F. BRUNE.

MACHINE FOR MAKING SHEET METAL PIPE ELBOWS.

APPLICATION FILED JAN. 31, 1906.

1,047,375.

Patented Dec. 17, 1912.

6 SHEETS—SHEET 1.

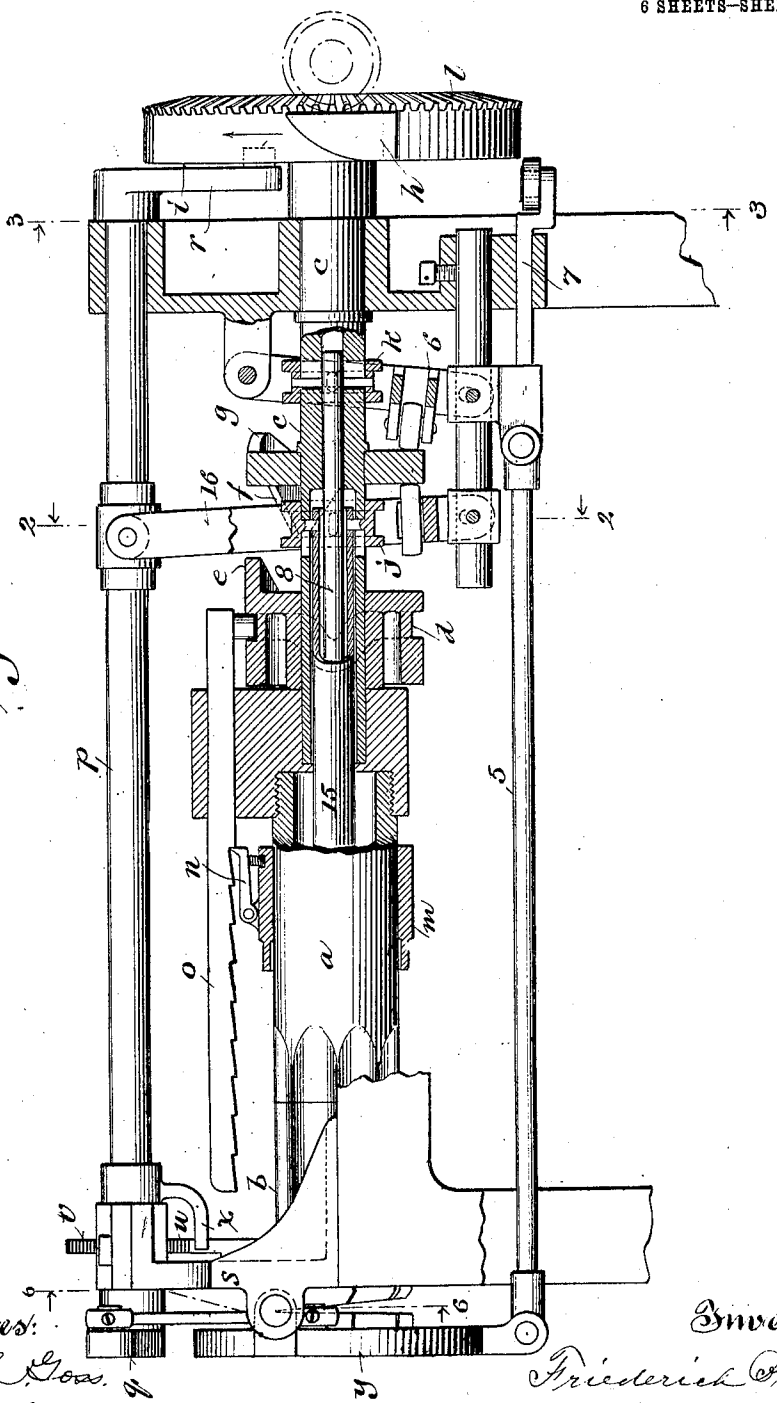

Fig. 1.

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Fig. 3.

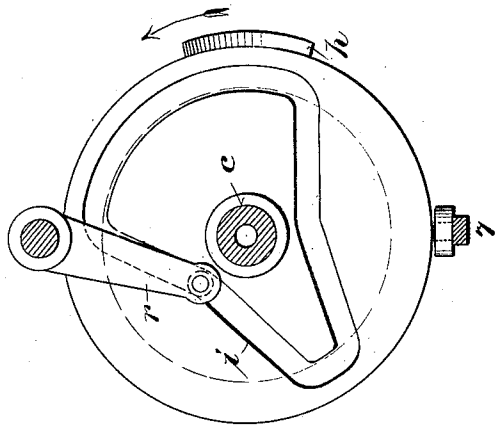
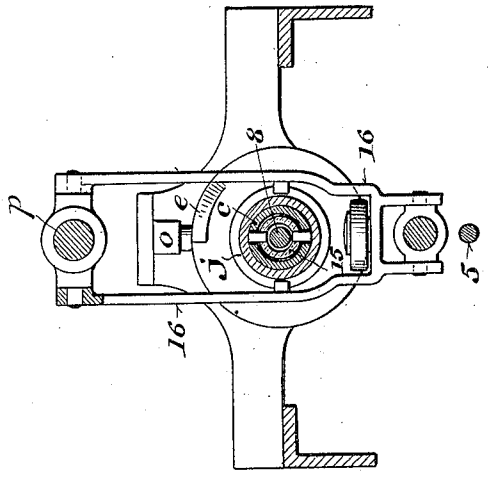


Fig. 2.



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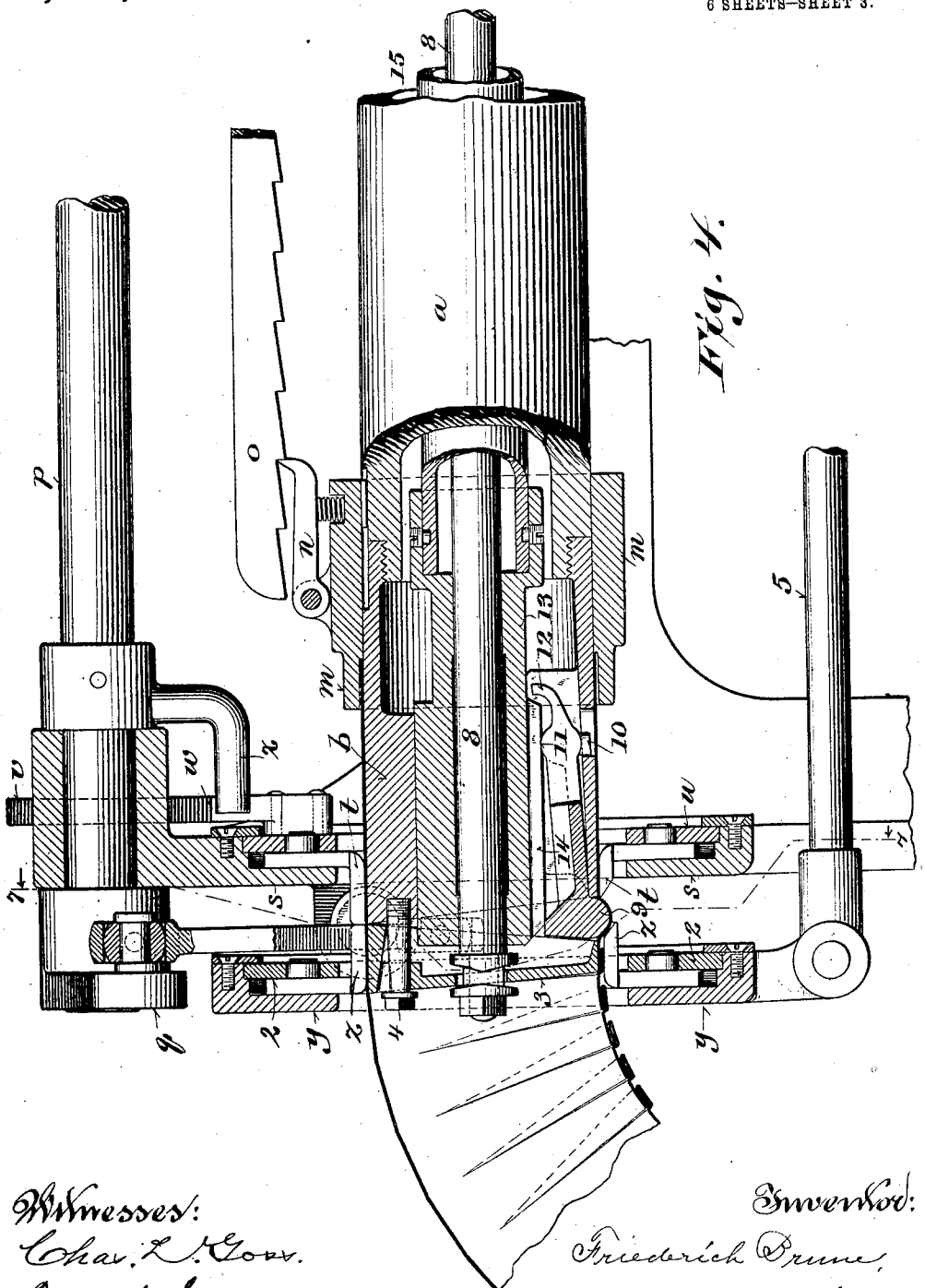

Fig. 4.

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6 SHEETS—SHEET 4.

Fig. 9.

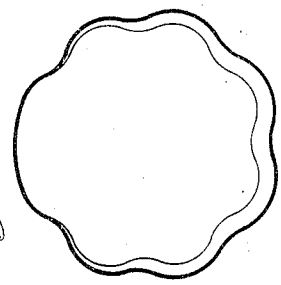


Fig. 10.

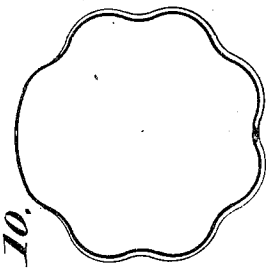


Fig. 8.

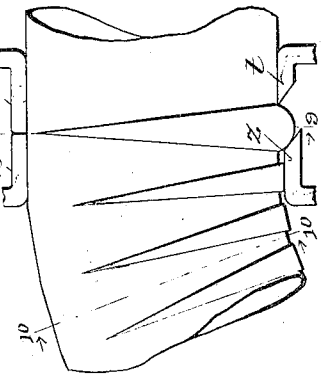
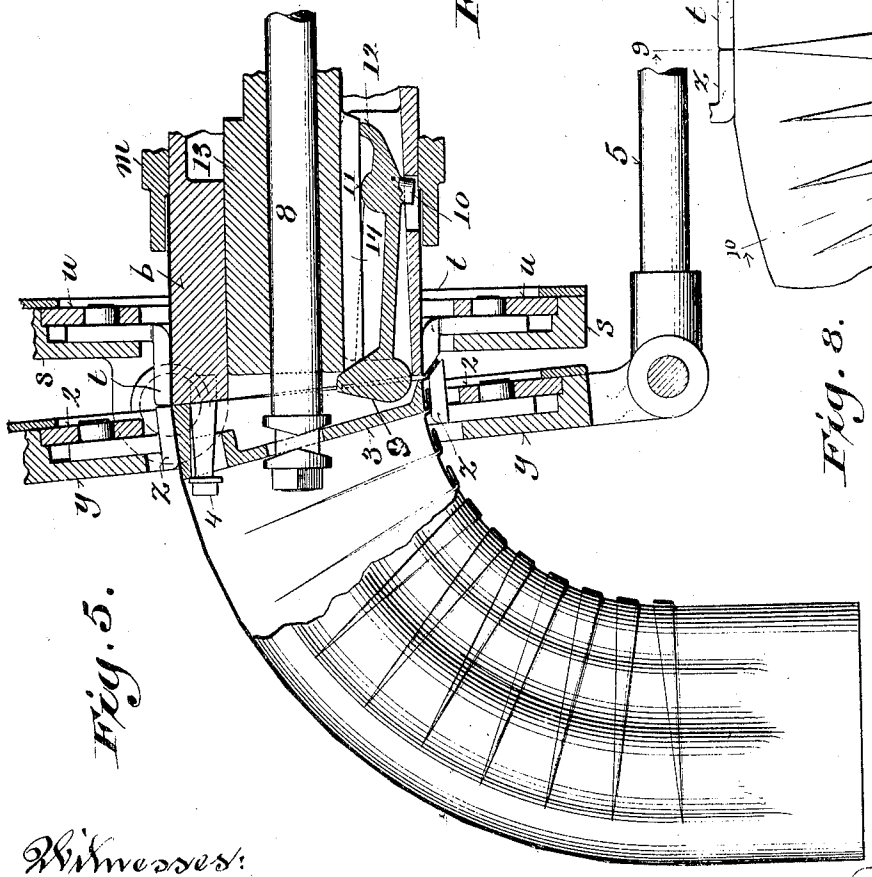


Fig. 5.



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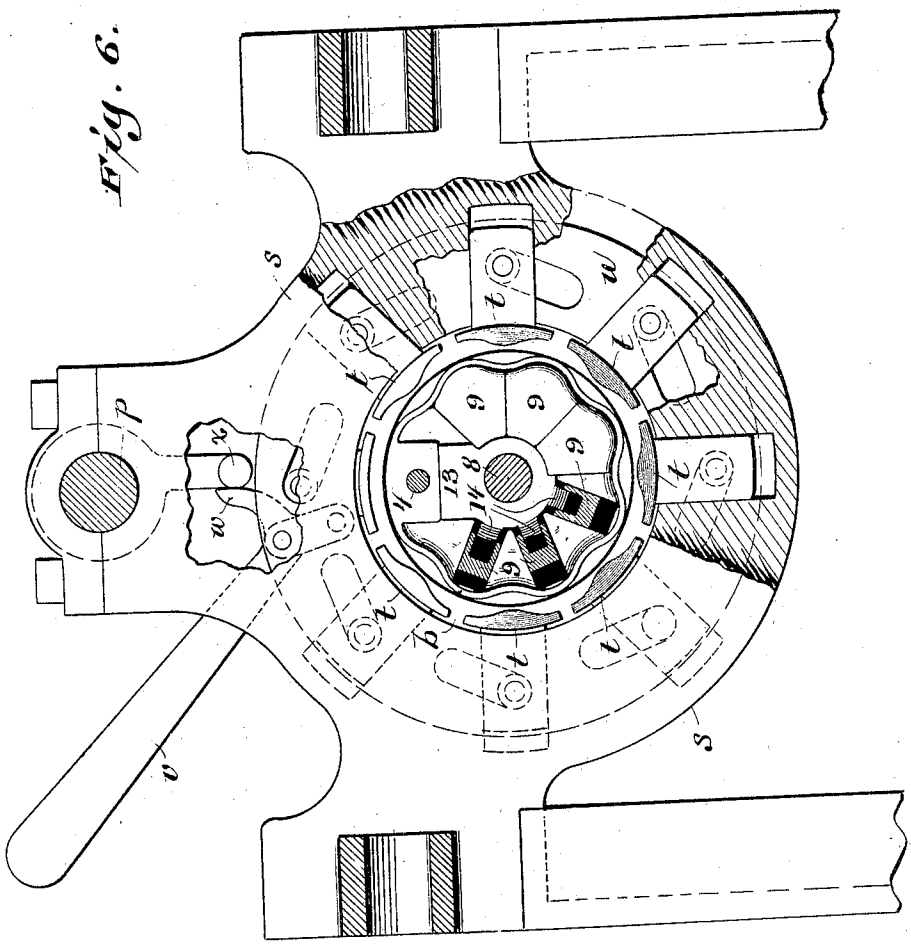
6 SHEETS—SHEET 5.

Fig. 6.



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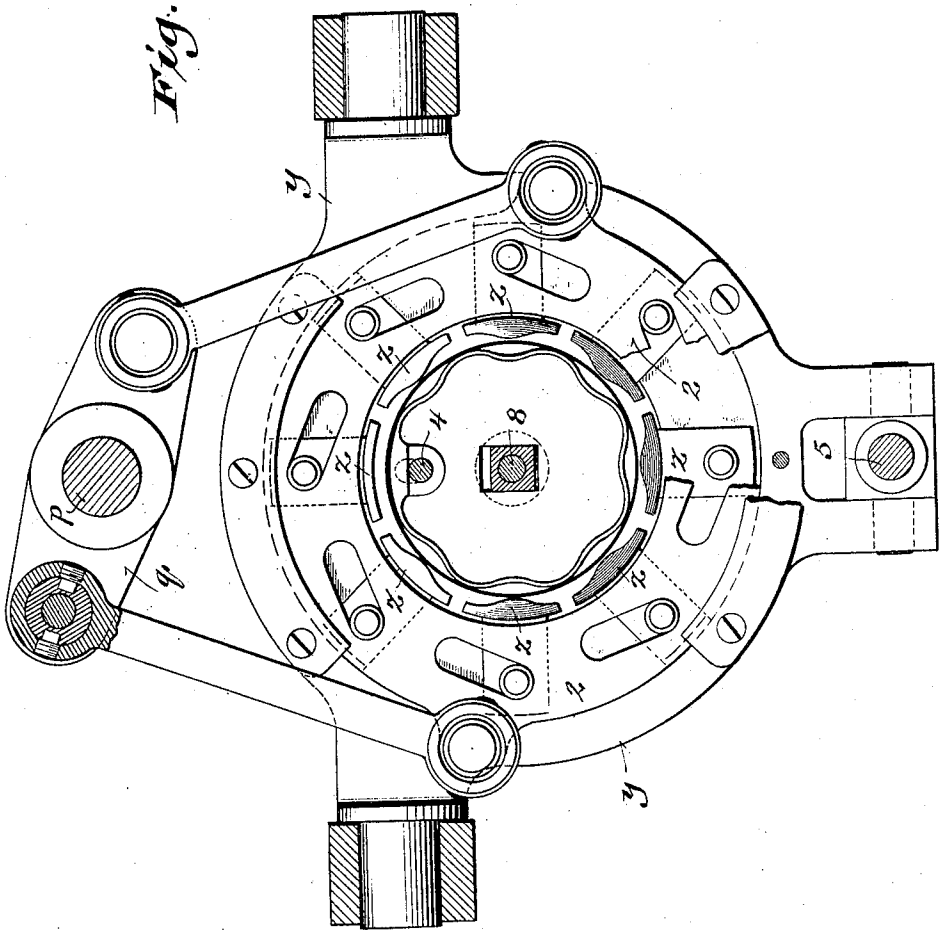
6 SHEETS—SHEET 6.

Fig. 7.



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UNITED STATES PATENT OFFICE.

FRIEDERICH BRUNE, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO MILWAUKEE CORRUGATING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

MACHINE FOR MAKING SHEET-METAL PIPE-ELBOWS.

1,047,375. Specification of Letters Patent. Patented Dec. 17, 1912.

Application filed January 31, 1906. Serial No. 298,745.

To all whom it may concern:

Be it known that I, FRIEDERICH BRUNE, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Machines for Making Sheet-Metal Pipe-Elbows, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

The object of this invention is to simplify, facilitate and cheapen the manufacture of longitudinally corrugated elbows from straight sheet metal pipe sections.

It consists in certain novel features of construction and in the peculiar arrangement and combinations of parts as hereinafter particularly described and claimed.

In the accompanying drawing, which shows a machine embodying the invention, like characters designate the same parts in the several figures.

Figure 1 is a vertical longitudinal section of the machine; Fig. 2 is a cross section on the line 2 2, Fig. 1; Fig. 3 is a cross section on the line 3 3, Fig. 1; Fig. 4 is an enlarged vertical longitudinal section of the elbow corrugating and crimping heads and associated parts showing one of the bulging dies in operative position; Fig. 5 is a similar view showing the parts in different positions and illustrating another operation; Fig. 6 is a cross section on the line 6 6, Fig. 1, showing in front elevation the corrugating heads and dies, parts being broken away; Fig. 7 is a cross section on the line 7 7, Fig. 4, showing in rear elevation the pivoted front head and clamping die and jaws, parts being broken away; Fig. 8 is a fragmentary side elevation of a partially formed elbow in connection with the outer corrugating and crimping dies and jaws, which are shown in position preparatory to compressing or closing and turning back a bulge or plait in the elbow; and Figs. 9 and 10 are cross sections of the elbow on the lines 9 9 and 10 10 respectively, Fig. 8.

a is a tubular mandrel or horn which is rigidly secured at its rear end to a part of the frame and is provided at its free front end with a corrugating head or die *b*.

c is a tubular shaft mounted in the frame at the rear end of and in line with the mandrel. It is provided with cams *d*, *e*, *f*, *g*, *h* and *i*, axially movable collars *j* and *k*, and a bevel gear *l* through which power is communicated to the machine by a driving pinion, as indicated in Fig. 1.

m is a ring or collar loosely fitted upon and movable endwise of the mandrel *a* and head *b*. It is held against turning on the mandrel by a spline and groove, as shown in Fig. 4. It is provided on the upper side with a spring-actuated pawl *n*, and is recessed in its front end to receive and hold the end of a sheet metal pipe section placed on said mandrel as shown in Figs. 4 and 5.

o is a ratchet bar supported and movable endwise in a bearing on the frame parallel with the mandrel *a* and in position to engage with the pawl *n*. It is provided at its rear end with a laterally projecting roller engaging the groove of cam *d*. The parts last described constitute the mechanism for feeding the pipe sections intermittently forward to the corrugating, crimping and forming heads and dies, as hereinafter explained.

p is a rocker shaft mounted in the frame above and parallel with the mandrel *a* and cam shaft *c*. It is provided at its front end with oppositely projecting crank arms or a cross head *q*, and at its rear end with a crank arm *r*, which engages with the groove in the cam *i*, as shown in Figs. 1 and 3.

s is a stationary corrugating head surrounding the head or die *b*, and provided, as shown in Figs. 4, 5 and 6, with radially movable dies *t*, the shanks of which are held and guided in radial grooves or recesses in the head.

u is a cam ring fitted and held by suitable keepers in an annular recess in said head over the shanks of the dies *t*. It is formed with oblique slots which engage projections on the shanks of the dies *t*, and is provided with a handle arm *v* for turning it and manually forcing the dies in and out.

The arm *v* is formed as shown in Figs. 4 and 6, with a toe *w* in the path of an angular arm *x* on the rocker shaft *p* for automatically moving the dies *t* inward, as hereinafter explained.

Referring to Fig. 7 in connection with Figs. 1, 4 and 5, *y* is a swinging head provided with trunnions by which it is pivoted to the head *s* or a part of the frame in a horizontal line transverse to the mandrel *a* and close to the top and front end of the corrugating die *b*, which is from that point

beveled or inclined rearwardly toward its lower side. The head *y* is provided with radially movable jaws or dies *z*, which correspond in shape with the corrugating dies *t* of the stationary head *s*. The shanks of the dies *z* are fitted and guided in radial grooves or channels in the head *y* and are held in place therein by a cam ring 2, which is let into an annular recess in said head and is held in place therein by suitable keepers. The ring 2 like the ring *u*, has oblique slots engaging projections on the shanks of the jaws *z*, and is connected on opposite sides by links with the crank arms or cross head *q*. As shown in Figs. 4 and 7, these links have universal joint connections with the cross head *q* and ring 2 to admit of the swinging movement of the head *y*.

Within the opening of the head *y* a clamping die 3, corresponding in peripheral contour with the die *b*, is pivoted on a bolt or stud 4 to the end of said die *b* near its upper side and as close as possible to the axis on which the head *y* swings. This die 3 is made wedge-shaped or tapering, its front and rear sides converging downwardly. The head *y* is connected on the lower side by a rod 5 with a forked lever 6, which is actuated in one direction by the cam *g* and in the opposite direction by the cam *h*, operating through the medium of a roller and slide 7, as shown in Fig. 1. The die 3 is connected by a rod 8 passing axially through the mandrel *a* and shaft *c* with the collar *k*.

A number of radially and axially movable bulging or crimping dies 9 have rearwardly extending shanks fitted in radial and longitudinal grooves or channels in the die or head *b*, as shown in Figs. 4, 5 and 6. They are held in place in said head while a limited axial movement is permitted by studs 10 on their shanks engaging longitudinal slots in the head *b*. The shanks of said dies 9 are formed on their inner sides opposite the studs 10 with rounded bearings 11 and at their rear ends with inward projections 12. They are longitudinally channeled on their inner sides between the bearings 11 and their front ends or heads, which have inwardly and forwardly inclined faces.

The heads of the dies 9 gradually diminish in thickness from the under toward the upper side of the die *b*, to correspond with the space between the opposing ends of the dies *b* and 3, when they are separated, as shown in Fig. 4. The front ends of the dies *t* adjacent to the dies 9 are beveled or inclined as shown in Figs. 4 and 5 rearwardly and downwardly, while the rear ends of the corresponding jaws *z* are likewise beveled or inclined.

An axially movable head 13, fitted and guided upon the rod 8 and in the head or die *b*, is formed with longitudinal ribs 14, which are beveled at their ends and fit into the channels in the shanks of the dies 9. The head 13 is connected with the collar *j* by a tubular rod 15 surrounding the rod 8 inside of the mandrel *a* and shaft *c*. This collar is engaged as shown in Figs. 1 and 2, by a forked lever 16, which is actuated in one direction by the cam *e* and in the opposite direction by the cam *f*.

The machine herein shown and described, operates as follows: The parts of the machine being in their normal or initial positions, as shown in Fig. 1, a plain straight pipe section from which an elbow is to be formed is placed on the mandrel *a* and head or die *b* through the front and rear heads *y* and *s*, the dies *t* and jaws *z* being drawn outward as shown in Figs. 6 and 7. The corrugating dies *t* are then forced inwardly against the pipe section and inner corrugating head or die *b* either manually by means of the arm *v*, or automatically when the machine is started by the arm *x* on the rocker shaft *p*.

The machine being set in motion through the usual or any suitable starting and stopping device, the pipe section is fed forward an interval by the action of the cam *d* and ratchet bar *o* on the follower ring *m*. As it is forced forward between the head or die *b* and the opposing dies *t*, it is fluted or corrugated, the rear ends of the dies *t* being rounded or beveled outwardly so as to gradually bend the sheet metal of the pipe section without breaking or tearing it, into conformity with the head or die *b*.

Assuming that the crank arm *r* stands normally when the machine is at rest, in the position in which it is shown in Fig. 3, when the machine is set in motion the cam *i* turning in the direction indicated by the arrow, turns said arm upwardly to the left, thereby rocking the shaft *p* in the proper direction to close the jaws *z* upon the pipe section, clamping and holding it firmly against the die 3. The pipe being thus clamped and held between the inner corrugating die *b* and the dies *t* on the one hand, and the inner die 3 and the jaws *z* on the other hand, and the pivoted head standing in the position in which it is shown in Fig. 4, the cam *f* acting through the lever 16, collar *j* and rod 15, thrusts the head 13 forward, thereby causing it to carry the dies 9 forward with it and to force them outward between the dies *b* and 3, and thereby forming an outward transverse bulge or crimp in the pipe section, as shown in Fig. 4. The head 13 is then withdrawn and the dies 9 are retracted into the positions in which they are shown in Fig. 5, by the action of the cam *e*. Upon the retraction of the dies 9 the head *y* and the die 3 are simultaneously swung backward toward the die *b* and head *s* by the action of the cam *g* on the lever 6, operating through the connecting rod 5 and the collar *k* and

connecting rod 8. By this operation the previously formed open bulge or crimp is closed and bent backward between the opposing beveled ends of the dies *t* and jaws *z* as shown in Fig. 5. The jaws *z* are thereupon moved outwardly by the action of the cam *i* operating through the rocker shaft *p* and its connections, and the pipe section is advanced another step by the action of the feeding mechanism as above explained. The head *y* and die 3 are swung forward to their original positions, as shown in Figs. 1 and 4, by the action of the cam *h* operating through the roller and slide 7 and the connections above mentioned. The jaws *z* are again closed upon the pipe against the die 3, and by this operation fold the previously formed and backwardly bent crimp or plait against the pipe, as shown in Fig. 4. The jaws *z* are then opened, releasing the pipe, which is fed forward another interval, and the operations for forming and folding back another crimp or plait in the previously corrugated part of the pipe are repeated as above explained. By the successive formation of the transverse crimps at intervals in one side of the pipe, it is gradually bent into elbow-shape, while by its advance movement to the clamping and crimping dies, it is longitudinally corrugated or given any desired cross sectional shape.

It will be observed by reference to Fig. 3, that the cam *i* is constructed to close the jaws *z* twice to each revolution of the cam shaft *c* and to each advance movement of a pipe section on the mandrel *a*. This is for the purpose of pressing the last crimp or plait flat against the elbow; otherwise it would remain at an angle thereto as bent and left by the opposing beveled ends of the dies *t* and *z*, and as shown in Fig. 5.

The term "corrugated" or "corrugation" as herein employed is intended to include various shapes and to apply to pipe of any fluted or polygonal shape in cross section.

I claim:

1. In a machine for making corrugated elbows the combination of corrugating heads arranged one within the other, the outer head having radially movable dies, means for manually moving said dies outward, means for feeding a pipe section intermittently step by step between said heads, means for automatically moving said dies inward against the pipe section before the latter is advanced between the corrugating heads, means for pressing transverse bulges at intervals in one side of the pipe, and means for closing said bulges and curving the pipe into elbow-shape, substantially as described.

2. In a machine for making corrugated elbows the combination of a hollow head formed inside with radiating longitudinal grooves, radially and longitudinally movable bulging dies fitted in said grooves, a reciprocating head movable axially in said hollow head and adapted to move said dies longitudinally therein and to project and withdraw them radially and jaws or dies adapted to support a pipe section on the outside and on opposite sides of the bulging dies when they are thrust outwardly, substantially as described.

3. In a machine for making corrugated elbows the combination of stationary corrugating heads arranged one within the other, means for intermittently feeding a pipe section step by step between said heads, radially movable bulging dies carried by the inner corrugating head, means for intermittently projecting said dies from said head, a pivoted head movable toward and from the corrugating heads and provided with radially movable jaws, a clamping die pivoted on one side to the inner corrugating head within the opening in said pivoted head, and connections for intermittently swinging said pivoted head and clamping die toward and from the corrugating dies, substantially as described.

4. In a machine for making corrugated elbows the combination of corrugating heads arranged one within the other, the inner head having a beveled end, means for intermittently feeding a pipe section between said dies, a wedge-shaped clamping die corresponding in peripheral contour with the inner corrugating head and pivoted on its thicker side to said head, a pivoted head having an opening corresponding with the opening in the outer corrugating head and provided with radially movable jaws outside of said clamping die, connections for swinging said pivoted head and clamping die toward and from the corrugating heads, radially movable bulging dies arranged between the corrugating heads and the pivoted head and diminishing in thickness toward the axis on which said pivot head swings, and means for projecting said bulging dies outward between the inner corrugating head and the clamping die when they are separated, substantially as described.

5. In a machine for making corrugated elbows the combination of a mandrel terminating at its free end in a corrugating head, a stationary head surrounding said corrugating head, and provided with radially movable dies, a cam ring having oblique slots engaging projections on said dies and provided with an arm for turning it and moving said dies in and out, and means for feeding a pipe section on said mandrel between the opposing dies, substantially as described.

6. In a machine for making corrugated elbows the combination of corrugating heads arranged one within the other, means for intermittently feeding a pipe section between said heads, a clamping die pivoted on

one side to the delivery end of the inner corrugating head, a pivoted head surrounding said die and provided with radially movable jaws, a cam ring having oblique slots engaging projections on said jaws, a rocker shaft having a crank arm connected by a link with said ring and connections for swinging said pivoted head and clamping die toward and from the corrugating head, substantially as described.

7. In a machine for making corrugated elbows the combination of a hollow mandrel terminating at its free end in a corrugating head, radially movable bulging dies, a head provided with radially movable corrugating dies surrounding said corrugating head, a clamping die pivoted at one side to the inner corrugating head and corresponding therewith in contour, a pivoted head movable toward and from the corrugating heads and having radially movable jaws, a cam ring having oblique slots engaging projections on said jaws, a rocker shaft having an arm connected by a link with said ring, an axially movable head in the inner corrugating head for projecting and retracting the bulging dies, an axially movable rod passing through said head and connected with said clamping die, and a cam shaft provided with cams for actuating said rocker shaft, pivoted head and jaws, substantially as described.

8. In a machine for making corrugated elbows the combination with corrugating heads one arranged within the other, means for intermittently feeding a pipe between said heads, a pivoted head movable toward and from said corrugating heads and provided with radially movable jaws, a clamping die pivoted at one side to the inner corrugating heads, means for swinging said pivoted head toward and from the corrugating heads once to each advance movement of the pipe, and means for moving said jaws in and out twice to each advance movement of the pipe, substantially as described.

9. In a machine for making corrugated elbows the combination of corrugating heads arranged one within the other, means for intermittently feeding a pipe between said heads, rapidly movable bulging dies carried by the inner head, an axially movable head adapted to project and retract said dies, a tubular shaft provided with a cam and with an axially movable collar, a rod within said shaft connecting said collar with the die operating head, and a lever actuated by said cam and engaging said collar, substantially as described.

10. In a machine for making corrugated elbows the combination of corrugating heads arranged one within the other, means for intermittently feeding a pipe between said heads, radially movable bulging dies carried by the inner head, a head movable axially in said inner corrugating head and adapted to move said dies out and in, a pivoted head movable toward and from the corrugating heads and provided with radially movable jaws, means for moving said jaws in and out, a clamping die pivoted at one side to the inner corrugating head within the opening in said pivoted head, a tubular shaft provided with cams and axially movable collars, a tubular rod connecting the bulging die operating-head with one of said collars, a rod passing through said die operating head and connecting the clamping die with the other collar, and levers actuated by said cams and engaging said collars, substantially as described.

11. In a machine for making corrugated elbows the combination of a mandrel terminating at its free end in a corrugating head, a head provided with radially movable dies and surrounding said corrugating head, a cam ring having oblique slots engaging projections on said dies, an arm for turning said ring, means for intermittently feeding a pipe on said mandrel between said dies and corrugating head, and a rocker shaft having an arm adapted to engage the arm on said cam ring and to move said dies inward before the advance movement of the pipe, substantially as described.

In witness whereof I hereto affix my signature in presence of two witnesses.

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