(No Model.) 10 Sheets—Sheet 1.

E. JORDAN.

MACHINE FOR FORMING AND SEAMING SHEET METAL TUBES.

No. 310,895. Patented Jan. 20, 1885.

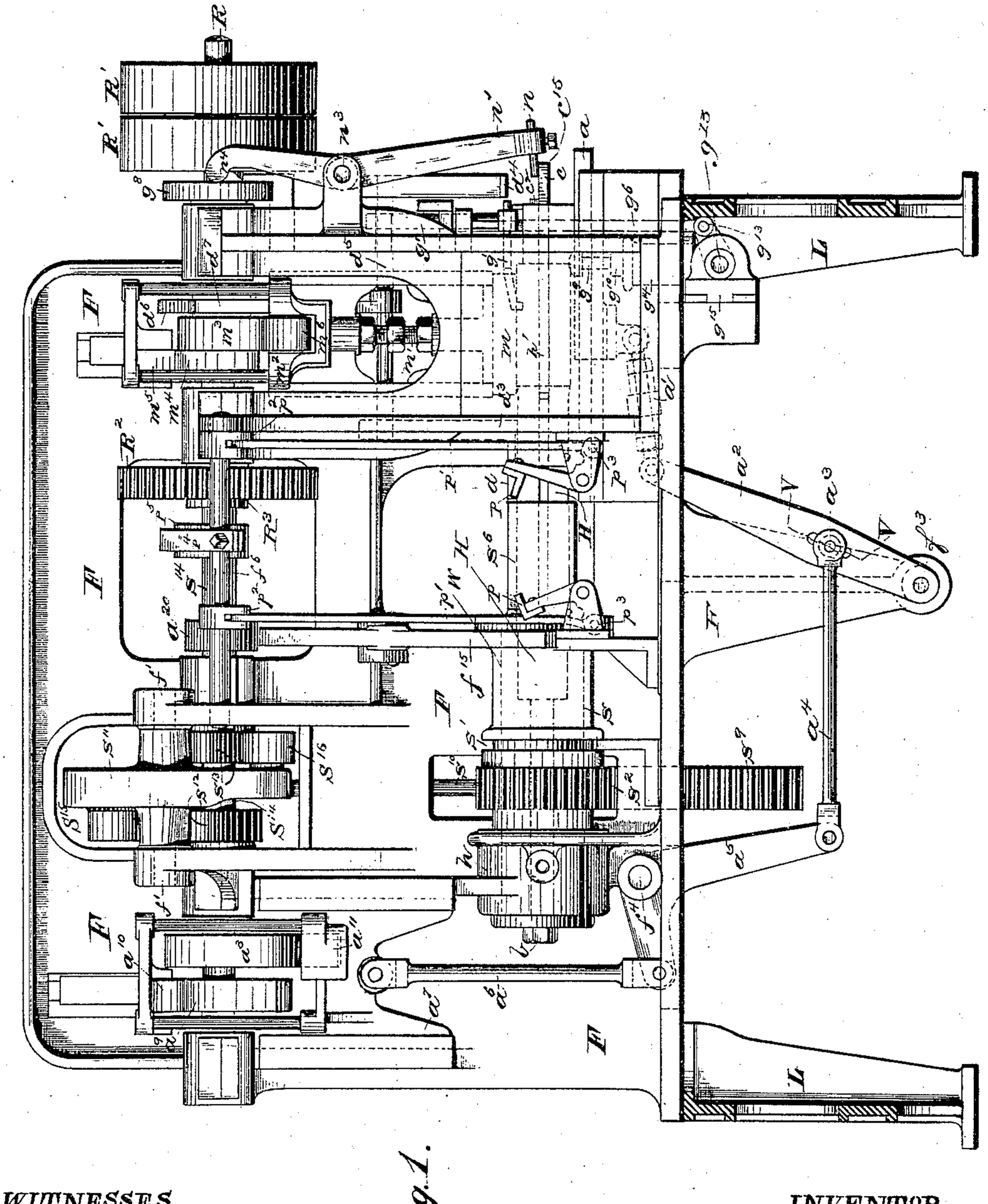

Fig. 1.

WITNESSES.

J. H. Templin.

C. A. Blomberg.

INVENTOR.

Edmund Jordan

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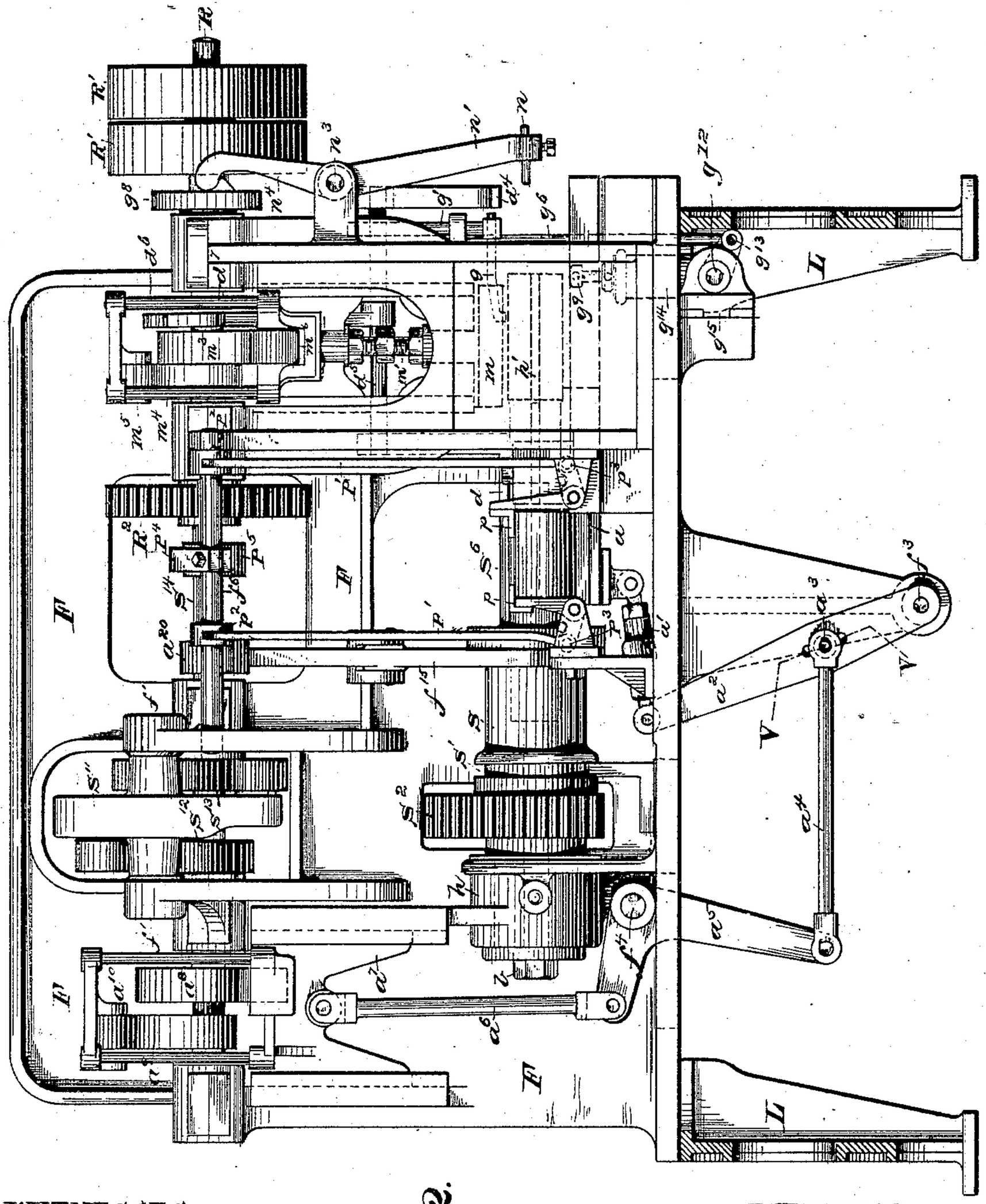

Fig. 2.

WITNESSES.

J. H. Templin.

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Edmund Jordan

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E. JORDAN.

MACHINE FOR FORMING AND SEAMING SHEET METAL TUBES.

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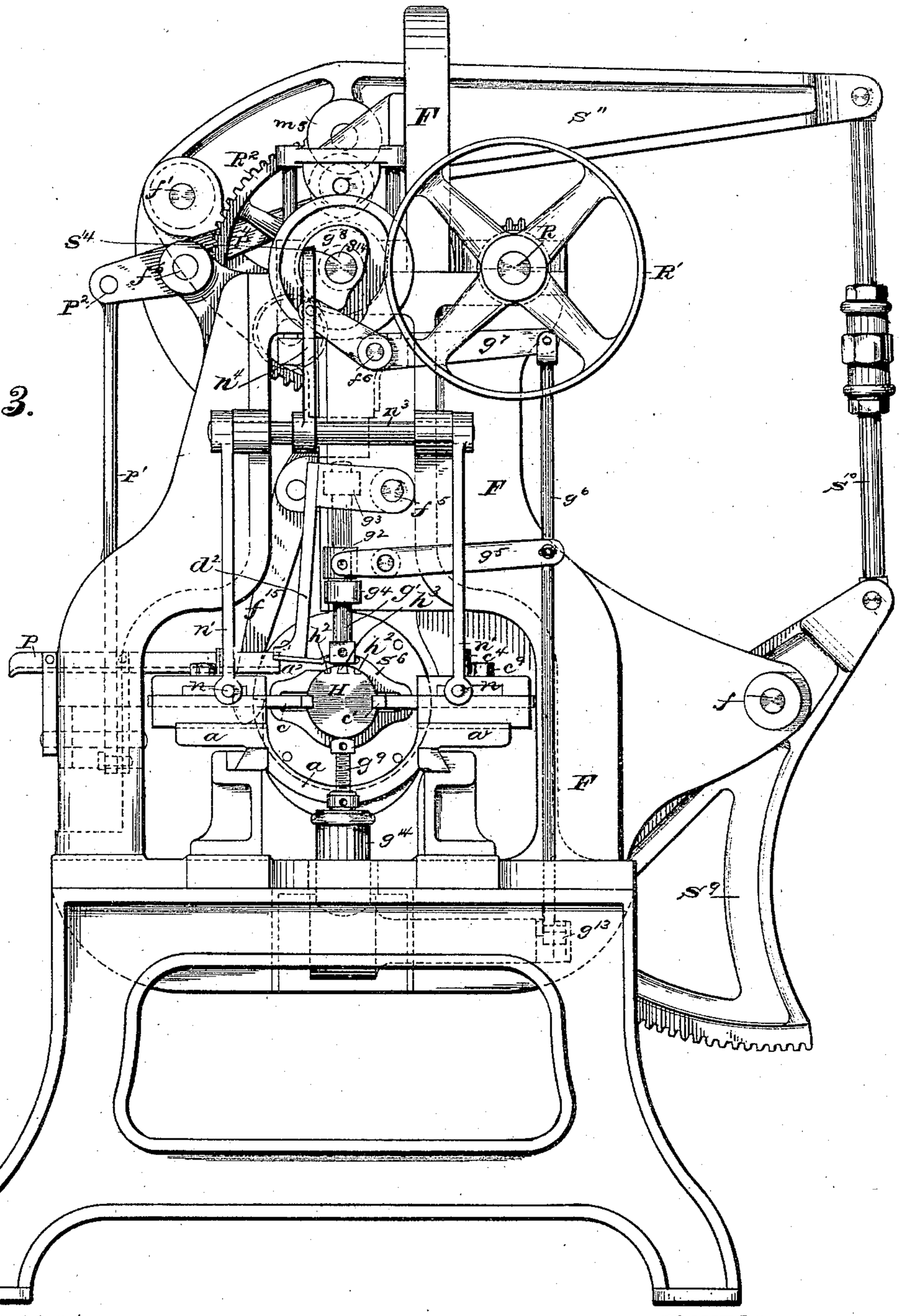
Fig. 3.



WITNESSES

J. H. Templin.

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INVENTOR

Edmund Jordan

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E. JORDAN.

MACHINE FOR FORMING AND SEAMING SHEET METAL TUBES.

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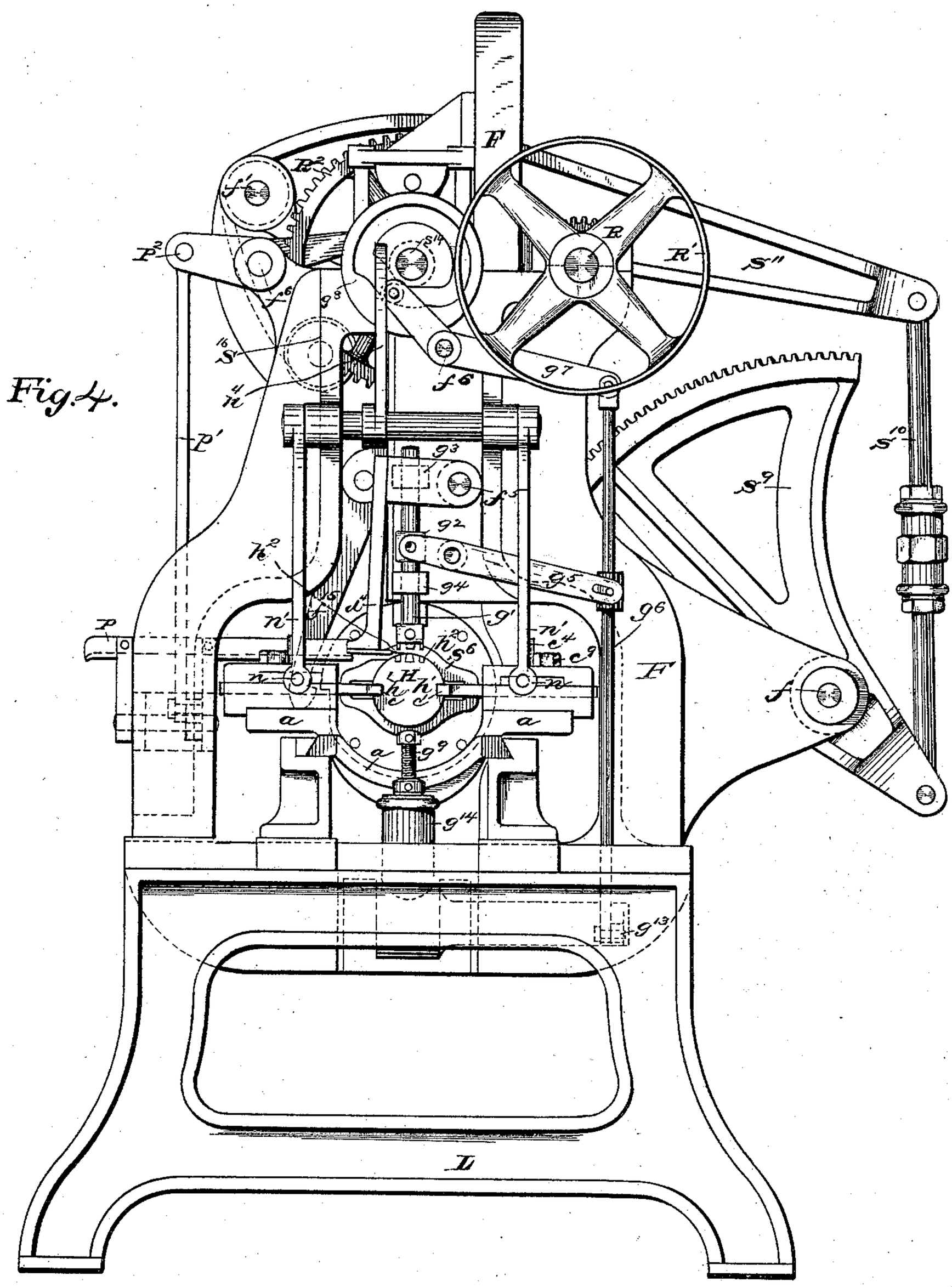
Fig. 4.



WITNESSES.

J. H. Templin.

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MACHINE FOR FORMING AND SEAMING SHEET METAL TUBES.

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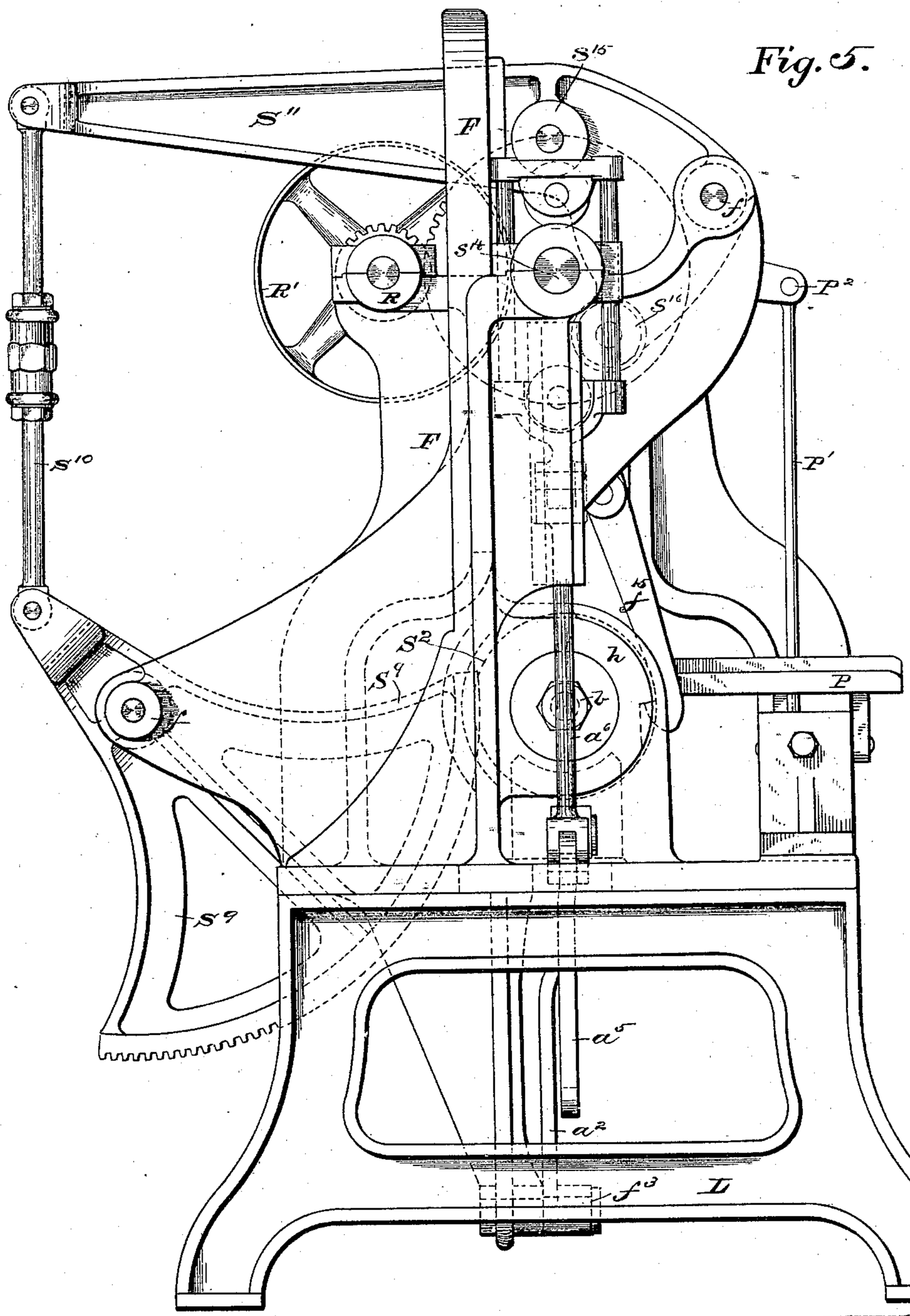
Fig. 5.



WITNESSES.

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MACHINE FOR FORMING AND SEAMING SHEET METAL TUBES.

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Fig. 9.

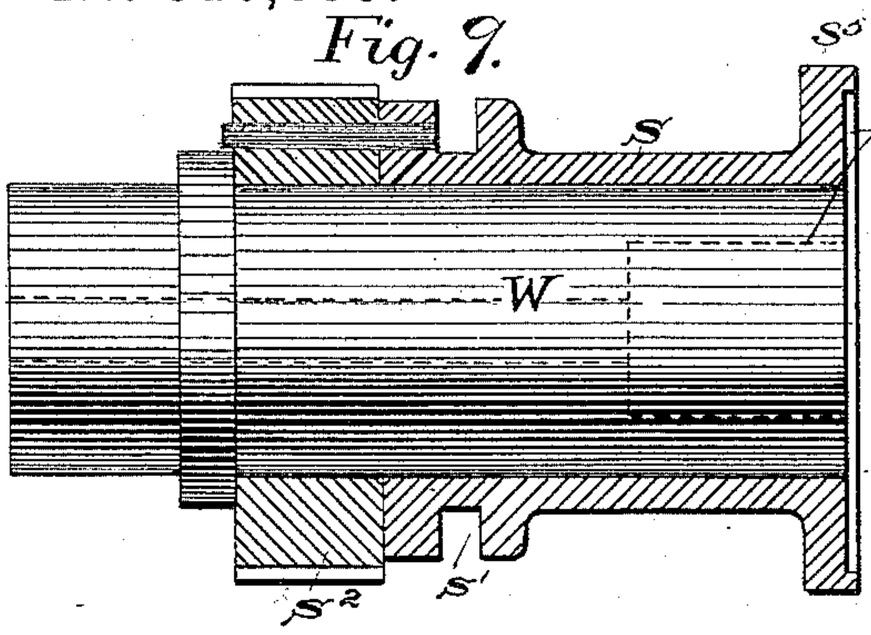


Fig. 10.

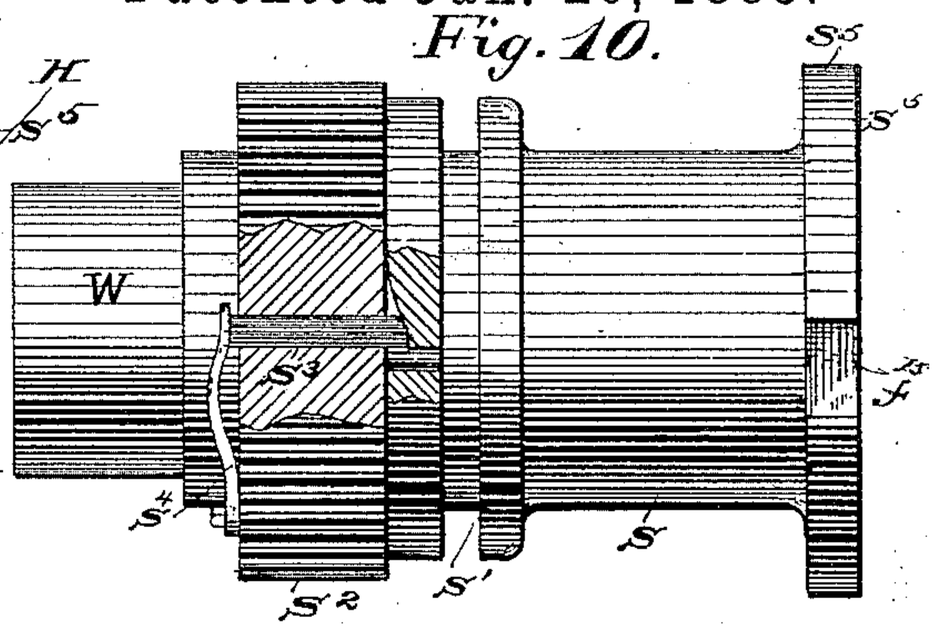


Fig. 7.

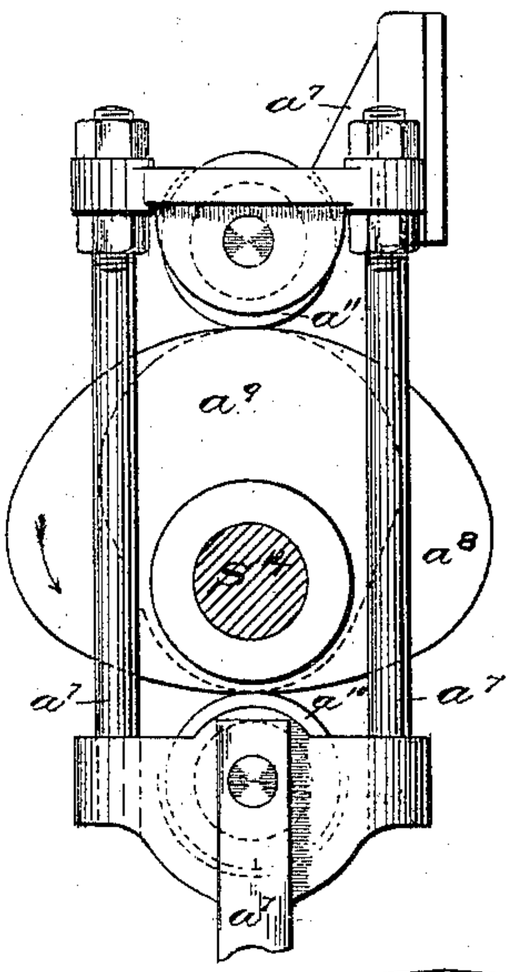
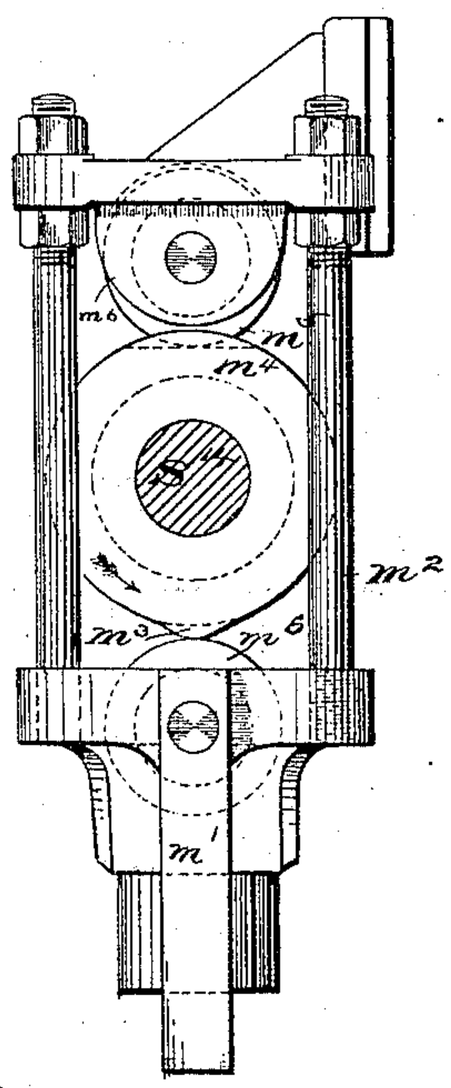


Fig. 8.



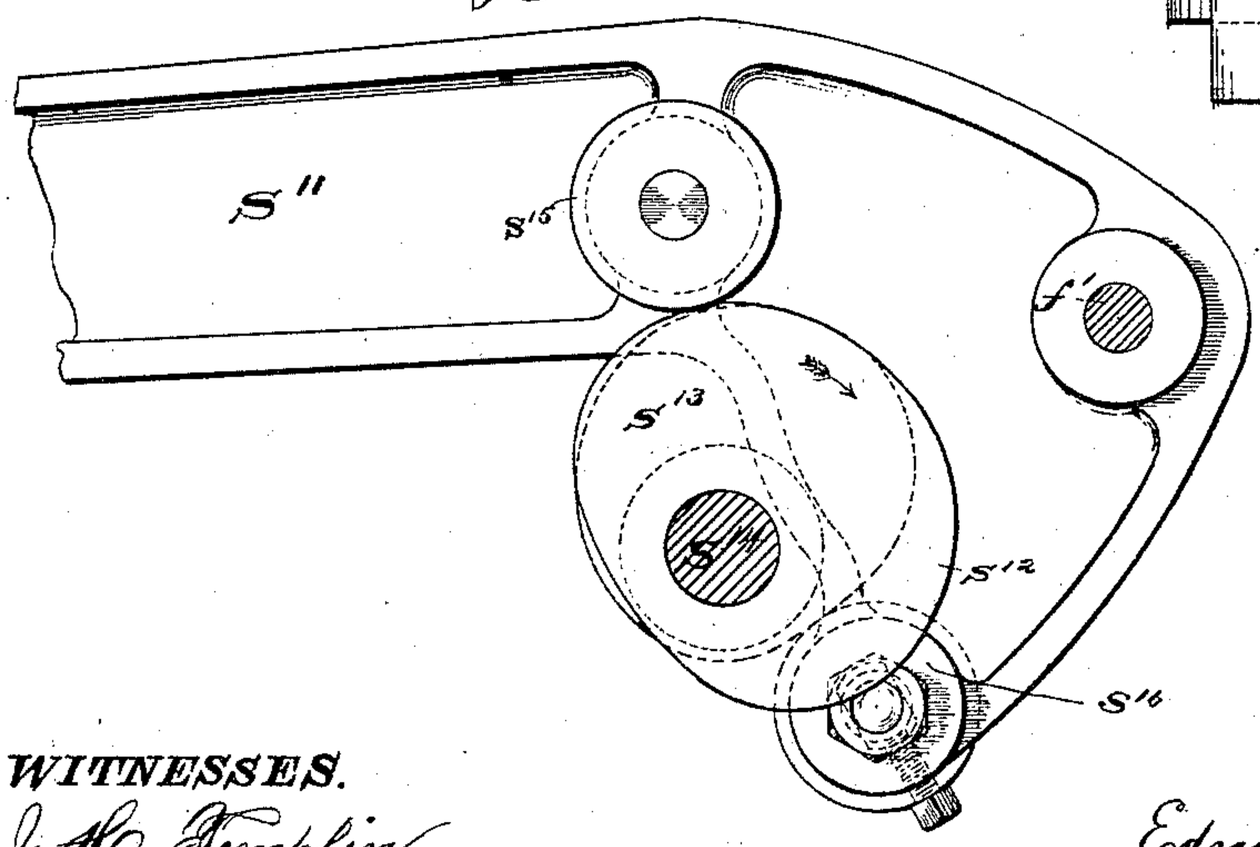


Fig. 6.

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INVENTOR.

Edmund Jordan

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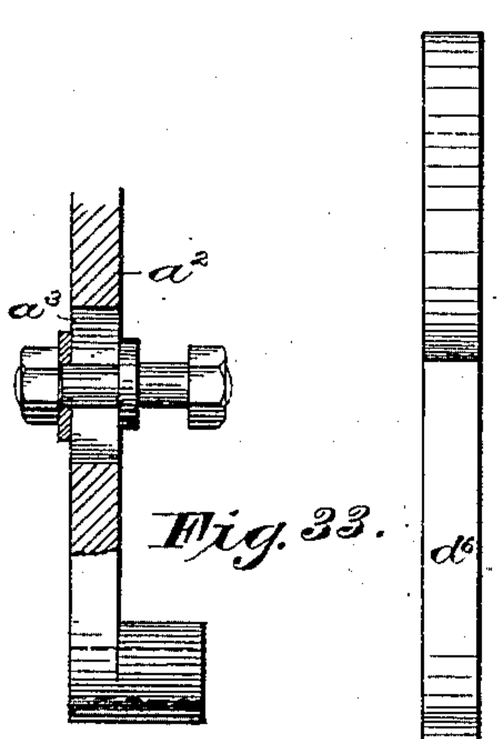


Fig. 33.

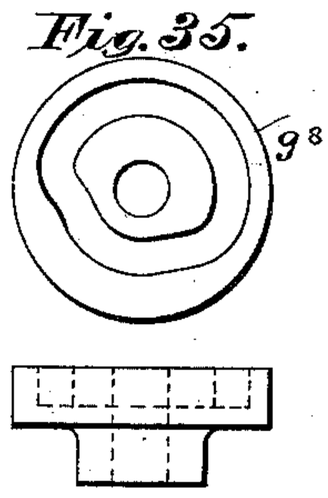
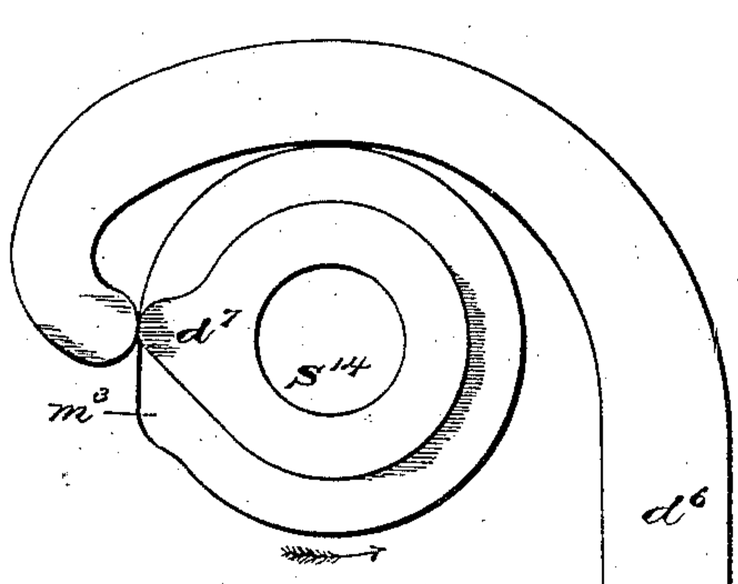


Fig. 34.

Fig. 35.



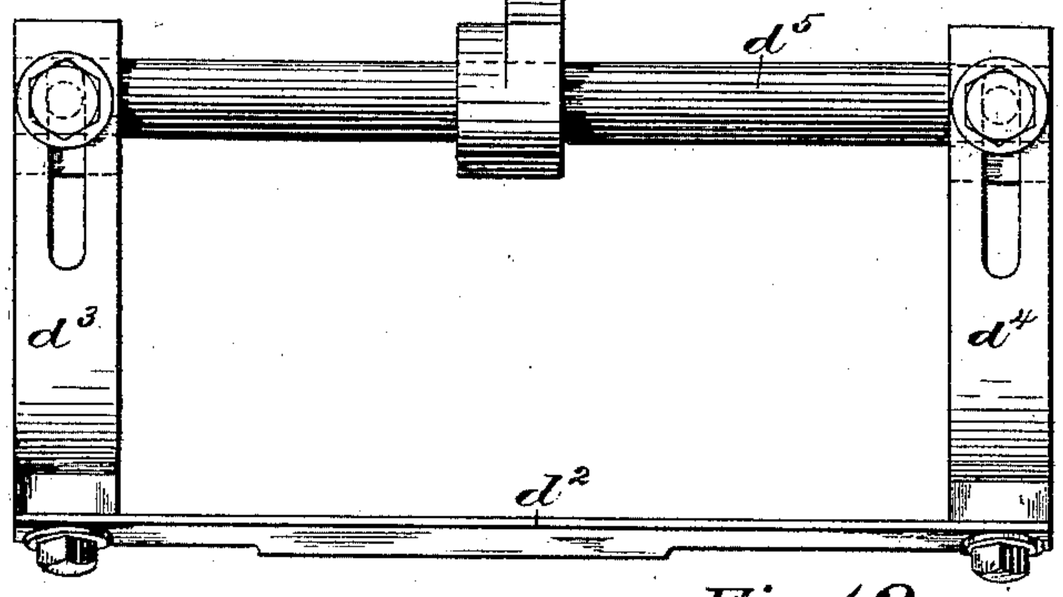


Fig 12.

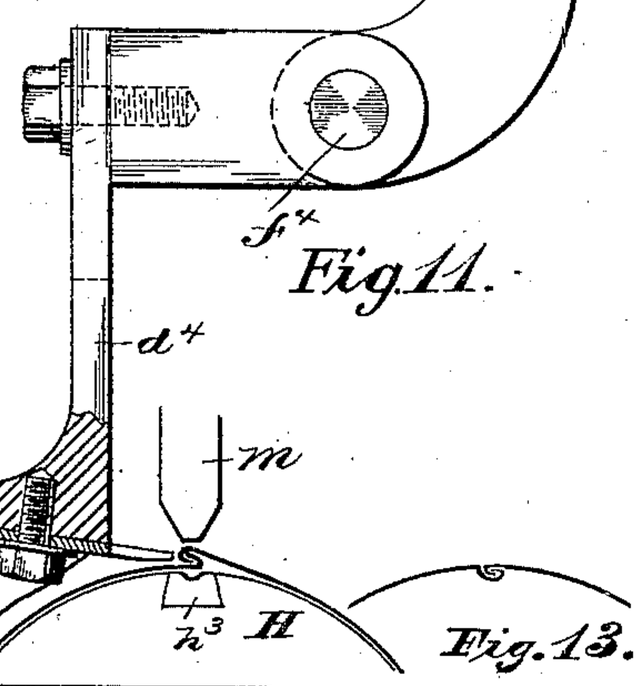


Fig. 11.

Fig. 13.

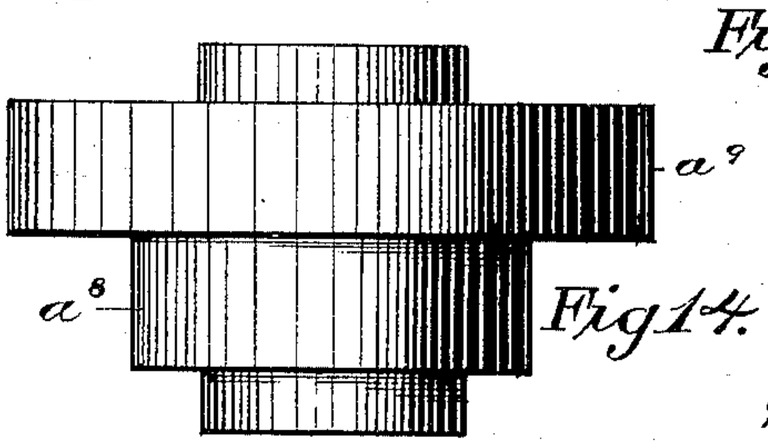


Fig 14.

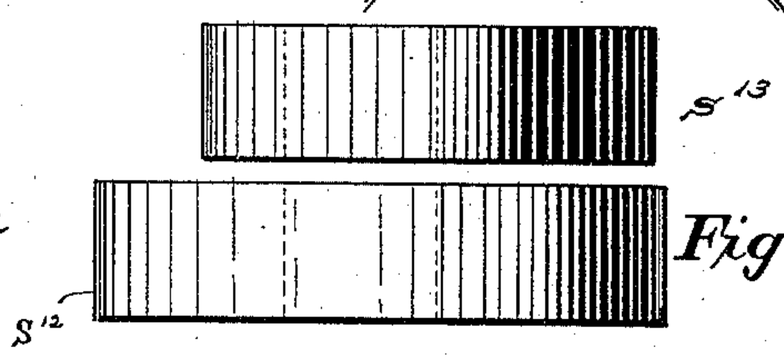


Fig 15.

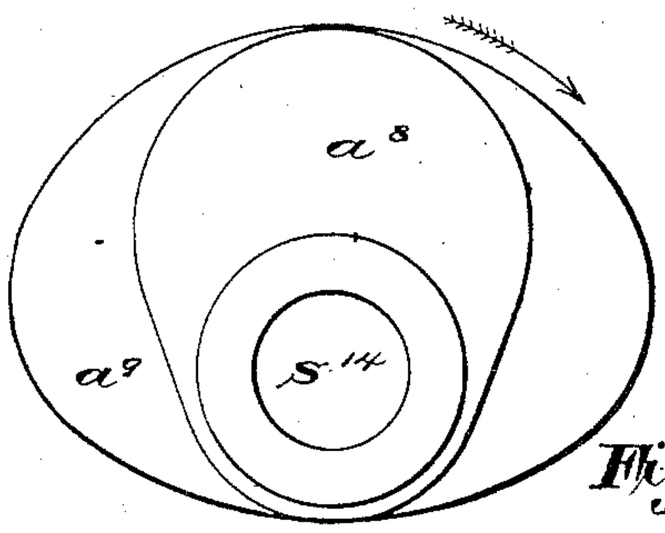


Fig. 16.

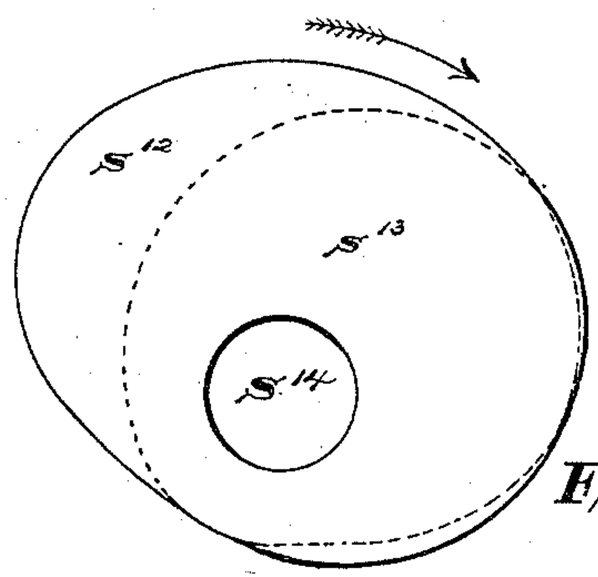


Fig 17.

WITNESSES.

J. H. Tomplin.

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MACHINE FOR FORMING AND SEAMING SHEET METAL TUBES.

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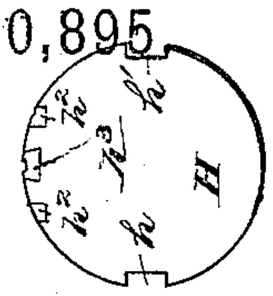


Fig. 20.

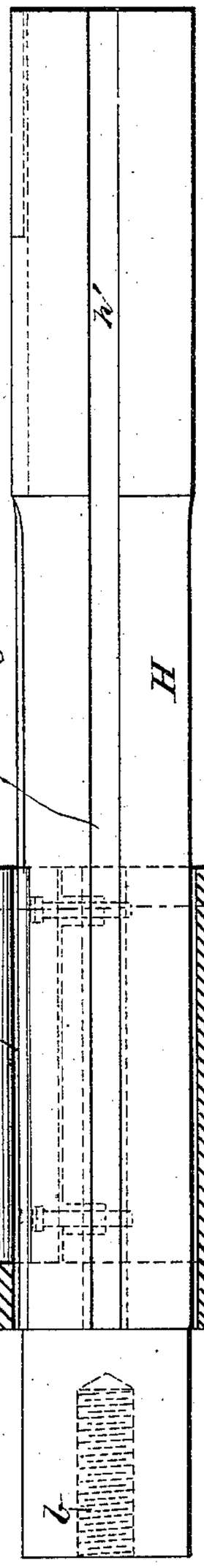
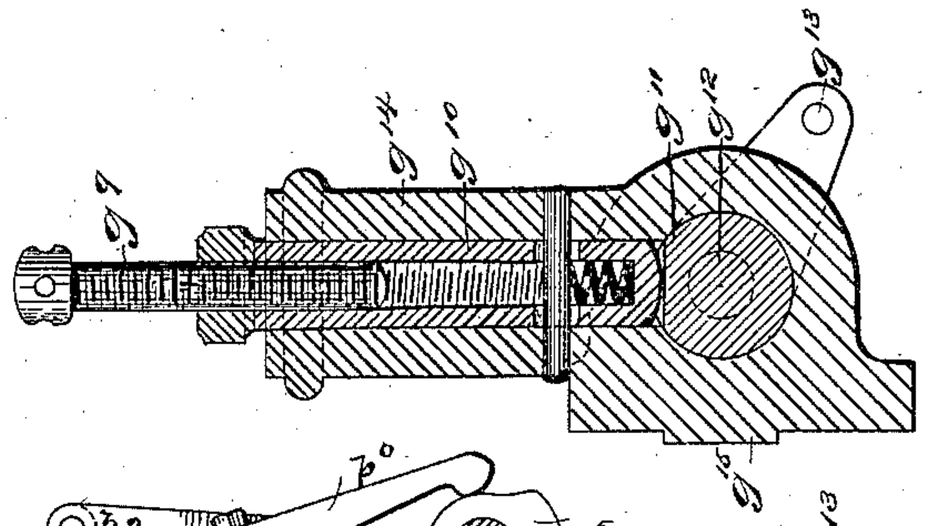


Fig. 18.



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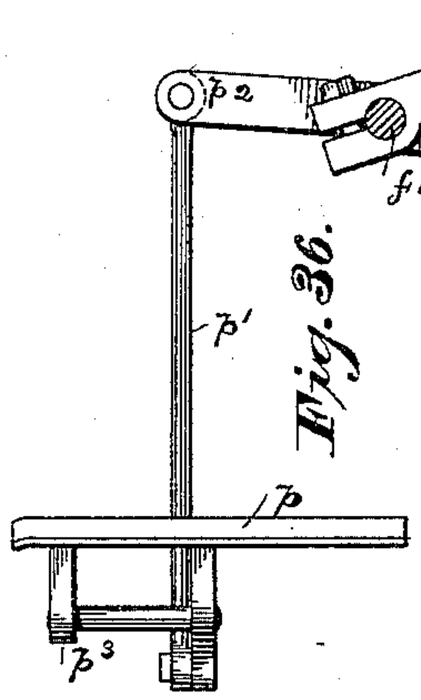

Fig. 36.

Fig. 21.

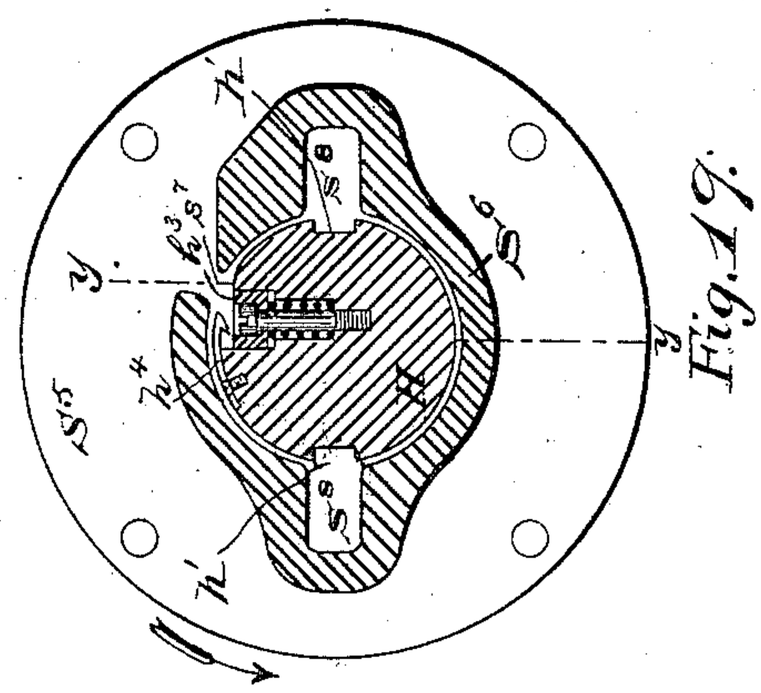

Fig. 19.

WITNESSES.

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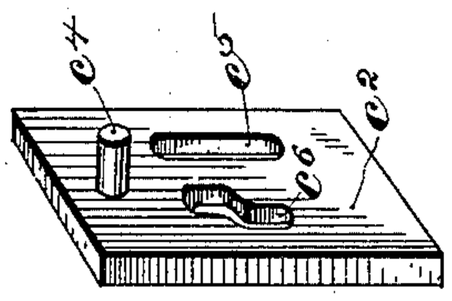

Fig. 26.

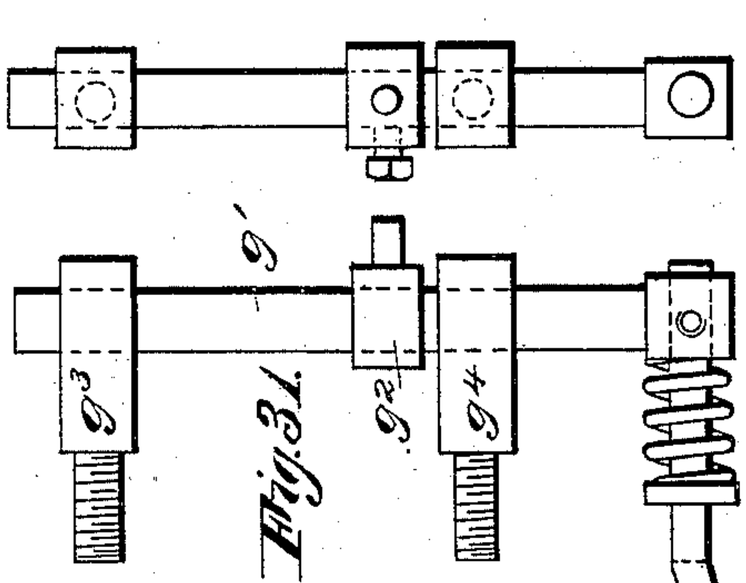

Fig. 30.

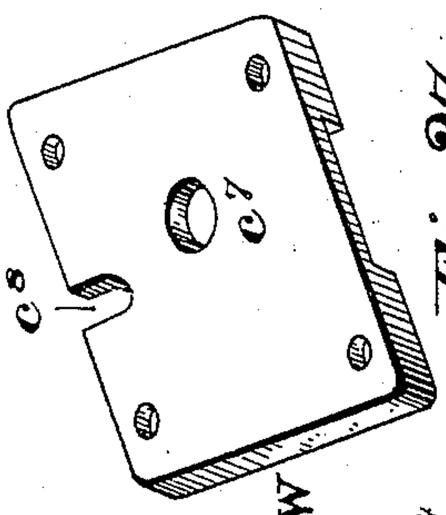

Fig. 27.

Fig. 31.

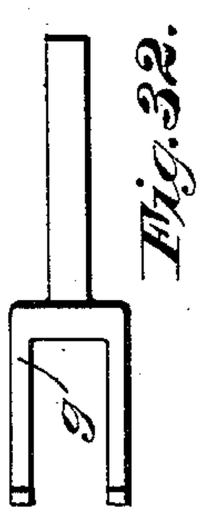

Fig. 32.

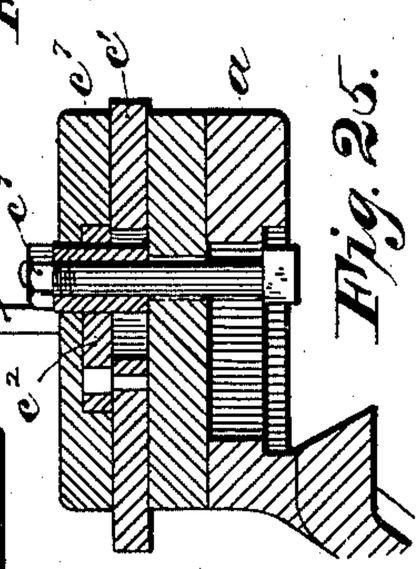

Fig. 25.

Fig. 23.

Fig. 28.

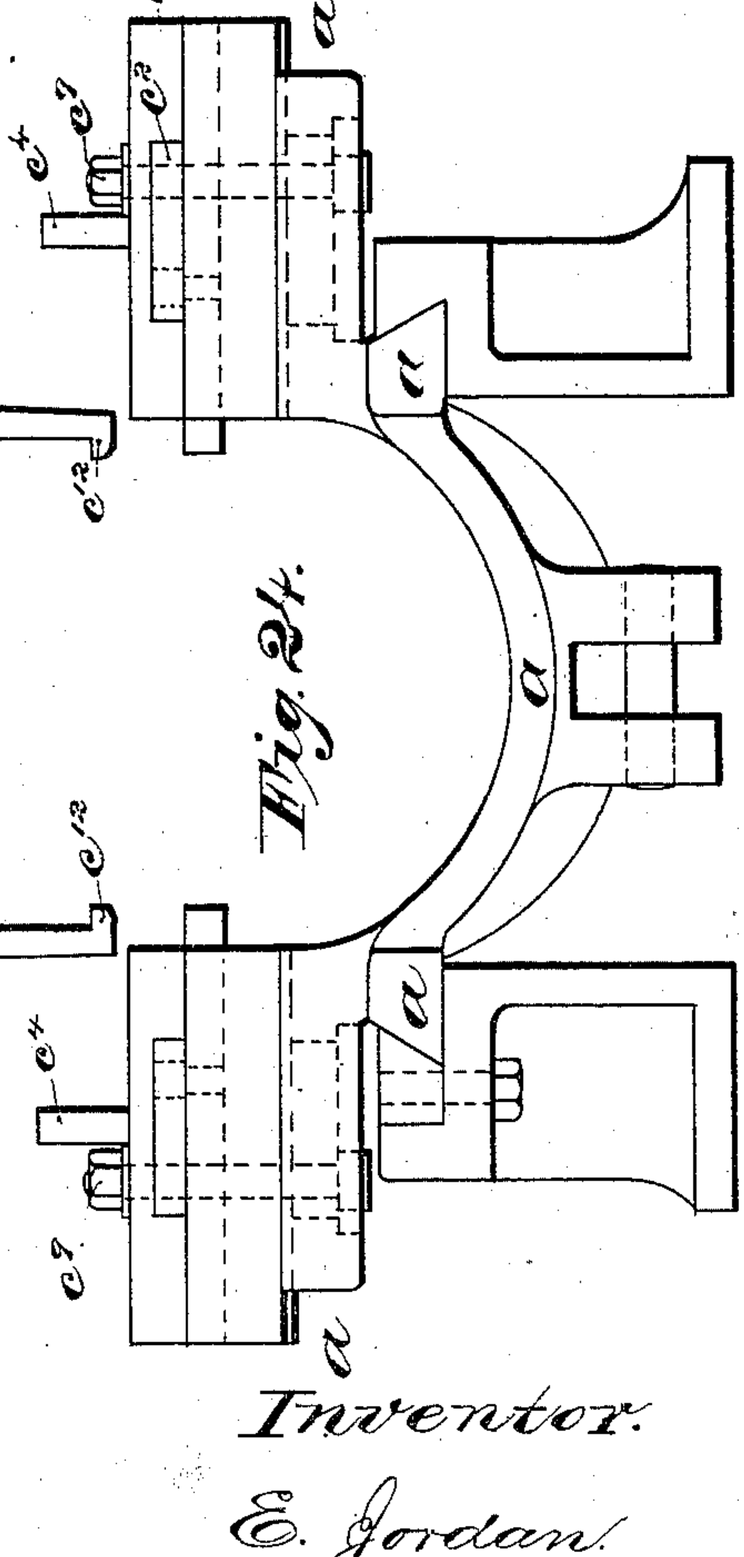

Fig. 24.

Fig. 29.

Attests:

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F. Rudolph.

Inventor.

E. Jordan.

by E. W. Bliss Atty.

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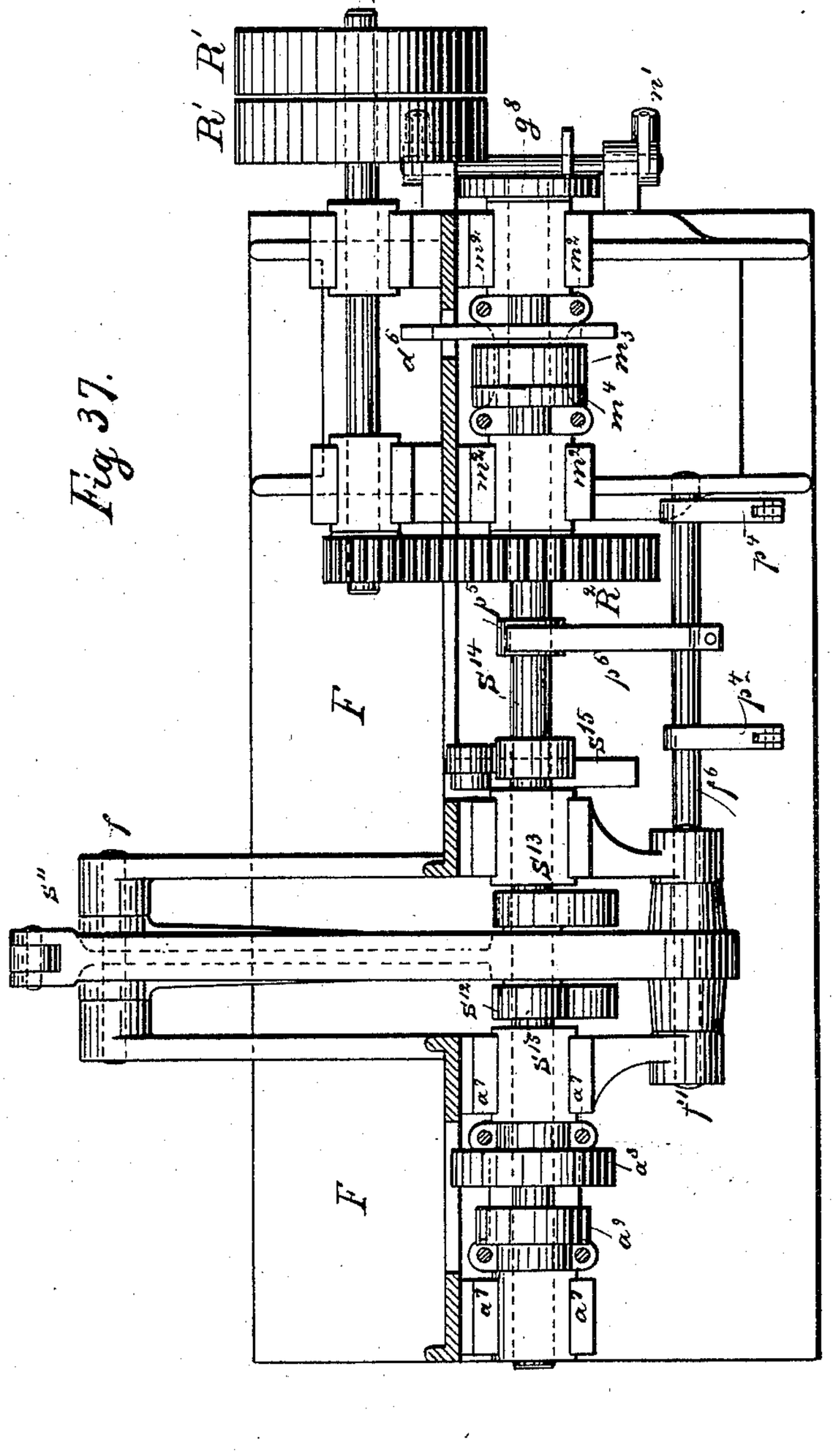
E. JORDAN.

MACHINE FOR FORMING AND SEAMING SHEET METAL TUBES.

No. 310,895. Patented Jan. 20, 1885.

Fig 37.



Attests:
F. Rudolph.
J. H. Templin.

Inventor:
Edmund Jordan.
by E. W. Bliss Atty.

UNITED STATES PATENT OFFICE.

EDMUND JORDAN, OF BROOKLYN, NEW YORK, ASSIGNOR TO E. W. BLISS, OF SAME PLACE.

MACHINE FOR FORMING AND SEAMING SHEET-METAL TUBES.

SPECIFICATION forming part of Letters Patent No. 310,895, dated January 20, 1885.

Application filed May 15, 1884. (No model.)

To all whom it may concern:

Be it known that I, EDMUND JORDAN, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Machine for Forming and Seaming Sheet-Metal Tubes, of which the following is a specification.

My invention consists in a machine for forming and seaming sheet-metal tubes, and comprises the following: a graduated horn, a sleeve or former revolving around the horn, a carrying device for moving the tubes from where they are formed toward the discharge end of the horn, a device for bringing the edges of the seams evenly together, a device for putting the tubes into proper position on the horn to have the seams closed, an adjustable jack to support the horn, a pressing device or force to close the seams, a device to strip the tubes off the horn after being formed and seamed, and a device to operate a feed-table, combined with other mechanism, fully described and claimed.

In the accompanying drawings similar letters of reference indicate corresponding parts throughout.

Figure 1 is a front elevation of my improved machine, showing its position after a tube has been formed around the horn. Fig. 2 is a front elevation of my improved machine after a tube has been formed on the horn and then moved under the force, showing the application of the force to the seam of the tube. Fig. 3 is an end elevation of Fig. 1, and Fig. 4 is an end elevation of Fig. 2. Fig. 5 is an end elevation, the opposite of Fig. 3. Fig. 6 represents a side view of a lever and cams to operate the gear-sector which rotates the sleeve and former. Fig. 7 is a side view of the cams and yoke which operate the carrier or slide and stripping-fingers, showing their form and relation to each other on the shaft. Fig. 8 is a side view of the cams and yoke to operate the force, showing their form and relative positions on the shaft. Fig. 9 is a side view of a longitudinal section of the sleeve carrying the former on a stud and the gear-wheel and clutch-pin which engage and rotate the sleeve, showing their relative positions on the stud. Fig. 10 is a side view of the sleeve and gear-wheel and their position on the stud, the broken lines indicating a portion of the gear-wheel removed, showing the clutch-pin, groove, stop, and spring. Fig. 11 represents a side view of the cam and lever which operate a mechanical doctor to move the seams of the tubes into proper position on the horn to be closed by the force. It also shows a cross-section of the doctor, an end view of the force, and an end view of the seam or a section of the horn ready to receive the force. Fig. 12 is a front view of the cam, lever, and doctor, showing the general features of the same and the manner of adjusting the doctor to accommodate different sizes of tubes. Fig. 13 is an end view of the seam after it is closed by the force. Fig. 14 is a side view of the cams which operate the slide carrying the stripping-fingers. These are placed in the yoke shown in Fig. 7. Fig. 15 is a side or top view of the cams which operate the lever for actuating the gear-sector, thereby rotating the sleeve and former. Fig. 16 is an end view of Fig. 14. Fig. 17 is a side view of Fig. 15, showing the forms of the cams and their relative positions on the shaft. Fig. 18 represents a longitudinal section of the former, taken at line *y y*, Fig. 19, and a longitudinal side view of the graduated horn, in their relative positions. Fig. 19 is a cross-section of the graduated horn and former, taken at line *z z*, Fig. 18. Fig. 20 is an end view of the horn, showing the grooves in the same. Fig. 21 is a front view of the adjustable supporting-jack which supports the end of the horn when the force is applied to the seam. Fig. 22 represents a vertical cross-section of the jack, taken at line *x x*, Fig. 21, and shows the crank and cam which give the jack an intermittent vertical motion. Fig. 23 represents a plan view of the slide carrying and operating the stripping-fingers. Fig. 24 represents an end view of the slide-fingers, and also of the sliding cam which operates them, and which is shown by dotted lines. Fig. 25 is a cross-section of the fingers, sliding cam operating the fingers, and the cam-plates, taken at line *w w*, Fig. 23. Fig. 26 is a perspective view of the sliding cam. Fig. 27 is a perspective view of the cap holding the sliding cams in place. Fig. 28 is a side view of a section of the fingers, showing the spring-joint in the same. Fig. 29 is a perspective view of a

guide for keeping the seam locked after the tube is formed on the small portion of the horn while it is being moved to the enlarged surface of the same, where the seam is closed. Fig. 30 represents the vertical bar or slide that carries the adjustable forked stop against which the tube strikes when moved on the horn under the force to bring the edges evenly together before the seam is closed by the force. Fig. 31 is a side view of the same and of the adjustable forked stop. Fig. 32 is a top view of the adjustable forked stop. Fig. 33 is a longitudinal section of the lever operating the slide which carries the fingers, taken at line *v v*, Fig. 2, showing the slot for adjusting the throw of the slide. Fig. 34 is a side view of the cam on the end of the shaft which operates the jack and the adjustable stop, and Fig. 35 is an end view of the same. Fig. 36 is an end view of a cam which actuates the levers and rock-shaft to operate the dividing feed-table. Fig. 37 represents a plan view of the machine with the top removed, taken at a line just above the main shaft.

F represents the frame, constructed of cast-iron, of suitable dimensions, set upon legs L or other supports.

H is a horn with different diameters, with a graduated surface from the smaller to the larger diameter. This horn is let into the end of a stud, Fig. 9, set into a hub or socket, *h*, cast in the frame. In the drawings this horn is shown cylindrical. It may be made in other shapes. The stud and horn are held in place by bolt *b*, passing through the hub *h* and stud *w*, and tapped into the end of the horn. *h' h'* are longitudinal grooves in the horn, in which the ends of the stripping-fingers move.

h^2 h^2 are longitudinal grooves in the upper surface of the horn, in which are adjustable stop-grooves.

h^3 is a horizontal groove in the upper surface of the horn to receive the seam of the tube. At the point on the horn opposite to the feed-table one end of this groove h^3 is slightly cut away to accommodate the width of the tube to be formed. On the opposite shoulder of the groove a hook, h^4, is rigidly attached to the horn. The hooks on the edges of the metal from which the tubes are formed are inserted between the hook h^4 and the surface of the horn, and thereby held while being formed. The part of the horn where the sheet metal is formed is of such diameter as to allow the hooks on the opposite ends of the metal to lap each other when formed around the horn and make a locked seam; but toward the discharge end the horn is graduated to the size of the tube, which is gradually expanded by being moved toward and over the graduated horn, thus drawing the hooked seam together.

s represents a metallic sleeve fitted over the stud *w*, and adapted to rotate the former, as hereinafter described. This is clearly shown in Figs. 9 and 10.

s' is a groove in the sleeve, which fits a guide on the frame, which holds it in proper position while being rotated, as the sleeve runs loosely against the gear-wheel s^2, which also runs loosely on the stud *w* between the sleeve *s'* and a collar on the stud.

s^3 is a movable clutch-pin sliding through the gear-wheel s^2, and engaging in a groove in the end of the sleeve *s*, thereby rotating the same.

s^4 is a spring on the gear-wheel to keep the clutch-pin against the surface of the sleeve, and to force the clutch-pin into the groove against the stop.

s^6 is a former, (clearly shown in Fig. 19,) rigidly attached to the sleeve *s* at s^5, and fitted over the horn in such manner as to allow the metal to be formed around the horn inside the former.

s^7 represents a longitudinal slot in the former, one edge cut away to allow the operator to insert the sheet metal under the hook h^4.

It is obvious that the construction of this former may be changed to a pin held rigidly to the sleeve s^5, and I claim either or any equivalent former; but if a sleeve-former is preferred, it should be provided with longitudinal grooves s^8 s^8, similar to those in the horn, to accommodate the stripping-fingers.

s^9 is a gear-sector pivoted in the frame at *f*, and meshed with gear-wheel s^2.

s^{10} is an adjustable connecting-rod, and s^{11} a lever pivoted to the frame at *f'*, and operated by cams s^{12} and s^{13}, rigidly attached to the main shaft s^{14}. The cams, lever, connecting-rod, and gear-sector rotate the sleeve and former. The sleeve and gear-wheel make a complete revolution, and the former then stands at rest, held by a stop-lever, f^{15}, operated by a cam, a^{20}, on the main shaft, and a spring held in the frame, while the revolution of the gear-wheel is reversed, until the clutch-pin is let into the groove in the sleeve, when the former is ready for a second operation.

a, Fig. 23, is a slide moving horizontally in the frame, and receives motion by means of connecting-rods, lever, and cams, as hereinafter mentioned. It is depressed in the longitudinal center, and carries the stripping-fingers, which will be fully described at a later point in this specification.

a' represents an adjustable connecting-rod, attached to the lugs on the slide *a* at one end, and at the other to a lever, a^2, pivoted to an arm of the frame at f^3.

a^3 is a longitudinal slot in the lever a^2, by means of which the throw of the slide *a* is regulated.

a^4 is a rod connecting to lever a^2 and the bell-crank a^5, which is pivoted to the frame at f^4.

a^6 is a rod connecting the bell-crank a^5 and the vertically-moving cam-yoke a^7, so constructed as to move in the frame.

a^8 and a^9 are cams fixed rigidly on the main shaft s^{14}.

a^{10} and a^{11} are rolls fitted in the cam-yoke,

which work on the face of the cams. These several devices are provided to impart a horizontal motion to the slide or carrier. On each side of the carrier are projecting ears or lugs, provided with a cross-groove at right angles to the slide, into which the projecting shanks on the fingers are fitted to impart a horizontal motion to the same.

c and c' represent the stripping-fingers, provided with projecting ends, which move in the grooves h' h' in the horn. The cam-plate c^2, Fig. 26, is placed over the projections on the fingers and the surface of the lugs or ears on the slide, and is fitted into a groove in the top plate.

c^4 represents a pin in the cam-plate.

c^5 is a slot in the cam-plate, and c^6 is a cam-slot in the cam-plate.

c^7 represents a cap covering the sliding cam c^2. The fingers, sliding cam, and cap are all held in place by bolt c^9.

c^{10} c^{10} are cross-slots provided in the projecting ends of the fingers to accommodate a horizontal motion of the fingers when in use. The angles of the cam-cap are provided with bolt-holes, and are rigidly bolted to an adjustable block sliding in the projecting ears of the slide.

c^{11} c^{11} are spring-joints in the fingers to impart elasticity to the same, thus preventing injury to the edges of the tubes while being moved on the horn. These may be omitted without interfering with the usefulness of my invention. The slide-fingers and cams move horizontally with the slide, and the fingers work in and out of the grooves in the horn by the sliding cam device already described. When a sheet of metal is formed on the horn, the slide carrying the fingers expanded moves forward at the time the gear-sector is traveling backward, while the former stands at rest until the pin c^4 strikes a stationary stop on the frame. The slide continues its travel, thereby crowding the fingers into the grooves h' h' in the horn by the motion of the cam-plate. When the travel of the slide is reversed, the projecting ends of the fingers c^{12} c^{12} embrace the end of the tube on the horn and carry it on to the enlarged surface of the horn under the force. At the extreme end of the throw pins n n in the levers n' n' move forward and strike the sliding cam-plate, reversing its position, and thereby expanding the stripping-fingers.

d represents a stationary adjustable guide fastened to the frame by a bolt. The flanged end is placed in close proximity to the horn over the locked seam, and the projecting end is located near the end of the former to keep the seam of the tube locked until the tube is carried on to the enlarged surface of the horn. The circular depression d' is provided to guide the seam into its proper place to be brought under the force. Any equivalent may be used without interfering with the usefulness of my invention.

d^2 represents the doctor, consisting of a plain sheet of metal with a projecting lip, as indicated in Fig. 12, the ends being attached to adjustable bars d^3 and d^4, provided with a slot to adjust the same. The slotted ends of the bars are attached to a cross-bar, d^5, which is rigidly attached to a circular lever, d^6, and pivoted to the frame at f^4.

The mechanism herein described is actuated by a cam, d^7, on the main shaft s^{14}, working against the circular end of the lever, as indicated in Fig. 11. The doctor is so adjusted that the projecting lip strikes the locked seam of the tube and moves it into position to receive the force to close the seam. This is so timed as to operate immediately after the tube comes to a rest, as indicated in d^7, Fig. 11.

g represents an automatic adjustable forked stop with projecting ends, as indicated in Fig. 32. The stem is fitted into rod g', provided with a collar, g^2, and attached to the frame by bearings g^3 and g^4. g' is a vertical slide working in its bearings. Around the stem of the forked stop is a coiled spring to form an elastic stop. The projecting ends of the fork work in grooves h^2 h^2 in the horn, as illustrated in Fig. 20. The stop is provided to bring the edges of the tubes evenly together before the force is applied, and is moved vertically to allow the tubes to be stripped from the horn after the seam is closed by lever g^5, one end of which is attached to collar g^2, and the other slotted end to connecting-rod g^6, which connects with levers g^7, pivoted at f^6. The projection on the end of the lever g^7 works in the cam-groove in the side of cam g^8, rigidly fixed on the main shaft s^{14}. When the force is applied, this forked stop is raised by the mechanism just described, in order that the ends of the stripping-fingers c^{15} c^{15}, which work in the grooves in the horn, may strip the tube from the horn at the same time that another tube is being carried by hooks c^{12} c^{12} from where it is formed to where it receives the force, and this same mechanism operates the supporting-jack g^9, which consists of a screw let into a movable slide, g^{10}, operated by a cam, g^{11}, which is rigidly fixed on shaft g^{12}. On the opposite end of this shaft is a crank, g^{13}, which is connected with a connecting-rod, g^6. g^{14} is a slide working in a sleeve. The jack is raised to support the horn immediately before the application of the force to the seam, and recedes immediately after to allow the tube to be stripped from the horn, as before mentioned. The jack and the mechanism immediately connected therewith are rigidly attached to the frame.

g^{15} is a tongue to fit a groove in the frame. n n are two adjustable pins in the ends of levers n' n', attached rigidly to rock-shaft n^3, which has bearing in the frame. To this rock-shaft a lever, n^4, is rigidly attached. The opposite end of the lever works on the face of a cam-wheel, and is actuated by a side cam, which actuates the pins n n, and causes them

to strike against the end of sliding cam-plate c^2, driving the same forward, and thereby expanding the stripping-fingers, so that they move forward to grasp a tube on the horn. This motion is so timed as to strike the sliding cam-plate immediately preceding the time when the slide reverses its travel to return for a tube formed over the horn, as before described.

m, Fig. 11, represents a vertically-moving force to close the locked seam; and it consists of a metallic force or die working in guides.

m' represents the adjusting-screw connecting the force with the cam-yoke m^2, Fig. 8, which is operated vertically by cams m^3 and m^4, rigidly fixed on the main shaft s^{14}, working on rollers m^5 and m^6 in the cam-yoke, and imparting a vertical intermittent motion to the force *m*, so timed as to apply to a seam when the fingers are returning for a tube.

p p, Fig. 2, represent a dividing feed-table, which closes to receive a sheet from the operator, to be conducted under the hook on the horn immediately preceding the rotation of the former.

p' p' represent two connecting rods, one end of each connected by a bell-crank, p^3, to each side of the dividing-table, and the upper ends rigidly fixed on a rock-shaft, f^6, on which one end of a lever, p^6, Figs. 3 and 36, is rigidly fixed, the opposite end working on the face of cam p^5, rigidly attached to the main shaft s^{14}. The mechanism described opens the dividing-table immediately after the sheet is pushed under the hook on the horn, allowing the former to form the sheet metal around the horn, and then closes to secure a second sheet. These several mechanical movements are so timed and arranged as to work in unison.

R represents a short shaft having its bearings in the frame.

s^{15} represents a roller pivoted to arm s^{11}, which works as the face of an actuating-cam.

R' represents a fast and a loose pulley on the shaft R. On the opposite end of this shaft is a small gear-wheel meshed with a larger gear-wheel, R^2, on the main shaft, which has its bearings in the frame.

The horn may be other than a true cylinder.

Operation: The sheets of metal, cut to the required size and having hooks turned on the ends to form a locked seam, are placed on the dividing feed-table with the upturned hook on the sheet in advance. The sheet is then conducted forward with the edge under the hook on the horn. At the time the former commences its rotation the feed-table opens, allowing the sheet to drop, when it is formed around the horn by the rotation of the former, bringing the hooked edges of the metal past each other and holding them stationary, when the former comes to a rest. The gear-sector reverses its travel, carrying the gear-wheel containing the clutch-pin backward until the clutch-pin slides into the inclined slot in the sleeve, when the former is ready to form another sheet around the horn. While the gear-sector is traveling backward the slide carrying the stripping-fingers extended moves forward, the projecting pin in the sliding cam striking the stationary stop and closing the fingers, which move into the grooves in the horn. When the travel of the slide and fingers is reversed, the projecting ends of the fingers are brought in contact with the edge of the tube, moving it to the graduated portion of the horn, the locked seam being kept in place by the stationary guide in the frame, and the elastic stop brings the edges evenly together, when the tube remains at rest under the force through the action of the pins *n n* against the sliding cams, thereby extending the fingers outward from the horn, when the tube is in readiness to receive the force to close the locked seam. Preceding the application of the force the jack is brought under the horn to support it when the force is applied. After the application of the force the jack and the adjustable forked stop recede from the horn, allowing the tube to be stripped from it.

I claim all equivalents to accomplish the same ends, whether used horizontally, vertically, or otherwise.

I claim and desire to secure by Letters Patent of the United States—

1. In a machine for forming tubes from sheet metal, a grooved horn having different diameters, with a graduated surface from the larger to the smaller diameter, in combination with suitable means for forming sheet metal round the smaller diameter, and means for moving it on to the larger diameter of the horn.

2. In a machine for forming sheet-metal tubes, a horn having different diameters, with a graduated surface from the smaller to the larger diameter, with longitudinal grooves in the same, provided with suitable means for forming the sheet metal round the smaller diameter of the horn, in combination with a moving slide carrying a stripping device constructed to engage with the longitudinal grooves of the horn, for moving the tubes from the smaller to the larger diameter of the horn to expand the tubes.

3. In a machine for forming and seaming sheet-metal tubes, a horn having different diameters, with a graduated surface from the smaller to the larger diameter, provided with suitable means for wrapping the sheet metal round the smaller diameter of the horn, in combination with a moving slide carrying a stripping device for moving the tubes from the smaller to the larger diameter of the horn, for expanding the tubes, and moving force to close the seam when the tube is expanded on the horn.

4. In a machine for forming and seaming sheet-metal tubes, the following mechanical combinations: a horn having different diameters, with a graduated surface between the different diameters, to allow the sheet metal to be

wrapped on the smaller diameter of the horn, so as to permit the hooks on the seam to lap and hook; a device operating to move the tubes on the longitudinal diameter of the horn and expand the same, lock the hooks, and strip the tubes from the horn; a device to keep the hooks locked when the tube is being moved and expanded on the horn; a device to even the edges of the tube; a force to close the seam when the tube is expanded and the edges evened, and a device for stripping the tubes from the horn after the seam is closed.

5. In a machine for forming sheet-metal tubes, a horn having different diameters, the horn having also a graduated surface from the smaller to the larger diameter, to allow the hooks on the sheet metal to lock during wrapping, with a graduated surface from the smaller to the larger diameter for expanding the tube to the required size, a former constructed and arranged to bend the sheets around the smaller portion of the horn, with its hooks overlapped, in combination with a force to close the seam on the horn.

6. In a machine for forming and seaming sheet-metal tubes, a horn having two diameters, with a graduated surface from the smaller to the larger diameter, the smaller diameter of the horn being of sufficient size to allow the sheet metal provided with hooks to be wrapped on the horn and to allow the hooks to overlap, a former to wrap the sheet metal on the horn, a carrier to move the tubes on the horn from the smaller to the larger diameter to expand the same, a force to close the seam of the tube while on the horn after the tube is expanded, combined and arranged substantially as stated.

7. A machine for forming and seaming sheet-metal tubes having a horn of different diameters, with a graduated surface from the smaller to the larger diameter, to expand the same and lock the seam, a former to wrap the sheet around the smaller diameter of the horn, with its hooks overlapped, a device to even the edge of the tube when moved on to the larger diameter of the horn, a device to move the tube on to the larger diameter of the horn under the force, a guide to hold the lock-seam when the tube is being moved under the force, a force to close the seam when the tube is expanded on the horn, a device to strip the tube from the horn, and an automatically-divided feed-table, to allow the sheet metal to drop in position to be wrapped on the horn and to close after the former commences its work, combined and arranged substantially as described, for the purposes stated.

8. A machine for forming sheet-metal tubes having a horn of different diameters, with a graduated surface from the larger to the smaller diameter, the larger diameter being provided to expand the tube and lock the seam, a former to wrap the sheet around the smaller diameter of the horn, where its hooks overlap, a device to even the edges of the tube when moved on to the larger diameter of the horn, a device to move the tubes on to the larger diameter of the horn under the force, a guide to hold the lock-seam when the tube is being moved, a force to close the seam when the tube is expanded, a device to strip the tube from the horn, combined and arranged substantially as described, for the purposes stated.

EDMUND JORDAN.

Witnesses:
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C. WILLIAMS.