No. 785,787. PATENTED MAR. 28, 1905.

E. ZEH.

CORRUGATED PIPE BENDING MACHINE.

APPLICATION FILED JUNE 13, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

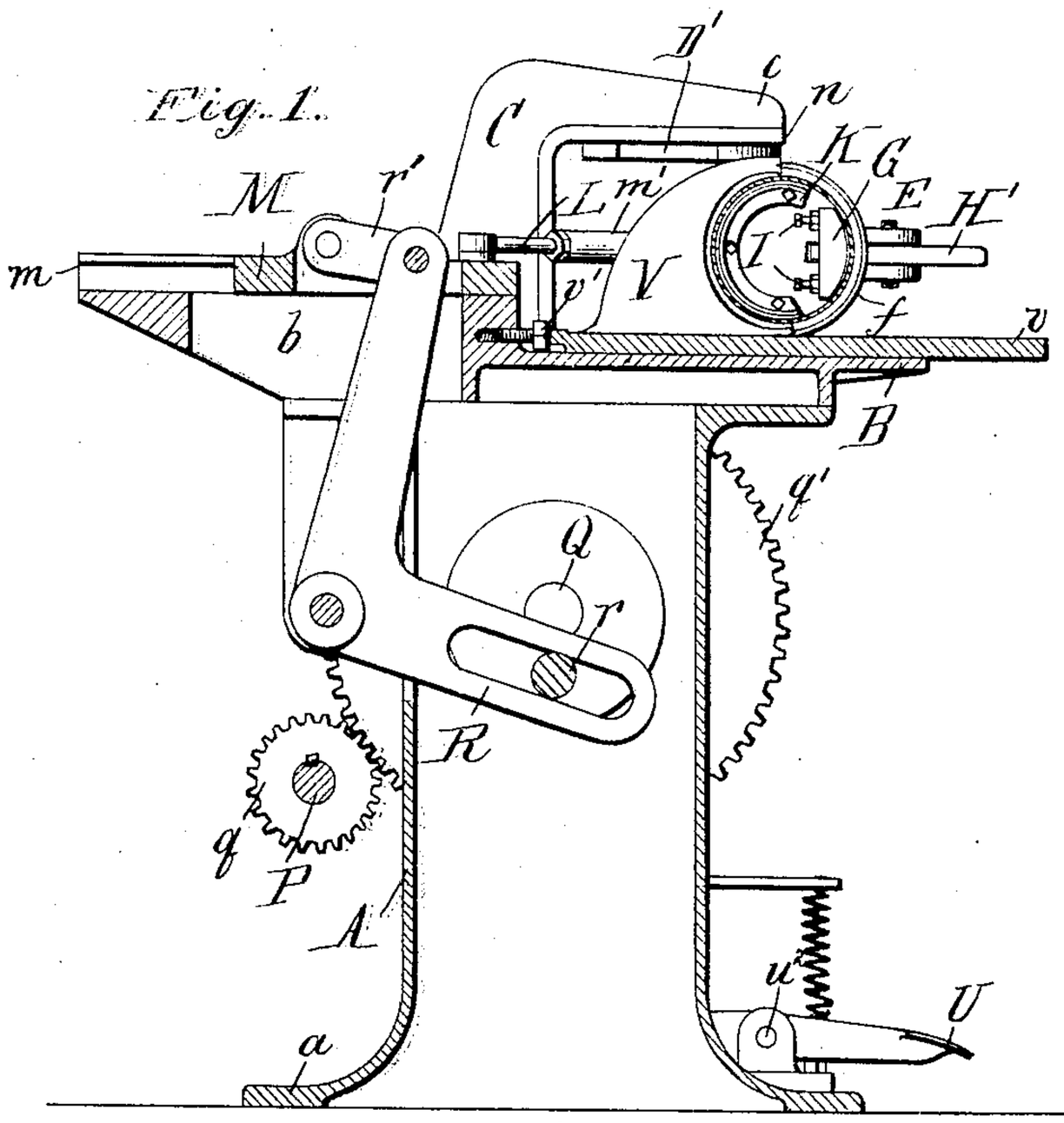
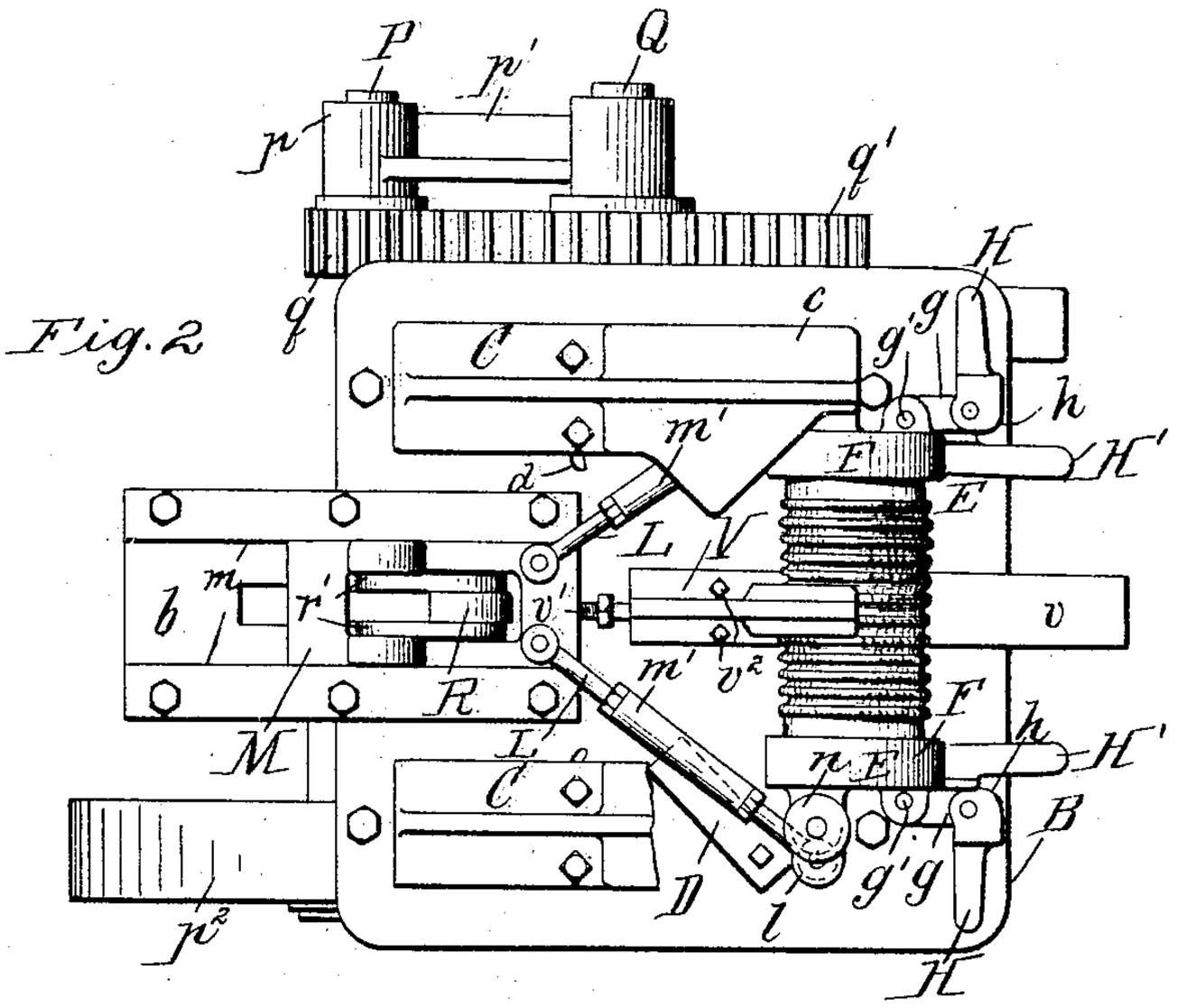


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

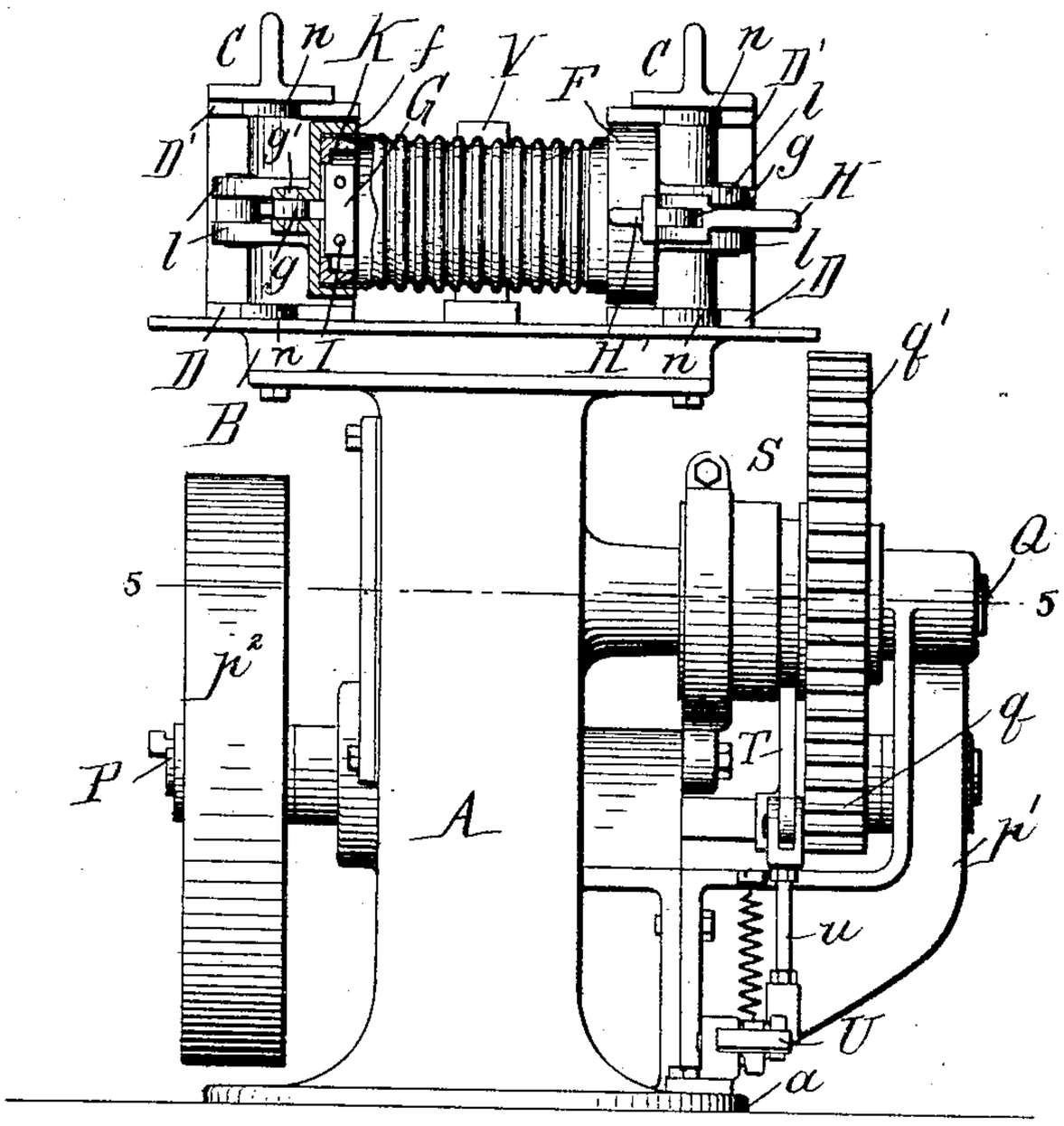
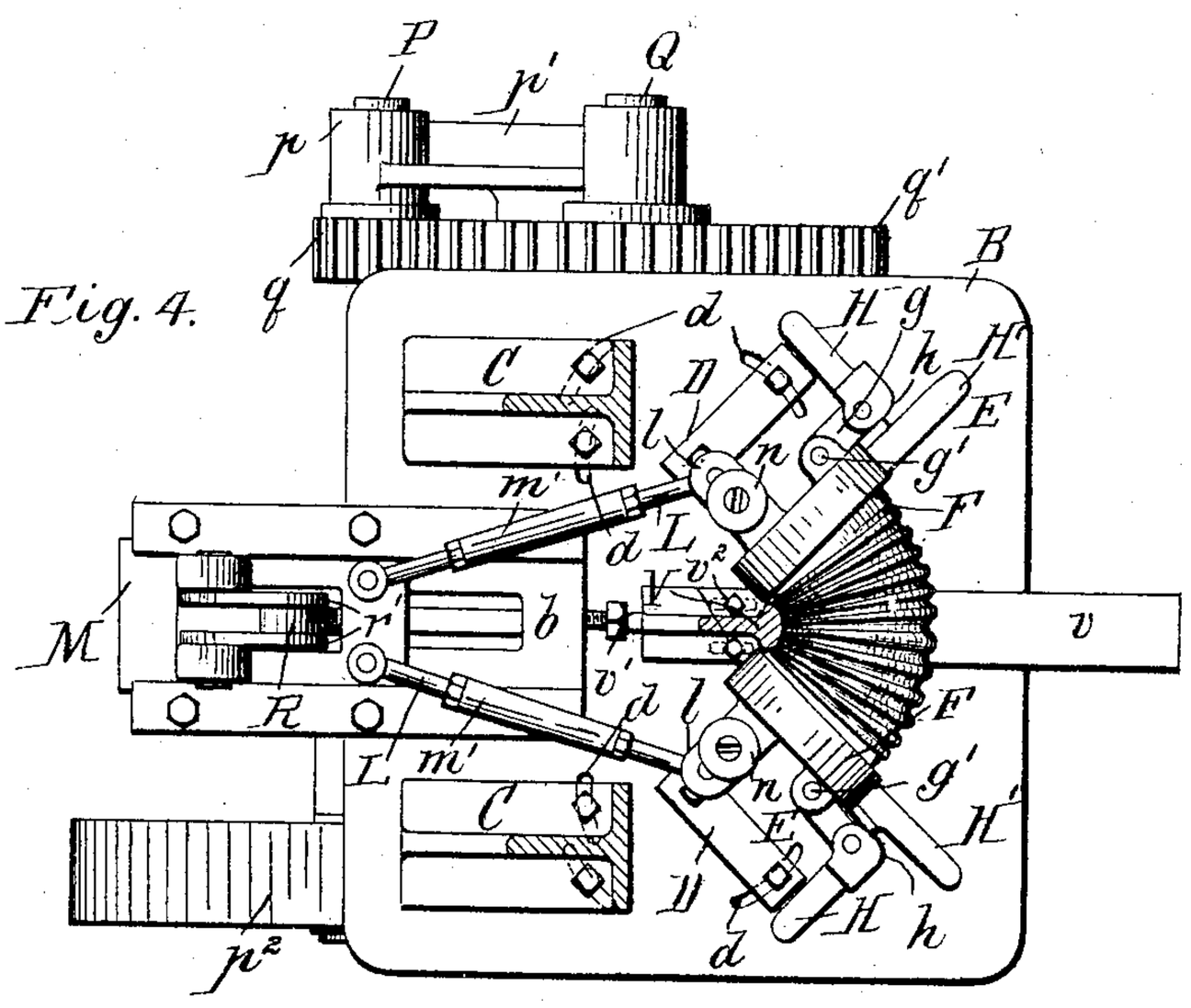


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

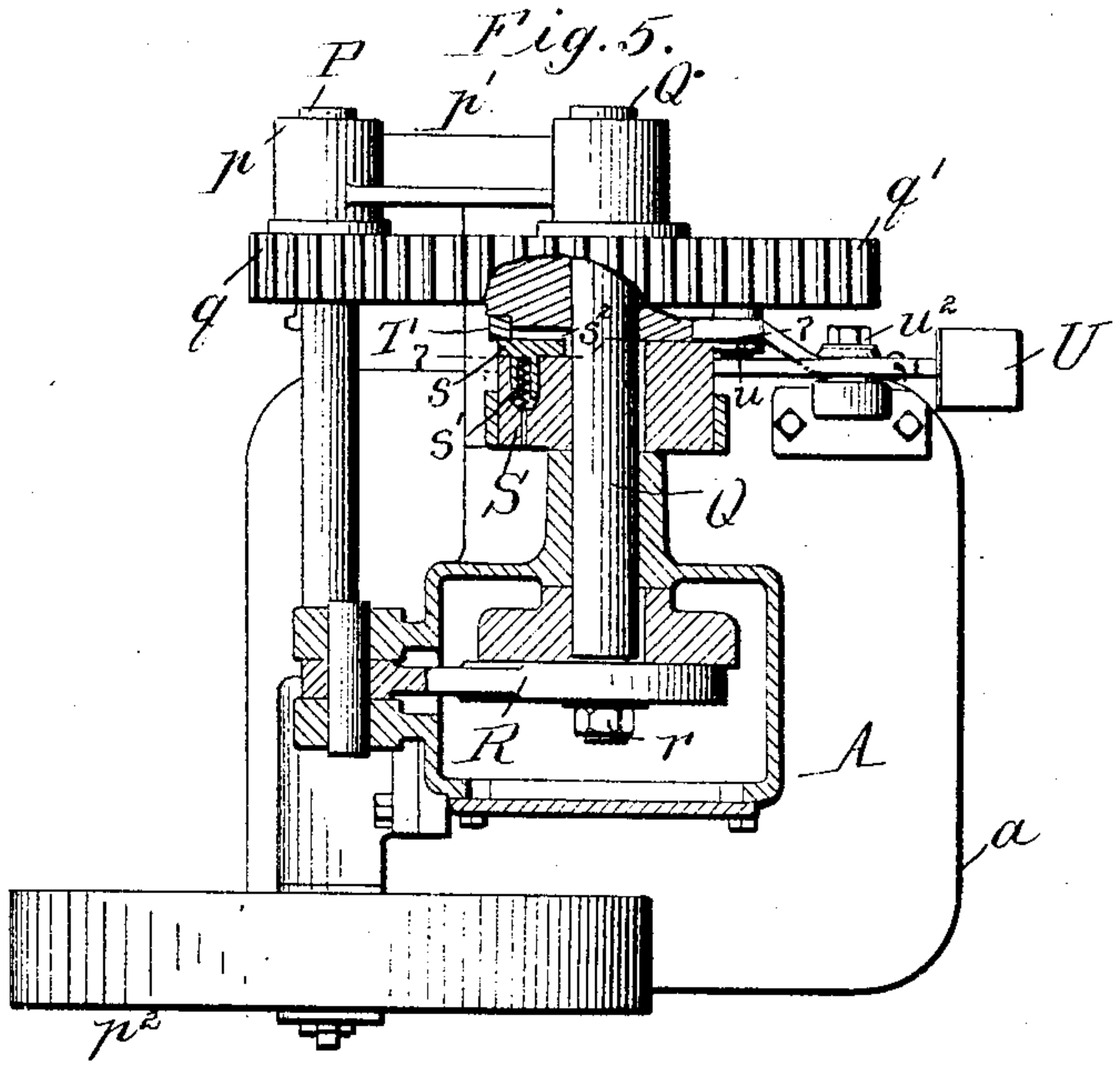


Fig. 6.

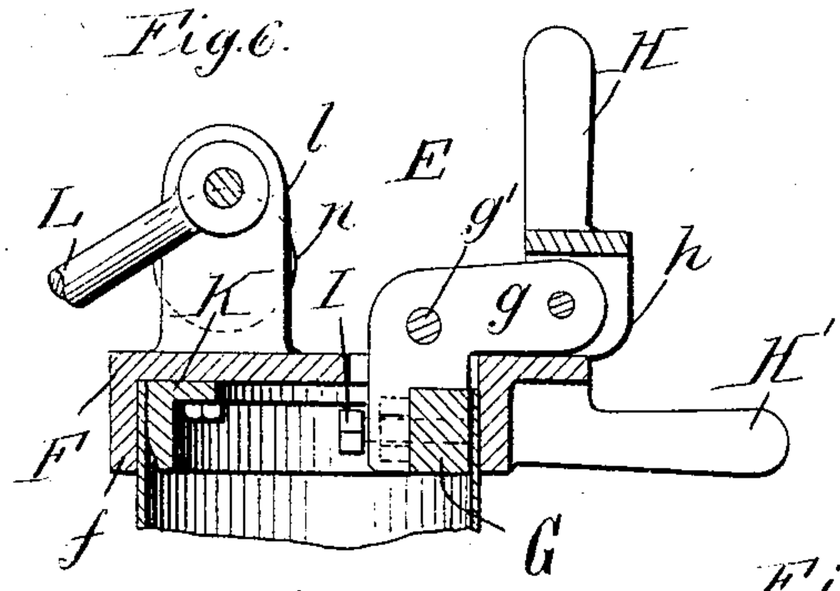


Fig. 8.

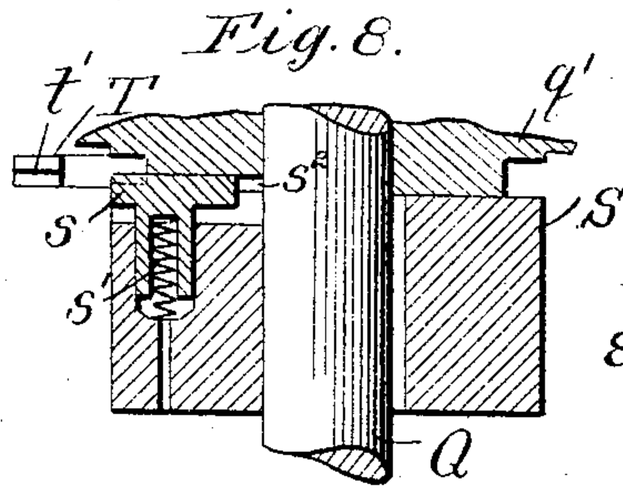


Fig. 7.

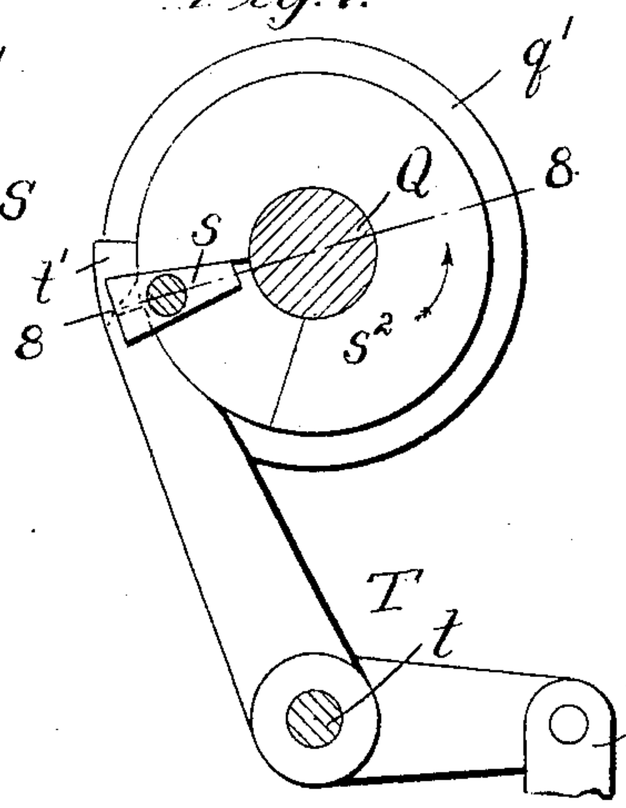
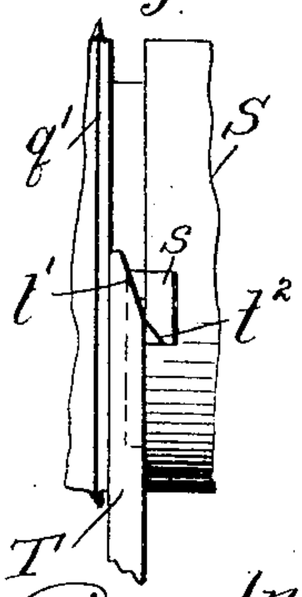


Fig. 9.



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UNITED STATES PATENT OFFICE.

EDMUND ZEH, OF BUFFALO, NEW YORK, ASSIGNOR TO NIAGARA MACHINE & TOOL WORKS, OF BUFFALO, NEW YORK.

CORRUGATED-PIPE-BENDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 785,787, dated March 28, 1905.

Application filed June 13, 1904. Serial No. 212,310.

To all whom it may concern:

Be it known that I, EDMUND ZEH, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Corrugated-Pipe-Bending Machines, of which the following is a specification.

This invention relates to machines for bending metal pipes into angular or elbow form.

One of the methods of making sheet-metal stovepipe-elbows at the present time is to bend a straight sheet-metal pipe which has been previously provided with circumferential corrugations or a helical corrugation into elbow form. In bending the pipe the corrugations are squeezed or compressed in the throat of the pipe, thus facilitating the bending of the pipe without buckling. The machine hereinafter described is intended particularly for bending such corrugated stovepipe-elbows.

The objects of the invention are to provide a rapid machine for the purpose stated which is of simple, desirable, and inexpensive construction, the provision of a power-operated machine for bending corrugated pipes which will greatly relieve the operator from work and exertion in bending the pipes, and the provision of mechanism whereby the machine is set in operation after the pipe has been secured therein by the depression of a treadle and will automatically come to rest after the pipe has been bent and returned to the position to be taken from the machine.

In the accompanying drawings, consisting of three sheets, Figure 1 is a longitudinal sectional elevation of a pipe-bending machine embodying the invention. Fig. 2 is a plan view thereof. Fig. 3 is a front elevation, partly in section, thereof. Fig. 4 is a plan view thereof, showing the position of the parts at the end of the bending movement. Fig. 5 is a sectional plan view of the machine in line 5 5, Fig. 3. Fig. 6 is a sectional plan view, on an enlarged scale, of one of the pipe-clamps. Fig. 7 is a sectional elevation, on an enlarged scale, in line 7 7, Fig. 5, of the clutch. Fig. 8 is a section in line 8 8, Fig. 7, showing the clutch-bolt projected into engagement with the gear-wheel. Fig. 9 is a detail fragmentary elevation of the clutch and operating-lever.

Like letters of reference refer to like parts in the several figures.

A represents the main frame of the machine, which may be of any suitable construction, that shown being in the form of a hollow standard or casting having a base *a* and provided at the front side of its top with a horizontal bed-plate or table B and in rear thereof with a raised horizontal portion *b*.

C C represent stationary brackets or parts bolted or otherwise secured to and rising from the opposite sides of the top of the frame and having horizontal arms or portions *c*, which project forwardly over the bed-plate.

D represents inclined tracks or faces which are bolted or otherwise secured to the bed-plate and project upwardly therefrom beneath the horizontal arms of the brackets, and D′ represents inclined tracks or faces bolted or otherwise secured to or formed on and depending from the horizontal arms of the brackets C, directly above and parallel with the inclined tracks or faces on the bed-plate. The tracks or faces on the bed-plate and bracket at one side of the machine are arranged at an angle to or diverge from those at the opposite side of the machine, and to enable this angle to be changed the brackets C and tracks D are angularly adjustable, for which purpose slots *d* are provided in the bed B, through which their securing-bolts pass. Any other means may be employed for securing these parts in adjusted positions.

E represents two oppositely-disposed clamps or devices in which the opposite ends of the corrugated pipe to be bent are secured. The clamps rest upon and are free to be moved toward and from each other and backwardly and forwardly on the bed-plate. Clamps of any suitable form which can be quickly applied to the ends of the pipe and which will securely hold the latter while being bent can be employed; but the clamps are preferably constructed as shown in the drawings. (See Figs. 3 and 6.) Each clamp comprises a circular head F, provided with an annular rim or flange *f* of a size to receive and embrace

the end of the pipe to be bent and a movable clamping-jaw G, located inside of and adjacent to the flange at the outer or front edge of the head. The jaw G is secured to or formed on a bent lever or arm g, which passes through a slot in the head and is pivoted to the latter in any suitable manner at g'. To the free end of the arm is pivoted an operating lever or handle H, having a face h of cam shape or eccentric to the pivot of the handle and bearing against the outer side of the clamp-head. The latter is also provided with an outwardly-projecting fixed handle H′ for moving the clamp to apply it to the end of the pipe. When the pivoted handle is turned toward the fixed handle, the clamping-jaw is swung toward the flange of the clamp-head and bites and securely holds the end of the pipe which has been inserted in the clamp-head. The clamp-jaw is preferably provided with screws I, which bear against the pipe and which can be adjusted to insure a firm hold on the pipe and to compensate for wear in the parts. The clamp-head is also preferably provided with a segmental circular guide-flange K, located inside of and concentric with the flange of the head and having a beveled outer edge which guides and centers the pipe in the clamp-head.

After the pipes E are secured to the ends of a pipe to be bent they are moved by suitable means into engagement with the stationary inclined tracks D D′, and their rear or inner edges are forced toward each other, as indicated in Fig. 4, to bend the pipe. The means shown in the drawings for this purpose is constructed as follows: The clamp-heads are provided at their inner or rear edges with fixed projecting arms l, to which are pivoted the front ends of links L, pivoted at their rear ends to a slide M, which is guided in suitable ways m on the elevated rear portion of the machine-frame. The links are preferably made adjustable in length by turnbuckles m', and each clamp-head is provided near its inner or rear edge above and below its fixed arm l with antifriction-rollers n to engage and roll on the inclined tracks. As there are two tracks for each clamp, one at the top and one at the bottom thereof, the clamps are maintained in their proper vertical relation during the bending operation. The operating-slide M for the clamps is reciprocated, preferably, by power-operated mechanism, which is put in action by the depression of a treadle and acts to move the slide and clamps rearwardly to bend the pipe and then return the parts to the forward position and come to rest to permit the bent pipe to be removed and replaced by another pipe to be bent.

The operating mechanism shown in the drawings is constructed as follows: P represents a main drive-shaft which is journaled in suitable bearings p on the lower portion of the standard and a bearing-arm p', Fig. 3, and is provided with a drive-pulley p^2. The shaft is driven continuously and has fixed thereto a gear-pinion q, which drives a gear-wheel q', journaled loosely on a crank-shaft Q, which is journaled in suitable bearings q^2 on the standard and bearing-arm p'. The crank-shaft is provided with a crank or wrist pin r, which works in a slot in one arm of a bell-crank lever R, the other arm of which extends up through slots in the top of the frame and in the clamp-operating slide to which the lever is connected by links r'. Upon each revolution of the crank-shaft Q the lever R is oscillated and the clamp-operating slide reciprocated back and forth once. S represents a clutch-disk fixed to the crank-shaft adjacent to the loose gear-wheel q' and provided with a laterally-movable clutch-bolt s, which is located in a pocket in the clutch-disk and is provided with a spring s' for projecting it into either of a plurality of recesses s^2 in the adjacent end of the hub of the gear-wheel q'. The clutch-bolt is normally held retracted or out of engagement with the gear-wheel q', so that the latter rotates freely without driving the crank-shaft by a clutch-lever T, pivoted on a fixed fulcrum-pin t and having an upright arm provided with an inclined face t', Fig. 9, which engages a correspondingly-inclined face on a projecting portion t^2 of the clutch-bolt. The clutch-lever is connected by a link u, Fig. 3, with a treadle-lever U, pivoted at u^2 on the standard. When the treadle is depressed, the clutch-lever is moved out of engagement with the clutch-bolt, which is projected by its spring into one of the recesses in the revolving gear-wheel q' to cause the clutch-disk and crank-shaft to rotate. After the treadle is depressed the operator releases it, and the clutch-lever is returned to its normal position with its inclined face in the path of the inclined face on the clutch-bolt, so that when the crank-shaft makes one revolution the clutch-bolt will be engaged and retracted to free the gear-wheel and permit the crank-shaft and the clamp-slide connected thereto to come to rest. Any other suitable drive and clutch mechanism may be employed which will thus reciprocate the clamp-slide once and then come to rest.

The operation of the machine is as follows: While the machine is at rest with the pipe-clamps E in their forward position, (shown in Fig. 2,) the clamping-heads are engaged over the opposite ends of the pipe. The clamps can be freely moved on the table by their fixed handles H′ for this purpose. The pipe is then secured in the clamps by turning the clamp-operating levers H toward the fixed handles H′. The operator then depresses the treadle U to set the machine in motion, as above explained, and the pipe-clamps and pipe are moved rearwardly and the clamps forced around into the inclined position (indicated in Fig. 4) by the movement of the antifriction-rollers of the clamps on the inclined tracks D

D′ and the pull of the links L on the fixed arms of the clamps, thereby squeezing or compressing the corrugations on the throat side of the pipe and bending the latter, as shown in Fig. 4. The clamps and bent pipe are then moved forward again from between the inclined tracks, and the machine comes to rest, permitting the operator to loosen the clamps, remove the pipe and replace it with another to repeat the operation. The angularity of the bend can be varied within the limits of the machine by changing the lengths of the clamp-operating links L, for when the links are lengthened the clamps will not engage the inclined tracks until after a partial movement of the operating-slide M, and the effective movement of the latter will be shortened, resulting in bending the pipe through a shorter arc. The inclination of the tracks is changed when operating upon pipes of different lengths, and for pipes of different diameters different-sized clamps are employed.

V represents a stationary horn which is secured to and projects upwardly from the central part of the bed-plate between the inclined tracks. The front face of the horn is of semicircular concaved form and embraces the throat of the pipe during the bending operation to prevent the buckling of the pipe and insure a perfect bend. The horn has a forwardly-projecting horizontal foot v to support and guide the pipe. An adjusting-screw v' works in a threaded hole in the raised rear part of the frame and abuts against the rear side of the horn. By turning the screw the horn can be adjusted forwardly on the table to properly position it, after which it is secured by bolts v^2, passing through elongated slots in the base of the horn. While the horn is preferably employed, it is not essential to the operation of the machine, which will bend the pipe and produce good results without it.

I claim as my invention—

1. The combination of pipe-clamps which are secured to the opposite ends of the pipe, inclined faces, means for causing a relative movement between said clamps and said inclined faces, said inclined faces causing said clamps to assume an angular position relative to each other whereby the pipe is bent, substantially as set forth.

2. The combination of pipe-clamps which are secured to the opposite ends of the pipe, means for moving said clamps in one direction, and means against which said clamps are moved and which turn them into an angular position relative to each other, substantially as set forth.

3. The combination of pipe-clamps which are secured to the opposite ends of the pipe, means for moving said clamps, and stationary parts against which said clamps are moved by said means and which parts turn the clamps into angular position relative to each other to bend the pipe, substantially as set forth.

4. The combination of pipe-clamps which are secured to the opposite ends of the pipe, means for moving said clamps and pipe, and stationary inclined faces which are engaged by said clamps and turn the latter into angular position relative to each other to bend the pipe, substantially as set forth.

5. The combination of pipe-clamps which are secured to the opposite ends of the pipe, a reciprocating operating device, swinging links connecting said operating device and clamps for moving the latter, and parts against which the clamps are moved and which turn the clamps into angular position relative to each other, substantially as set forth.

6. The combination of pipe-clamps which are secured to the opposite ends of the pipe, fixed arms projecting from said clamps, a reciprocating slide, swinging links connecting said reciprocating slide and said fixed arms of the clamps, and stationary inclined faces which are engaged by said clamps and turn the latter into angular position relative to each other, substantially as set forth.

7. The combination of pipe-clamps which are secured to the opposite ends of the pipe, means for moving said clamps and pipe, a pair of separated inclined faces for each of said clamps which are engaged by parts at the opposite sides of said clamps and turn the clamps into angular position relative to each other, substantially as set forth.

8. The combination of pipe-clamps which are secured to the opposite ends of the pipe, inclined faces, power-operated mechanism for causing a relative movement between said clamps and said inclined faces, and means under the control of the operator for setting said mechanism in motion and automatically stopping the same, substantially as set forth.

9. The combination of pipe-clamps which are secured to the opposite ends of the pipe, power-operated mechanism for moving said clamps and pipe, means engaged by said clamps for causing them to assume an angular position relative to each other, and means under the control of the operator for setting said mechanism in motion and automatically stopping the same, substantially as set forth.

10. The combination of pipe-clamps which are secured to the opposite ends of the pipe, a reciprocating slide to which said clamps are movably connected, stationary parts which are engaged by said clamps to turn the latter into angular position relative to each other, a shaft and connections for reciprocating said slide, a driving element, and a clutch for connecting said driving element to said shaft and automatically disconnecting said driving element from the shaft, substantially as set forth.

11. The combination of pipe-clamps which are secured to the opposite ends of the pipe, means for moving said clamps and pipe in one direction, means against which the clamps are moved for causing them to assume an angu-

lar position relative to each other, and a horn which engages the pipe between said clamps, substantially as set forth.

12. The combination of pipe-clamps which are secured to the opposite ends of the pipe, inclined faces, means for causing a relative movement between said clamps and said inclined faces, said inclined faces causing said clamps to assume an angular position relative to each other, and a relatively stationary horn which engages the pipe between said clamps, substantially as set forth.

13. The combination of clamps for the ends of the pipe, one of said clamps comprising a head having a flange to embrace the pipe, a clamping-jaw movably mounted on said head to engage the inside of the pipe, and a lever for operating said clamping-jaw, and means for operating the clamps to bend the pipe, substantially as set forth.

14. The combination of clamps for the ends of the pipe, one of said clamps comprising a head provided with a flange which embraces the pipe, a clamping-jaw, an arm pivoted to said clamp-head and carrying said jaw, an operating-lever for said jaw pivoted to said arm and having a cam-shaped portion which engages a part on said clamp-head, and means for operating the clamps to bend the pipe, substantially as set forth.

15. The combination of clamps for the ends of the pipe, one of said clamps comprising a head having a circular flange which surrounds the pipe, a segmental circular guide secured to said head inside of said flange, and a clamping-jaw arranged inside of said flange, an arm carrying said jaw and pivoted to said clamp-head, an operating-lever for said clamping-jaw, and means for operating the clamps to bend the pipe, substantially as set forth.

Witness my hand this 9th day of June, 1904.

EDMUND ZEH.

Witnesses:
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C. M. BENTLEY.