Sept. 21, 1926.

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A. KLARWASSER

PIPE BENDING MACHINE

Filed June 24, 1925

Fig. 1

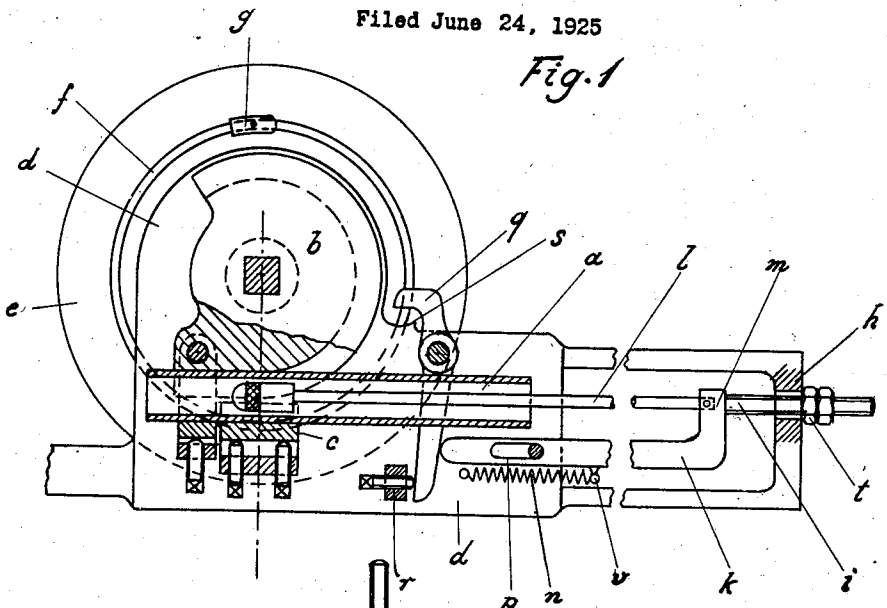
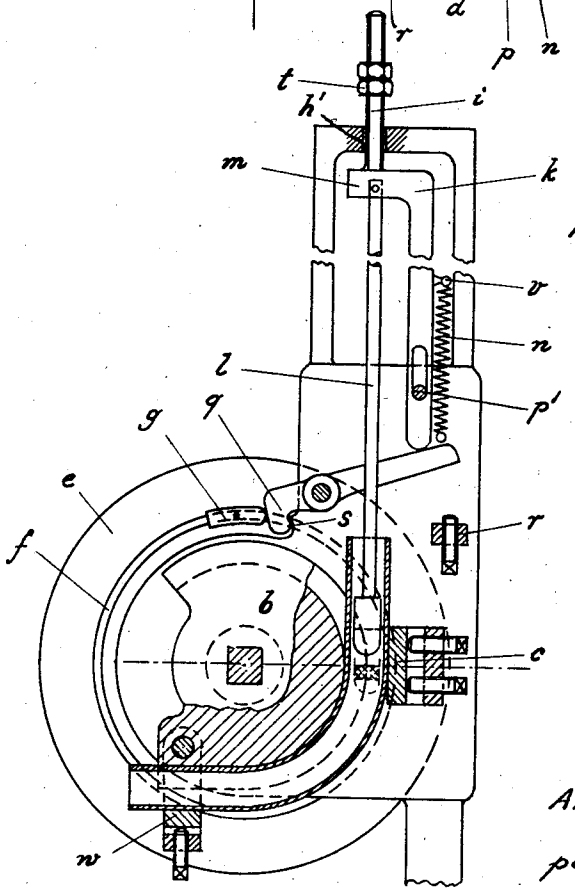


Fig. 2



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UNITED STATES PATENT OFFICE.

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PIPE-BENDING MACHINE.

Application filed June 24, 1925, Serial No. 39,346, and in Germany June 26, 1924.

This invention relates to a machine for manufacturing pipe-bends of the kind comprising a stationary form, a revoluble pipe-bending member and a supporting mandrel movable in the work in conformity with the working movement.

In the methods and machines of the kind known hitherto, the supporting mandrel follows accurately the movement of the revolving pipe-bending member. The cylindrical portion of the mandrel always extends for a certain distance rearwardly beyond the point of contact between the pipe-bending member and the pipe. This is necessary in order to render the mandrel effective and prevent the same from becoming worn out rapidly which would be the case if the mandrel would act on the inner surface of the pipe-wall only along a circular line. The portion of the mandrel referred to is indicated in the drawing by shading. As the supporting mandrel thus has to act on the pipe-wall by a relatively long cylindrical surface, a jamming action is always produced between the mandrel and the pipe-wall. This jamming is without any permanent influence at the beginning and in the course of the bending operation, but it entails an outward bulging of the pipe as soon as the bending member and the supporting mandrel come to a standstill at the end of the bending operation.

The invention has for its object to obviate the said disadvantage, this object being attained by providing the machine with means for imparting to the mandrel a lead with respect to the pipe-bending member shortly before the bending of the pipe is terminated so that the bending of the last portion of the bend takes place without the action of the supporting mandrel.

In the new machine it is possible to define the lead of the mandrel with relation to the revoluble pipe-bending member in such a manner that also in the last part of the bending operation there is neither produced an outward nor an inward bulging. The bend will therefore have a smooth curvature throughout.

Another object of the invention resides in providing means for returning the supporting mandrel always exactly into its initial position in spite of the lead imparted to it in the last part of the bending operation.

The advantages of the present machine reside in the possibility of relieving the mandrel of the bending pressure at the end of the bending operation and returning it automatically into its initial position as well as in the great accuracy of adjustment obtainable without any special expenditure of work and time and entirely independent from the skill of the workman.

An embodiment of the subject-matter of the invention is illustrated in the accompanying drawing in which:

Fig. 1 is a plan view, partly in section, of the pipe-bending machine at the beginning of the bending operation, and

Fig. 2 is a similar view of the machine after the bending operation has been terminated.

The machine essentially consists of a stationary form b and of a pipe-bending member c which is adjustably fastened on a frame d. The form b is of a circular shape and the frame d with the member c is adapted to revolve around the axis of the form b. The frame d rests on a stationary base plate e which has an annular guiding groove f in which a stop g is adjustably fastened. The frame d has a yoke-like extension h provided with a bore h' in which is guided a rod i which is connected with a bent arm k. The rod i and arm k are connected at m with the supporting mandrel l. A tension spring n is connected by one end to the frame d and by its other end to a nose v of the arm k. The latter has a guiding slot p which is engaged by a guide pin p' fastened to the frame d. Mounted for rotation on the frame d is a double-armed lever q having arms of different lengths. The movement of the long arm of the lever q is limited on the one hand by the arm k and on the other hand by a stop r on the frame d, while its short bent arm terminates in front of a nose s of the frame d. Screwed on the rod i are nuts t which serve to adjust the rod i with relation to the frame d.

The view according to Fig. 2 shows the supporting end of the mandrel l in the position in which it is relieved of the bending pressure. Shortly before the bending operation is terminated, the supporting mandrel occupies the position indicated by dotted lines, while the short arm of the lever q takes a position against the stop g. The further rotary movement of the frame d causes a rotation of the lever q in such a manner that its long arm moves the rods

k, m, i and the mandrel l with relation to the frame d and the pipe-bending member o, contrary to the action of the spring n. Owing to this movement the mandrel has imparted to it a lead with respect to the member c shortly before the bending operation is terminated, so that the supporting end of the mandrel is already in the straight section of the pipe a and thus relieved of the bending pressure while the last part of the bending operation is still being executed. As the bending of the last portion of the pipe-bend is, in this way, effected without the action of the mandrel which has been drawn out of the range of the bending pressure, a visible bulging which otherwise occurs in the bending of thin-walled pipes, is positively avoided.

After loosening the holder w the pipe a can be easily withdrawn from the machine and the frame d can be returned into its initial position (Fig. 1). At the same time, the rods k, m, i and the mandrel l are returned into their initial position by the action of the spring n which contracts until the nuts t rest again on the yoke h and the lever q carried along by the arm k again bears against the stop r.

It will be understood that in bending a pipe, the inner wall, i. e. the wall which bears against the stationary form b, is jumped while the outer wall, i. e. the wall acted upon by the bending member c, is drawn or elongated. If no supporting mandrel is used in the interior of the pipe, the said elongating action will, of course, produce to a certain extent an inward bulging of the outer pipe wall. The mandrel therefore serves to compensate this inward bulging by producing an outward bulging. The outward bulging caused by the mandrel is positive and somewhat stronger than the inward bulging due to the elongation. The outward bulging therefore outweighs the inward bulging. According to the size of the pipes, this outward bulging ranges between fractions of a millimeter in small tubes and about 2 millimeters in large tubes. This slight outward bulging is of no importance in the curved portion (bend) of the pipe because it is uniform throughout the bend, but it would leave a visible disturbant protuberance or outward bulging at the point where the curved portion of the pipe passes into the straight portion, if the mandrel would be allowed to remain in action during the very last step of the bending operation. In order to avoid this visible disturbant outward bulging at the end of the bent portion, the mandrel is automatically drawn out of the range of the bending pressure during the last part of the bending operation. The result thereof is that in this last part of the bending operation without mandrel the elongation of the outer pipe wall compensates the outward bulging and produces a gradual and smooth transition from the curved portion to the straight portion of the pipe.

It will be clear from the foregoing that the lead is imparted to the mandrel at the end of the bending operation for preventing the formation of a visible disturbant outward bulging or pretuberance at the end of the bend and for allowing the continued bending operation to produce a smooth transition from the curved or bent portion to the straight portion.

Having thus described my invention, what I claim as new and desire to secure by Letters-Patent, is:—

1. In a pipe-bending machine, comprising in combination a stationary form, a revoluble pipe-bending member and a supporting mandrel movable in the work in conformity with the working movement, an automatically operating stop mechanism for imparting to the supporting mandrel a lead with relation to the pipe-bending member shortly before the bending operation is terminated.

2. In a pipe-bending machine, comprising in combination, a base plate, a stationary form, a frame mounted for rotation around the axis of the form on the base plate, a pipe bending member carried by and movable with the said frame and a supporting mandrel likewise carried by the said frame and movable with relation to the latter and in the work during the bending operation, a stop member adjustably fixed on the base plate, a double-armed lever mounted for swinging motion on the frame, one arm of this lever being held in contact with the mandrel and the other arm of the lever being adapted to strike against the said stop member of the base plate shortly before the rotary movement of the frame and bending member is terminated and to be rocked by the said stop member so as to cause the first-said arm of the lever to impart to the mandrel a lead with relation to the pipe-bending member, and stops on the frame for limiting the swinging movement of the lever.

3. In a pipe-bending machine, comprising in combination, a base plate, a stationary form, a frame mounted for rotation around the axis of the form on the base plate, a pipe-bending member carried by and movable with the said frame and a supporting mandrel likewise carried by the said frame and movable with relation to the latter and in the work during the bending operation, a stop member adjustably fixed on the base plate, a double-armed lever mounted for swinging motion on the frame, one arm of this lever being held in contact with the mandrel and the other arm of the lever being adapted to strike against the said stop member of the base plate shortly before the rotary movement of the frame and bending

member is terminated and to be rocked by the said stop member so as to cause the first-said arm of the lever to impart to the mandrel a lead with relation to the pipe-bending member, a spring attached by one end to the mandrel and by the other end to the frame and adapted to return the mandrel and the double-armed lever into their initial positions when the pipe-bending member is returned into its initial position, stops for limiting the swinging movement of the lever and stops for limiting the movement of the mandrel with relation to the frame.

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

ARNOLD KLARWASSER.