March 1, 1932. E. VOLLMERHAUS 1,847,200

PIPE BENDING MACHINE

Filed Sept. 21, 1929

Fig. 1.

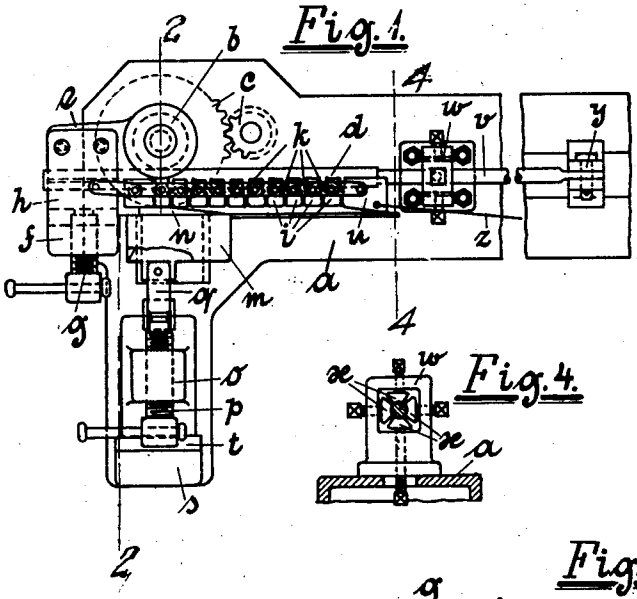


Fig. 2.

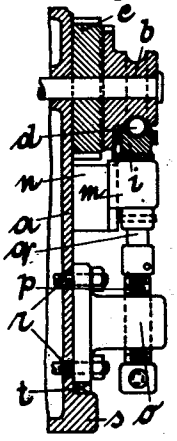


Fig. 4.

Fig. 3.

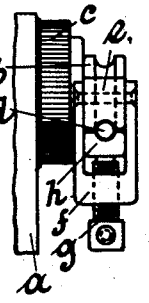


Fig. 5.

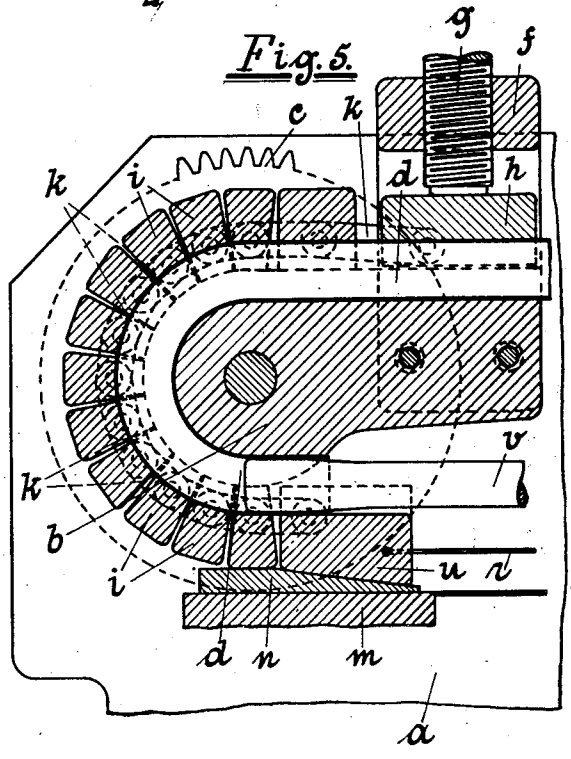


Fig. 6.

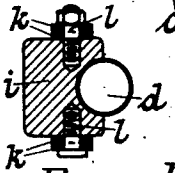


Fig. 7.

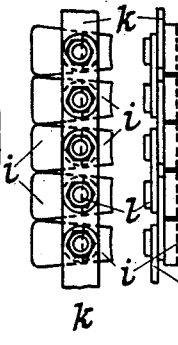
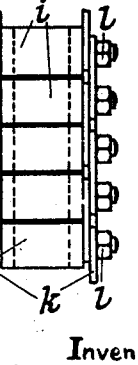


Fig. 8.



Inventor:
Ewald Vollmerhaus.
Attorney:

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UNITED STATES PATENT OFFICE

EWALD VOLLMERHAUS, OF HAGEN IN WESTFALEN, GERMANY

PIPE BENDING MACHINE

Application filed September 21, 1929, Serial No. 394,225, and in Germany July 25, 1929.

My present invention has for its object to provide a bending machine for bending seamless boiler tubes, welded steam and gas pipes and other similar metal tubes or pipes on a comparatively very little bending radius and in a cold state.

Heretofore boiler or similar tubes of steel or other hard material with thin or thick walls to be bent according to a little bending radius would not be bent otherwise than in a hot state, because it was not possible to bend them in a cold state in the known bending machines and devices. The minimum radius which it was possible to bend in a cold state was about 4 to 5 times the diameter of the tube. However it is also desired to have bends with a radius of about 1½ times the diameter of the tube and for this operation the known bending machines and devices were not convenient. Such bending had to be made in a hot state of the tubes which was expensive in fuel, time, work and other expenses.

The improved bending machine provided by my present invention comprises a chain formed of individual members or links, which will be closely applied against each other at the bending point of the tube in the bending operation, said members or links being apertured or recessed according to the radius of the tube, whereby they are enabled to embrace the tube on the outer half portion of the surface to be bent. The inner half portion of the surface of the tube will be embraced in the well known way by the known bending body, whereby the tube will be completely embraced not only at the bending point in the bending operation, but also on the complete bent portion or length. Consequently a distortion of the tube in the bending operation will be completely impossible.

In the accompanying drawings I have illustrated one preferred embodiment of my invention.

Fig. 1 is a top plan view of my improved bending machine;

Fig. 2 is a cross section on line 2—2 of Fig. 1.

Fig. 3 is a fragmentary elevation.

Fig. 4 is a cross section on line 4—4 of Fig. 1.

Fig. 5 is an enlarged horizontal section of the bending members, and

Figs. 6 to 8 show details of the bending chain.

Referring to the drawings *a* is the machine frame and *b* is the known bending body rotatably mounted on said frame and adapted to be rotated in the well-known way by means of gear-wheels *c* in the bending operation. The bending body *b* has an extension or arm *e* recessed according to the radius of the tube to be bent and connected to a clamping device *f* provided with a tightening screw *g* and a clamping jaw *h* recessed according to the radius of the tube.

Upon tightening the screw *g*, the tube *d* will be firmly clamped.

Arranged on the outer surface of the tube *d* is a bending chain formed of links *i* and side plates *k*. The side plates *k* are pivotally connected to the links *i* as near as possible to the sides of the tube and the first link is arranged on the clamping device *f*. The links *i* of the chain are recessed according to the radius of the tube *d* and connected to each other in such a way that in the bending operation they will be closely applied against each other at their inner edges, as best shown in Fig. 5, whereby the tube *d* will be completely embraced on its entire periphery at the bending point as well as in the bending operation on the whole length or portion bent. Therefore it will not be possible for the tube *d* to be distorted at any point and in any direction.

Provided at the bending point is a pressure member *m* having a bevelled pressure strip *n*. The pressure member *m* is slidably arranged and adapted to be pressed against the chain by means of a screw threaded spindle *p* screwed into a slide *o* and acting on an intermediate pressure bolt *q*. The latter is detachably connected to the pressure member *m* and threaded spindle *p* and upon the backward rotation of the latter said pressure bolt *q* will move the pressure member *m* backwardly. The slide *o* is prevented from being moved by the high pressure pro-

duced in the bending operation by fastening screws r and moreover by a strip t inserted behind an extension or shoulder s on the machine frame a or by a threaded spindle (not shown) to be applied thereto.

Arranged at the end of the bending chain is a link u having an outer bevelled face and intended to be moved against the pressure strip n at the end of the bending operation, as clearly shown in Fig. 5, whereby the end of the tube d will be prevented from being flattened upon the removal of the well known bending mandrel v. It will be obvious that the link or member u may be omitted.

The bending mandrel v is supported in a bracket w arranged the nearest possible to the bending point, in order to prevent said mandrel from being bent, which would occur owing to the excessive stresses produced in the bending operation on a little radius without said bracket w, omitted in known bending machines. Referring to Fig. 4 the bracket w has jaws x adjustable by means of screws, whereby the bending mandrel may be adjusted exactly. The bending mandrel v may be moved and locked in position by means of the well known slidable bracket y.

Attached to the bending chain is a cord or cable z, provided with a weight and serving to remove said chain upon the bending of the tube d.

After the tube d has been clamped in the clamping device f, the first link i of the bending chain will be pressed against the tube d by means of the pressure strip n by the tightening of the threaded spindle p, whereby the tube d will be firmly pressed against the bending body b. Upon the rotation of the bending body b the bending chain will be drawn forwardly. Thus it will be seen that the tube d will be completely enclosed on its entire periphery from the beginning of the bending and during the whole bending operation, because the bending chain is permanently under the high pressure required for bending the tube d. Therefore the tube cannot be distorted and the links i of the bending chain will produce a stretching or drawing and smoothing action on the walls of the tube, whereby the formation of folds and grooves will be prevented.

Having now fully described my said invention, what I claim and desire to secure by Letters Patent, is:

1. In a pipe bending machine the combination with a suitable frame, a rotatable bending body and a slidable bending mandrel on said frame, of a bending chain having links adapted to embrace the outer surface of the tube or pipe to be bent in a cold state and connecting plates pivotally connected to said links on pivots tangent to the surfaces of the links that engage the outer portion of the bent pipe.

2. In a pipe bending machine the combination with a suitable frame, a rotatable bending body and a slidable bending mandrel on said frame, of a bending chain having links adapted to embrace the outer half surface of the tube or pipe to be bent in a cold state and connecting plates pivotally connected to said links on pivots tangent to the surfaces of the links that engage the outer portion of the bent pipe, a pressure strip or bar having a bevelled working face, and means for slidably displacing said bevelled bar towards the links of the chain whereby the latter will be pressed against the tube or pipe to be bent.

3. In a pipe bending machine the combination with a suitable frame, a rotatable bending body and a slidable bending mandrel on said frame, of a bending chain having links adapted to embrace the outer half surface of the tube or pipe to be bent in a cold state and connecting plates pivotally connected to said links on pivots tangent to the surfaces of the links that engage the outer portion of the bent pipe, a particular end link having a bevelled outer face on said bending chain, a pressure strip or bar having a bevelled working surface, and means for slidably pressing said bevelled bar against said bevelled end link.

4. In a pipe bending machine the combination with a suitable frame, a rotatable bending body and a slidable bending mandrel on said frame, of a bending chain having links adapted to embrace the outer half surface of the tube or pipe to be bent in a cold state, and connecting plates pivotally connected to said links on pivots tangent to the surfaces of the links that engage the outer portion of the bent pipe, a bracket supporting the bending mandrel immediately after the end link of the bending chain, and adjustable jaws on said bracket.

5. In a pipe bending machine the combination with a suitable frame, a rotatable bending body and a slidable bending mandrel on said frame, of a bending chain having links adapted to embrace the outer half surface of the tube or pipe to be bent in a cold state and connecting plates pivotally connected to said links on pivots tangent to the surfaces of the links that engage the outer portion of the bent pipe, and a cord or cable charged with a suitable weight attached to said bending chain.

EWALD VOLLMERHAUS.