Aug. 11, 1925.

1,549,527

J. FIELDING

TUBE FORGING APPARATUS

Filed March 6, 1923

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Fig. 3.

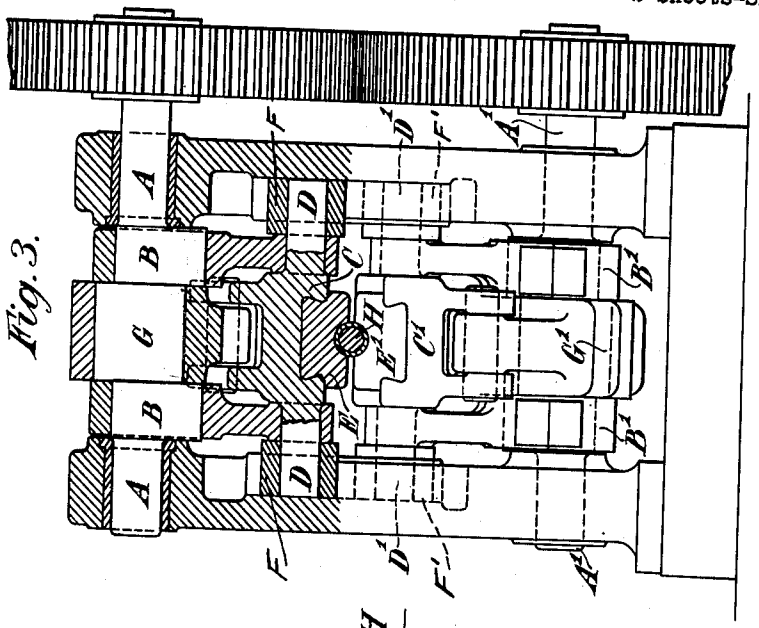


Fig. 2.

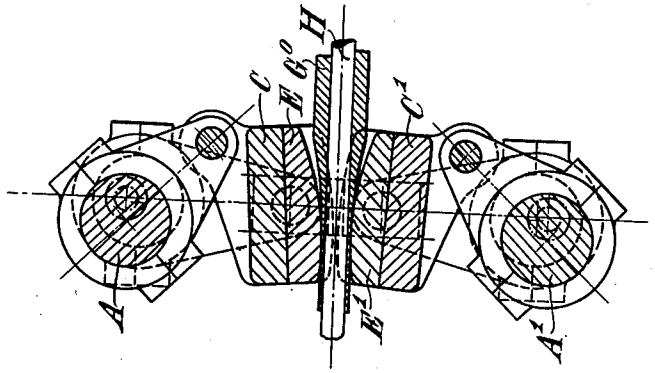
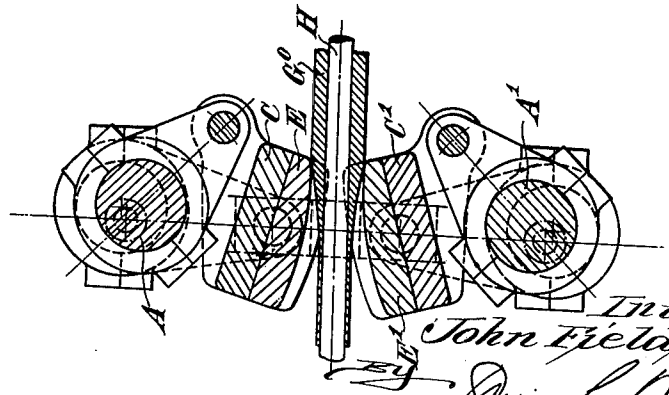


Fig. 1.



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Fig. 6.

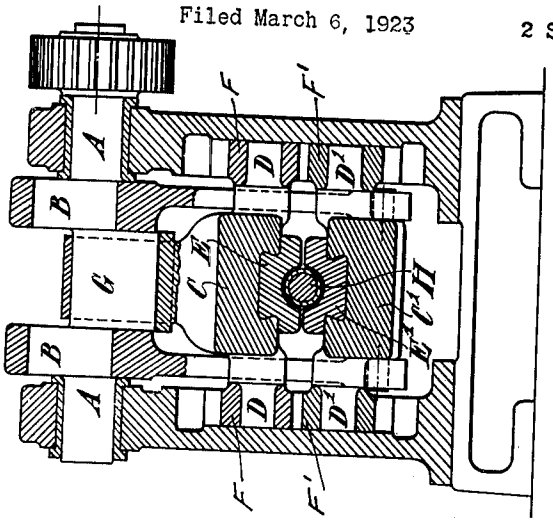


Fig. 5.

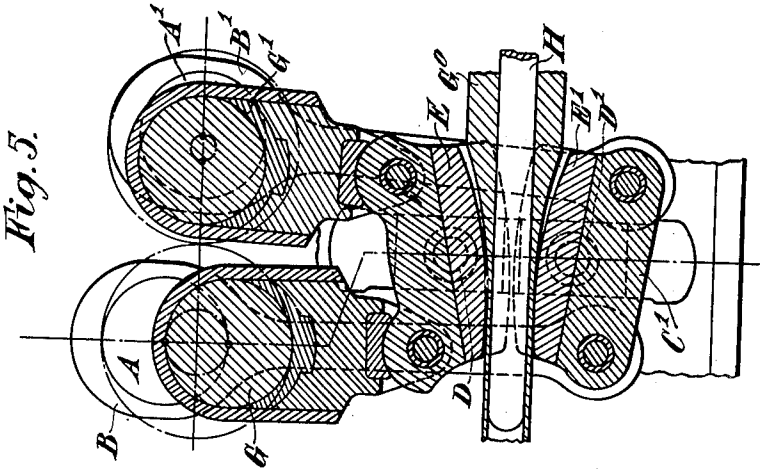
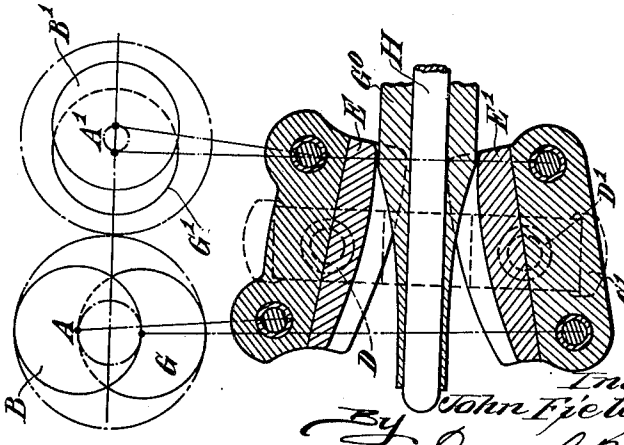


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN FIELDING, OF GLOUCESTER, ENGLAND.

TUBE-FORGING APPARATUS.

Application filed March 6, 1923. Serial No. 623,235.

To all whom it may concern:

Be it known that I, JOHN FIELDING, a subject of the King of Great Britain, residing in Gloucester, England, have invented certain new and useful Improvements in Tube-Forging Apparatus, of which the following is a specification.

This invention relates to the production of tubes or tubular bodies from hollow billets or blanks, carried by a mandrel, by means of reciprocating swages or dies which intermittently close on the billet in pairs to apply a reducing pressure and are arranged to oscillate simultaneously about longitudinal axes so that the working faces of the swages have a rolling action on the billet.

One object of the invention is to provide an improved construction of such apparatus in which the stresses transmitted to the frame are substantially balanced.

Another object is to provide a construction of such apparatus in which the amplitude of the oscillating movement imparted to the swages is not determined solely by the amplitude of the reciprocating radial movement of the swages.

The first object is attained by reciprocating the opposing swages in synchronism with each other but in opposite phase by means of cranks or eccentrics on a single operating shaft, one swage holder being preferably actuated by a central thrust rod and the other by a pair of rods in tension, symmetrically disposed on each side.

The second object is attained by effecting the oscillating movement of the swages about their horizontal pivots by means of a second set of eccentrics or cranks upon the same operating shaft or upon a separate shaft, preferably located upon the same side of the work, which can be run at any required speed relatively to the aforesaid operating shaft by which the reciprocating radial movement of the swages is effected. The oscillating movement is preferably imparted to the opposing swages by means of a central thrust rod actuating one swage holder and a pair of rods in tension actuating the other holder and symmetrically disposed on each side of the central thrust rod, so that in this case also the stresses are substantially balanced.

The arrangement of a single operating shaft or two shafts disposed on the same side of the work reduces the height of the apparatus, apart from the other advantages accruing from this construction.

These and other features of the invention are more specifically described with reference to the accompanying drawings wherein—

Fig. 1 is a central vertical section through the axis of the billet and mandrel showing one arrangement of the swages and their driving mechanism at the beginning of the operative stroke; Fig. 2 is a corresponding view showing the position of the parts at the end of the operative stroke;

Fig. 3 is an end elevation partly in section of a machine embodying the aforesaid arrangement of the swages and their driving mechanism;

Figs. 4, 5 and 6 are views corresponding respectively with Figs. 1, 2 and 3 showing a modified construction.

In the construction shown in Figs. 1 to 3 the reciprocating and oscillating movements of the swages are derived from two shafts A, A′ geared together to rotate at equal speeds in opposite directions and disposed respectively on opposite sides of the blank G^o upon which the reciprocating swages E, E′ operate. Each of the shafts A, A′ has three eccentrics, viz, a centrally disposed eccentric, G and G′ respectively, and a pair of cooperating eccentrics, B, B and B′, B′ respectively, arranged one on either side of the central eccentric.

The straps of the two pairs of eccentrics B, B and B′, B′ operate to reciprocate slippers F, F′ respectively in radial guides synchronously but in opposite phase, as for example by being pivotally connected with trunnions D, D′ respectively of the swage holders C, C′, which trunnions are journalled in the radially guided slippers F, F′.

The straps of the eccentrics G, G′ are pivotally connected with the swage holders C, C′ at points symmetrically displaced from the trunnions D, D′ and operate to oscillate the swages about their trunnion axes.

The throw of the eccentrics B, B, G and B′, B′, G′ and the phase relation of the eccentrics G, G′ with the respective pairs of eccentrics B, B and B′, B′ are such as to effect the required simultaneous radial and pivotal movements of the swages.

In the modification illustrated in Figs. 4 to 6 the slippers F, F′ are shown as guided radially with respect to the axis of the bil-

let. In this construction there are two parallel operating shafts A, A′ on the same side (as shown in the drawings on the upper side) of the blank, which shafts are geared to rotate at the same speed in opposite directions and have two sets of eccentrics each, viz, a centrally diposed eccentric G and two eccentrics B, B on either side thereof on shaft A, and a similarly disposed set of eccentrics G′ and B′, B′ on shaft A′.

The straps of eccentrics G, G′ are pivotally connected with the upper swage holder C at points on opposite sides of the trunnions D, and the straps of the two pairs of the eccentrics B, B and B′, B′ are pivotally connected with the lower swage holder C′ at similarly disposed points on opposite sides of the trunnions D′, the arrangement being such that one of the eccentrics or pairs of eccentrics imparts a thrust to one swage holder at one side thereof and a simultaneous pull to the other swage holder at the corresponding side, while the other set of eccentrics is applying in the same manner a simultaneous thrust and pull respectively to the swage holders at corresponding points on the other side of the trunnions, the phase relation and throw of the two sets of eccentrics being such as to impart the requisite reciprocating and oscillating movements to the swages.

The oscillation of the opposing swages upon their linearly guided horizontal trunnions is such that the entrance ends of the swages, which are curved or flared as shown in the drawings from their entrance or front ends towards their rear ends, will first engage the blank and then successively from point to point along their length the remaining surface of the swages will come into action, leaving always a gap between the surfaces of the blank and of the swages in advance of the momentarily operative portion of the latter so as to permit the free flow of the metal displaced by the swages. The swages themselves are preferably removably mounted in the swage holders for convenience of substitution or replacement. It will be obvious that there may be more than one pair of opposing swages, each pair being brought successively into operative engagement with the blank.

As is usual in apparatus of this kind the hollow blank or billet is carried on a mandrel H which determines the internal diameter of the finished tube and which in turn is carried by the ram of a hydraulic cylinder axially aligned with the swaging dies or by an equivalent device, whereby the billet can be fed through the swages. Such feeding devices are of known character and it has not been deemed necessary to describe or illustrate such a device as it forms no part of the present invention, but the feeding device should be of such a character as to permit the mandrel and billet to be rotated slightly between successive operative strokes of the swages, as by means of a small electric motor geared with the mandrel holder through worm gearing and a slip clutch which permits the motor to continue to drive the worm gear when the billet is gripped by the swages without rotating the mandrel.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:—

1. An apparatus for producing tubes or tubular bodies from hollow billets or blanks carried by a mandrel, comprising a pair of opposing swages having horizontal trunnions, linear guides for said trunnions, means for reciprocating the swages towards and from the blank and means for oscillating the swages upon said trunnions.

2. An apparatus for producing tubes or tubular bodies from hollow billets or blanks carried by a mandrel, comprising a pair of opposing swages having horizontal trunnions, radial guides for said trunnions, means for reciprocating the swages towards and from the blank and means for oscillating the swages upon said trunnions.

3. An apparatus for producing tubes or tubular bodies from hollow billets or blanks carried by a mandrel comprising opposing swages and means for reciprocating said swages towards and from the blank, said means comprising eccentric elements arranged to impart a thrust to one of the opposing swages and a simultaneous pull to the other of the opposing swages.

4. An apparatus for producing tubes or tubular bodies from hollow billets or blanks carried by a mandrel, comprising opposing reciprocating swages, comprising means for oscillating the opposing swages about horizontal axes simultaneously with the reciprocation of the swages, said oscillating means comprising eccentric elements arranged to impart a thrust to one swage at a point displaced laterally from its horizontal axis and a simultaneous pull to the opposing swage at a correspondingly situated point thereof.

5. An apparatus for producing tubes or tubular bodies from hollow billets or blanks carried by a mandrel, comprising an operating shaft, eccentric elements mounted on said shaft, a pair of opposing swages and connections between said swages and said eccentric elements adapted to impart a simultaneous thrust and pull to the said swages.

6. An apparatus for producing tubes or tubular bodies from hollow billets or blanks carried by a mandrel, comprising an operating shaft, eccentric elements mounted thereon, a pair of opposing swages and connections between said swages and said eccentric

elements adapted to impart oscillating movement to the swages.

7. An apparatus for producing tubes or tubular bodies from hollow billets or blanks carried by a mandrel comprising two shafts geared with each other, eccentric elements mounted on said shafts, a pair of opposing swages and connections between said swages and said eccentric elements adapted to impart reciprocating and oscillating movements to the said swages.

In testimony whereof I have signed my name to this specification.

JOHN FIELDING.