. In a swaging apparatus, the combination of oscillating swages or reducing-dies, a feed-rod movable synchronously with the dies, means for rotating the feed-rod, a head adapted to engage the article operated on, and a yielding connection between said head and feed-rod, substantially as set forth.

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

OTTO BRIEDE.

Witnesses:
MAX WESCHER,
WILLIAM ESSENWEIN.