(No Model.) 4 Sheets—Sheet 1.

G. W. TAFT.

MECHANISM FOR BENDING METAL BARS.

No. 411,941. Patented Oct. 1, 1889.

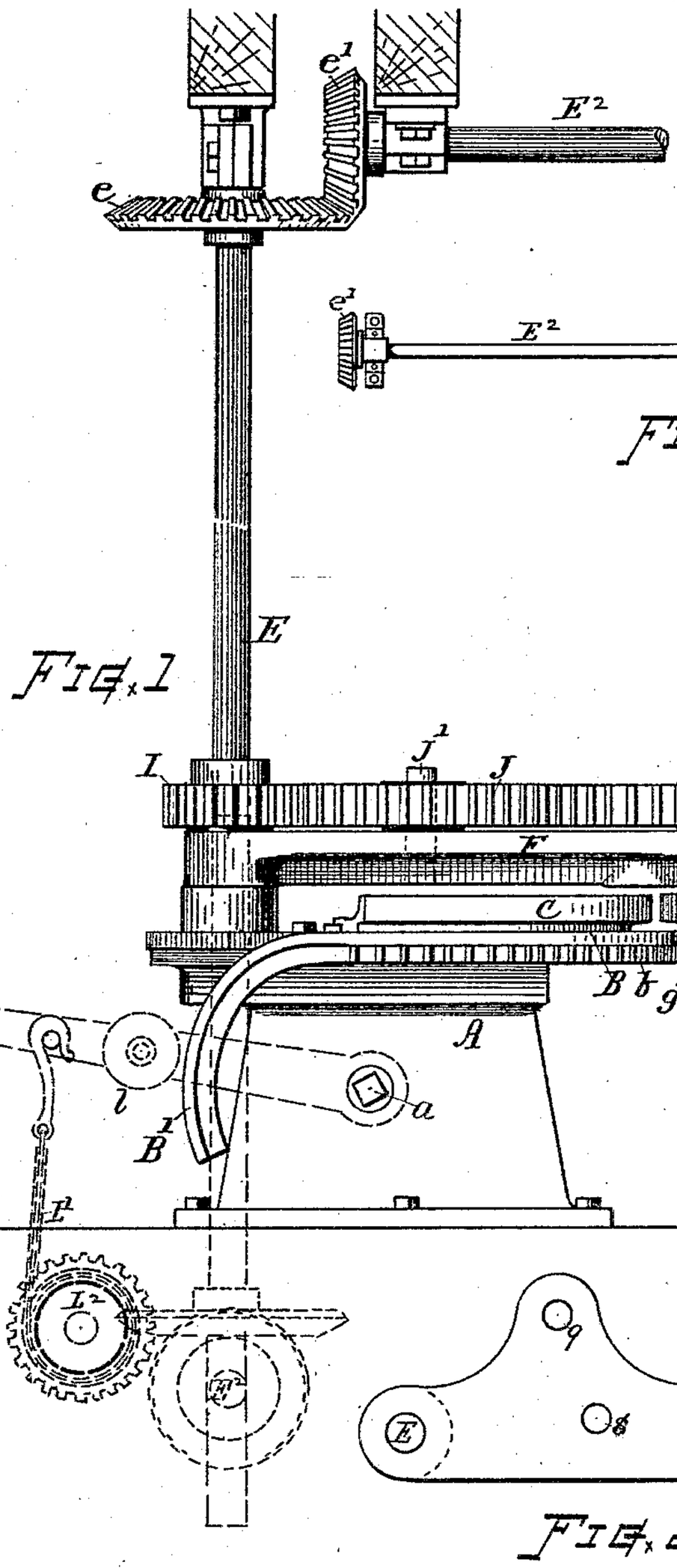

FIG. 1

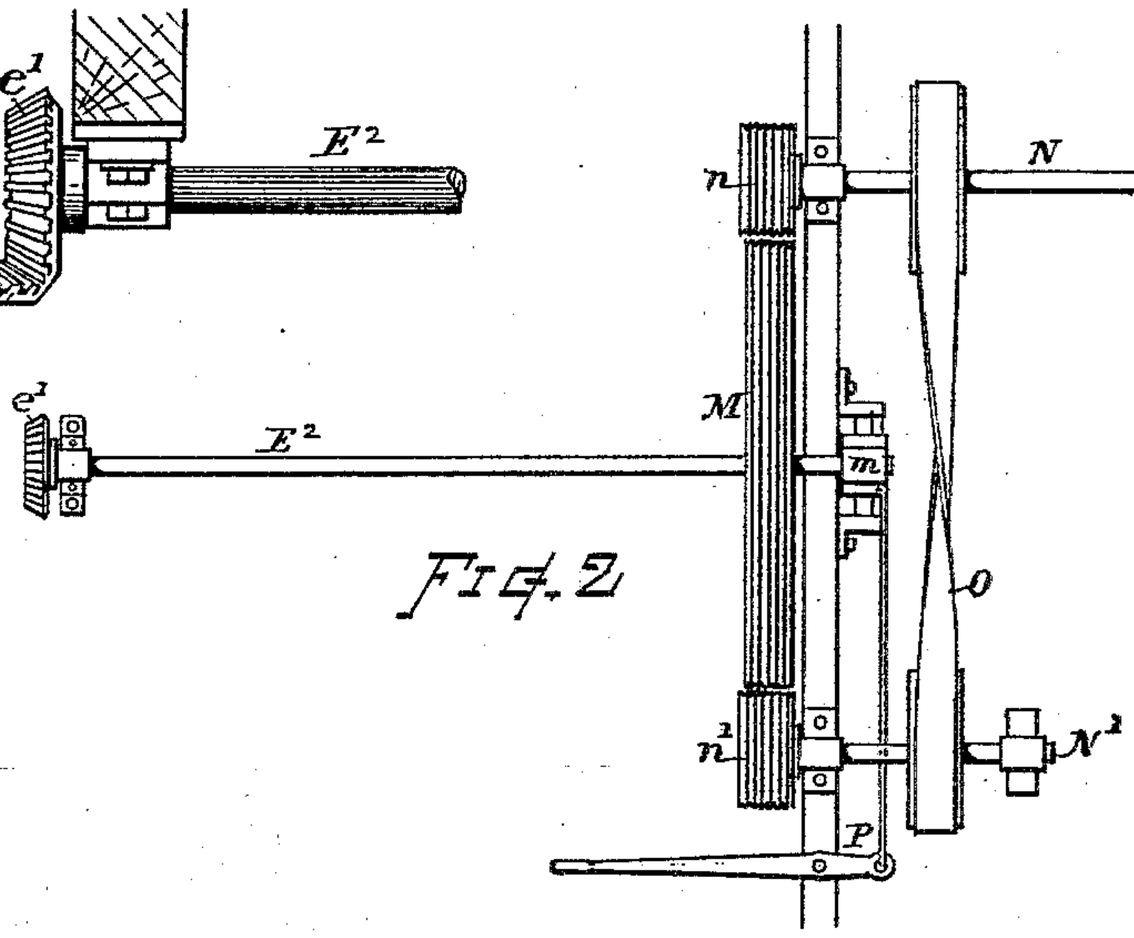

FIG. 2

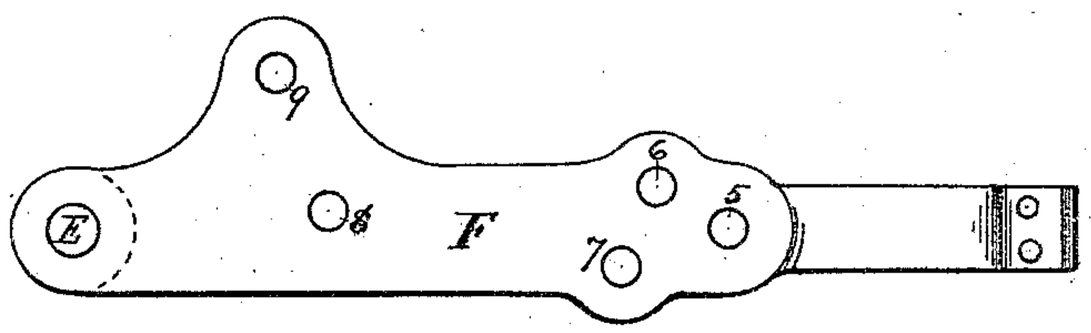

FIG. 3

Witnesses—
Geo. H. Lee
A. R. Baxton

Inventor—
George Warner Taft.
By Chas. A. Burleigh
Attorney

(No Model.) 4 Sheets—Sheet 2.

G. W. TAFT.

MECHANISM FOR BENDING METAL BARS.

No. 411,941. Patented Oct. 1, 1889.

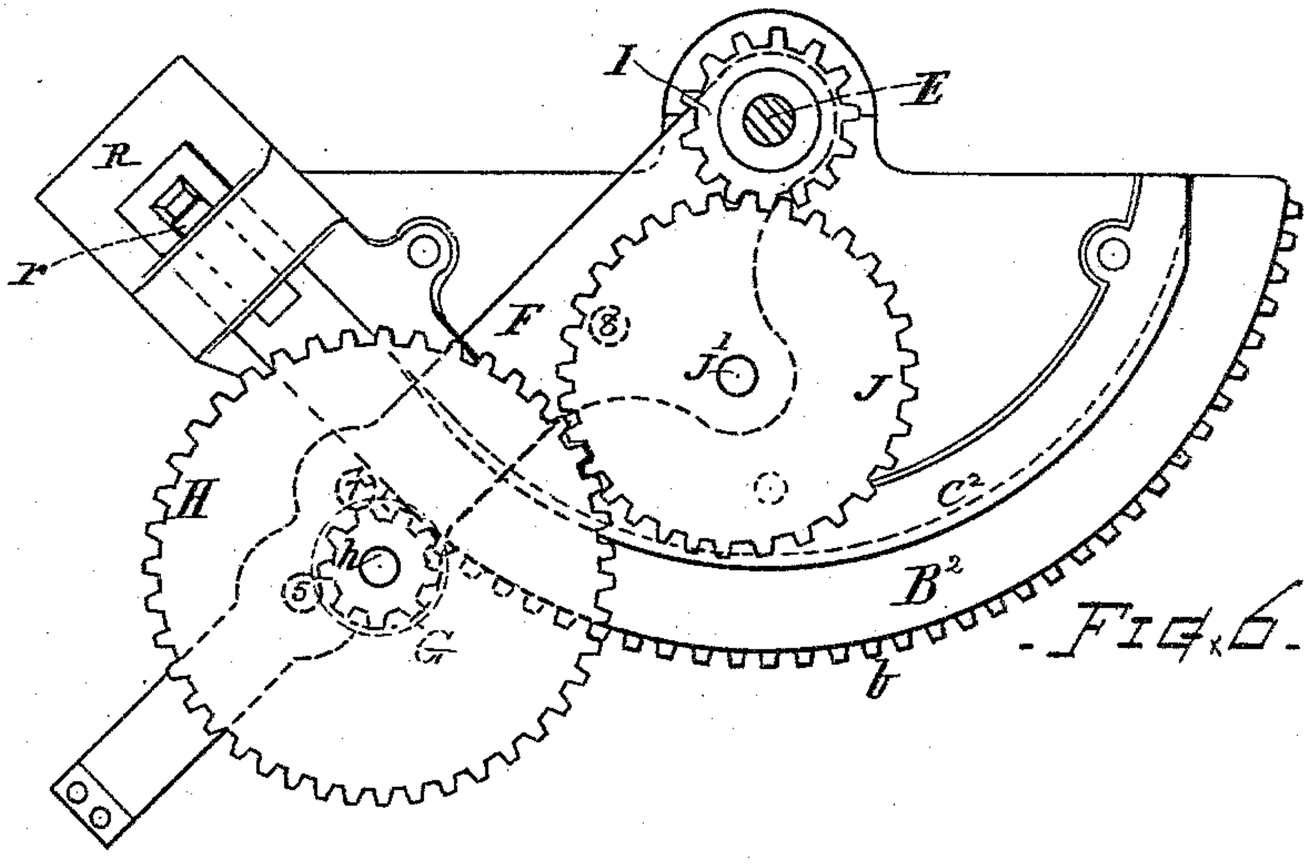

FIG. 6.

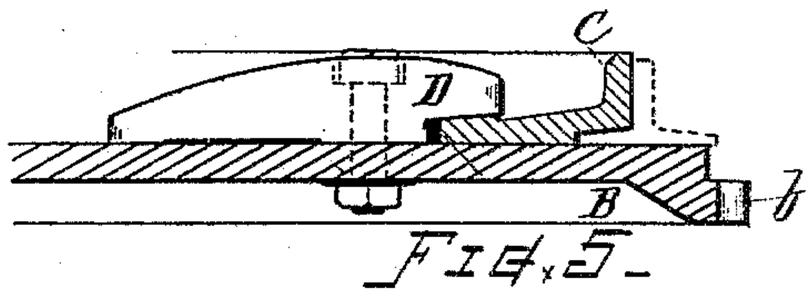

FIG. 5.

FIG. 4.

Witnesses—

Geo. H. Strong

A. B. Burton

Inventor.

George Warner Taft

By Chas. A. Burleigh

Attorney

(No Model.) 4 Sheets—Sheet 3.

G. W. TAFT.

MECHANISM FOR BENDING METAL BARS.

No. 411,941. Patented Oct. 1, 1889.

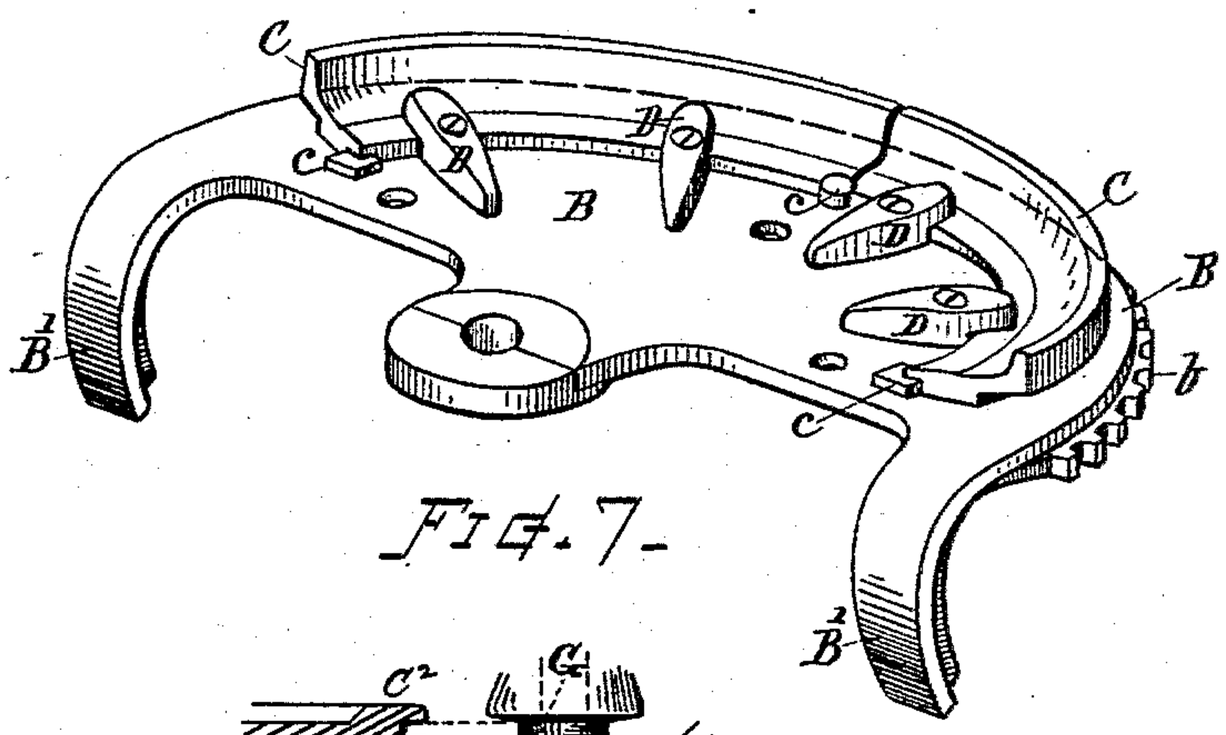

FIG. 7.

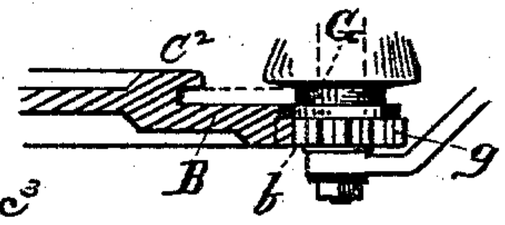

FIG. 9.

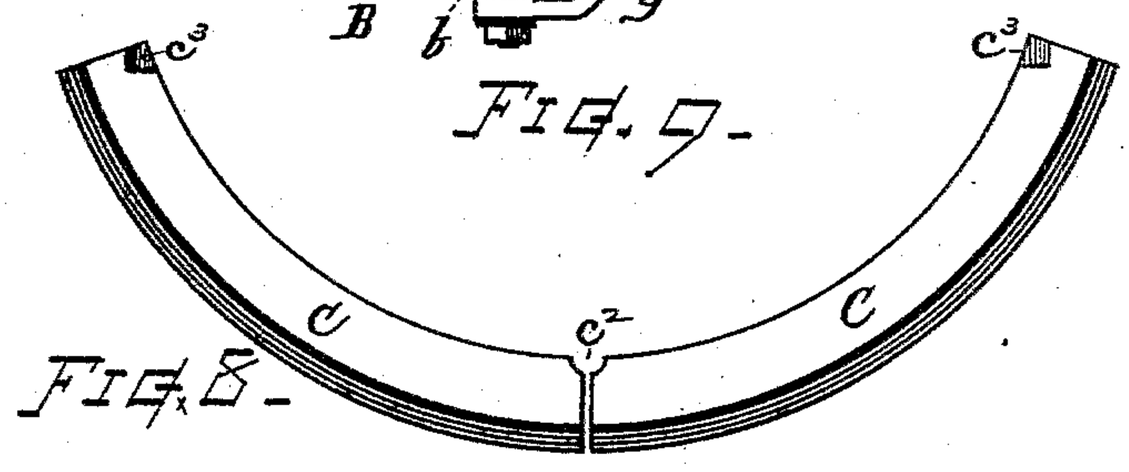

FIG. 8.

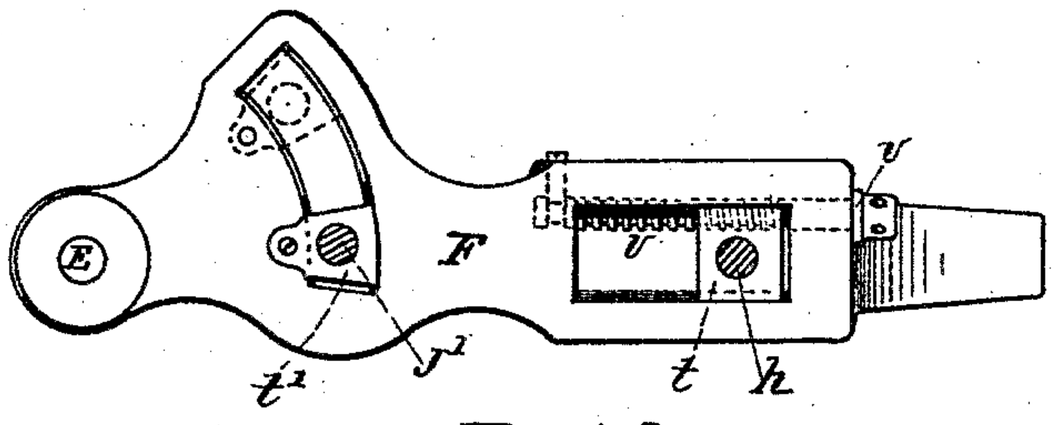

FIG. 10.

Witnesses.

Geo. M. Lee

W. F. Barton

Inventor.

George Warner Taft

By Chas. A. Burleigh

Attorney.

(No Model.) 4 Sheets—Sheet 4.

G. W. TAFT.

MECHANISM FOR BENDING METAL BARS.

No. 411,941. Patented Oct. 1, 1889.

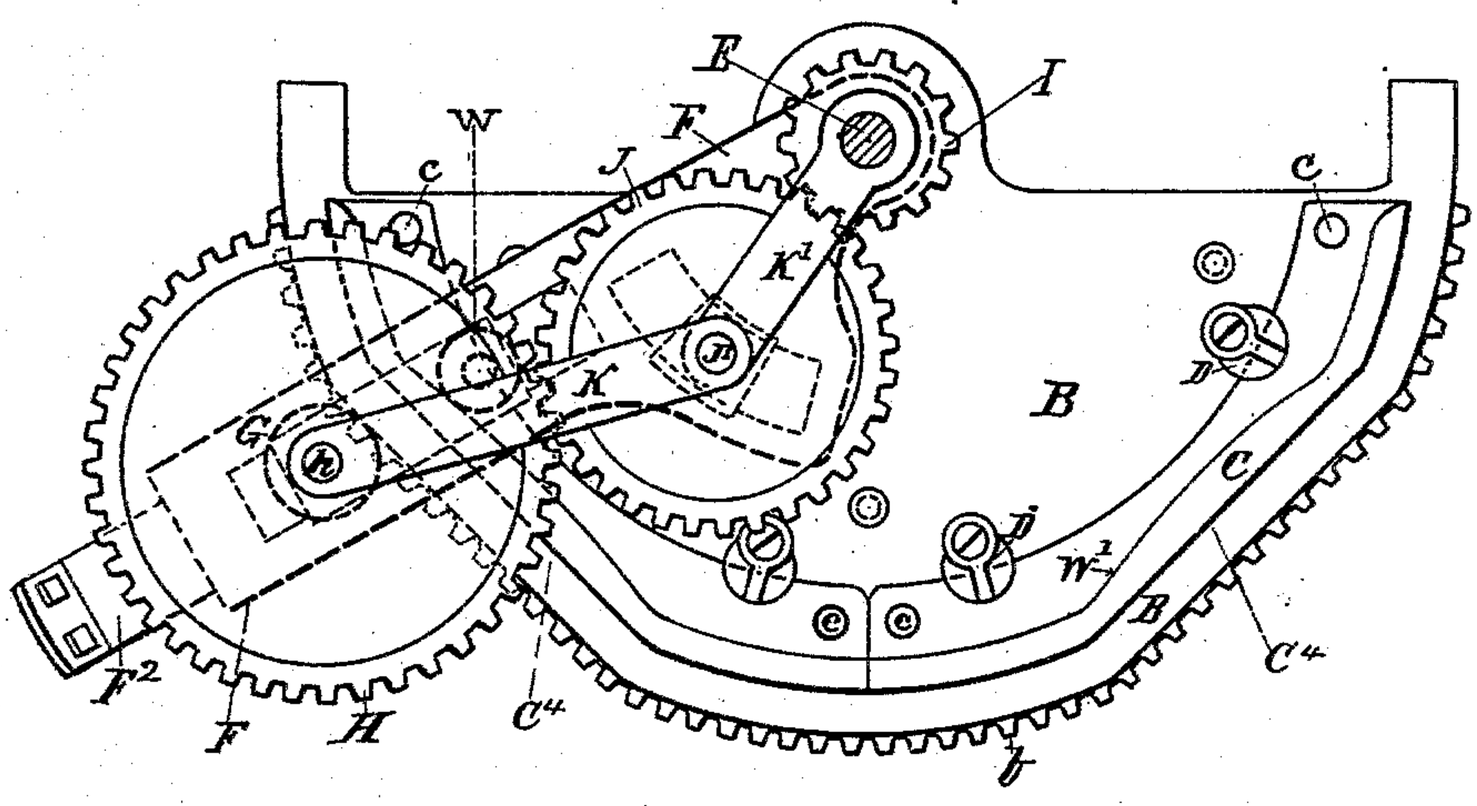

FIG. 11.

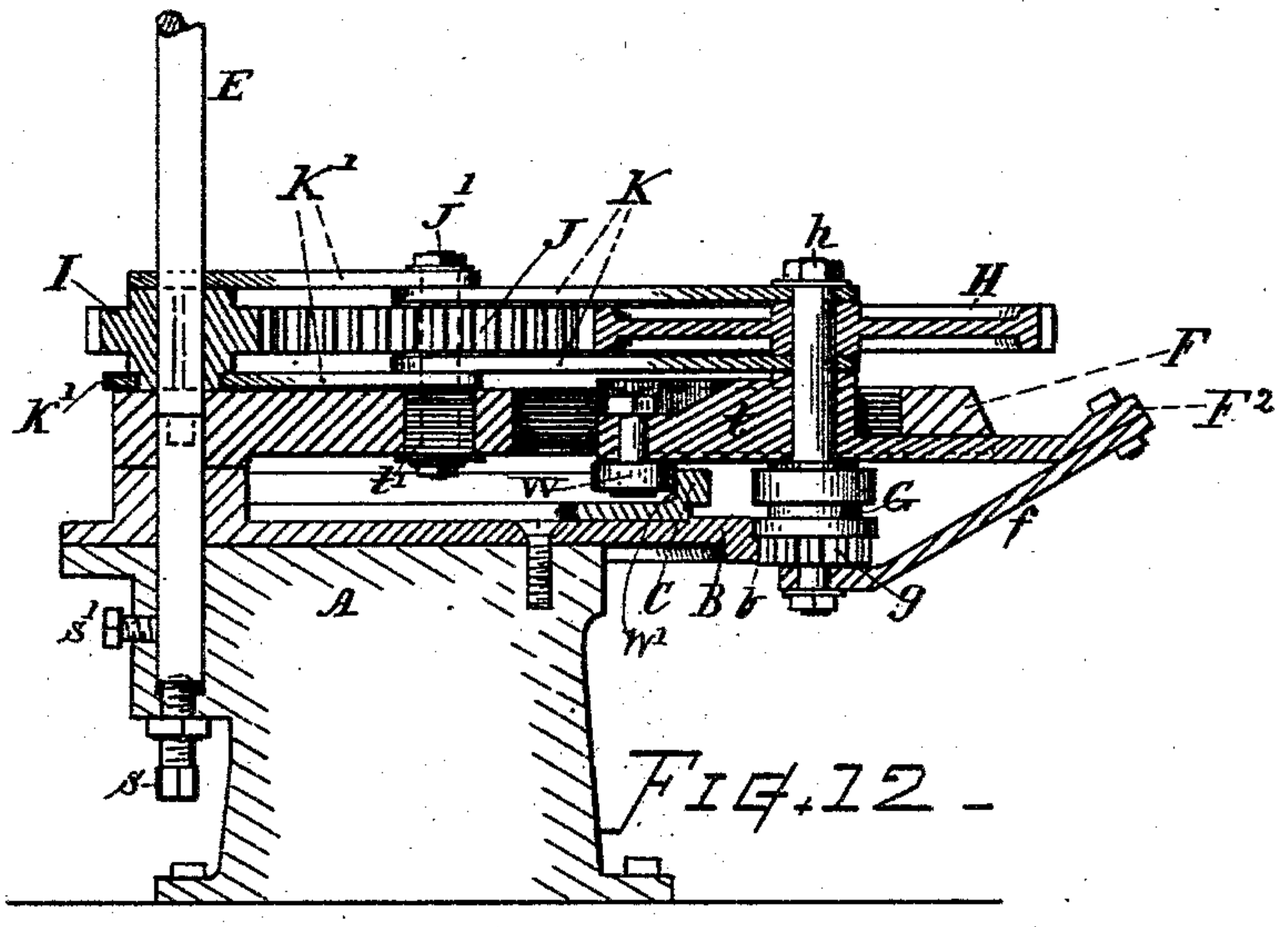

FIG. 12.

Witnesses.
Geo. M. Rice
A. R. Baston

Inventor.
George Warner Taft
By Chas. H. Burleigh
Attorney

UNITED STATES PATENT OFFICE.

GEORGE WARNER TAFT, OF KENNETT SQUARE, PENNSYLVANIA.

MECHANISM FOR BENDING METAL BARS.

SPECIFICATION forming part of Letters Patent No. 411,941, dated October 1, 1889.

Application filed June 3, 1889. Serial No. 312,975. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WARNER TAFT, a citizen of the United States, residing at Kennett Square, in the county of Chester and State of Pennsylvania, have invented certain new and useful Improvements in Mechanism for Bending Metal Bars and Shaping Semicircles for Road-Machines, Scrapers, &c., of which the following, together with the accompanying drawings, is a specification sufficiently full, clear, and exact to enable persons skilled in the art to which this invention appertains to make and use the same.

The objects of this my present invention are, first, to provide efficient means whereby the shaping of semicircles for road-machines or scrapers and similar product having a main semicircle or curve, with supplemental end curves in continuation of but in different planes from the main curve can be accurately and conveniently effected, the mechanism being adapted for either hand or power operated benders, and for facilitating the complete and uniform bending of the combined curves at one operation or at a single heat of the metal; second, to provide a former for the purpose stated composed of a peripherally-toothed semicircle or main segment having supplemental end segments integral with or fixed thereto, and standing with their curvature in different planes or transverse to the plane of the main segment or semicircle, and having a removable overhanging supporting-flange or flanges secured thereto by detachable fastenings that allow the ready displacement of said flange or flanges to permit the free discharge of the compoundly-curved product from the former; third, to provide in a circle-bending mechanism a power-driven shaft and gear, or means for operating the sweep or radial arm which carries the follower-roll disposed at the axis or fulcrum position about which the arm swings, and a suitable train of gearing for transmitting power and motion from said shaft to the follower-roll; fourth, to provide a bending-machine of the class specified with interchangeable formers, such as described, for shaping different styles and sizes of circular shapes, and having facilities for shifting or adjusting the position of the follower-roll and its operating-gearing on the arms to accommodate different dimensions of radius between the axis of the actuating-gear and the follower-roll gear; fifth, to provide, in combination with the radial arm, peripherally-toothed former, and geared follower-roll, an operating-shaft and reversible frictional driving-gear, whereby the direction of rotation of the operating-shaft can be conveniently reversed for effecting movement of the follower-roll and arm in either direction. These objects I attain by mechanism the nature and operation of which is explained in the following detailed description, the particular subject-matter claimed being hereinafter definitely specified.

In the drawings, Figure 1 is a side view of my improved bending-machine. Fig. 2 is a plan view of the driving and reversing gear, drawn to a somewhat smaller scale. Fig. 3 is a plan view of the radial arm, separate. Fig. 4 is a plan view of the bending-machine fitted with my former, having supplemental end segments as employed for shaping semicircles with downwardly-curved ends. Fig. 5 is a vertical section through the rim of said former and its removable flange. Fig. 6 is a plan view showing my bending-machine fitted with a former of smaller dimension for shaping flat semicircles or goose-neck plates, and showing the gearing shifted on the arm for the shorter radius. Fig. 7 is a perspective view of my improved former, having supplemental end segments and removable flanges, as adapted for bending semicircles of road-machines or scrapers. Fig. 8 is a bottom view of the removable flanges as made in two sections. Fig. 9 is a vertical section through the rim of the former shown in Fig. 6 and the lower part of the follower-roll. Fig. 10 shows a modification in the radial arm, wherein adjustable journal-boxes are employed for the gear-studs instead of a series of separate openings. Fig. 11 is a plan view showing the machine as adapted for bending forms which deviate slightly from a true circular segment, also showing a modification in which the journal-boxes for the gear-studs are arranged to slide on the arms as the follower-roll is guided by a flange or surface, the studs being linked together, so that the gears will run in mesh while the follower-roll axis moves outward or inward; and

Fig. 12 is a vertical sectional view of the mechanism as in Fig. 11.

Referring to parts, A denotes the supporting-frame, which can be of any suitable construction for supporting the mold or former B and its accompanying mechanism, the former being preferably detachable from the frame A and interchangeable with other formers adapted for different styles and sizes of curves, or for working the various kinds of metal bars, as T-sections, flat bars, angle-bars, or other desired shapes such as are common to merchantable bar iron and steel.

The former B, (shown in Fig. 7,) designed for shaping the semicircles for road-scrapers, consists of a metal plate shaped as a large semicircular segment, having a suitable forming-surface on which the metal is bent and a toothed peripheral rim *b*, and also having at the respective ends of said large semicircular segment smaller downwardly-curved supplemental segments B′, the curved surfaces of which are in continuation of the forming-surfaces of the main or large segment; but the planes of these supplemental segments stand transverse or at an angle to the plane of the larger segment. Upon the top of the larger segment there is arranged an overhanging removable flange C, preferably formed in two or more parts or sections, held in place upon the former-plate by turn-buttons D, in the manner illustrated. Guide lugs or stops *c* are provided on the former-plate, that engage with recesses c^2 and c^3, formed in the flange-sections, for aid in placing the flange accurately in proper position on the former. The overhanging edge of the flange *c*, for supporting a T-shaped bar, is made as indicated in Fig. 5.

The former B is best made with a center or eye concentric with its toothed periphery, whereby it is centered on the operating-shaft E, which shaft is arranged as an axial center for the former B and bender-arm F. The operating-shaft extends above the former B, with actuating-gear at the top of the room; or, if preferred, said operating-shaft may extend below the machine, with the actuating-gear below the floor. (See dotted lines, Fig. 1.)

The sweep or bender-arm F is centered or fulcrumed on the operating-shaft E or on a stud or bearing axially coincident with said shaft. Said arm projects outward over the former B, in the manner illustrated, carrying a follower-roll G, which is furnished with a gear or pinion *g*, that meshes with the toothed periphery *b* of the former-segment. Said follower-roll is fixed on a shaft or stud *h*, that extends up through the arm F, and has fixed to its upper end a gear H. A driving-gear I is fixed on the shaft E, adjacent to the fulcrum of the arm, and the gears I and H are connected for operation by an intermediate gear J, mounted on a stud J′, supported on the arm F in such manner that when the shaft E is rotated power and motion are transmitted therefrom, through the gearing I, J, and H, to revolve the follower-roll G, and its gear *g*, meshing with the toothed periphery *b* of the former B, causes the arm to sweep or travel around the segment or semicircle of the former. The arm is preferably provided with a brace *f*, to sustain the pressure at the lower end of the follower-roll shaft. The arm F is provided with a series of openings 5, 6, and 7, in either of which the follower-roll shaft *h* can be adjusted to accommodate formers of different radius. Openings 8 and 9 are also provided in the arm for the adjustment of the intermediate gear J, so that said gear will properly mesh with the gears H and I when the shaft *h* is adjusted in either of the openings 5, 6, or 7.

For bending the metal about the supplemental end segments B′, I employ a removable lever L, carrying a follower-roll *l*. For working this lever a chain L′, attached to a winding-drum L^2, and provided with a hook for connection with the lever, can be employed, as indicated in Figs. 1 and 4. The bender or lever L is best fulcrumed on a shaft or stud *a*, supported on the frame A, as indicated. The bending-follower at L may be of any suitable form for effecting the required results in curving the metal around the supplemental segments B′.

The mold or former composed of a main segment and supplemental end segments and having the removable flange section or sections arranged thereon for forming draft-semicircles for road-scrapers, such as described, is a feature of my invention, whether used in connection with a bending-follower operated by hand or by power.

In Fig. 6 I have shown a former of smaller radius and adapted for bending flat bars or forming the goose-neck plates of road-machines. In this the rim of the former and the follower-roll are shaped as shown in Fig. 9, the overhanging flange C^2 being solid or integral with the former-segment. With a flat product this flange can be fixed, since the plates, being curved in only one direction, can be moved from the former without reference to the flange; but in the case of a former having the transverse end segments the flange C requires to be removed in order to release the compoundly-curved finished product.

The operating-shaft E is connected by beveled gears *e e′* with a shaft E^2, having its outer end mounted in a sliding journal box or bearing *m*. Said shaft is provided with a large friction-gear M, disposed between two friction-gears *n* and *n′*, one fixed on the main driving-shaft N and the other on a supplemental driving-shaft N′, with either of which the gear M can be respectively engaged by sliding the bearing-box *m* in one direction or the other, or freed from engagement with either of the driving-frictions when at a central position. The shaft N′ is operated from the main driving-shaft N by suitable pulleys and a crossed belt O, so that the friction-gears

n and n' rotate in opposite directions. Thus, when the friction-wheel M is engaged with the friction-gear n the arm F will be moved forward for bending the metal bar about the former, and when said friction-wheel is engaged with the friction-gear n' the arm F will be swung back to its original position. A suitable shipper-lever and connection P is provided for moving the journal-box m and bringing the friction-wheel M into and out of engagement with the drivers, as required.

In the operation of the machine, the arm F being at the first end of the toothed segment, a bar of T-shaped metal of sufficient length to produce the semicircle of a road-scraper and properly heated is inserted between the follower-roll G and the supporting-flange C on the former, a sufficient portion of its length being extended beyond the end of the main segment to form the downward curve around the first supplemental end segment B′. The bender L is then placed on the stud a, with its follower-roll l above the heated bar, and said bender is forced down so as to bend and shape the metal around said supplemental segment. The shipper P is then moved to throw the wheel M into engagement with the driving-friction n, causing revolution of the shaft E and gear I. The power and motion from the gear I are transmitted through the gears J and H to rotate the follower-roll G, and its gear g causes the arm F and follower-roll to sweep around the toothed segment b of the former. The follower-roll presses the heated metal bar against and under the overhanging flange C, bending it about the circle until the arm has reached the opposite end of the toothed segment, when the friction-gear M is thrown out of action. The supplemental bender L is then put onto the opposite stud a', with its follower-roll l above the end of the heated bar, which is therewith bent downward around the second supplemental end segment B′ of the former B, thus imparting to the central part of the bar a semicircular curve in a horizontal plane, and to its ends a downward curve in a vertical or oblique plane, the whole bending operation being performed at one time or at a single heating of the metal, and in a very rapid, economical, and efficient manner. After the bar has been properly bent the buttons D are knocked around by a sledge or other instrument struck against their long, extended ends, and the flange-sections C are removed from the former, releasing the flange of the bent T-bar, so that the variously-curved product can be discharged from the former. The flange-sections are then replaced and buttoned down, the wheel M shifted into clutch with the driver n', and the arm F returned to its original position by the reverse rotation of the shaft E and gears I, J, H, and g, so that the machine is ready to receive another bar.

The former B may be removed from the frame and a former B^2, such as shown in Fig. 6, for bending flat metal bars to form goose-neck plates, can be interchanged therefor. Said former B^2 is provided with an end socket R, into which the end of the heated bar is inserted and held by a wedge r, while the follower-roll and arm traverse around the toothed segment of this former in a manner similar to that above described. Different-sized formers can be employed in similar manner, the gearing H and J, supported on the arm F, being changed or adjusted to different positions to accommodate the different lengths of radius, and the follower-roll G being interchanged to accommodate bars of different section, as flat bars, T-bars, angles, &c.

In Fig. 10 I have shown the construction of the arm F as provided with movable journal-boxes $t\,t'$, in lieu of the series of holes for supporting the journals of the follower-roll G and power-transmitting gears H and J. The journal-box for the follower-roll G is in this instance adjusted by means of a screw v. This construction affords adjustment to smaller degrees of variation; but where the different adjustments are of sufficient length the construction with the separate holes in the arm, such as in Fig. 3, is the cheaper and simpler method.

In case it is desired to employ a former B, which is not a true segment, or which deviates somewhat from a circular curve, then the arm F can be constructed with slots or guides, so that the journal-boxes t and t' of the gears H and J can slide thereon, as indicated in Figs. 11 and 12, said journal-boxes or the gear-axles being connected by links K and K′ for maintaining the proper radial distances between the gear-axles, while allowing them to change their position on the arm. In connection with the journal-box t, that supports the shaft h, to which the gear H and the follower-roll G is fixed, I arrange a roll W, which runs against a guiding-surface W′ on the supporting flange C; or, if preferred, a separate flange or surface can be specially provided for the purpose. The roll W serves to control and hold the action of the follower-roll G by sliding its journal-box t on the arm, and to keep it in proper relation to the former B at the parts C^4, where the outline or shape of the former and flange C deviates from the true circular curve. The roll W and the follower-roll G act in opposition to each other, one on the surface W′ of the flange and the other on the edge of the former B, and thus guide the bending action in accordance with the contour of the forming-surface, while the links K and K′ throw the intermediate gear J more or less to one side, accordingly as the radial distance between the axes of the shaft h and the operating-shaft E increases or diminishes as the arm F sweeps around the former-segment. In this case the brace f is best attached to an extension F^2 on the sliding

journal-box *t*, instead of directly to the arm proper, (see Fig. 12,) so that said brace can move with the shaft *h*, which it supports.

The operation of the mechanism, arranged as in Figs. 11 and 12, when bending a bar, is substantially the same as that above described, with the exception that the gear-axes are movably supported on the arm F instead of rigidly supported thereon, as in the arrangement illustrated in Figs. 1 and 4.

It having heretofore been the practice to employ a circular former and a lever carrying a follower-roll supported thereon to sweep around said circle for bending metal bars, it will be understood that I do not herein broadly claim such feature; but so far as I am aware in all machines of this class as heretofore employed the construction of the former and the arrangement of the operating-shaft, the arm, and the follower-roll are different from my improved mechanism herein shown and described, and the power for moving the arm is applied in an essentially different manner.

I claim as my invention herein to be secured by Letters Patent—

1. A bending-machine having a shaping-former, a central operating-shaft, a radial arm that swings about the axis of said operating-shaft as a fulcrum, a follower-roll journaled in said arm and provided with a toothed pinion that engages with gear-teeth on the frame or former-plate for rolling about the periphery of the former, and a train of gears carried on said arm by which power and motion are transmitted to said follower-roll from a gear fixed on said operating-shaft and axially coinciding with the fulcrum-axis of said arm, substantially as set forth.

2. In a machine for bending segmental forms of flat, T, or angle iron, the combination of a former having an overhanging rim or flange and a toothed periphery, a swinging arm carrying a presser or follower roll provided with gear-teeth that mesh with the teeth on said periphery, a central operating-shaft about which said arm swings as an axis, and a train of gears supported on said arm for rotating said follower-roll from said operating-shaft, substantially as set forth.

3. In a machine for shaping compound curved semicircles from T-bars or angle-bars, the combination, substantially as described, of the former composed of a main segment provided with supplemental end segments disposed with their planes at an angle or transverse to the plane of the main segment, and continuing the forming-surface on downward curves, the removable flange-section or sections, guide-lugs, and recesses that indicate the position for the flange-section on the former-plate, and turn-buttons that detachably secure said flange-section to the main segment, for the purpose set forth.

4. In a machine for bending semicircles for road machines or scrapers, the former comprising a main segment with shaping-periphery and supplemental end segments disposed in planes at an angle to the plane of the main segment, and an overhanging supporting-flange detachably fixed on the forming curvature of said main segment, in combination with an arm and follower-roll that travels around said main segment, and an auxiliary arm and follower for forcing the metal bar to the curves of the supplemental segments in a direction transverse to said main curve, substantially as set forth.

5. The combination of the removable former provided with a toothed segment, the sweep or radial arm F, carrying the follower-roll G, said roll being geared to match into said toothed segment, the operating-shaft E, disposed at the center or axis of the radial arm and former, a train of gears for rotating said follower-roll, and means for adjusting the axes of the follower-roll and intermediate gear to accommodate formers of greater or less radial diameter, substantially as set forth.

6. In a machine for the purpose specified, the arm F, provided with means for shifting or adjusting the follower-roll axis *h*, and gear-stud J′, the geared follower-roll G, and its actuating-gear H, mounted on the axis or shaft *h*, that is adjustable in said arm, and the intermediate gear J, journaled on a stud J′, that is adjustable in said arm, in combination with a peripherally-toothed removable former and a central operating-shaft provided with a driving-gear I, substantially as and for the purpose set forth.

7. The combination of the former composed of the main segment having the overhanging flange and toothed periphery, and the supplemental end segments continuing the forming-surface on curves in a different plane from that of the main segment, the central shaft, the radial arm fulcrumed on said shaft, the follower-roll journaled on said arm and geared to the toothed periphery of said former, the driving-gear fixed on said shaft, a train of gears mounted on said arm for rotating said presser-roll, and a supplemental follower for bending the metal around said supplemental end segments, substantially as set forth.

8. The combination of the former composed of the main segment having the toothed periphery, overhanging flange, and the supplemental end segments continuing the forming-surface on curves different from that of the main segment, the radial arm or sweep fulcrumed at the axis of the former, the follower-roll journaled on said arm and geared to the toothed periphery of said former, the supplemental bending-follower for bending the metal around said supplemental end segments, and means, substantially as described, for applying power to said supplemental bending-follower, substantially as set forth.

9. In mechanism for the purpose specified, the combination, with the peripherally-toothed former B, the backwardly and forwardly

swinging arm F, carrying the pressing-roll or follower G, its actuating-gears H, I, and J, and the operating-shaft E, of the vibrating shaft E^2, having the friction-wheel M fixed thereon, the oppositely-rotating drive-shafts N and N′, and with driving friction-wheels *n* and *n′*, respectively fixed thereon, and means, substantially as described, for swinging said shaft to bring the wheel M into or out of engagement with either of the driving-wheels *n* or *n′*, all substantially as set forth.

10. In mechanism for the purpose specified, the combination of a peripherally-toothed former, an operating-shaft carrying an actuating-gear I at the center of said former, the swinging arm F, the follower-roll G, and roll-operating gears H and J, adjustably mounted on said arm, the flange on said former having guiding-surface, the follower guide-roll W, connected with the follower-roll journal-support, and links K and K′, connecting the gear-axes with the operating-shaft, substantially as and for the purpose set forth.

Witness my hand this 22d day of May, A. D. 1889.

GEORGE WARNER TAFT.

Witnesses:
S. JONES PHILIPS,
W. E. VOORHEES.