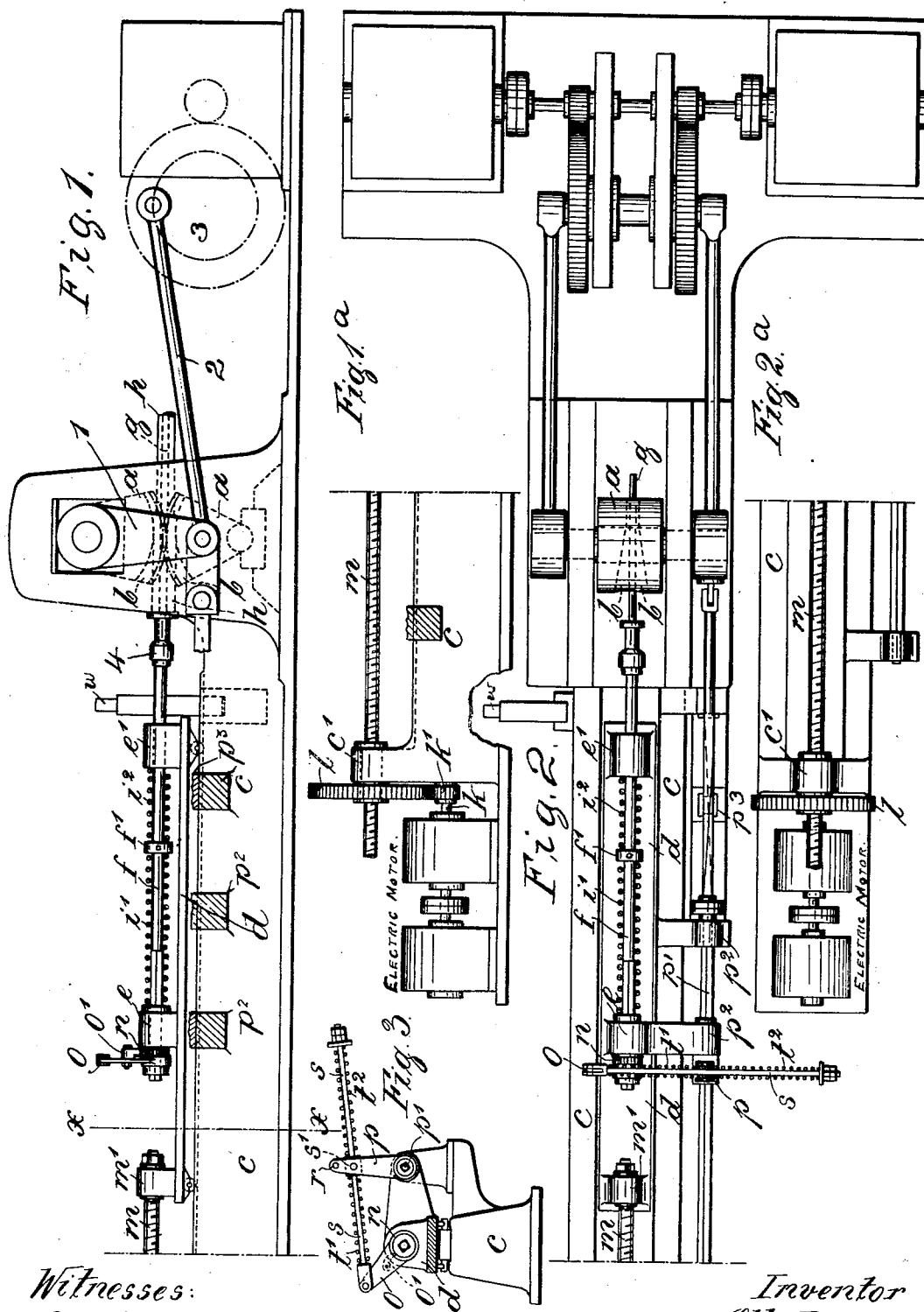


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O. BRIEDE.
FORGING MACHINE.
APPLICATION FILED FEB. 3, 1903.



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OTTO BRIEDE, OF BENRATH, NEAR DUSSELDORF, GERMANY.

FORGING-MACHINE.

No. 822,878.

Specification of Letters Patent.

Patented June 5, 1906.

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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 Forging-Machines, of which the following is an exact specification.

The invention described herein relates to certain improvements in forging-machines, such improvements being more especially applicable for the production of seamless tubes.

The invention has for its object a construction and combination of parts whereby the ingot or billet is moved back and forth by and with the swaging-dies and is also given a forward feed and partial rotation through the dies.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side elevation of my improved forging-machine, the mechanism for rotating the billet being broken away. Fig. 1^a is a continuation of Fig. 1. Fig. 2 is a top plan view of a portion of the swaging-machine. Fig. 2^a is a continuation of Fig. 2, and Fig. 3 is a sectional elevation on a plane indicated by the line X X, Fig. 1.

In the practice of my invention the swages or dies *a* are secured to journals mounted in a suitable housing. The movement of the dies is effected from the driving mechanism through pitman 2 and arm 1, as shown in Figs. 1 and 2. These dies or swages are provided with grooves the diameter of which increases from one end to the other end. The ingot or billet to be operated on is held and supported by a suitable holder, which may be of any form or construction adapted to the article to be reduced. In the construction shown such holder consists of a mandrel *g*, having a shoulder or abutment at its rear end and connected by a coupling 4 to the feed-rod *f*. This feed-rod is movably mounted in bearings or abutments *e e'* on the carriage or slide *d*. In order that the feed-bar may move at certain times with the slide or carriage and at other times independent thereof, springs *i'* and *i²* are interposed between the bearings or abutments *e e'* and a collar or abutment *f* on the feed-bar. As the feed-bar is drawn forward by the swages

in swinging to the right the spring *i²* will be compressed; but when the swages or dies swing in the opposite direction the spring *i'* will be compressed, and when the ingot or billet is released from the bite of the dies or swages the spring under the greater tension will become operative to shift the feed-bar. The slide or carriage *d* can be shifted back and forth by any suitable means—such, for example, as that shown, consisting of a threaded rod *m*, extending through the bearing *c'* on the bed of the machine, and a power-driven wheel *l*.

The rod *m* is, as stated, threaded and engages the internally-threaded hub of the wheel, which is provided with a hollow journal extending into the bearing *c'*, so that the wheel will be held from movement, but free to rotate. A suitable means for rotating the wheel *l* consists of electric motors, as indicated, having a spur-wheel *k'* on their armature-shaft and engaging the wheel *l*, which in this case is suitably toothed. As these motors will operate continuously, and thereby effect a continuous movement of the carriage or slide *d* toward the swages, it is evident that during a portion of the time—*i. e.*, when the swages swing to the left—the spring *i'* will be under considerable compression. When, however, the swages release the ingot at the end of their movement, the spring *i'* will expand and thrust the feed-bar forward, causing the ingot or billet to further enter in between the swages. Hence although the feed mechanism—*i. e.*, the slide—and the parts actuating the same move continuously the feed of the billet or ingot in between the swages will be intermittent.

Any suitable or desirable means may be employed for imparting rotation to the feed-bar and the article carried thereby. A convenient means to this end consists of a ratchet-wheel *n*, having a journal mounted in the bearing *e* of the slide or carriage, so that the ratchet-wheel will be free to turn, but will be held as against any movement with the feed-bar *f*, which has its rear portion angular in cross-section and passes through the ratchet-wheel *n*. An arm or lever *o* is provided with a pawl adapted to engage the ratchet-wheel and is connected by a bar *s* to an arm *p*, extending from a head which is journaled in a bearing *p²* of a longitudinally-movable rod *p'*. This rod *p'* is

made angular in cross-section and passes through a similar opening in the head of the arm p , so that by a rotation of the arm p' the arm p will be swung correspondingly. The rod p' is adapted to be shifted back and forth by any suitable means—*e. g.*, by one of the arms 1, connected to the swages. The rod p' has a swiveled connection with this arm, so that it can be free to rotate. The rotation of the rod p' is effected by means of fixed nut p^3 , through which the angular portion of the rod p' is moved, such portion being also given a partial twist. By this construction a rotation to the feed-rod will be effected by the movement of the swages. It is not necessary to specifically time this rotation of the feed-rod, for the reason that provision is made for the movement of the driving-arm p without affecting the feed-rod. This provision consists of springs t' and t'' , arranged on opposite sides of a swiveled block mounted on the arm p , so that such arm can move freely back and forth without swinging the lever o , such movement merely compressing one or the other of the springs. As soon as the ingot or billet is released from the swages after a compression of the springs t' and t'' such spring can expand, and thereby impart the desired rotation to the feed-bar and the article carried thereby.

In order to strip the finished tube from the mandrel, suitable means, such as an arm, as indicated at w , is pivotally connected to one side of the bed and in such relation to the mandrel and feed-bar that it may be turned down to engage the finished tube and hold the same as against movement while the mandrel is being drawn back out of the tube.

It is characteristic of my preferred form or construction of forging mechanism that the feed mechanism is so constructed that the feed-pressure is constantly exerted on the billet or other article, so that the instant the frictional grip of the swages is reduced sufficiently the billet or other article will move forward until checked by contact of portions of the billet with the operative faces of the swages. This obviously will require that the spring acting on the mandrel-stem or billet-carrier should be under feed tension at the moment the swages release the billet. This end is best attained by maintaining the spring under constant tension and regulating or varying the amount or degree of the tension as required by conditions of use. In other words, pressure is stored up and effects a forward or feed movement of the billet; but this pressure should be such as not to prevent the reverse movement of the billet. The loosening of the grip of the swages on the billet occurs when enlarged portions of the grooves move across a plane passing through the axes of oscillation of the dies or swages, as the feed occurs when the enlarged portions of the grooves pass through a certain portion of the

arc of oscillation of the dies or swages, and as the feeding-pressure on the billets is constant it follows that the amount of feed exerted at any one time is dependent upon the rate of movement of enlarged or feeding portions of the grooves through such arc, or, in other words, the rate of feed of the billet is controlled primarily and to a great extent by the rate of oscillation of the dies or swages.

It will readily be seen that in a machine of this construction and operation, especially if it be operated at a high speed, the billet as it is being reduced will in each movement forward and back receive a considerable momentum and a momentum which should be promptly arrested. To attain this end, a suitable means of resistance should be employed by which to arrest any excess of momentum. Springs suitably arranged on the mandrel-stem are believed to be the best for this purpose, and such springs are illustrated herein. Of course their strength or tension of resistance should be suitably proportioned with reference to this end, and their resilience may be utilized in effecting the return movement of the billet with reference to the continuance of the operation described.

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 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 forging-machine, the combination of oscillatory dies or swages, an ingot or billet holder movable back and forth substantially synchronous with the dies or swages, and means for feeding the holder toward the dies or swages when released from the dies or swages, substantially as described.

2. In a forging-machine, the combination of oscillatory dies or swages, an ingot-holder movable back and forth substantially synchronous with and by the dies or swages, and means for feeding the holder toward the dies or swages when released from the dies or swages, substantially as described.

3. In a forging-machine, the combination of oscillatory dies or swages, an ingot-holder movable back and forth substantially synchronous with the dies or swages, and resilient means for feeding the holder toward the dies or swages when released from the dies or swages, substantially as described.
4. In a forging-machine the combination of oscillatory swages or dies, an ingot or billet holder spring-held in each direction and movable back and forth by the dies and means for feeding the holder toward the dies or swages, substantially as described.
5. In a forging-machine the combination of oscillatory dies or swages, an ingot or billet holder movable back and forth substantially synchronous with and by the dies or swages and a resilient means for feeding the holder toward the dies or swages, substantially as described.
6. In a forging-machine the combination of oscillatory dies or swages, a movable carriage or slide, a feed-bar movably mounted in bearings on said slide or carriage and adapted to be reciprocated by the swages, springs interposed between said bearings and an abutment or shoulder on the feed-bar, and means for shifting the carriage or slide, substantially as described.
7. In a forging-machine the combination of oscillatory dies or swages, a movable carriage or slide, a feed-bar movably mounted in bearings on said slide or carriage, springs interposed between said bearings and an abutment or shoulder on the feed-bar and a continuously-operating means for shifting the bearings or carriage, substantially as described.
8. In a forging-machine the combination with swaging-tools and means for actuating them, a rotatable ingot-holder, a spring for exerting pressure to turn the ingot-holder, and means for applying tension to the spring during the swaging action, substantially as described.
9. In a forging-machine the combination of two sector-formed pieces provided with grooves, the diameter of which increases from one end to the other, with means for oscillating these pieces, an ingot-holder, a sliding carriage in which said holder is journaled, means for resiliently connecting one of said sector-formed pieces to said ingot-holder for exerting pressure to turn said ingot-holder and means for shifting the ingot-holder independent of the carriage, substantially as described.
10. In a forging-machine the combination with swaging-tools, and means for actuating them, of a rotatable holder, resilient means for applying turning pressure to the holder during the action of the swaging-tools and means for advancing the ingot, substantially as described.
11. In a forging-machine the combination of the swaging devices, an ingot-holder, with a slide, d , carrying the ingot-holder and springs $i' i^2$, provided between this slide and the ingot-holder, means for moving the slide, d , and a lever o , for rotating the ingot-holder, the lever, p , and bar, s , passing freely through and connecting the same to the lever o , and spiral springs, $t' t^2$, arranged on opposite sides of the lever p and adapted to exert a yielding pressure on the lever o , and means operated by the swages for shifting the lever p , substantially as described.
12. In a rolling-mill the combination of oscillatory swaging devices, an ingot-holder and a mechanical connection interposed between the ingot-holder and the swages and comprising a shaft reciprocated by the swages during their oscillation and means adapted to be operated by the shaft for rotating the ingot-holder, substantially as described.
13. In a forging-machine the combination of oscillatory dies or swages, means for supporting the billet or other article and adapted to permit the billet to reciprocate synchronously with the dies or swages and means for constantly exerting resilient feeding pressure on the billet or other article, substantially as described.
14. In a forging machine the combination of oscillating dies or swages, a resilient or spring member, and a billet-holder free to move longitudinally at all times except as controlled by said dies and by resilient spring action.
15. In a forging-machine the combination of oscillatory dies or swages, an ingot-holder movable back and forth, substantially synchronous with the dies or swages, and means permitting the reciprocation of the ingot-holder and adapted to effect a forward or feed movement of the holder on the release of the ingot by the swages, substantially as described.
16. In a forging-machine the combination of oscillatory dies or swages, an ingot-holder movable back and forth substantially synchronous with the dies or swages, mechanism for effecting a forward or feed movement of the ingot-holder, and means permitting a reciprocation of the ingot-holder independent of the feed or forward movement and adapted to render the feed effective on the release of the ingot from the bite of the swages.
17. In a forging-machine the combination of oscillatory swages means for rotating the billet or other article comprising a rotary member and mechanism for rotating the same, said mechanism including a yielding element adapted to exert a yielding force on the rotary member while the billet is gripped by the swages and to become effective to rotate said member when the billet is released.
18. In a forging-machine, the combination of swaging-tools, means for actuating them, a rotatable holder, means for turning the holder

operative during the action of the swaging-tools, and having a yielding connection to the holder whereby the turning means becomes operative to turn the holder when the latter is released from the dies or swages, and means
5 for advancing the ingot, substantially as described.

19. In a machine for forging tubes, the combination of oscillatory dies or swages, a
10 mandrel movable back and forth substantially synchronous with the dies or swages, and means for feeding the mandrel toward the dies or swages, when released from the dies or swages, substantially as described.

15 20. In a machine for forging tubes, the combination of oscillatory dies or swages, a mandrel movable back and forth substantially synchronous with and by the dies or swages, and means having a yielding connection with the mandrel for feeding the latter
20 toward the dies or swages when released therefrom, substantially as described.

21. In a forging-machine the combination of oscillatory dies or swages, a billet-carrier
25 adapted to permit the billet to reciprocate with respect thereto synchronously with the dies or swages and means for exerting a constant pressure on the carrier to feed the billet.

22. In a forging-machine the combination
30 of a carrier adapted to permit the billet to move back and forth with respect thereto, oscillatory dies or swages adapted to engage

the billet and impart to it a back and forth movement, means for imparting a feed movement to the carrier and a yielding resistance
35 device adapted to operate against the billet while being reduced.

23. In a forging-machine the combination of oscillatory dies or swages, a billet-carrier and means for exerting constantly a feeding
40 pressure on the carrier during the reduction of the billet.

24. In a forging-machine the combination of a carrier provided with means whereby the billet may move back and forth with respect
45 thereto, oscillatory dies or swages adapted to engage the billet and impart to it a motion in both directions forward and back, means for imparting a feed movement to the carrier and a yielding resistance device arranged to operate against the billet on its reverse motion.
50

25. In a forging-machine the combination of oscillatory dies or swages, a carrier provided with yielding means for supporting the
55 billet and means for exerting a constant feeding pressure on the carrier.

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

OTTO BRIEDE.

Witnesses:

PETER LIEBER,
ERNEST ANDRÉ.