No. 630,449. Patented Aug. 8, 1899.

T. CORSCADEN, Dec'd.

A. J. CORSCADEN, Administratrix.

MACHINE FOR SHAPING SHEET METAL.

(Application filed Aug. 25, 1898.)

(No Model.) 3 Sheets—Sheet 1.

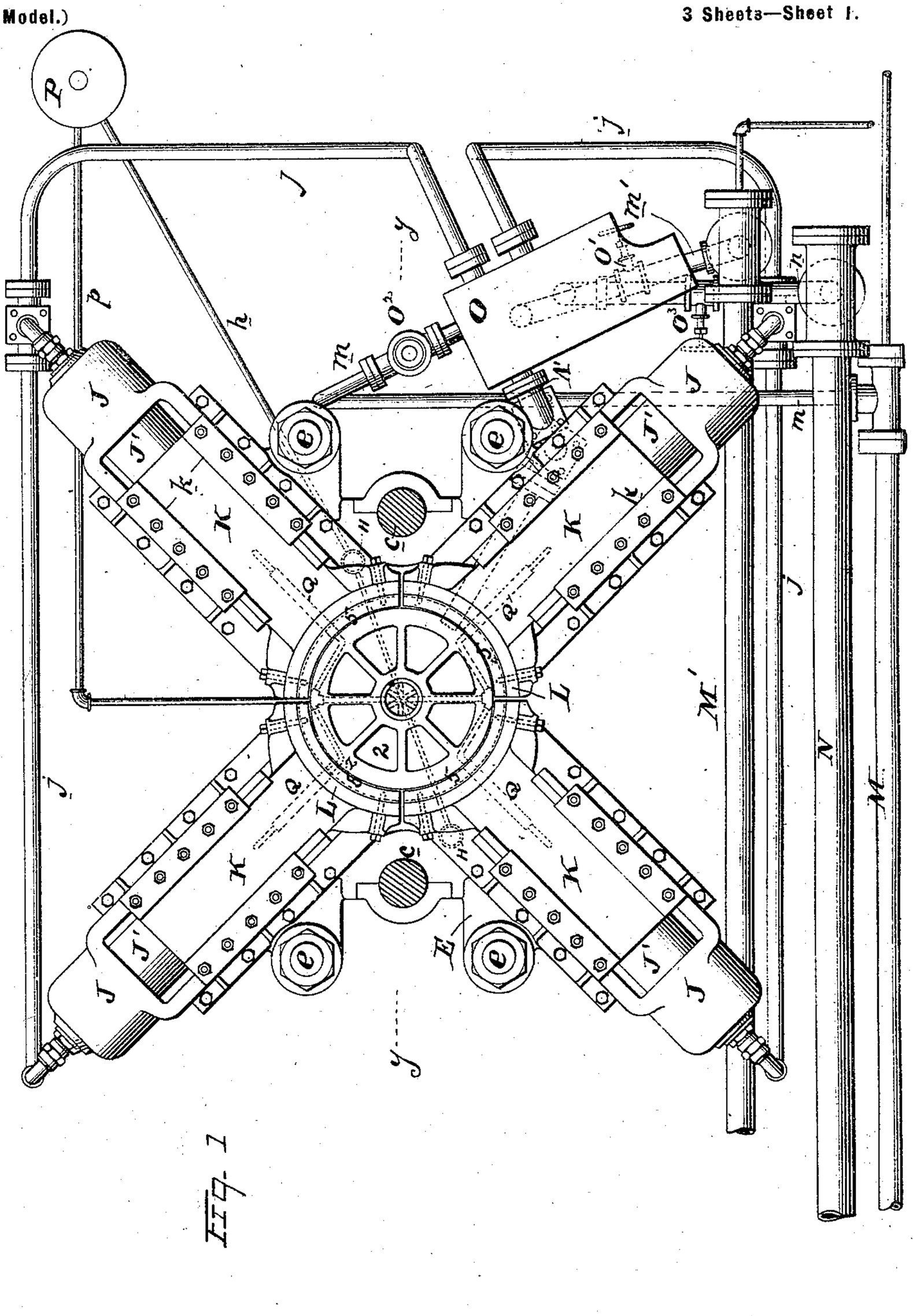

Fig. 1

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(No Model.) 3 Sheets—Sheet 2.

Fig. 2

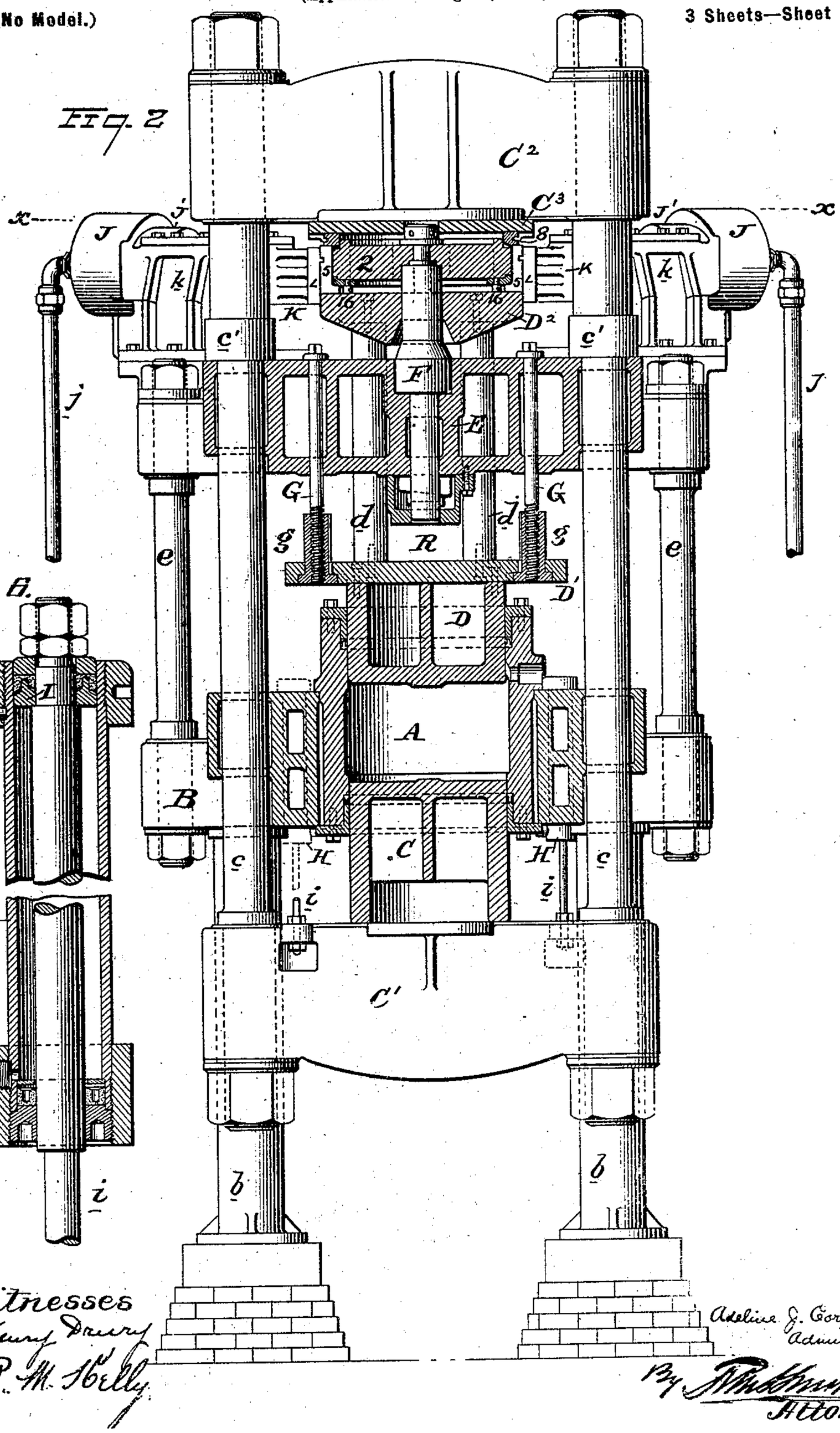

Fig. 6.

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MACHINE FOR SHAPING SHEET METAL.

(Application filed Aug. 25, 1898.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 3

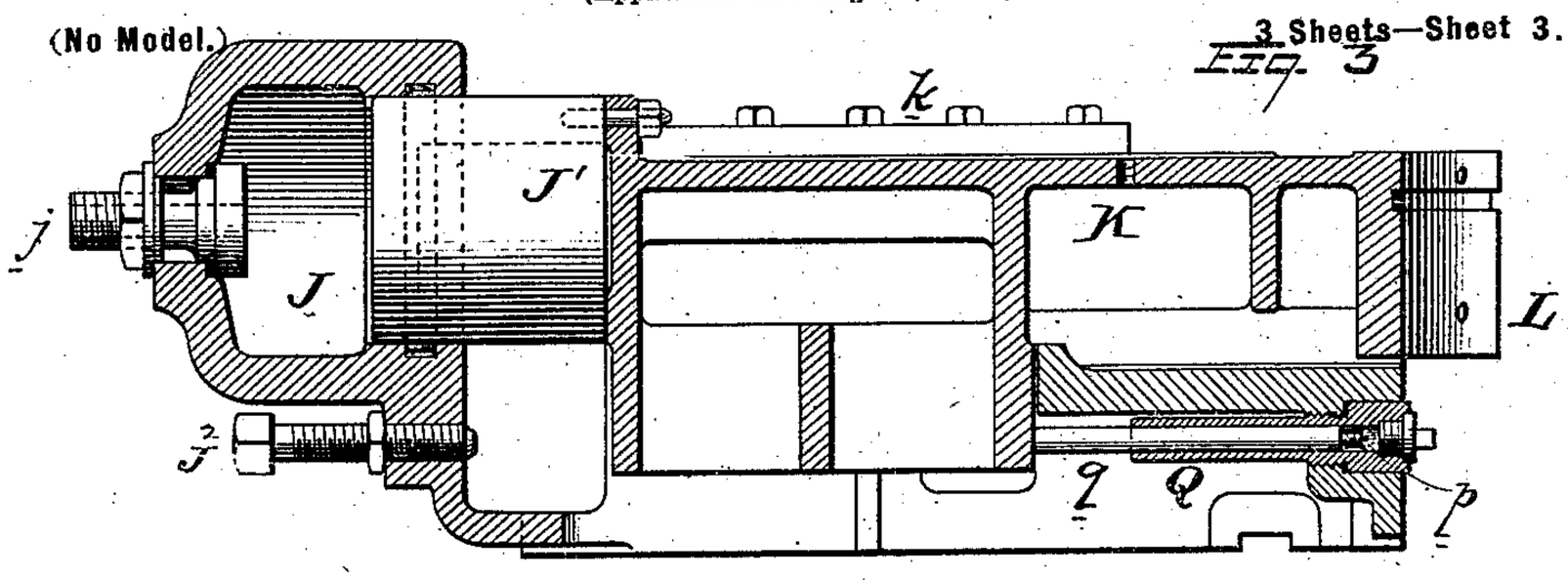

Fig. 4

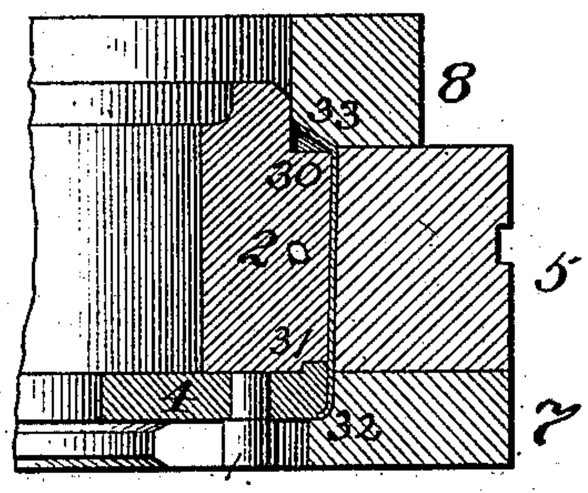

Fig. 5

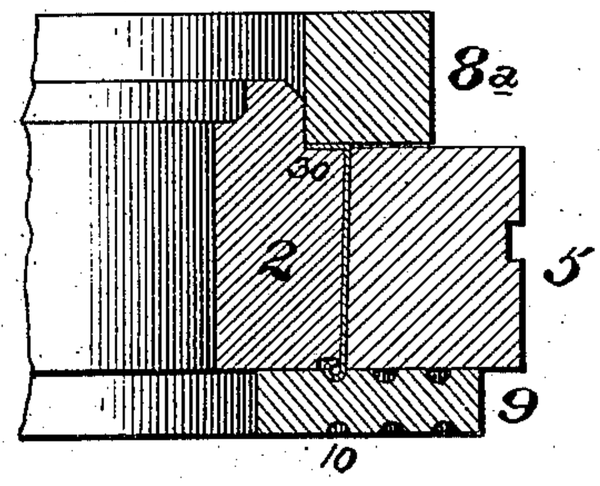

Fig. 9.

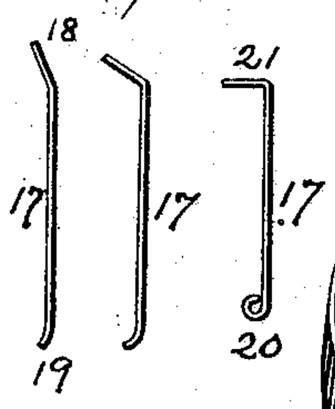

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Fig. 7.

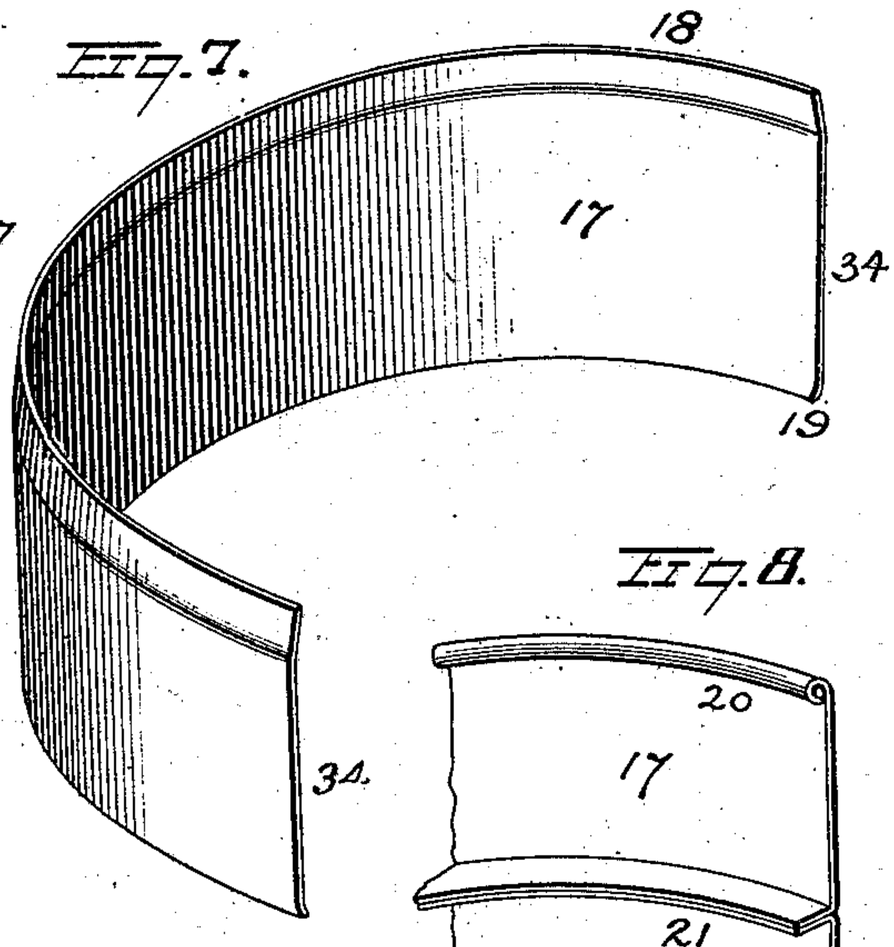
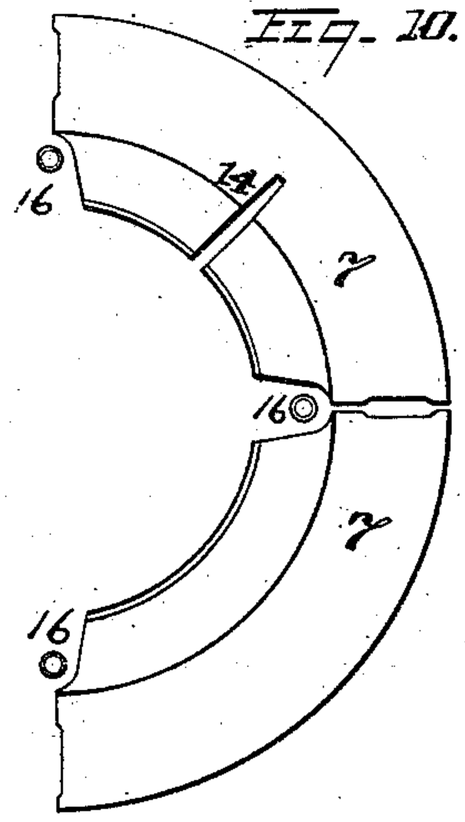


Fig. 8.

Fig. 10.



Witnesses:
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UNITED STATES PATENT OFFICE.

ADELINE J. CORSCADEN, OF PHILADELPHIA, PENNSYLVANIA, ADMINISTRATRIX OF THOMAS CORSCADEN, DECEASED.

MACHINE FOR SHAPING SHEET METAL.

SPECIFICATION forming part of Letters Patent No. 630,449, dated August 8, 1899.

Application filed August 25, 1898. Serial No. 689,533. (No model.)

To all whom it may concern:

Be it known that THOMAS CORSCADEN, deceased, late of the city and county of Philadelphia, State of Pennsylvania, did invent an Improvement in Machines for Shaping Sheet Metal of which the following is a specification.

This invention has reference to machines for shaping sheet metal; and it consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

The object of the invention is to provide suitable dies and means to operate them which shall be capable of forming sheet metal into predetermined shapes especially adapted for the rims of sheet-metal pulleys.

In the preferred form of the apparatus the object is to produce semi-annular segments of the rim, applying a flange upon one edge, and beading or otherwise forming the other edge.

In carrying out the invention there are employed three sets of dies—namely, an upper and a lower set with an intermediate set adapted to operate in connection with the other two, and preferably the intermediate set is stationary. This, however, is not necessary, so long as the several movements are imparted to the different sets to bring them together or move them apart. Furthermore, by proper adjustment and arrangement of the mechanism two of these may be relatively fixed, while the third die is made movable, or vice versa, so that when desired the upsetting or forming operation may be confined to one side of the metal being acted upon. Furthermore, in conjunction with the intermediate or stationary die there are employed outside dies, two or more in number, adapted, preferably, to move in horizontal directions on radial lines from the central die, the outer dies being adapted to hold or grip the metal and retain it in the proper shape or conformation, while the upsetting or beading action takes place by the operation of the upper and lower dies or either of them. All of these dies are preferably operated by means of hydraulic power, and the construction is such that it is preferred to employ one set of hydraulic devices for operating the intermediate upper and lower dies and separate hydraulic devices for operating the outer or clamping dies. Furthermore, the arrangement is such that the clamping-dies operate so as to grip and hold the metal to be operated upon to the stationary die, and then the upsetting, flanging, or beading dies are put into operation by the second set of hydraulic devices.

Another portion of the invention has reference to the dies proper, and this, as well as the construction of the press as a whole, will be understood by reference to the accompanying drawings, illustrating the invention, in which—

Figure 1 is a sectional plan view of a hydraulic press embodying the invention, taken on line *x x* of Fig 2. Fig. 2 is a sectional elevation of the improved press, taken on line *y y* of Fig. 1. Fig. 3 is a longitudinal section on line *z z* of Fig. 1, showing the construction of the means for moving the horizontal clamping-dies. Figs. 4 and 5 are cross-sections of the dies, taken at one side, showing the adjustment for forming the flanges and the beading. Fig. 6 is a sectional elevation of one of the cushioning-cylinders and pistons. Fig. 7 is a perspective view of one of the segments ready to be placed in the press. Fig. 8 is a perspective view of a portion of the completed pulley-rim, showing two of the fully-formed flanges and beads. Fig. 9 shows the cross-section of the plates, indicating the changes under action of the press; and Fig. 10 is a plan view of a portion of one of the lower dies.

As the operation of the press is specially designed for the dies adapted to the forming of the rims of pulleys, reference will first be made in a general way to the dies, so that the construction and movements of the different parts of the press will be more readily understood.

2 is a central cylindrical fixed die and, as shown, is made circular, corresponding to the diameter of the pulley. Arranged about this die are four segmental dies 5, adapted to be moved horizontally, so as to meet the periphery of the die 2 and strongly grasp any metal arranged between the said dies 2 5. In addition to these dies there is a lower die, which in some instances is fixed and in other instances is movable. When said dies are fixed,

they are indicated as at 4 in Fig. 4 and also shown in Fig. 2. When they are movable, they are as shown at 9 in Fig. 5. These dies are supported by a head D^2, which is adapted to be raised or lowered, when desired, relatively to the fixed die 2. 8 is an upper die and is vertically movable downward to or from the fixed die 2 and is clearly shown in Figs. 2, 4, and 5. These several movable dies are moved under the action of suitable hydraulic-actuated pistons, and these devices will now be described.

The central die 2 is supported upon a post F, adjustably fitted and secured to a fixed frame E. This frame is supported upon uprights *e*, connected at the bottom to a cylinder-frame B, in turn supported upon a suitable foundation by tne columns *b*. The cylinder-frame B carries the hydraulic cylinder A, arranged below the dies. In this cylinder is arranged the oppositely-acting plungers C D. Of these the plunger D is connected by uprights *d* with the annular head D^2 for operating the lower die. Adjusting-screws G extend from the stationary frame E and are provided at the lower portions with nuts *g*, which limit the downward movement of the plunger D, and consequently the head D^2. The nuts *g* may be adjusted to vary the limit of the downward movement as desired. The lower plunger C connects with a head C′, which is united to an upper head C^2 by means of the rod *c*, so that as the plunger C is forced downward it moves the head C^2 downward also and with it the upper die 8. Collars *c*′ limit the downward motion of the head C^2 by striking upon the fixed frame E, as shown in Fig. 2.

H H are hydraulic cylinders in which pistons I operate, the piston-rods *i* thereof being connected with the head C′. The cylinders H are secured to the cylinder-frame B, as shown in Fig. 2 and indicated in dotted lines in Fig. 1. By supplying water under pressure to the cylinder H through the pipe *h* sufficient power is obtained to raise the plunger C, together with the framework C′ C^2 *c* and upper die 8, the only duty necessary being to overcome the weight of these parts. A head-plate C^3 may be secured to the upper head C^2, and to this the dies 8 may be directly secured. In this manner the dies may be readily secured to the head C^2 and also adjusted. The horizontal dies 5 are segmental in shape, as clearly shown in Fig. 1, and are respectively connected to heads K, movable in horizontal guideways *k*, formed upon the fixed frame E, and the heads K are moved toward the fixed die 2 by plungers J′, moving in hydraulic cylinders J. As shown, there are four of these cylinders with the corresponding parts, and these are all connected by suitable hydraulic pipes *j* with a controlling valve mechanism O of any suitable construction, so that water under high pressure may be simultaneously supplied to the several cylinders J or allowed to escape therefrom, as the case may be.

A vertical section through the parts for operating the horizontal dies 5 is shown in Fig. 3. Referring to this figure, J^2 is an adjustable back-stop for limiting the backward movement of the plunger and the head K. To return the parts to their normal position after the pressure has been applied a plunger *q* is employed, secured to the head K and working in a hydraulic cylinder Q. The cylinder Q is connected by pipes *p* with an accumulator P of any suitable construction, so as to exert a substantially constant pressure upon the water, with the object in view of creating a sufficient force to move the movable dies away from the fixed dies or return them to a normal position. The cylinders H before referred to, in connection with the plunger C and heads C′ C^2, are also connected by a pipe *h* with the hydraulic accumulator P for the purpose of returning the parts to their normal position after the pressure for upsetting and forming has been removed. It will be understood that the pressure of the accumulator is largely overcome when the power hydraulic devices are put into operation for acting upon plungers C D J′. M is a pipe containing water under a very heavy pressure, and M′ is a corresponding pipe containing water under a considerably lower pressure. N is a pipe acting as an exhaust or return pipe forming a common return for the two supply-pipes M M′. The pipe M communicates with the valve mechanism O by a pipe *m* containing a valve O^2. The pipe M′ communicates with the valve mechanism O by a pipe *m*′, containing a valve O′. The exhaust-pipe N communicates with the valve mechanism O by a pipe *n*, containing a valve O^3. The valve mechanism is not shown in detail, as it may be of any suitable construction, so as to be operated by a single or multiplicity of levers, as found most expedient. A pipe A′ leads from the valve mechanism O to the hydraulic cylinder A, as indicated in Fig. 1. In operation water is supplied from the pipe M′ through the valve mechanism O into the clamping-cylinders J, so as to move the clamping-dies 5 into clamping position upon the die 2. Water from the pipe M is then supplied to the pipe A′ and thence to the hydraulic cylinder A to secure the movements of the upper and lower dies. After the pressure operation the valve mechanism O is manipulated so as to permit the water to escape into the return-pipe N, and then the accumulator P comes into operation and through the cylinders H Q the several dies are moved away from the die 2. The details of the valve mechanism O are not shown, as it is quite evident that suitable valves in the pipes *m*, *m*′, *n*, A′, and *j* may be employed to control the operation of the water to secure all of the movements desired.

Returning now to the dies, the die 2 is pro-

vided with an upper annular shoulder 30, over which the upper edge 18 of the metal rim 17 is adapted to be bent, as indicated in Figs. 4, 5, and 9. The lower outer edge of this die 2 is provided with an annular recess 31. In the preliminary operation of forming the sheet-metal blank from the cross-section shown in the left-hand view of Fig. 9 to that of the middle view the lower part of the die 2 is fitted with an annular portion 4, which is held up into place upon studs 16, projecting from the annular head D^2. The outer clamping-die 5 is also fitted at the bottom with a section of the annular die 7, of which there are four sections, one to each of the dies 5. These die-sections 7 have curved portions 32, which force the lower edge 19 of the blank into a more rounded shape, as indicated in Fig. 4. The movement of the die 5 carries with it the die 7. In the preliminary operation of these several dies die 8 is formed with a bevel-face 33, which crowds down the upper flange 18 into a position approximating an obliquity of about seventy degrees to the upright portion 17 of the blank. After the sheet-metal blank is transformed from the condition shown in Fig. 7 to a condition indicated in Fig. 4 and the middle view of Fig. 9 the die-sections 7 are removed, the studs 16 withdrawn, together with the die 4, and the die indicated at 9 substituted therefor. Also the die 8, Fig. 4, is removed and the die 8^a is substituted for it, omitting the inner bevel edge 33. The same result would be obtained by simply inverting the die 8. The die 9 may be provided with a series of annular grooves 10, corresponding to different diameters of wheel-rims, and the upward movement of this die 9 under the action of the head D^2 is to curl over the partly-bent edge 19 into a tubular edge or rim 20, as clearly shown in Figs. 5 and 8 and right-hand view of Fig. 9. Simultaneously with this formation of the tubular edge or bead 20 the upper flange 18 of the blank, which was previously bent, is further bent downward until it stands at right angles to the main surface 17 of the rim, as clearly shown in Figs. 5, 8, and 9. It will be observed that while this forming action takes place the metal is upset as well as being bent, and consequently the rim maintains the same circular condition in which it was held during these formative actions of the dies. The complete rim of a pulley is made up of four of these sections after they have been completely formed. The adjacent sections on the face of the pulley are abutted upon their annular flanges 21, which extend inwardly, as shown in Fig. 8. The sections are made semi-annular, as indicated in Fig. 7, and are slightly bent by a previous manipulation in a set of shaping-rolls. Two such sections, as indicated in Fig. 7, are placed in the press with the edges abutted so as to make up a ring. It is desirable that the metal in the circumference of the bodies 17 is slightly greater than the die 2, so that when the clamping-dies 5 are forced inward the edges 34 of the opposite blanks are forced firmly against each other and produce more or less of an upsetting action, so that they absolutely fit to make a continuous surface. These actions of upsetting as well as forming taking place at the same time enable the press to so shape the rim-sections that they retain their positions assumed, and the resulting pulley is very true with regard to shape.

It will be observed that when the upwardly-movable die 9 is employed the lower sections 7, attached to the dies 5, are removed, as they would be in the way. During the operation of the dies shown in Fig. 4, which are designed to change the blank from the shape shown in Fig. 7 to the intermediate condition shown in the middle diagram of Fig. 9, the head 16 is held out of action by inserting a heavy block of any suitable material into the space R, Fig. 2, which prevents the upward movement of the plunger D. Under this condition the dies 4 of Fig. 4 remain stationary with the circular die 2; but when it is desired to operate the dies in the manner indicated in Fig. 5 after dies 4 and 7 have been removed and die 9 substituted the block last spoken of is removed, and then the plunger D raises and lowers the head D^2, with the result of vertically reciprocating the die 9.

In some forms of pulleys the rim is made without crowning, and in that case the opposing surfaces of the dies 2 and 5 are vertical and the diameter of curvature is the same at the top as at the bottom. In cases, however, where the pulley-rim is to be crowned, as is customary in most pulleys, the opposing surfaces of the dies 2 and 5, while curved and parallel, are formed somewhat conical, whereby the opposing clamping curved and parallel surfaces have the curvature at one end (the upper end, as illustrated) greater than the curvature at the other end, (the lower end,) so that the sheet when compressed will have one edge of somewhat greater diameter than the other edge, and the edge of greater diameter will be that having the internal annular flange 21, so that the crown shall lie in the central portion of the outer surfaces of the rim, as indicated in Fig. 8. The tapering character and different diameters of the upper and lower edges of the clamping-surfaces of the dies 2 and 5 are clearly indicated in Figs. 4 and 5. It will be further observed that the flanging-die 8^a, Fig. 5, is adjacent to the end of the clamping edges or surfaces having the greatest curvatures of the dies 2 and 5 and has an operating edge or surface curved to correspond to said curvature.

Broadly considered, it is evident that the preferred press does not necessarily require that all four of the horizontal dies be made to operate conjointly, for it is quite evident that if the formative action were only required to take place upon a semi-annular rim, for example, or upon a single section, as shown in Fig. 7, then the combined working surfaces

of the dies would only have to be semi-annular; but the construction herein shown is preferred, since it is more economical to operate upon all sides of the circular die 2, and there is less liability from breakage with the enormous pressures employed, since the strains are more fully distributed and balanced. It is, furthermore, to be understood that while the particular dies herein shown for the specific construction of rim are employed any change or modification of shape of the rim will of necessity require a change or modification of shape of the dies, and consequently the invention is not limited to any particular construction of said dies. It is also evident that so long as a relative movement is secured between the parts D^2 and C^2, whereby the two oppositely-moving dies may be moved to or from each other and properly with respect to the stationary die 2, the hydraulic devices for operating said dies may be modified or varied as desired. For example, if the cylinder A be permitted to move vertically in the frame B it is quite evident that the parts A and D might be made integral and secure the same results, since the only thing necessary is to secure a relative movement between the parts C D.

While it is convenient to refer to some of the dies as being "above" or "below" or "vertically movable," it is to be understood that these are relative terms, and no limitation is to be taken from the use of such terms, since under some conditions it is self-evident that the location of said dies might be shifted—as, for example, if the machine were set on its side. It is also evident that while the hydraulic devices for operating the upper and lower dies are arranged below said dies, they might equally as well be arranged above the dies—as, for example, as would occur by simply inverting the machine. Therefore no limitations are to be understood from the use of these general terms, which are found convenient and almost necessary to properly explain the mechanism disclosed in the drawings.

While it is preferred, the construction shown is not limited to the minor details, as these may all be modified without departing from the spirit of the invention.

What is claimed as new, and desired to be secured by Letters Patent, is—

1. In a hydraulic press the combination of an intermediate set of clamping-dies having opposing curved clamping-surfaces concentric or parallel so as to be adapted to clamp opposite faces of a sheet of metal between them, suitable upper and lower dies movable to and from the clamping-dies, a support for the intermediate clamping-dies, and hydraulic devices for simultaneously moving the upper and lower dies to or from each other and relatively to the intermediate clamping-dies.

2. In a hydraulic press the combination of an intermediate set of clamping-dies, suitable upper and lower dies movable to and from the clamping-dies, a support for the intermediate clamping-dies, and hydraulic devices for simultaneously moving the upper and lower dies to or from each other and relatively to the intermediate clamping-dies, consisting of two movable water-actuated parts having a water-space intermediate of them into which the water is forced under pressure, a connection between one of said parts and the lower dies, and a separate connection between the other of said moving parts and the upper die.

3. In a hydraulic press, a main frame, a support thereon extending upward, a fixed die carried thereby, a vertically-movable lower die, a vertically-movable upper die, hydraulic-power devices arranged to one side of the dies in the direction of their movements and having two movable portions, a direct connection between one of said portions and one of said movable dies, and an open frame or link connection between the other of said movable parts and the other movable die.

4. In a hydraulic press, a main frame, a support thereon extending upward, a fixed die carried thereby, a vertically-movable lower die, a vertically-movable upper die, hydraulic-power devices arranged to one side of the dies in the direction of their movements and having two movable portions, a direct connection between one of said portions and one of said movable dies, an open frame or link connection between the other of said movable parts and the other movable die, one or more horizontal clamping-dies adapted to move to or from the stationary die, and power devices for moving the horizontal die.

5. In a hydraulic press the combination of suitable upper lower and intermediate dies, a support for the intermediate die, hydraulic devices for simultaneously moving the upper and lower dies to or from each other and relatively to the intermediate die, a series of segmental and radially-movable dies arranged about the intermediate die, and independent power devices for operating said radially-movable dies.

6. In a hydraulic press the combination of suitable upper lower and intermediate dies, a support for the intermediate die, hydraulic devices for simultaneously moving the upper and lower dies to or from each other and relatively to the intermediate die, a series of segmental and radially-movable dies arranged about the intermediate die, and independent power devices for operating said radially-movable dies consisting of a series of plungers and cylinders, a source of liquid-supply under pressure common to all of said cylinders, and a single operating control device for regulating the supply to all of the hydraulic cylinders simultaneously.

7. In a hydraulic press, the combination of a fixed central die, one or more radially-movable dies laterally disposed with regard to said stationary die, and power devices for mov-

ing said radially-movable dies comprising a reciprocating head having a plunger and a hydraulic cylinder in which the plunger works.

8. In a hydraulic press, the combination of a fixed central die, one or more radially-movable dies laterally disposed with regard to said stationary die, power devices for moving said radially-movable dies comprising a reciprocating head having a plunger and a hydraulic cylinder in which the plunger works, means for moving the radially-movable die away from the fixed die consisting of a cylinder and plunger of relatively small size one of which parts is movable with the radially-movable die and the other part fixed, a hydraulic accumulator, and a connecting-pipe between said accumulator and the cylinder and plunger, whereby when the pressure is removed from the operating power-plunger the accumulator-pressure may come into play to return the parts to their normal positions.

9. In a hydraulic press, the combination of a vertically-movable die, a hydraulic cylinder and plunger for forcing said die downward, a heavy connecting-yoke making a connection between the movable plunger and the movable die, and a piston-and-cylinder device connecting with said yoke and communicating with a source of accumulated hydraulic power for sustaining the weight of the yoke its die and its plunger and adapted for raising the same to a normal position when the power is removed from the main plunger.

10. In a hydraulic press, the combination of a main stationary frame, a die-support carried by said frame, a lower movable die-supporting head, an upper movable separate die-head, a stationary hydraulic cylinder, an upper movable plunger therefor connecting with the lower movable die-supporting head for raising it, a lower movable plunger in said cylinder connecting with the upper movable die-supporting head, and means to control the supply of fluid to the hydraulic cylinder whereby both plungers are simultaneously operated.

11. In a hydraulic press, the combination of a main stationary frame, a die-support carried by said frame, a lower movable die-supporting head, an upper movable supporting die-head, a stationary hydraulic cylinder, an upper movable plunger therefor connecting with the lower movable die-supporting head for raising it, a lower movable plunger in said cylinder connecting with the upper movable die-supporting head, means to control the supply of fluid to the hydraulic cylinder whereby both plungers are simultaneously operated, and adjusting devices for limiting the downward movements of the lower die-supporting head when assuming a normal position out of action.

12. In a sheet-metal-forming press, the combination of a stationary circular die presenting a cylindrical outer surface, in combination with a series of radially-movable sectional dies having curved clamping-surfaces arranged about the stationary circular die and movable to or from it in the same plane, a vertically-movable upper die, and independent means for moving the radially-movable dies and the upper dies.

13. In a sheet-metal-forming press, the combination of a stationary circular die presenting a cylindrical outer surface, in combination with a series of radially-movable sectional dies having curved clamping-surfaces arranged about the stationary circular die and movable to or from it in the same plane, a vertically-movable upper die, and a vertically-movable lower die arranged below the stationary die and movable to and from it.

14. In a sheet-metal-forming press, the combination of a stationary circular die presenting a cylindrical outer surface, in combination with a series of radially-movable sectional dies having curved clamping-surfaces arranged about the stationary circular die and movable to or from it in the same plane, vertically-movable upper and lower dies arranged respectively above and below the stationary die, and independently-operated hydraulic plungers for actuating the several movable dies or sections of dies independently.

15. In a sheet-metal-forming press, the combination of a stationary die having an outer curved surface, a series of external radially-movable dies having curved surfaces corresponding to the outer curvature of the stationary die, independent power devices for moving each of the several outer sectional dies to or from the stationary die, and a die movable to and from the stationary and radially-movable dies and arranged in line with their junction and movable transversely to the movement of the radially-movable dies.

16. In a sheet-metal-forming press, the combination of a stationary die having an outer curved surface, a series of external radially-movable dies having curved surfaces corresponding to the outer curvature of the die, a series of independent power devices for moving the outer sectional dies toward the stationary die consisting of hydraulic-actuated plungers, and means to move said dies away from the stationary die consisting of cylinders and plungers of small size actuated by a hydraulic accumulator.

17. In a sheet-metal-forming press the combination of a fixed die having a curved outer surface, a radially-movable clamping-die having a curved lateral surface corresponding to the curvature of the fixed die, and an upper movable die extending partly over the fixed die and having an inner and lower operating edge adapted to bend a metal flange inwardly.

18. In a sheet-metal-forming press, the combination of a fixed die having a curved outer surface, a radially-movable clamping-die having a curved lateral surface corresponding to the curvature of the fixed die, an upper mov-

able die extending partly over the fixed die and having an inner and lower operating edge adapted to bend a metal flange inwardly, and a lower vertically-movable die having one or more curved grooves in its upper surface substantially on a line with the separation between the fixed die and the radially-movable die.

19. The combination of the fixed die 2 having the lower portion 4 curved at its lower edge and in which the die 2 is provided with the offset or shoulder 30, a radially-movable die 5 having a curved surface corresponding to the curvature of the die 2 and provided with a portion 7 having a curved forming edge 32, and a vertically-movable die 8 having a forming-shoulder adjacent to the shoulder 30 of the stationary die.

20. In a sheet-metal-forming press the combination of a pair of clamping-dies having their opposing or clamping surfaces made curved and parallel and in which the curvature at one end is greater than the curvature at the other end, a flanging-die having its operating edge curved to correspond to the curvature of the operating-faces of the clamping-dies at the end of greatest curvature and movable to or from the clamping-dies, and means for operating said dies.

21. In a sheet-metal-forming press the combination of a pair of clamping-dies having their opposing or clamping surfaces made curved and parallel in the plane of their clamping movement and substantially straight transversely thereto, means for moving said dies relatively to and from each other for clamping a sheet of metal between them, a flanging-die having its operating edge curved to correspond to the curvature of the operating-faces of the clamping-dies, and means for moving the flanging-die to or from the clamping-dies and in a direction transversely to the movement of said clamping-dies.

In testimony of which invention I hereunto set my hand.

ADELINE J. CORSCADEN,
Administratrix of the estate of Thomas Corscaden, deceased.

Witnesses:
JOHN F. JOHNSON,
EDWARD FELL LUKENS.