(No Model.)

2 Sheets—Sheet 1.

J. H. FERGUSON.

MACHINE FOR BENDING METAL PLATES.

No. 338,944. Patented Mar. 30, 1886.

Fig. 2.

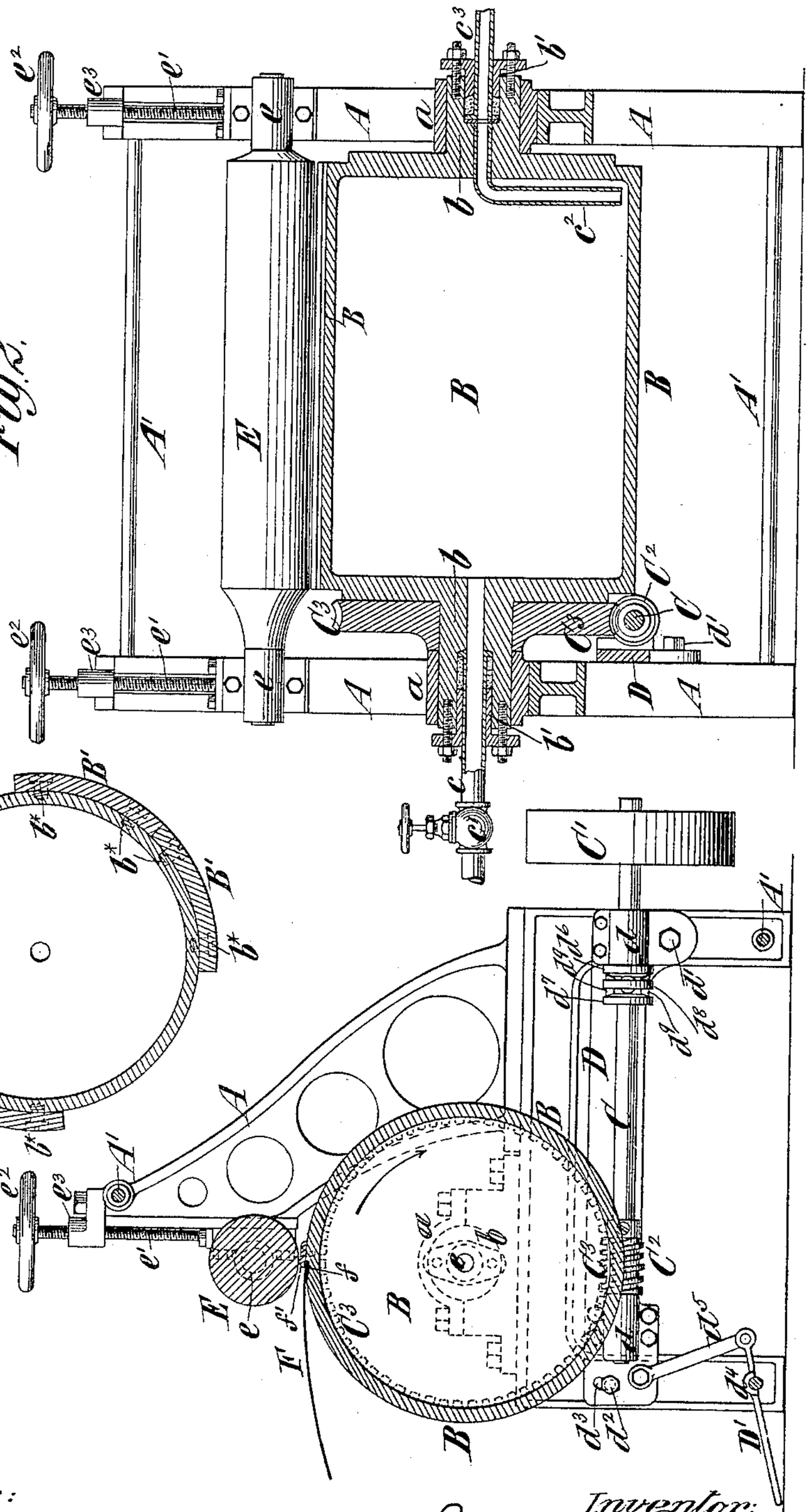

Fig. 3.

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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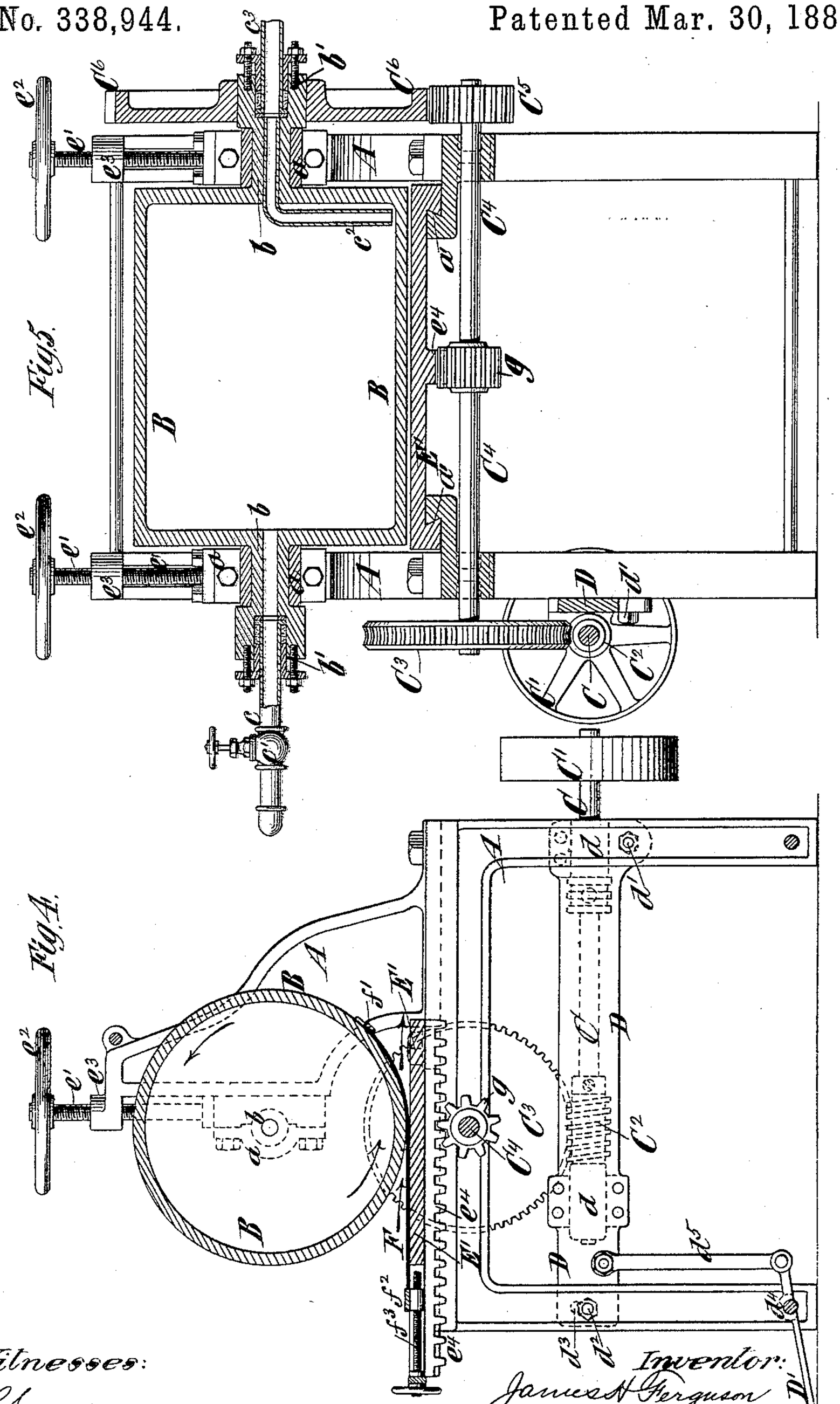

UNITED STATES PATENT OFFICE.

JAMES H. FERGUSON, OF BROOKLYN, ASSIGNOR TO LOVEJOY SON & CO., OF NEW YORK, N. Y.

MACHINE FOR BENDING METAL PLATES.

SPECIFICATION forming part of Letters Patent No. 338,944, dated March 30, 1886.

Application filed October 3, 1885. Serial No. 178,869. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. FERGUSON, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Machines for Bending Metal Plates, of which the following is a specification.

My invention is applicable more particularly to machines for bending stereotype-plates and electrotype-plates; but it may also be embodied in machines for bending plates of similar metal for other purposes.

The invention relates to machines which comprise a rotary cylinder to which the sheet of metal to be bent is gripped or secured at one edge and a movable abutment, which, when the cylinder is rotated, serves to bend the plate to the curvature of the cylinder, the latter serving as a former, to which the plate is bent.

I have discovered that the bending of stereotype and electrotype plates is greatly facilitated by employing a heated rotary cylinder, as by such cylinder the plate will be so heated as to be much more readily bent; and one feature of my invention consists in the combination, with a hollow rotary cylinder constituting a former and provided on its exterior with a grip to receive one edge of the plate for holding the plate upon the cylinder, of pipes for introducing a heating agent into the cylinder, and an abutment movable with the cylinder and which bears directly against the outer side of the plate as the cylinder is rotated, and thereby causes the plate to be bent to the curvature of the cylinder. The movable abutment above described may consist either of a bending-roll adjustable toward and from the cylinder or a sliding plate or bed, as hereinafter described.

The type-cylinders of presses upon which bent stereotype or electrotype plates are to be used are always one of two or three standard sizes, and a further object of my invention is to adapt one machine for bending plates of different curvatures without changing the rotary cylinder for one of larger or smaller size; and this feature of the invention consists in the combination, with a rotary cylinder or former provided with a grip for holding one edge of the sheet to be bent, of a number of removable lags or segments having an arc-shaped section and fitted to the cylinder to vary the size thereof, and also provided with a grip for holding the edge of the sheet, and a bending-roll arranged parallel with and adjustable toward and from the cylinder or a movable abutment operating in conjunction with the cylinder.

In the accompanying drawings, Figure 1 is a vertical section of a machine embodying my invention, and in which a bending-roll constitutes the movable abutment, the section being taken in a plane transverse to the axis of the cylinder. Fig. 2 is a vertical section in a plane lengthwise of the cylinder. Fig. 3 is a transverse section of the cylinder alone, having applied to it lags or segments for making a former of different size or diameter. Fig. 4 is a section similar to Fig. 1 of a machine also embodying my invention, but in which the movable abutment is formed by a sliding bed; and Fig. 5 is a sectional elevation in a plane parallel with the axis of the cylinder of the machine shown in Fig. 4.

Similar letters of reference designate corresponding parts in all the figures.

Referring first to Figs. 1, 2, and 3, A A designate the two end frames or standards of the machine, which are connected by horizontal stays or stretchers. A′ and B designate the rotary cylinder or former, which has at opposite ends journals *b*, fitted to bearings *a* in the frame. Rotary motion may be imparted to the cylinder by any suitable mechanism. As here represented, I employ a counter-shaft, C, which is arranged transversely to the axis of the cylinder, and has upon it a pulley, C′, for the reception of the driving-belt. The shaft C also carries a worm or screw, C^2, which engages with a worm-wheel, C^3, fast upon one of the journals of the cylinder B.

The shaft C is here represented as fitted to bearings *d* in the frame D, which at one end is fulcrumed at *d*′, and the opposite end of which may be raised and lowered to bring the worm or screw C^2 into and out of engagement with the worm-wheel C^3 upon the cylinder. As here shown, the free end of the frame D is guided and has its motion limited by a bolt, d^2, passing through a slot, d^3, in the frame, and

the frame may be raised by means of a treadle, D′, which is fulcrumed at d^4, and is connected by a rod, d^5, with the free end of the frame D. When the foot is placed upon the treadle D′, the frame D will be raised to bring the worm or screw C^2 into engagement with the worm-wheel C^3, and as soon as the treadle is relieved of pressure the frame D will drop and carry the worm or screw out of engagement with the worm-wheel.

In order to relieve the bearings of the shaft C of the thrust produced by the worm or screw C^2, I have represented in Fig. 1 a thrust-bearing, which consists of a collar or seat, d^6, a collar, d^7, fast on the shaft C, and a ring, d^8, arranged between the two collars and carrying conical rollers d^9. By this means the bearings of the shaft C are relieved of friction in a great measure and the wear resulting from the thrust of the worm or screw C^2 is greatly reduced.

As here represented, the journals *b* of the cylinder B are hollow or tubular, and with one of them is connected a pipe, *c*, controlled by a valve, *c′*, and through which steam may be introduced into the cylinder. In the other journal is secured an exhaust-pipe, c^2, which extends into and extends radially in the cylinder nearly to the inner circumference thereof, and this pipe c^2 communicates with the exhaust-pipe c^3, extending outward from the journal. The pipes *c* c^3 are fitted to suitable stuffing-boxes, *b′*, in the journals *b*, and when by the rotation of the cylinder the pipe c^2 projects downward nearly to the bottom of the cavity in the cylinder all the water of condensation contained therein will be forced out through the pipes c^2 c^3.

The heating agent which is employed in the cylinder is usually steam of comparatively-high temperature, which is introduced through the pipe *c*, under control of the valve *c′*, and the cylinder and the plate bent upon it will be thereby so heated that the bending of the plate will be greatly facilitated.

In connection with the cylinder B, I employ a bending-roll, E, which is journaled in suitable bearings, *e*, and these bearings are adjustable upward and downward along the end frames, A, by means of screws *e′*, which are provided with hand-wheels e^2, and are fitted to stationary nuts e^3. By adjusting these screws the roller E may be moved toward and from the cylinder B, in order to vary the distance between them.

The bending-roll constitutes a movable abutment to hold the plate to the cylinder.

The cylinder B is provided with a grip, whereby the plate to be bent will be held fast at one edge. As here represented, this grip is formed by a longitudinal recess or groove, *f*, in the exterior of the cylinder, and a lip or tongue, *f′*, which consists of a plate secured upon the exterior of the cylinder and overlapping the rear side of the groove or recess *f*. The recess or groove *f* is joined at its front edge to the periphery of the cylinder by an incline, and the lip or tongue *f′* overhangs the recess or groove at the opposite or rear side. When the edge of the plate is inserted under the lip *f′* and the cylinder is turned, the plate will receive a bend at the inclined front of the groove *f*, which will hold its edge in strong engagement with the lip *f′* as the cylinder is rotated and the plate bent. An important feature of this grip is the incline by which the front of the groove *f* is joined to the periphery of the cylinder, for by this incline is produced the bend in the plate which is depended on to hold its edge immovable relatively to the cylinder during the bending operation. If one edge of the plate F (shown in Fig. 1) be introduced into the groove or recess *f* and under the tongue or lip *f′* and the machine then started, the bend which the plate will receive at the front edge of the recess or groove, which is inclined, will enable the grip to hold that edge of the plate very securely and cause it to be carried forward beneath the bending-roll E by the rotation of the cylinder B. The plate will then be bent to the curvature of the cylinder B, which should be the same as that of the type-cylinder on which the plate is to be placed for printing.

The type-cylinders of presses are one of two or three standard sizes, and in order to enable the same cylinder B to be used for bending plates of different curvatures I provide lags or segments B′, which may be detachably secured to the cylinder by means of screws *b**. One of the lags or segments B′ has a grip, *f f′*, similar to that before described, and by attaching said lags or segments to the cylinder the latter will be made to form a former of increased diameter, so as to bend plates to fit a larger type-cylinder.

In Fig. 3 I have represented the cylinder B with two lags or segments secured upon the upper side thereof, one of the latter being provided with a grip, and diametrically opposite on the cylinder I have represented other lags or segments which may be secured to the cylinder for the purpose of balancing it. If there are provided lags or segments of two or three thicknesses which may be readily and detachably secured upon the cylinder, it will be understood that the latter may be made to constitute a bending-former for as many different sizes as are necessary to correspond with the several sizes of type-cylinders on which the bent plates are to be afterward used.

Referring now to the machine shown in Figs. 4 and 5, A A are the end frames, and B the heated cylinder. In this example of my invention the bending of the plate F is effected by the rotary cylinder B, acting in conjunction with a sliding bed, E′, which constitutes the movable abutment. The journals *b* of the cylinder are fitted to bearings *a*, which may be adjusted upward and downward along the frames A by adjusting-screws *e′*, fitting nuts e^3, and provided with hand-wheels e^2 for turning them. The hollow journals *b* are fitted with heating-pipes *c* c^2 c^3, as before described

with reference to Figs. 1 and 2. The bed E′ is fitted to slideways a' on the frame A, and is operated by a shaft, C^4, on which is a pinion, g, engaging a rack, e^4, on the bed E′. This shaft C^4 carries a worm-wheel, C^3, and receives motion from a worm or screw, C^2, on a shaft, C. The shaft C is supported in a frame, D, fulcrumed at d', so that it may be raised and lowered by a treadle, D′, and the same letters of reference are used as in Figs. 1 and 2 to designate corresponding parts.

The cylinder B in this example of my invention receives motion from the shaft C^4 by a pinion and gear-wheel, C^5 C^6, as best shown in Fig. 5.

The grip employed in Figs. 4 and 5 consists simply of a flange or lip, f', secured on the cylinder B, and in order to hold the plate F in engagement therewith I have shown a gage or projecting bar, f^2, on the bed E′. After the one edge of the plate F is inserted under the lip f' the gage f^2 is adjusted by screws f^3, or otherwise, up against the other edge of the plate, and as the cylinder is rotated in the direction of the arrow, Fig. 4, the bed E′ will be moved in the direction of the arrow thereon. When this cylinder B is to be built up with lags or segments to make it of larger size, the pinion and wheel C^5 C^6 should be changed for others of proper proportion, and the pinions and wheels used should be so proportioned as to give the cylinder a surface velocity equal to the speed of movement of the bed.

I am aware that when an alloy of metal—such as that of which electrotype-plates are composed or with which they are backed—is heated to a high degree the cohesive qualities of the metal are impaired and the metal is less flexible than when cold; but by heating such plates to a slight degree compared to the temperature necessary to produce their fusion the plates may be more readily bent, with less danger of fracture, and will better retain their form than when bent cold.

I am aware that a machine has been devised for bending the pasteboard backs of account and other books, which comprises a series of cylinders or rolls to be heated by steam or otherwise, and aprons, each attached at one edge to a roll. In the use of such machine the pieces of pasteboard are placed between one of the rolls and its apron, and by turning said roll the apron and pasteboard are carried through between the two rolls and are given a curved form. Neither of the rolls has a grip which is adapted to receive and retain the edge of a metal plate, and in the operation the roll does not bear directly against the outer side of the plate, but against the apron. The use of a machine of the kind above referred to as old for bending pasteboard book-backs would certainly not involve the discovery that electrotype and stereotype plates might be bent much more readily on a heated cylinder than on a cold cylinder, and I do not desire to include in my invention a machine of the kind referred to.

I am also aware that it is not new, in a machine for making sheet-metal pipe, to employ two rolls which are geared together and rotate in close contact, and to slip over and secure upon these rolls tubular sleeves or bushings when it is desired to increase their size. Such a means of enlarging the large rotary former or cylinder of my machine would not be practicable or desirable, as the plates bent in such a machine are never of sufficiently large size to cover the periphery of the cylinder or former; and I therefore employ a number of separate segments or lags, B′, which are arc-shaped in their transverse section, and two or more of which may be applied to the cylinder, according to whether the plate to be bent thereon be a large or small one.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a machine for bending electrotype or stereotype plates, the combination, with a rotary hollow cylinder constituting a former, and provided on its exterior with a grip to receive the edge of a plate, for holding the plate on the cylinder, of pipes for introducing a heating agent into the cylinder, and a movable abutment for bearing directly against the outer side of the plate to hold the plate against the cylinder as the latter rotates, substantially as herein described.

2. In a machine for bending electrotype or stereotype plates, the combination, with a rotary hollow cylinder constituting a former, and provided on its exterior with a grip to receive one edge of a plate, for holding the plate to the cylinder, of pipes for introducing a heating agent into the cylinder, and a bending-roll arranged parallel with and adjustable toward and from the cylinder for bearing against the outer side of the plate to hold it against the cylinder as the latter rotates, substantially as herein described.

3. The combination, with a rotary cylinder or former provided with a grip for holding one edge of the plate to be bent, of a number of removable lags or segments made arc shape in their transverse section and fitted to the cylinder to vary the size thereof, and also provided with a grip for holding the edge of the plate, and a movable abutment for holding the plate against the cylinder as the latter rotates, substantially as herein described.

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