No. 782,004. PATENTED FEB. 7, 1905.

L. D. CHANDLER.

MACHINE FOR FLANGING THE ENDS OF PIPES OR OTHER TUBULAR BODIES.

APPLICATION FILED JULY 21, 1904.

4 SHEETS—SHEET 1.

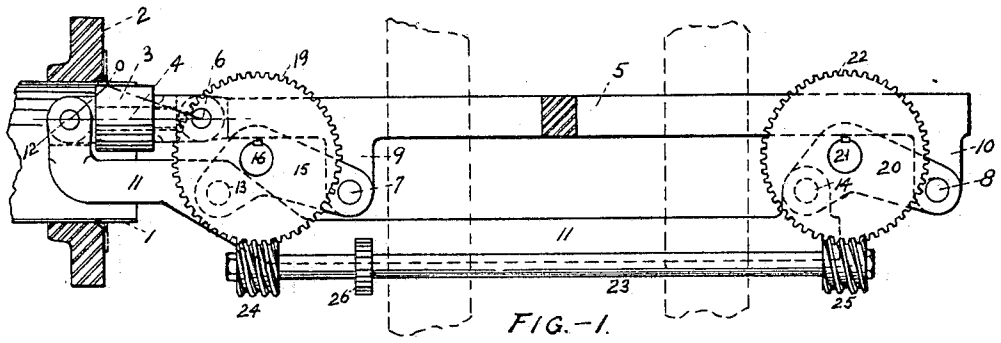

FIG.-1.

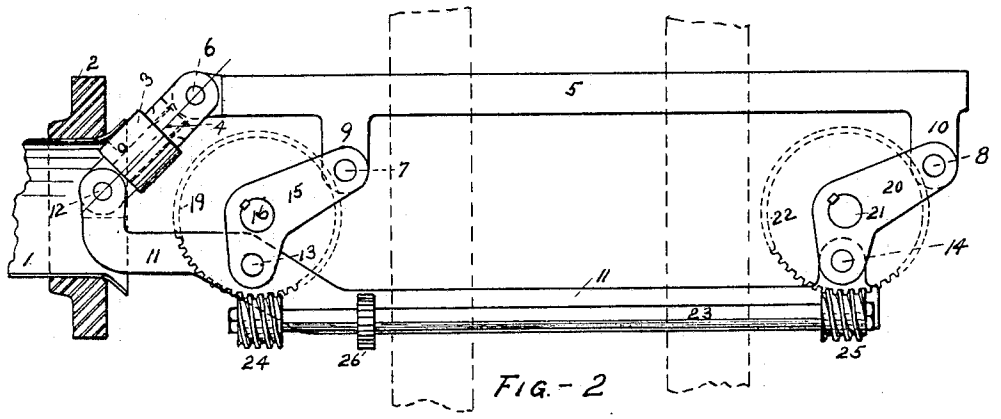

FIG.-2

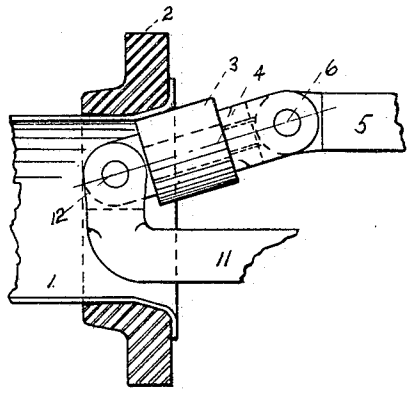

FIG.-3.

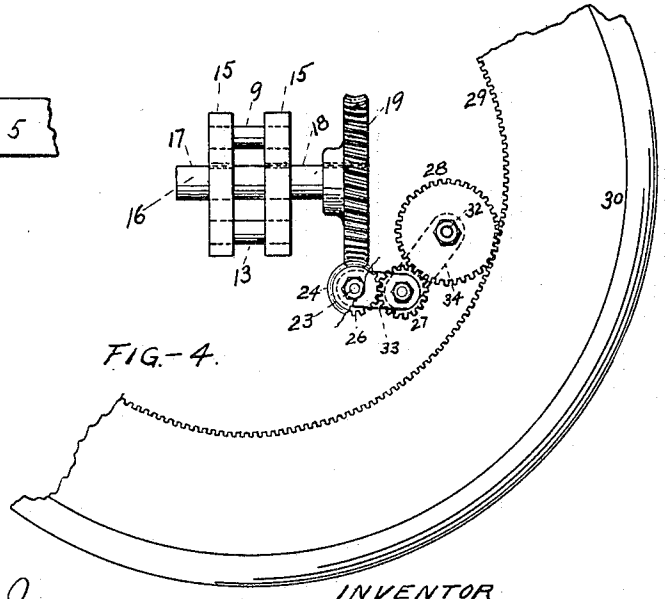

FIG.-4.

WITNESSES

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4 SHEETS—SHEET 2.

FIG.-5.

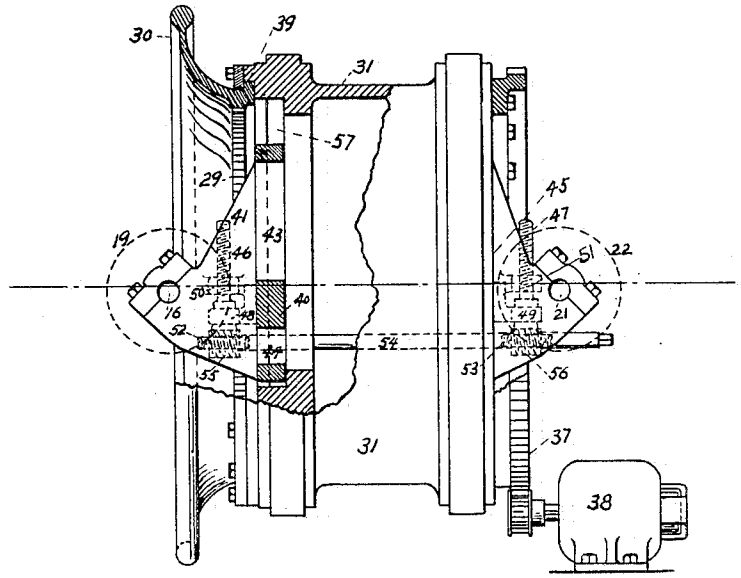
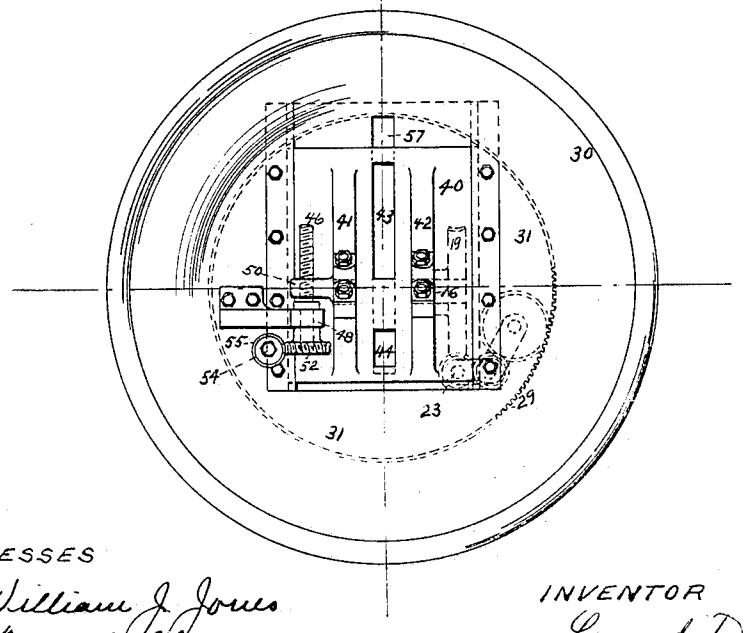


FIG.-6.



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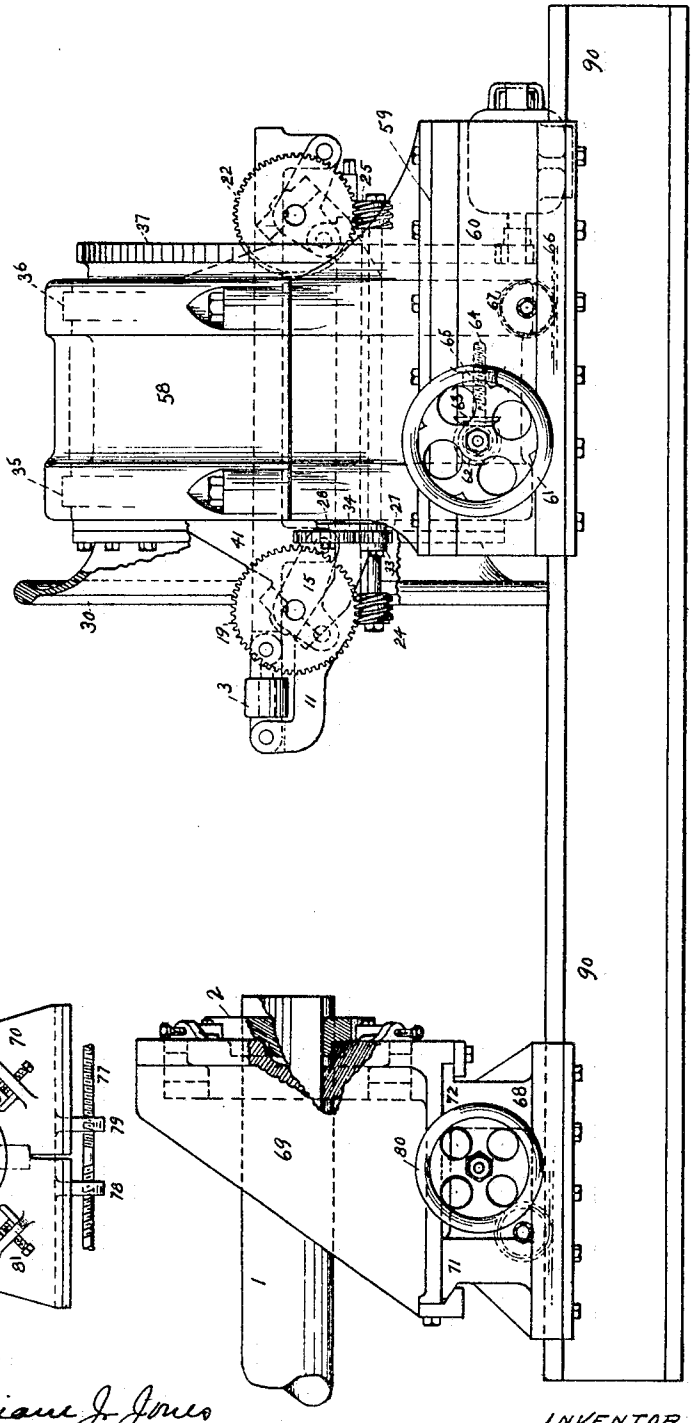

FIG.-7.

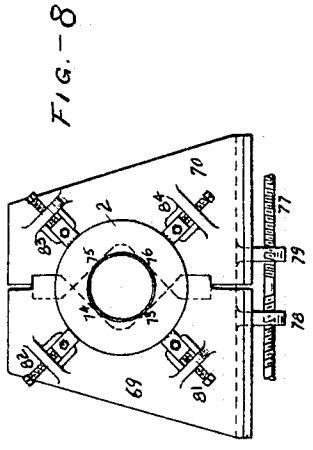

FIG.-8

WITNESSES

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4 SHEETS—SHEET 4.

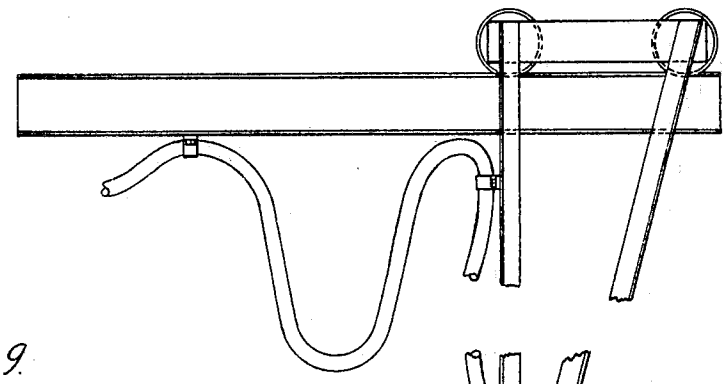


FIG.-9.

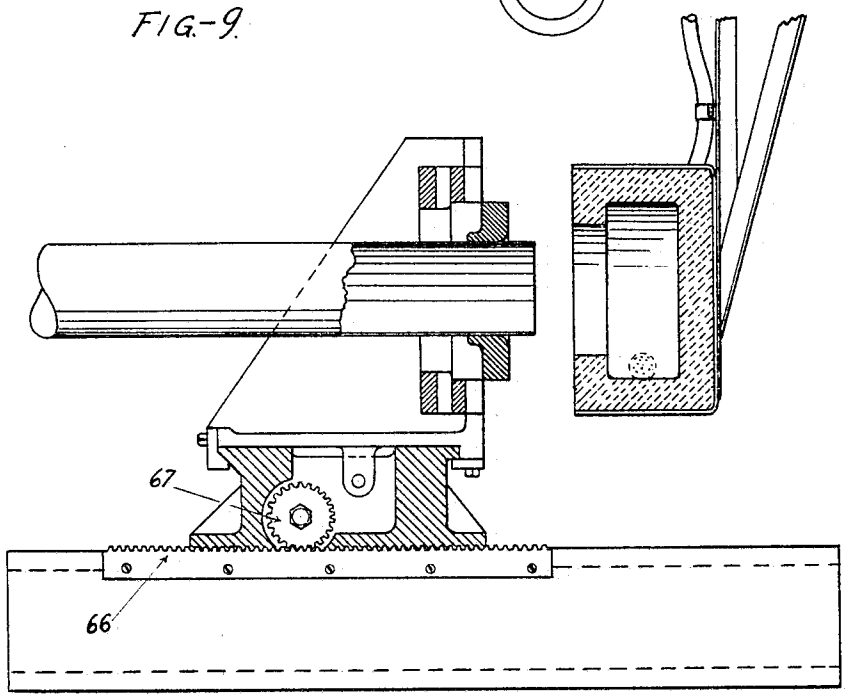
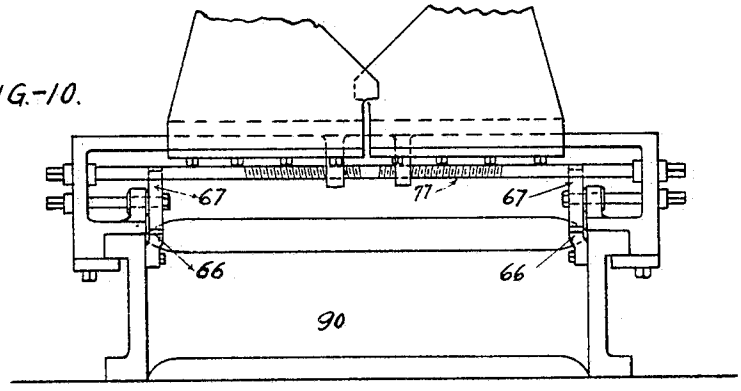


FIG.-10.



Witness
Harry S. Chandler.
Leonard B. Chandler

INVENTOR
Leonard D. Chandler

No. 782,004. Patented February 7, 1905.

UNITED STATES PATENT OFFICE.

LEONARD DEXTER CHANDLER, OF SOMERVILLE, MASSACHUSETTS.

MACHINE FOR FLANGING THE ENDS OF PIPES OR OTHER TUBULAR BODIES.

SPECIFICATION forming part of Letters Patent No. 782,004, dated February 7, 1905.

Application filed July 21, 1904. Serial No. 217,595.

To all whom it may concern:

Be it known that I, LEONARD DEXTER CHANDLER, residing in the city of Somerville, county of Middlesex, and State of Massachusetts, have invented new and useful Improvements in Machines for Flanging the Ends of Pipes or other Tubular Bodies, of which the following is a specification.

My invention relates to that class of machines used for turning over, expanding, or flanging the ends of pipes or tubes.

The object of my invention is to produce a simple efficient machine the operation of which will economize in time and cost, and produce a flange or lip on the ends of the pipes of maximum thickness and high degree of uniformity and finish and in every way mechanically superior to the flange made by the sledge or hammer method.

In the accompanying drawings, Figure 1 is an elevation of the principal mechanism shown in its starting position, the roll engaged with the end of the pipe, the whole being removed from the machine. Fig. 2 is another view of Fig. 1, showing mechanism and roll in its middle or flanging position. Fig. 3 is a special form of flanged-over joint and shows the adaptability of the machine to various curves, angles, and shapes of flanges. Fig. 4 is a part end view of the front face of machine, showing the mechanism for giving the roll its changing inclination to the axis of the pipe. Fig. 5 is an elevation of the cylindrical drum, part of the shell being broken away, showing in section the carriage with means for radial adjustment, the whole removed from the frame of the machine. Fig. 6 is an end view of Fig. 5, showing the carriage with radial adjustment for same. Fig. 7 is a side elevation, partly in section, of the machine completely assembled. Fig. 8 is a part end view of Fig. 7, showing the V-shaped jaws gripping the pipe and four radial adjusting-screws for holding the flange. Fig. 9 is a side elevation of the vise for holding the pipe and of a portable oil-furnace for heating the end of the pipe. Fig. 10 is a part end elevation of the vise shown in Fig. 7.

Similar parts are similarly numbered in the different figures.

In Fig. 1 or Fig. 2, 1 is a pipe or other tubular body on which the operation is to be performed. 2 is a flange placed over the end of the pipe and onto the face of which the end of the pipe is to be turned over or flanged into the position shown in dotted lines. 3 is a roller mounted on and free to turn on the roller-shaft 4. 4 is the roller-shaft. 5 is a rectangular bar carrying at its front end one end of the shaft 4 on the pin 6 and being itself carried by the two pins 7 and 8, engaging its two lugs 9 and 10, respectively. 11 is another rectangular bar similar to 5, its front end being bent at right angles to its length, and carrying the other end of shaft 4 on the pin 12, the arm 11 itself being carried similarly to arm 5 by the two pins 13 and 14. The pins 7 and 13 are carried by and form part of the double bell-crank rocker 15. The double bell-crank rocker 15 is keyed to and turned by a shaft 16, which is free to turn in the bearings 17 and 18, Fig. 4. 19 is a worm-wheel keyed on the end of shaft 16. 20 is a double bell-crank rocker carrying pins 8 and 14 and identical in shape with double bell-crank rocker 15. 21 is a shaft, and 22 a worm-wheel keyed to 21, each identical respectively with 16 and 19. 23 is a shaft carrying the two worms 24 and 25, which are keyed to it, and which engage and drive the two worm-wheels 19 and 22, respectively. 26 is a pinion fastened to shaft 23, and providing means for driving it. Shaft 23 is driven through the train of gears 26, 27, 28, and 29. 30 is the operating-wheel having a concentric bearing 39, Fig. 5, on the front of the drum 31. 33 and 34 are links for keeping 27 in gear with 28 and 26. 31, Figs. 5 and 6, is a cylindrical drum turning in bearings 35 and 36, Fig. 7, in the frame 58 and being driven through the gear 37 by the motor 38, which is mounted on the carriage 60. 40 is a carriage having radial motion in ways in the front face of the drum 31. 41 and 42 are arms forming part of and projecting from the face of said carriage 40, and contain the bearings 17 and 18 for the shaft 16. 43 and 44 are slots cut through the carriage 40, and through which the bars 5 and 11 pass and by which the said bars are given their revolving motion. 45 is another car-

riage almost identical with carriage 40, having radial motion in ways in the rear face of the drum and forming the bearings for the shaft 21. Shaft 23 passes through and is journaled in the carriages 40 and 45 at the points 23, Fig. 6, the faces of the drum being slotted to allow of the radial motion of the shaft 23 as it moves with the carriages. 46 and 47 are the radial adjusting-screws for the carriages 40 and 45, turning in the lugs 48 and 49, respectively, which are fast to the front and rear faces of the drum, respectively, and engaging the lugs 50 and 51, which are fast to the carriages 40 and 45, respectively. 52 and 53 are worm-wheels keyed to the screws 46 and 47, respectively. 54 is a shaft passing through and having bearings in the front and rear faces of the drum 31. Shaft 54 carries the two worms 55 and 56, which are fast to it and which engage the worm-wheels 52 and 53, respectively. Shaft 54 is turned from its rear end by means of a crank-wrench. (Not shown on the drawings.) 57 is a radial slot through the front and rear faces of the drum 31, through which the bars 5 and 11 pass. 58, Fig. 7, is the main frame, receiving the drum 31 in its bearings 35 and 36. Frame 58 is supported and slides in longitudinal ways 59 on a carriage 60. Said carriage 60 is supported on and slides on the main longitudinal ways 90. The frame of the machine has a slight longitudinal adjustment on the carriage 60, by means of the hand-wheel 61, through the bevel-gears 62 and 63 and the lead-screw 64, which is fast to the carriage, and engages the lug 65, which is fast to the frame 58. Carriage 60 is moved on the ways 90 through the rack and pinion 66 and 67.

In Fig. 7, 68 is a carriage with longitudinal motion on the ways 90 through a rack and pinion, same as the carriage 60. 69 and 70 are carriages sliding on the crossways 71 and 72 of the carriage 68. The carriages 69 and 70 have V-shaped jaws that clamp the pipe securely at the points 73, 74, 75, and 76 and are drawn together or forced apart by the right and left hand screw 77, which engages the lugs 78 and 79, projecting from their under sides. The right and left hand screw 77 is turned by the hand-wheel 80. 81, 82, 83, and 84 are adjusting-screws and blocks on the front faces of the carriages 69 and 70 and are used for adjusting and securely clamping the flange 2 in position.

As I before stated, the work of this machine is the flanging over of the ends of pipes, the operation being performed with the end of the pipe either cold or hot, depending on the nature of the metal composing the pipe, the size of the pipe, the thickness of the metal, and the degree of turning over or flanging—that is, whether the pipe is simply to be expanded tightly into the flange or to be turned over with a wide lip, as shown in Figs. 1, 2, and 3. With a pipe of soft ductile metal or of large diameter and of little thickness, the flanging operation may advantageously be performed cold; but when the pipe is of considerable thickness and of a tough metal, such as our present commercial steel pipe, it will be found desirable to heat it, especially if there is to be a wide lip formed on it. It is for this latter class that this machine was particularly designed.

The operation of the machine is as follows: The pipe to be flanged is placed in the vise and securely clamped and held in place by the jaws 69 and 70, which are drawn together by means of the wheel 80, care being taken that the axis of the pipe coincides exactly with the axis of the machine and that the end of the pipe projects through the face of the chuck the exact distance to give the required dimensions to the lip when turned over. The flange 2 is now placed over the end of the pipe with a good support against the face of the vise, adjusted in position, and securely clamped by the adjusting-screws and blocks 81, 82, 83, and 84, care being taken to have the flange exactly normal to the axis of the pipe. A portable gas or oil furnace, Fig. 9, is now brought into position over the end of the pipe, and the pipe end is brought to the required heat, generally a bright red, when the furnace is removed. The eccentricity of the roller 3 or the carriage 40 with respect to the axis of the pipe or machine is now adjusted by turning the shaft 54 from its rear end, to suit the particular size of pipe to be flanged. The machine is now set revolving by means of the motor, the bars 5 and 11, and also the roller 3, revolving about the axis of the pipe or machine, the bars 5 and 11 being driven by the slots 43 and 44 in the carriage 40. The machine is now moved along the ways 90 by means of the rack and pinion 66 and 67 until the roller has entered the pipe the correct distance, when the machine is securely clamped to the ways 90. The axis of the roll up to this point has been parallel to the axes of the pipe and machine and now simply rolls around on the inside surface of the pipe, doing no flanging, but simply revolving with the drum 31, and the operating-wheel 30. Now, in order to flange the end of the pipe it is necessary to give the roll its varying inclination from nothing when starting, to ninety degrees, or normal to the axis of the pipe when finishing. This is done by retarding or braking the motion of the operating-wheel 30 by hand, which can very easily be done, as the machine turns slowly. When the lip of the pipe has been turned over to a position normal to the axis of the pipe, the machine is speeded up and given a slight feed by means of the wheel 61 against the lip of the pipe, forcing the back of said lip to an even and true bearing against the face of the containing-flange, and giving the front face of said lip a true and finished surface requiring no further tool finish, thus

completing the operation. The flanging operation may be done by degrees or it may be done in one continuous operation. The operating-wheel is independent of and free to turn upon the drum, but turns with it unless disturbed from external sources. So, since there is no relative motion between the operating-wheel and the drum, the roll will stay at whatever inclination it is set, and so can be given different sets at different intervals, or it may be given a gradually-increasing inclination until the flanging is completed. The resistance offered to the hand by the operating-wheel serves as a good indicator of the advisable rate of inclination of the roll. In this flanging-over operation it is desirable that the bending action should be confined to a zone adjacent to the front inside edge of the containing-flange. In order that the roll may do this and also that in its varying inclinations it may not put undue pressure on the pipe, it is necessary that the inclination of the axis of the roll should be about a certain point in said zone and external to its own axis. The certain point that I have chosen (marked 0) is the intersection of the face of the lip after it has been turned over, with the engaging element of the roll when in its starting position, although the exact location of this point is a matter of judgment. In order that the roll or its axis may have an inclination about or around this point, it is necessary that the ends 12 and 6 of its axis, and of the bars 5 and 11, move on the circumference of a circle with radii 0 to 12 and 0 to 6, respectively. This is done as follows: The design of the double bell-crank rockers 15 and 20 is such that the triangles formed by lines drawn through the axes of the pins 13, 16, and 7, and through the axes of the pins 14, 21, and 8, are identical with the triangle formed by the axis of the roll and the two radii 0–12 and 0–6 and the roller-shaft, the two bars 5 and 11, and the two double bell-crank rockers 15 and 20 are so connected together that the similar sides of the above three triangles are parallel. From this construction it follows that whatever motion the roller has or the ends of the roller-axis have must be on the circumference of a circle with the point 0 as a center. This inclination of the roller about a point external or eccentric to its own axis is a very vital and important feature of this machine.

Although the machine turns slowly, the entire operation is of short duration and can easily be done with one heat, doing away with the injurious effects of excessive heating.

The roller shown in the drawings is of cylindrical shape; but any other shape may be used to suit any special form of flanged-over joint or expanded pipe.

The machine lends itself very readily for expanding purposes, as the pipe may be pressed or expanded into the flange, first, by the radial adjustment of the carriages 40 and 45; second, by using the longitudinal feed; third, by the inclination of the roller, and, lastly, by any combination of these three adjustments. Another important point is, that the machine can be running all the time during the flanging operation, all the necessary adjustments being made while it is in motion.

This machine is readily made to suit all sizes of pipe by the simple radial adjustment of the carriages carrying the flanging mechanism. It insures of the flange being perfectly normal to the axis of the pipe. It is bound to give a lip of true and uniform dimensions and of maximum thickness and with a true and perfect bearing on the face of the supporting-flange and with none of the irregularities, strains, or burns common with the hammer method of flanging.

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

1. In a pipe-flanging machine, the combination of: a flanging-roll; a shaft for carrying said roll; two bars connected together and carrying the ends of said shaft; two double bell-crank rockers for connecting and supporting said bars, and giving them their radial motion; two shafts acting as fulcrums and bearings for said double bell-crank rockers and keyed to them; an operating-shaft carrying two worms and a pinion-gear fastened to it; two worm-wheels keyed to the ends of said fulcrum-shafts, and engaged by said worms; an operating-wheel provided with an internal gear and mounted in bearings on the face of the machine; a spur-gear mounted on a stud on the face of the machine, and in gear with the operating-wheel; an idler-gear connecting said spur-gear with said pinion on the operating-shaft; links for keeping said idler in gear, all substantially as shown and described.

2. The combination in a pipe-flanging machine of a cylindrical drum; gears for driving said drum; radial ways formed in the front and rear faces of said drum; carriages sliding in said ways; arms forming part of and projecting from said carriages; bearings for double bell-crank-rocker shafts in said arms; radial slots through said carriages and through the faces of said drum; screw-shafts journaled in lugs on the face of said drum, and in threaded engagement with lugs on the faces of said carriages; worm-wheels keyed to said screw-shafts; an adjusting-shaft, operated from its rear end, passing through both faces of said drum, and carrying two worms engaged with the worm-wheels on said screw-shafts; an operating-wheel with concentric bearings on the front face of said drum, and provided with an internal gear; a motor in spur-gear connection with said drum for driving it, all substantially as shown and described.

3. In combination in a pipe-flanging machine: a longitudinal bed provided with ways;

a carriage having longitudinal motion on said bedways; a rack fast to said longitudinal bed; a pinion mounted on a shaft journaled in side of said carriage and engaging said rack; a cylindrical drum; a flanging mechanism carried in said drum; a drum-frame furnishing bearings for said drum and provided with longitudinal guides, said guides sliding in longitudinal ways on the top of said carriage; a motor mounted on said carriage and in spur-gear drive with said drum; a screw-shaft journaled in a lug on said carriage, and in threaded engagement with a lug on said drum-frame; a shaft journaled in the side of said carriage, provided with a hand-wheel on its external end, and in bevel-gear connection with said screw-shaft at its inner end, all substantially as shown and described.

4. In a pipe-flanging machine the combination of: a roller-shaft eccentric to the axis of the pipe and hinged at its two ends; a roller mounted on, and free to turn on, said shaft; two bars supporting and hinged at their front ends to the ends of said roller-shaft; two double bell-crank rockers identical in shape, connecting said bars, and giving them their motion in a radial plane, said double bell-crank rockers being so shaped and connected that the front ends of the said bars, and so the two ends of the said roller-shaft will move on the circumference of a circle with its center external or eccentric to the axis of the said roller-shaft; a revolving cylindrical drum; means for driving said drum; parallel radial ways in each face of said drum; carriages mounted in said radial ways; a screw-shaft radial adjustment for said carriages; radial slots cut in and through said carriages; radial slots cut in and through each end of said drum and coinciding with the slots in said carriages; two arms projecting from the face of each of the said carriages, and containing bearings for the fulcra shafts of said double bell-crank rockers; worm-wheels fast to ends of fulcra shafts of said double bell-crank rockers; an operating-shaft having bearings in each of the two said carriages and carrying fastened to itself a pinion and two worms, said worms engaging said worm-wheels; an operating-wheel provided with an internal gear mounted in bearings on the front face of said revolving drum, and free to turn independently of it; a spur-gear mounted on a stud in the front face of said drum and in gear with said operating-wheel; an idler-gear connecting said spur-gear with said pinion on said operating-shaft; links for holding said idler in gear for the different radial positions of said carriages; an intermediate carriage for supporting and carrying the frame for the said revolving drum; a screw-shaft longitudinal adjustment of said frame on said carriage; a bed-frame with ways for supporting said carriages and on which it slides; a rack and pinion longitudinal feed for said carriage on said longitudinal bedways, all substantially as shown and described.

5. In a flanging-machine, the combination of a revolving drum; means for driving said drum; a frame for carrying said drum; longitudinal guides on side of said frame; an intermediate carriage; ways on the top of said carriage for receiving said frame; means for longitudinal adjustment of said frame on said carriage; a main bed-frame with ways for receiving said carriage; means for longitudinally feeding said carriage on said bedways; parallel radial ways in each face of said revolving drum; carriages sliding in said ways of revolving drum; parallel radial slots cut through said carriages; parallel radial slots cut through the ends of said drum, and coinciding with slots in said carriages; two bars passing through said slots in said carriages and given a revolving motion by them; two double bell-crank rockers mounted in bearings on said radiating carriages, and hingedly connected to said bars by pins; a roller-shaft hingedly supported and guided by the front ends of said bars; a flanging-roller mounted on, and free to turn on, said shaft; worm-wheels fastened to the axes or fulcrum-shafts of said double bell-crank rockers; worms engaging said worm-wheels; an operating-shaft carrying said worms fastened to it; an operating-wheel concentrically mounted on bearings on the front face of the said revolving drum, and provided with an internal gear; a train-gear connection or drive between said operating-wheel and said operating-shaft, all substantially as shown and described.

6. The combination in a pipe-flanging machine of: a forming or flanging roller; a shaft eccentric to the axis of the pipe for carrying said roller; a motion of varying inclinations to the axis of the pipe of the said roller-shaft, about a point external or eccentric to the axis of said roller or shaft; two bars of varying eccentricity to the axis of the machine, carrying on their front ends by hinged connection the ends of the said roller-shaft; two double bell-crank rockers hingedly connecting the said two bars; a revolving cylindrical drum; parallel radial ways in the front and rear faces of said drum; carriages sliding in said parallel radial ways; bearings in projecting arms on said carriages for carrying said double bell-crank rockers; radial slots in said carriages for receiving said bars and for giving them their revolving motion; an operating-wheel mounted in bearings on face of said revolving drum, but free to turn independently of it; spur-gear and worm-wheel connection between said operating-wheel and said double bell-crank rockers for giving the said roller-shaft, and thus the roll, its varying inclinations to the axis of the pipe; means for equal radial adjustment for the two said carriages; means for longitudinally adjusting said revolving drum and its included mechan-

ism on the supporting-carriage, all substantially as shown and described.

7. In a pipe-flanging machine the combination of: a main bed-frame with ways; an intermediate carriage sliding on said bedways; crossways on the top of said carriage; two transverse carriages sliding on said crossways, each provided with a V-shaped jaw for gripping and securely holding the pipe; adjusting-screws and blocks on the front faces of said transverse carriages for clamping the flange in position; a right and left hand screw-shaft journaled in the side of said intermediate carriage and provided with a hand-wheel for its operation; lugs projecting from the under sides of the said transverse carriages and in threaded engagement with the said right and left hand screw-shaft; a shaft journaled in the side of said intermediate carriage and provided with a pinion on its inner end; a rack fastened to the main bed-frame and engaged by said pinion, all substantially as shown and described.

8. In combination in a pipe-flanging machine: two V-shaped jaws sliding on transverse or cross ways of an intermediate carriage; adjusting-screws and blocks on the face of said jaws; a right and left hand thread for the transverse adjustment of the two said V-shaped jaws; a rack-and-pinion feed for the intermediate carriage on the main bedways, all substantially as shown and described.

In testimony whereof I herewith set my hand in presence of two witnesses.

LEONARD DEXTER CHANDLER.

Witnesses:

W. J. JONES,

W. L. CLARK.