J. UHRI.

METAL FORMING MACHINE.

APPLICATION FILED NOV. 13, 1907.

922,217.

Patented May 18, 1909.

8 SHEETS—SHEET 1.

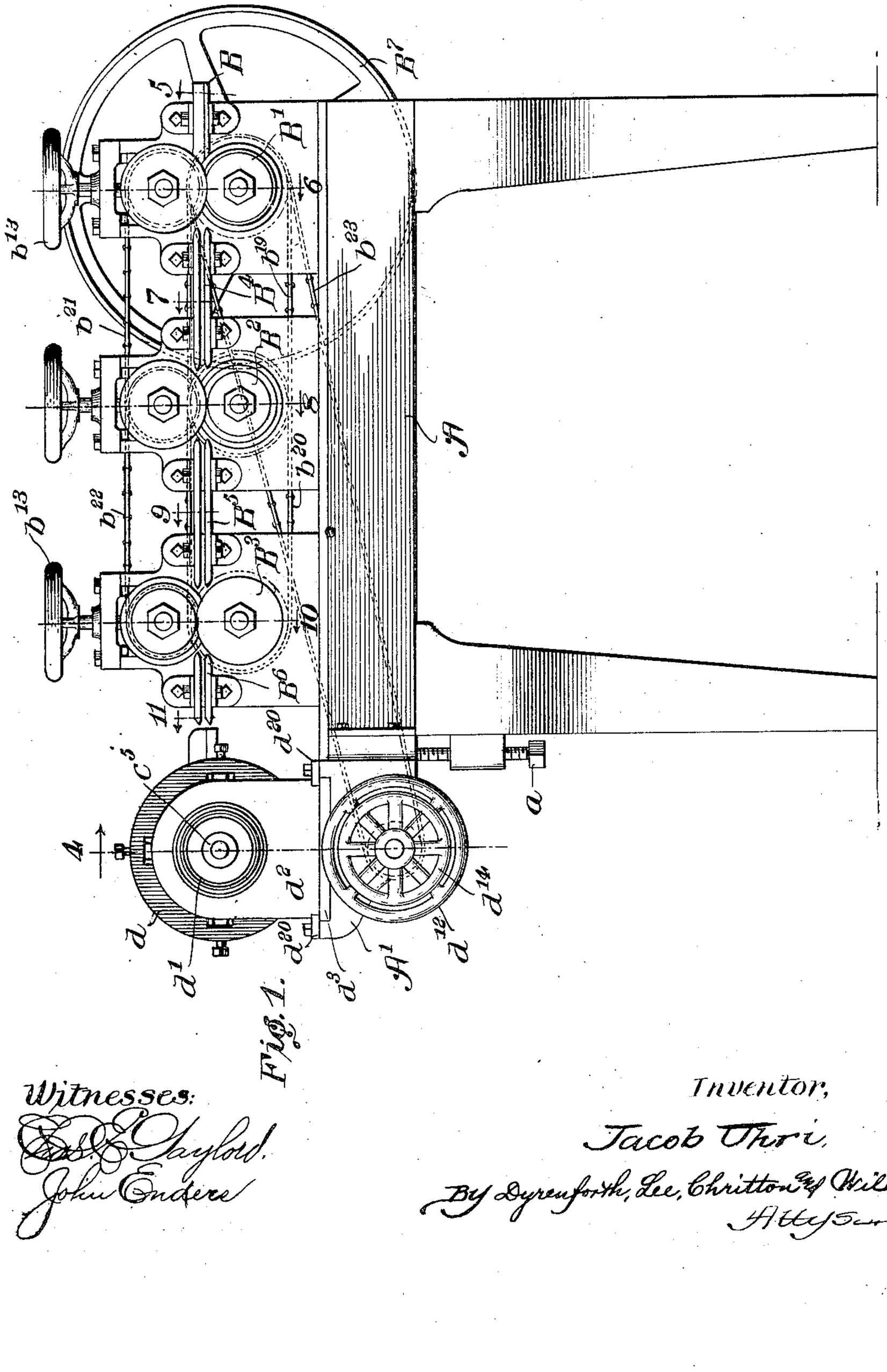

Fig. 1.

Witnesses:
Carl L. Gaylord.
John Endere

Inventor,
Jacob Uhri,
By Dyrenforth, Lee, Chritton & Wiles
Attys

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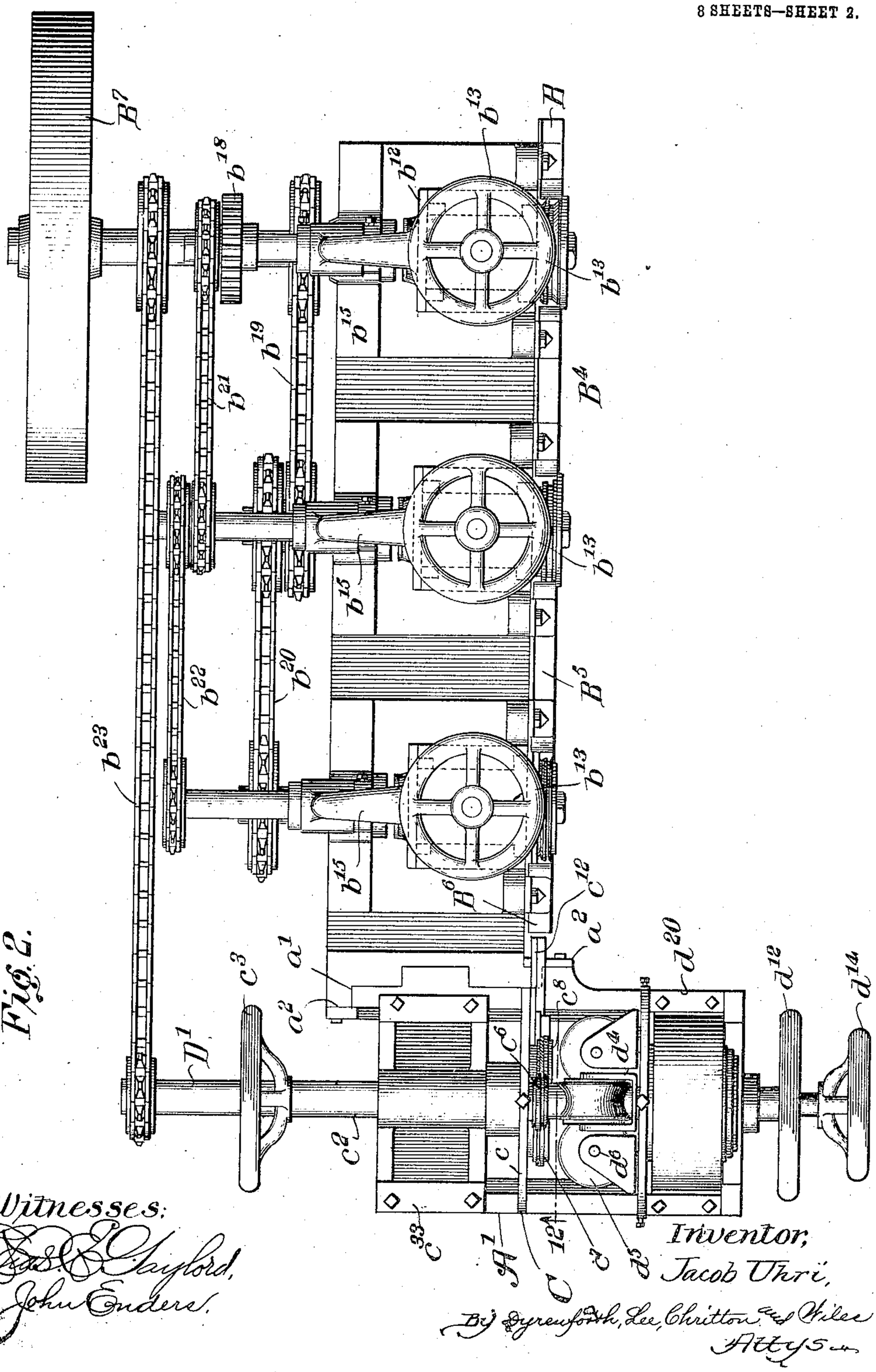

Fig. 2.

Witnesses:
Chas. L. Gaylord.
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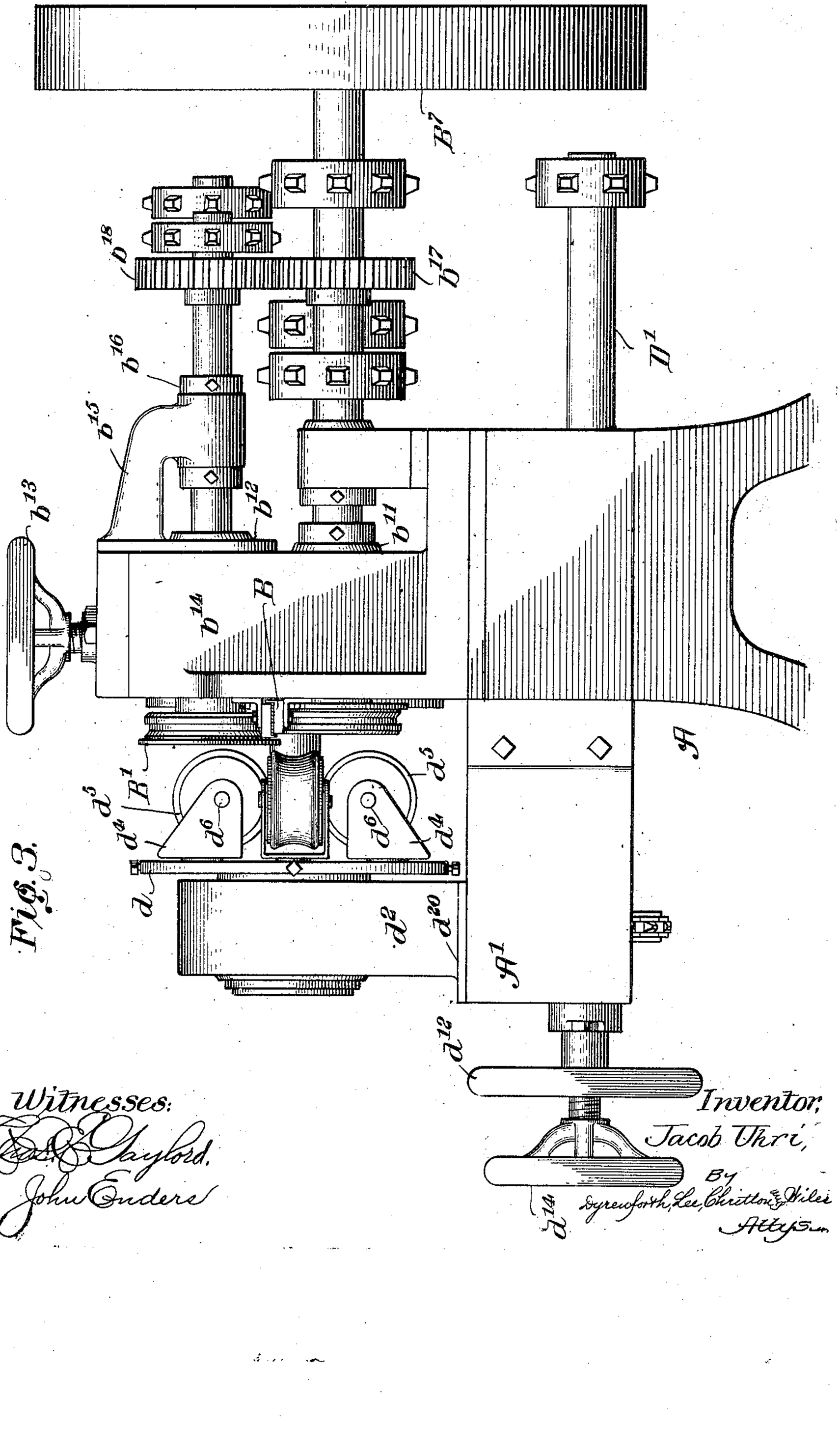

Fig. 3.

Witnesses:
Chas. E. Gaylord.
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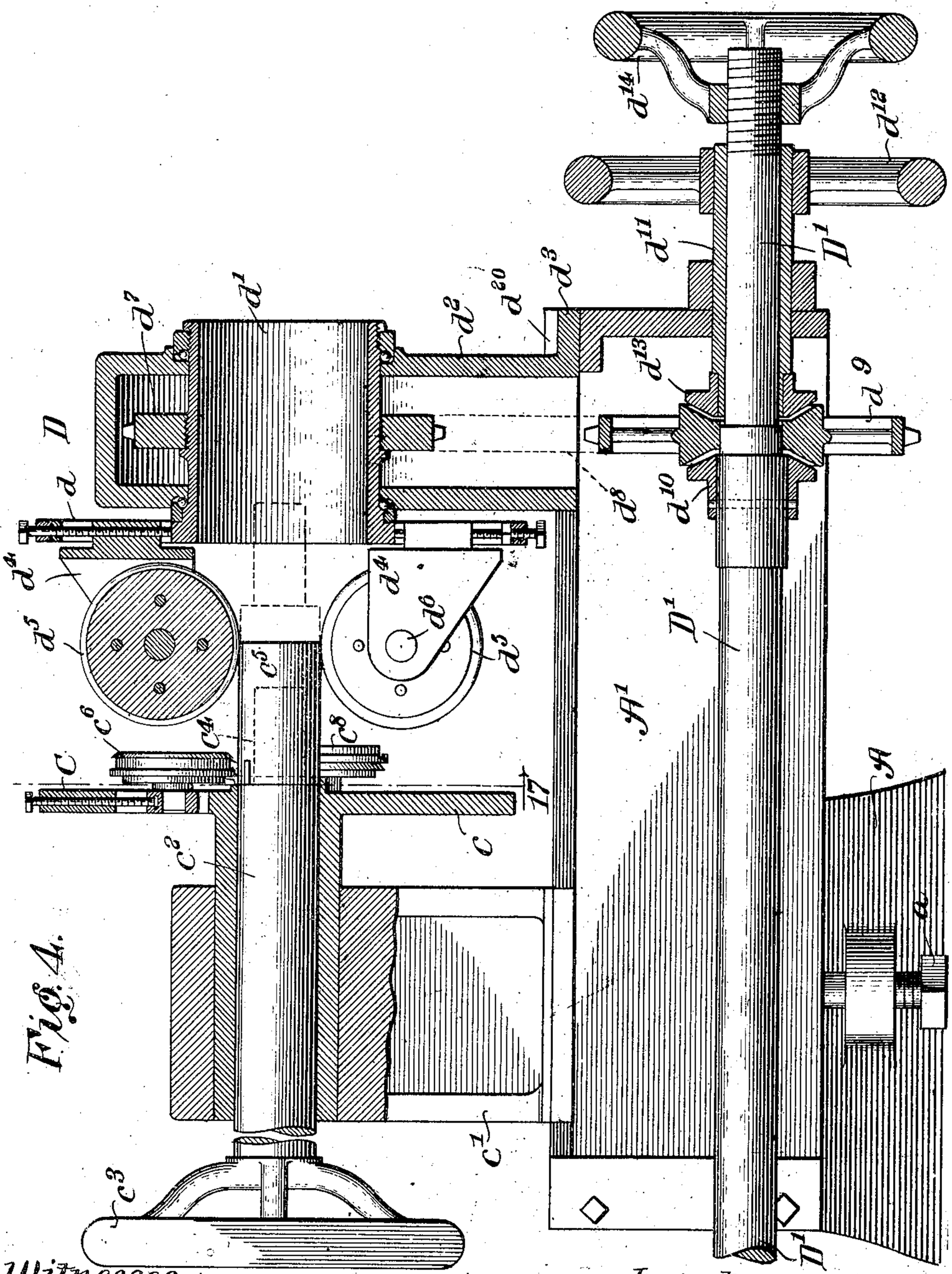

Fig. 4.

Witnesses:

Carl L. Taylord.

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Fig. 5.

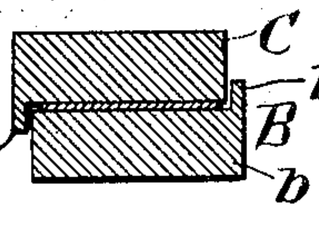


Fig. 7.

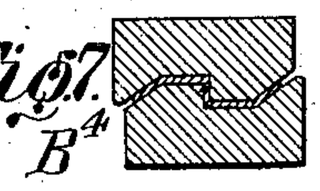


Fig. 9.

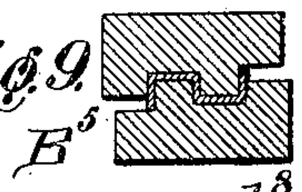


Fig. 6.

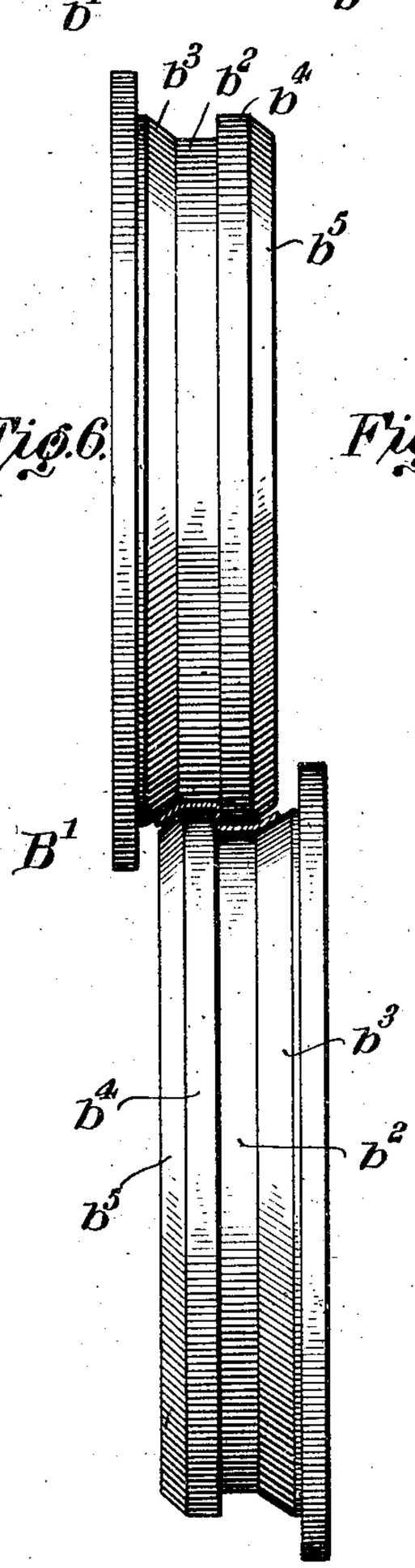


Fig. 8.

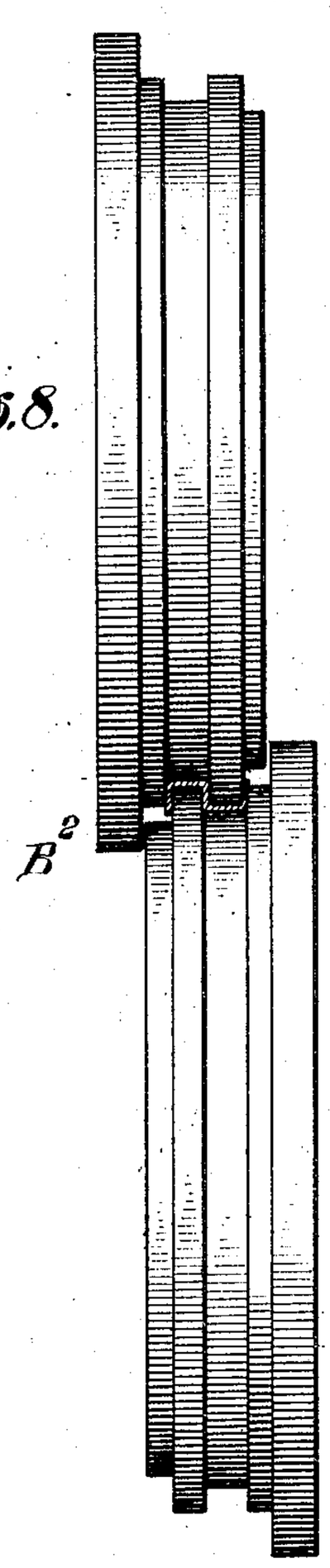


Fig. 10.

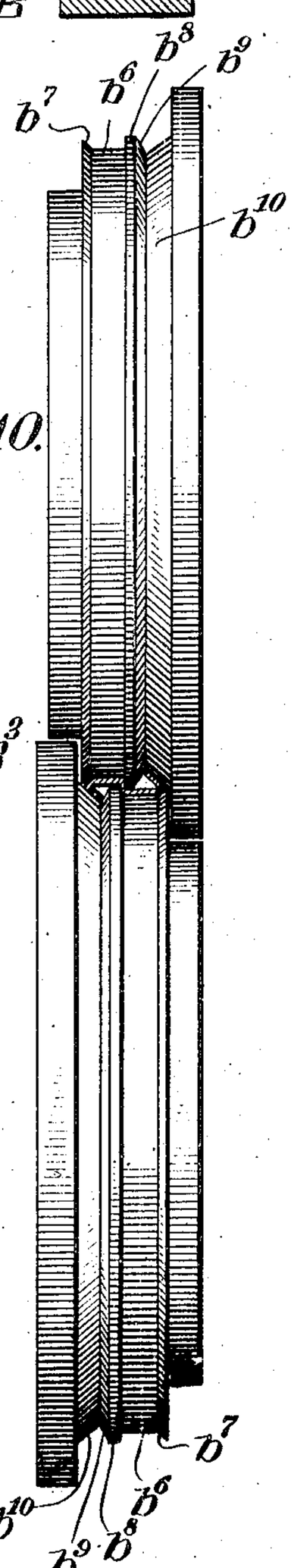
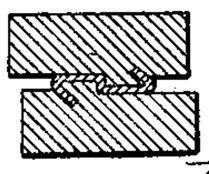


Fig. 11.



Witnesses;

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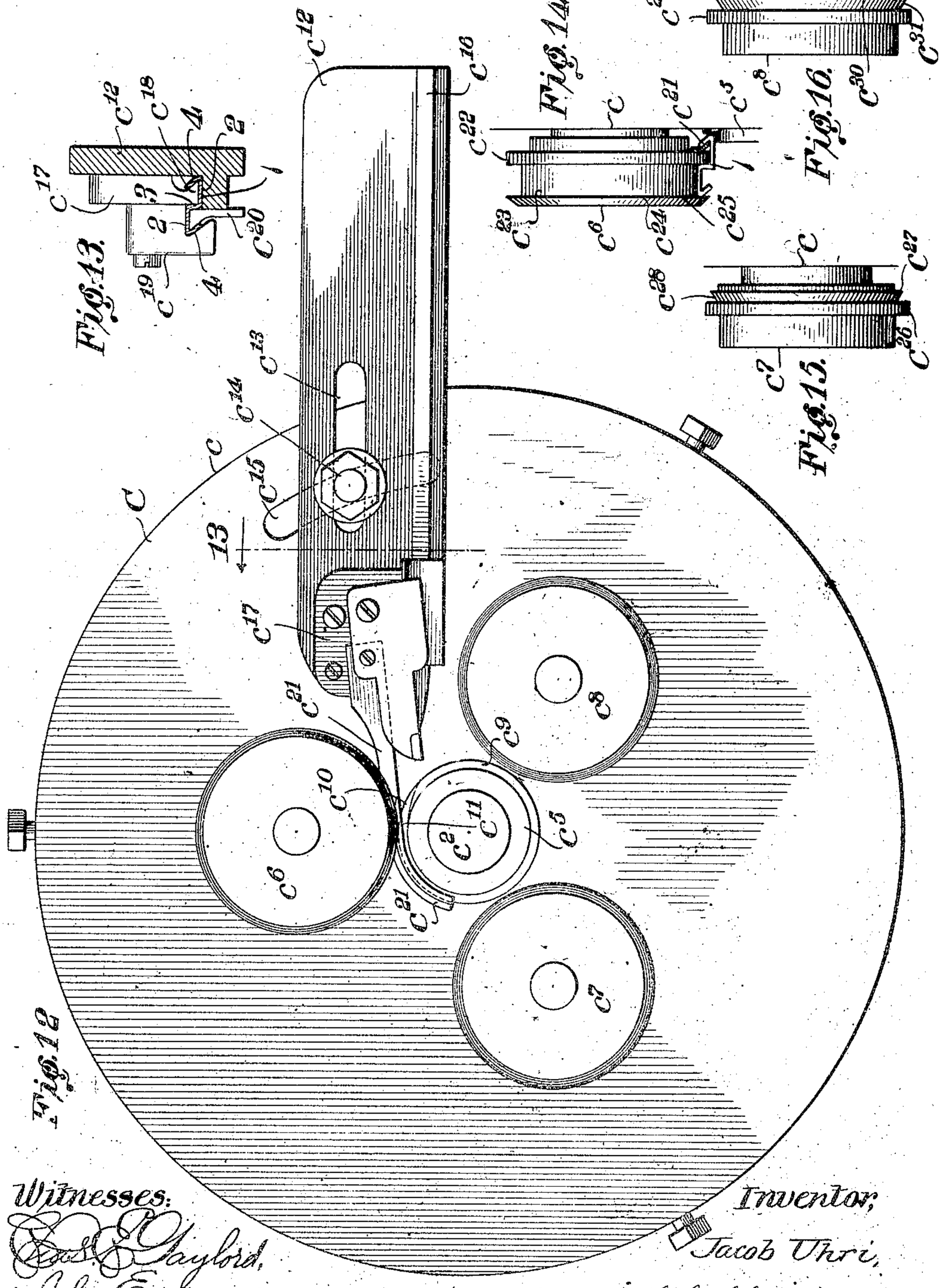

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 16.

Fig. 15.

Witnesses:

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8 SHEETS—SHEET 7.

Fig. 17.

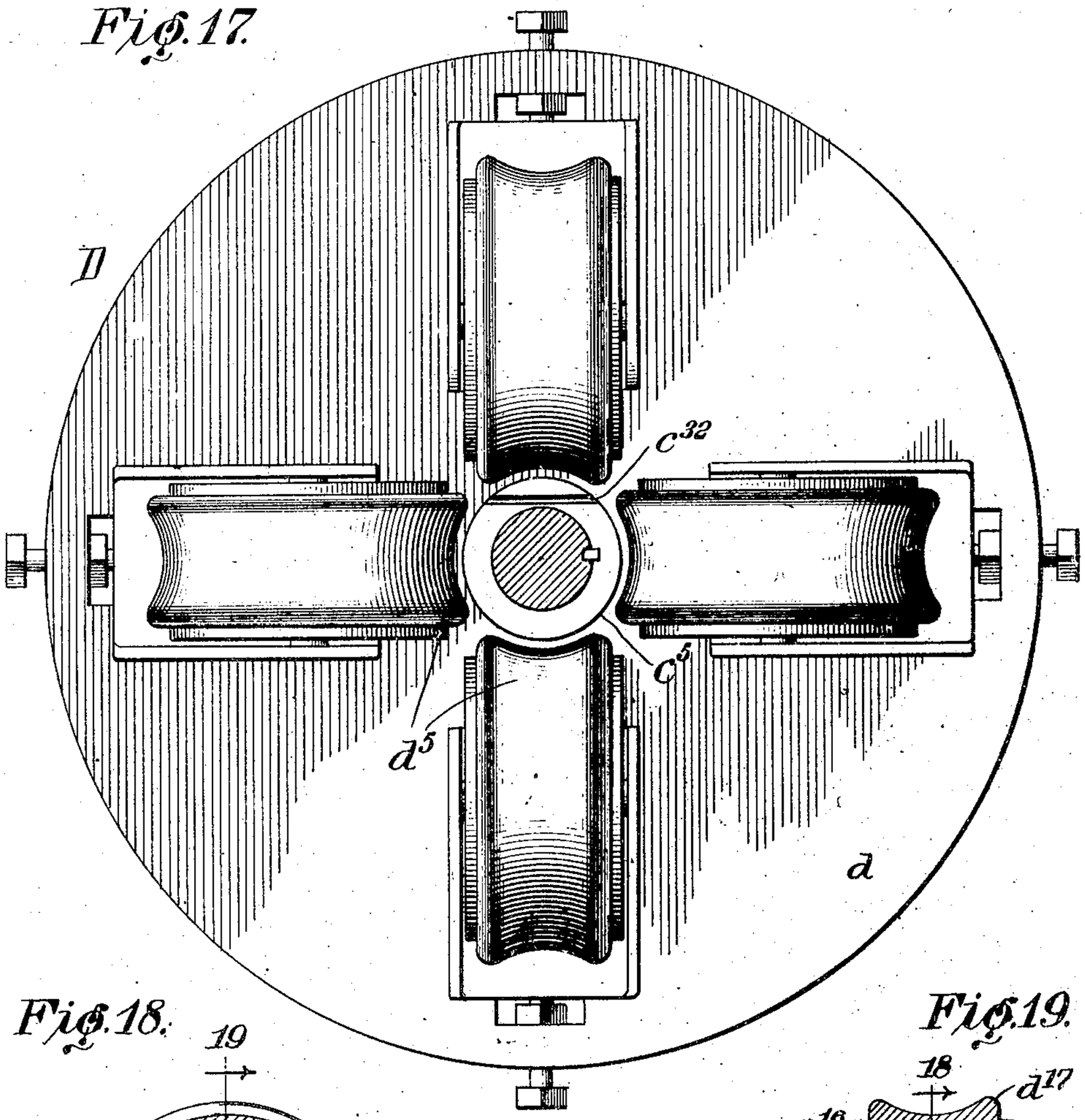

Fig. 18.

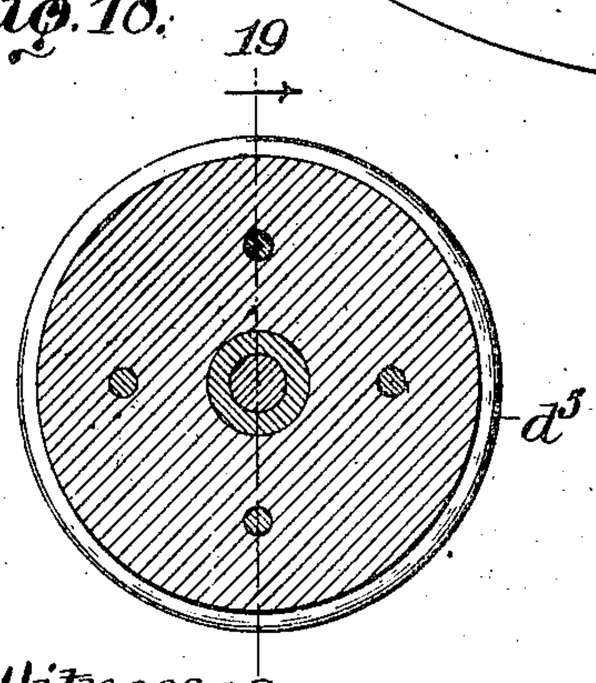

Fig. 19.

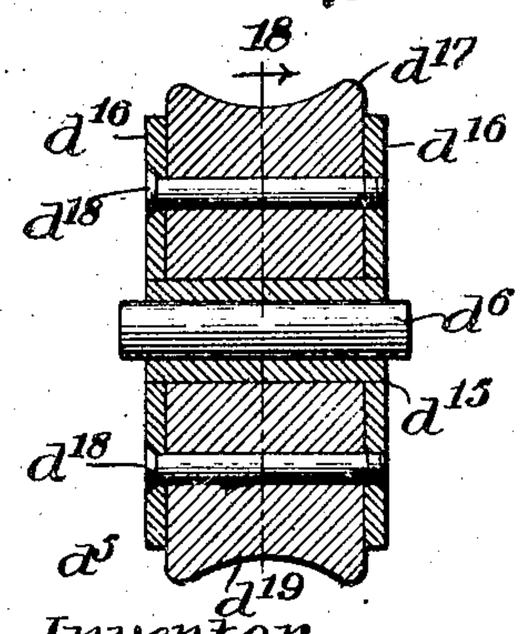

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Fig. 20.

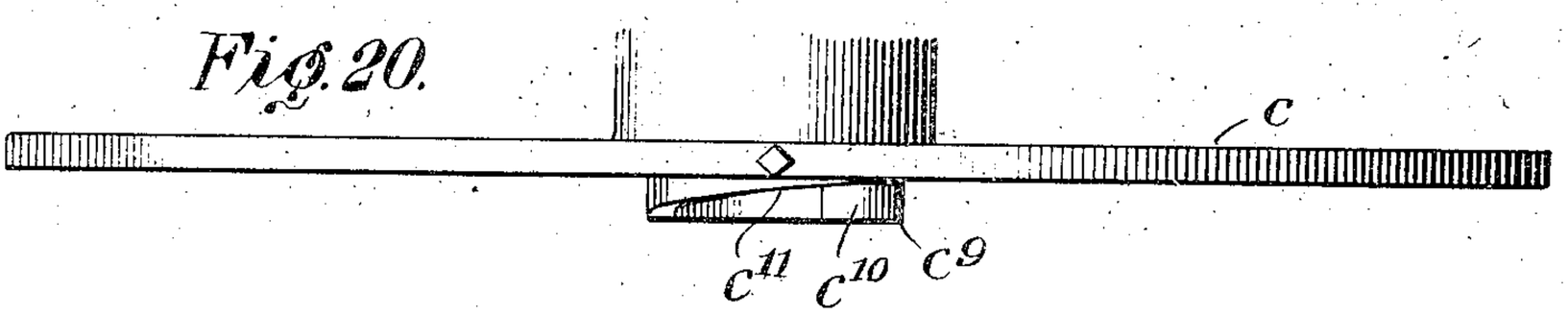


Fig. 21

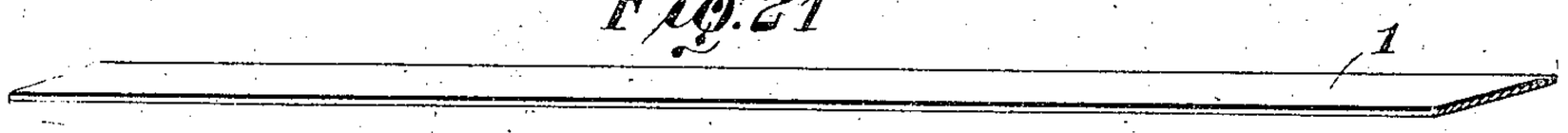


Fig. 22.

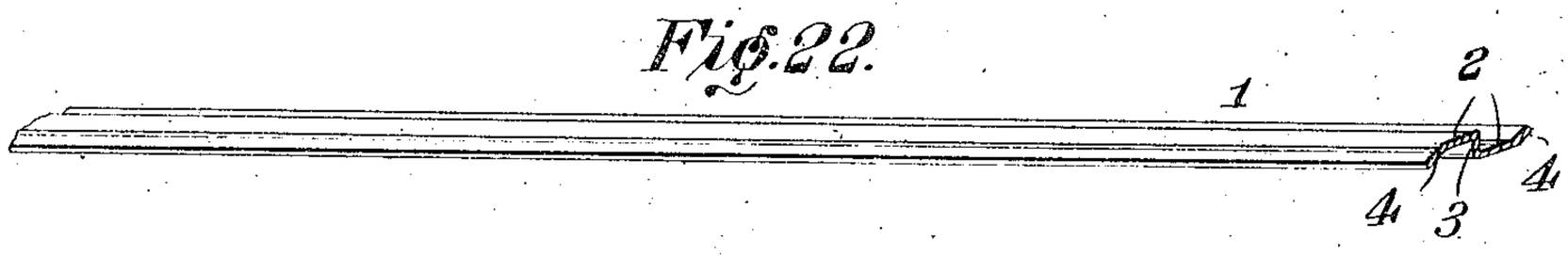


Fig. 23.

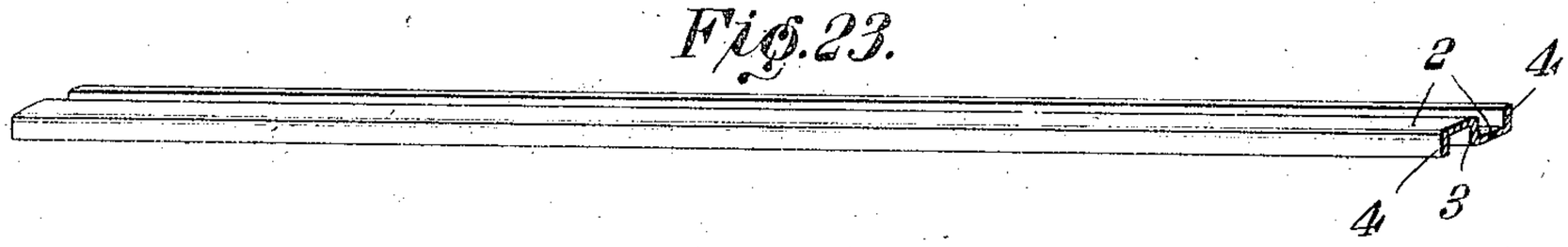


Fig. 24.

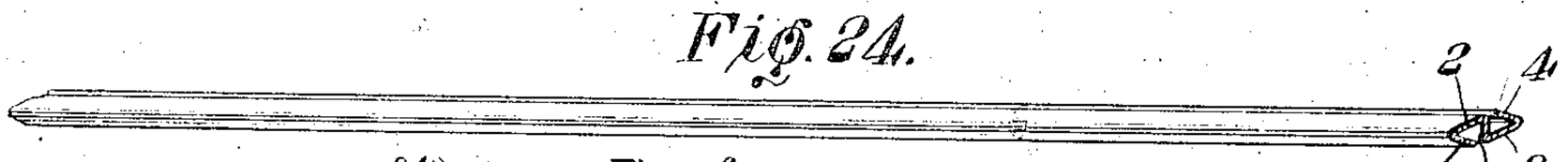


Fig. 25.

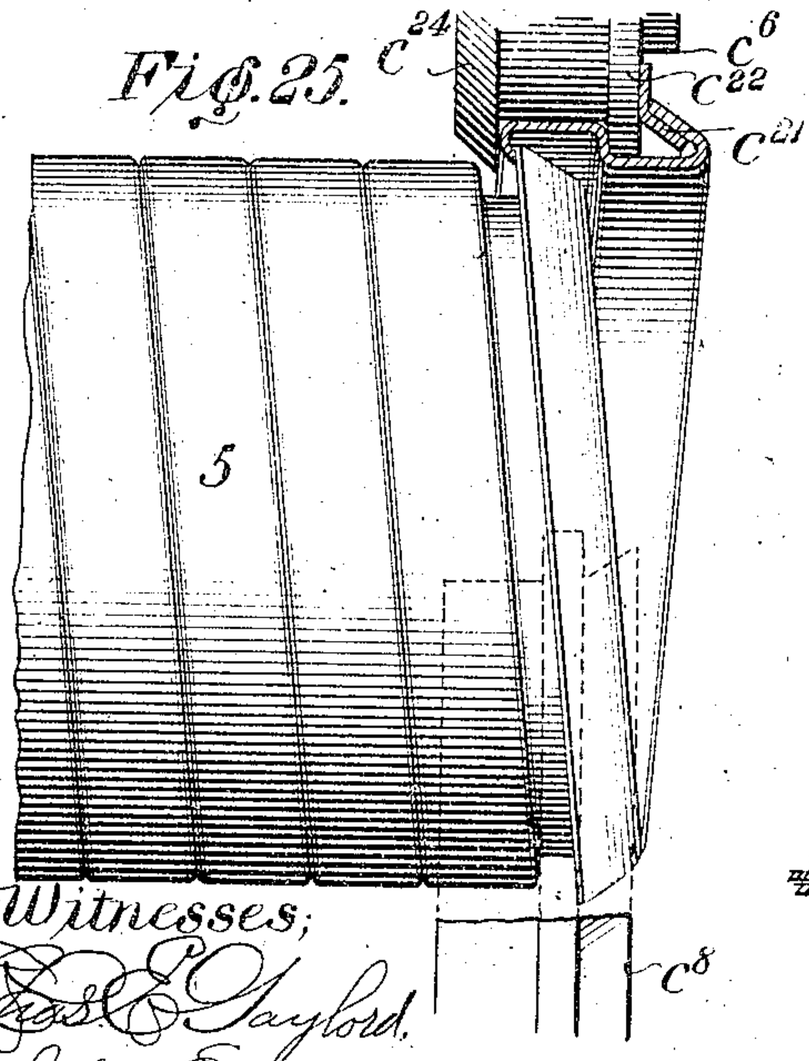
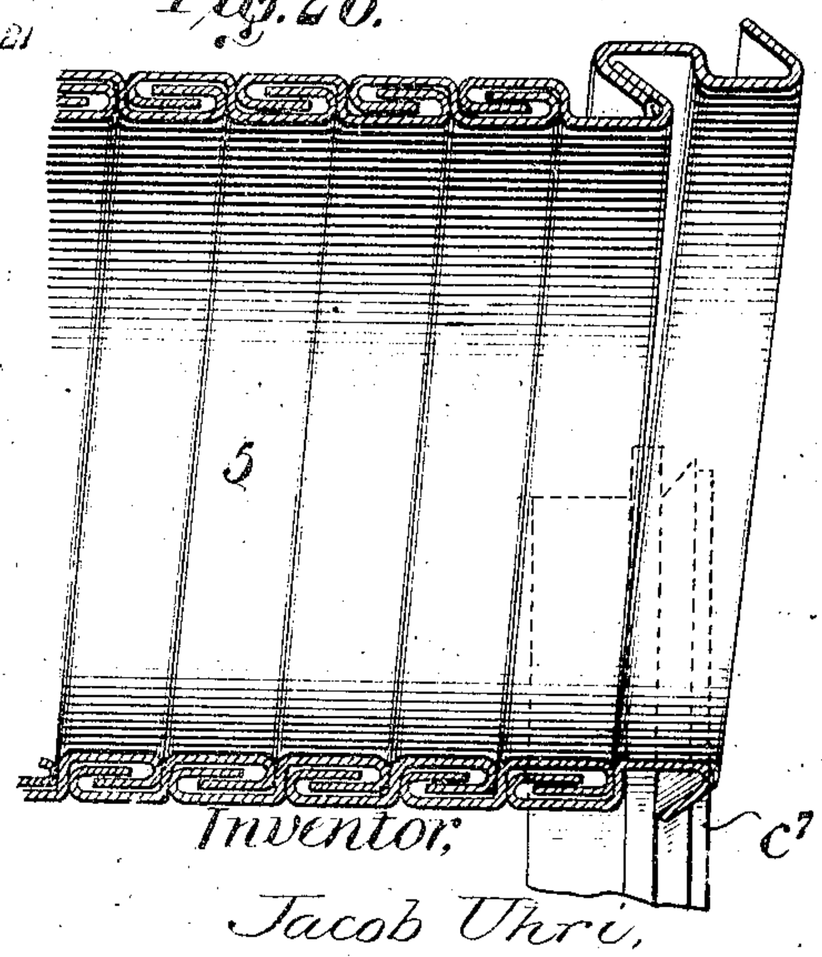


Fig. 26.



Witnesses;

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John Enders.

Inventor,

Jacob Uhri,

By Dyrenforth, Lee, Chritton & Wiles,

Attys.

UNITED STATES PATENT OFFICE.

JACOB UHRI, OF LAPORTE, INDIANA, ASSIGNOR OF ONE-HALF FO AUGUST KEMPF, OF LAPORTE, INDIANA.

METAL-FORMING MACHINE.

No. 922,217. Specification of Letters Patent. Patented May 18, 1909.

Application filed November 13, 1907. Serial No. 401,924.

To all whom it may concern:

Be it known that I, JACOB UHRI, a citizen of the United States, residing at Laporte, in the county of Laporte and State of Indiana, have invented a new and useful Improvement in Metal-Forming Machines, of which the following is a specification.

My invention relates particularly to machines for use in forming flexible metal-tubing such as is commonly employed for hose-armor.

My primary object is to provide a machine of simple and durable construction capable of rapidly forming flexible metal-tubing from a metal strip or tape which is fed into the machine.

The invention is illustrated in its preferred embodiment in the accompanying drawings, in which—

Figure 1 represents a side elevational view of a tube-forming machine constructed in accordance with my invention; Fig. 2, a plan view of the same; Fig. 3, a front end elevational view of the same; Fig. 4, an enlarged broken sectional view taken as indicated at line 4 of Fig. 1; Fig. 5, a sectional view taken as indicated at line 5 of Fig. 1 and showing the guide through which the metal strip or tape passes into the machine; Fig. 6, a view of the first set of rolls through which the tape passes, the tape being shown in section; Fig. 7, a section taken as indicated at line 7 of Fig. 1 and showing the guide through which the tape passes from the first set of forming rolls to the second set of forming rolls; Fig. 8, a view of the second set of forming rolls with the tape in section as it appears after subjection to the action of the second set of forming rolls; Fig. 9, a section taken as indicated at line 9 of Fig. 1 and showing the guide between the second set of forming rolls and the third set of forming rolls; Fig. 10, a view of the third set of forming rolls with the tape of the form imparted thereto by said rolls; Fig. 11, a section taken as indicated at line 11 of Fig. 1 and showing the guide through which the tape passes when it leaves the third set of forming rolls; Fig. 12, a face view of the means by which the preparatorily shaped metal tape is turned from its longitudinal course through the machine and formed into a spiral extending at right angles to the longitudinal course of the tape, the view being taken approximately as indicated at line 12 of Fig. 2 and showing also the guiding means through which the tape passes from the guide shown in Fig. 11 to the spiral forming means shown in Fig. 12; Fig. 13, a section taken as indicated at line 13 of Fig. 12; Fig. 14, an edge view of the first spiral-forming roll which engages the tape; Fig. 15, a similar view of the second spiral-forming roll which engages the tape; Fig. 16, a similar view of the third spiral-forming roll which engages the tape; Fig. 17, a view taken as indicated at line 17 of Fig. 4 and showing the mandrel in section and showing also a rotary disk equipped with spiral-engaging rolls, whose function is to aid in rotating and feeding the spiral and in compressing the interlocking flanges of the convolutions of the spiral; Fig. 18, a sectional view of one of the rollers shown in Fig. 17, the section being taken as indicated at line 18 of Fig. 19; Fig. 19, a section taken as indicated at line 19 of Fig. 18; Fig. 20, a top-edge view of the stationary disk shown in Fig. 12, this view showing also an oblique or tapering surface which serves to deflect the metal tape from its longitudinal course through the machine; Fig. 21, a perspective view of a portion of the tape as it is fed into the machine; Fig. 22, a similar view of a portion of the tape after it has been subjected to the action of the first pair of forming rolls; Fig. 23, a similar view of a portion of the tape after it has been subjected to the action of the second pair of forming rolls; Fig. 24, a similar view of a portion of the tape after it has been subjected to the action of the third pair of forming rolls; Fig. 25, a broken elevational view, on an enlarged scale, of a portion of the flexible tubing or armor in process of formation; and Fig. 26, a sectional view of the same.

It may be preparatorily stated that in the operation of the machine illustrated, a flat strip or band of metal is fed through three successive pairs of forming rolls, from the final set of which it emerges in the form shown in Fig. 24 with acutely bent oppositely turned flanges adapted to interlock during the process of formation of the spiral; that the tape passes from the final set of forming rolls through the guide shown in Fig. 11, thence through the guide shown in Fig. 12, thence impinges against the oblique surface near the axis of the stationary disk shown in

Fig. 20, at the same time passing beneath the top roller shown in Fig. 12, thence beneath a curved guide to the lower left-hand roller shown in Fig. 12, thence between the lower right-hand roller shown in Fig. 12 and the mandrel, the flanges of the tape being brought into interlocking engagement as the spiral is being formed; and that the spiral thence passes into the grip of the rollers carried by the rotary disk shown in Fig. 17, which exert a winding as well as a compressing effect upon the spiral, the combined result of which is to produce the finished flexible armor. The mandrel, it should be observed, has a removable end-portion or collar, as appears from Figs. 4 and 17, which is provided with a slot adapted to receive the initial end of the tape, the collar being rotatable on its axis to form a hook at the end of the tape which remains in engagement with the collar, the collar being fed out with the armor and being detached from the armor after the work is completed.

In the construction illustrated, A represents the main frame of the machine; A^1, a vertically adjustable bracket or extension connected with the rear end of the main frame; B, a guide mounted on the front end of the main frame at one lateral edge thereof; B^1, B^2, B^3, an initial pair of forming rolls, a second pair of forming rolls, and a third pair of forming rolls, respectively, in longitudinal alinement with the guide B; B^4, a guide between the first and second pairs of forming rolls; B^5, a guide between the second and third pair of forming rolls; B^6, a guide in the rear of the third set of forming rolls; B^7, a pulley mounted on the shaft of the lower one of the first pair of forming rolls B^1, through which power is supplied to the machine; C, mechanism for deflecting the tape from its longitudinal course, forming it into a spiral and causing the flanges of the successive convolutions to interlock; and D, means for gripping the spiral and exerting a twisting action thereon and compressing the interlocking flanges of the convolutions to form the finished armor, or flexible metal tubing.

Referring to Figs. 21 to 24, inclusive, 1 represents a portion of the metal strip or tape which by passage through the rolls B^1 has the metal on opposite sides of its longitudinal center struck in opposite directions to form raised portions 2 connected by a web 3, the lateral portions of the raised portions being bent backwardly somewhat to form oblique flanges 4 which extend in opposite directions. When the strip is subjected to the action of the rolls B^2 the flanges 4 are bent farther, so as to extend at right angles to the raised portions 2 and parallel with the web-portion 3, as illustrated in Fig. 23. When the strip passes through the rolls B^3, the flanges 4 are bent inwardly to occupy oblique positions, as illustrated in Fig. 24; and in this condition, the flanges are adapted to interlock with each other during the formation of the spiral, thus forming the flexible tubing or armor 5.

The guide B, as shown most clearly in Fig. 5, preferably comprises two parallel bars b, the upper one of which has a downturned flange b^1 which embraces the adjacent edge of the lower bar, and the lower one of which has an upturned flange b^1 which embraces the adjacent edge of the upper bar. Thus is formed a guide adapted to receive a flat strip of metal. The rolls B^1 are duplicates of each other in form, but oppositely turned. Each of said rolls has a circumferential channel b^2 flanked on one side by a bevel surface b^3 and on the other side by a flange b^4, and adjacent to the flange b^4 is a second bevel surface b^5. The channel b^2 of each roller receives the flange b^4 of the other roller; and the bevel surface b^3 of each roller is opposed to the bevel surface b^5 of the other roller. It will thus be understood that the rollers are adapted to give to the steel ribbon or tape the conformation shown in Fig. 22. The rolls B^2 are duplicates of each other, but turned in opposite directions. They are provided with intermeshing circumferential channels and flanges of rectangular shape which give to the tape the conformation shown in Fig. 23. The rollers B^3 are duplicates of each other, but turned in opposite directions. Each set of rollers has a circumferential channel b^6 flanked on one side by a bevel surface b^7 and on the opposite side by a flange b^8, said flange having an abrupt shoulder at one side and an oblique surface b^9 at the opposite side which forms a V-shaped channel with an oblique surface b^{10}. From Fig. 10, it will be understood that these rolls are adapted to give to the ribbon the conformation shown in Fig. 24. The guide B^4 is composed of bars which are longitudinally grooved or cut away to conform to the shape of the ribbon, as shown in Fig. 7. The guide B^5 is composed of bars which are longitudinally grooved to conform to the shape of the ribbon as it appears in Fig. 9.

As appears from Fig. 2, the forming rolls B^1, B^2, B^3, have shafts which extend across the main frame of the machine and are journaled in bearings b^{11}, b^{12}, the latter or upper ones of which are vertically adjustable by means of hand-wheels b^{13}. The bearings b^{11}, b^{12} are connected with standards b^{14} mounted on the main frame, the bearings b^{12} being supported in slides which are vertically adjustable by means of the hand-wheels b^{13}. Said slides support arms b^{15} which carry supplemental bearings b^{16} for the upper shafts of the rollers. The shaft of the lower one of the rollers B^1 extends beyond the shafts of the other rollers and supports the pulley B^7. The shaft with which the pulley B^7 is connected is equipped with a cog-wheel b^{17} which meshes with a cog-wheel b^{18} with

which the shaft of the companion roll B^1 is equipped. Motion is transmitted from the shaft of the lower roller B^1 to the shaft of the lower roller B^2 by a sprocket-chain b^{19}, and from the shaft of the lower roller B^2 to the shaft of the lower roller B^3 by a sprocket-chain b^{20}. Motion is communicated from the shaft of the upper roller B^1 by a sprocket-chain b^{21} to the shaft of the upper roller B^2, and from said last-named shaft by a sprocket-chain b^{22} to the shaft of the upper roller B^3. Motion is transmitted from the shaft of the lower roller B^1 through a sprocket-chain b^{23} to a shaft D^1 (Figs. 2 and 4), which constitutes the driving shaft of the spiral-gripping and rotating device D.

The mechanism C, which serves to deflect the tape from a direct course and form it into a spiral with interlocking convolutions, comprises a stationary disk c mounted upon a slide c^1 which is carried by the vertically adjustable frame-section A^1, the slide c^1 being adjustable on the frame-section A^1 laterally with relation to the main frame A; a mandrel c^2 extending through a perforation at the axis of the disk c and equipped at one end with a hand-wheel c^3 and having at the opposite end a reduced extremity c^4 which receives a detachable collar or sleeve c^5; radially adjustable rollers c^6, c^7, c^8 carried by the disk c and grouped about the mandrel; a short hub c^9 at the axis of the disk c cut away to form a guide c^{10} having an oblique surface c^{11}, as shown in Figs. 12 and 20; a guide-bar c^{12} provided with a longitudinal slot c^{13} which is connected by a bolt c^{14} with a curved slot c^{15} struck on a radius from the center of the disk c, said guide-bar c^{12} being provided on one side with a horizontal flange c^{16}; a member c^{17} secured to the bar c^{12} and provided with a nose c^{18} which engages one of the channels of the steel tape; a member c^{19} provided with a channel conforming to the adjacent portion of the tape, as shown in Fig. 13; a member c^{20} provided with a nose received by the other channel of the tape, as shown in Fig. 13; and a member c^{21} which projects beyond the other members just described and is curved somewhat about the hub c^9, as shown in Figs. 12 and 14. The member c^{21} has its lower portion bent laterally to form an oblique lip which underlies the adjacent flange of the tape, as shown in Fig. 14, whereby the tape will be held to its true course during the operation of winding to form it into a spiral. As appears from Fig. 14, the roller c^6 is provided with a circumferential flange c^{22} which is located adjacent to the stationary guide-finger c^{21} and is received with said guide-finger in the adjacent channel of the tape; and said roller c^6 is provided with a circumferential channel c^{23} flanked by a flange c^{24} having a bevel surface c^{25}. The channel c^{23} is adapted to receive the adjacent raised portion of the tape. The manner of engagement of the roller c^6 with the tape is further illustrated in Fig. 25. The roller c^7 is provided centrally with a circumferential flange c^{26} and between said flange and the disk c with a smaller flange c^{27} having a bevel surface c^{28}. The manner in which the roller c^7 engages the spiral is shown in Fig. 26, from which it appears that the flange c^{26} enters the outer channel of the convolution in process of formation, while the beveled flange c^{27} engages the outstanding flange of said convolution. The roller c^8 is provided with a circumferential flange c^{29} and between said flange and the disk c with a smaller flange c^{30} having a bevel surface c^{31}. The manner of engagement of the roller c^8 with the spiral is similar to that of the roller c^7, and is illustrated in Fig. 25. The rollers c^6, c^7, c^8 are chiefly for guiding purposes and to prevent the convolutions of the tape from springing out of engagement with each other, although said rollers may serve to aid to some extent in clenching the flanges of the adjacent convolutions upon each other. The collar c^5 is splined on the reduced end of the mandrel c^2, as shown in Fig. 17, and is provided at some distance from its axis, in a plane parallel with a large diameter of the collar, with a slot c^{32} adapted to receive the end of the tape at the beginning of the operation of the machine. It will be understood from Fig. 17, that if the end of the tape is entered in said slot c^{32} and the collar rotated upon its axis, a hook will be formed on the tape which will cause the tape to wind about the collar. After the tape has been properly entered beneath the rollers c^6, c^7, c^8, the winding action thereafter is automatic. It may be here observed that the mandrel c^2 may be turned by means of the hand-wheel c^3 to loosen the mandrel from the spiral being formed thereon in the event the winding should be too tight. The slide c^1 is secured in position by plates c^{33}.

The mechanism D comprises a disk d formed with a hub d^1 supported in the standard d^2 of a slide d^3; radially adjustable brackets d^4 connected with the disk d and supporting gripping and compressing rolls d^5, whose axes d^6 are journaled in the furcations of the brackets d^4; a sprocket-wheel d^7 mounted on the hub d^1, which hub is tubular; and a sprocket-chain d^8 connecting said sprocket-wheel with a sprocket-wheel d^9, the opposite sides of the hub of which are made concave to afford friction cones. The sprocket-wheel d^9 has an opening at its center through which the shaft D^1 extends. The shaft D^1 is equipped with a fixedly secured friction cone d^{10} adapted to engage one side of the hub of the sprocket-wheel d^9. Upon the end portion of the shaft D^1 is a sleeve d^{11} which extends through a bearing in the frame A^1 and is equipped at one end with a hand-wheel d^{12} and at the opposite end with

a friction cone d^{13} adapted to bear against the hub of the sprocket-wheel d^9. The extremity of the shaft D^1 projects beyond the hand-wheel d^{12} and has threaded thereon a hand-wheel d^{14}, by means of which the cones d^{10} and d^{13} may be forced together to clamp the sprocket-wheel d^9 between them and cause said sprocket-wheel to rotate with the shaft D^1. It will thus appear that the disk d may be caused to rotate at will. Each of the rollers d^5 preferably is formed as shown in detail in Figs. 18 and 19. That is to say, each roller comprises a metal tube d^{15}, whose ends are fitted with disks or flanges d^{16}; and a rubber roller d^{17} fitted over the tube d^{15} and confined between the disks d^{16} and firmly secured thereto by rivets d^{18}. The circumference of the rubber roller d^{17} is made concave, as indicated at d^{19}. It will now be understood that the rollers d^5 are adapted to firmly grip the spiral; and inasmuch as the axes of the rollers d^5 are at right angles to the axis of the rotary disk d, the rollers will exert a pull or twist upon the spiral, tending to rotate the spiral, and the rollers will also rotate upon their own axes as the convolutions of the spiral pass in turn beneath them. The manner of adjustment of the brackets d^4 will be understood without further description, and it will be understood that any desired tension may be applied, so that the spiral will be more or less tightly wound and the flanges of the convolutions be more or less tightly compressed upon each other, according to the adjustment of the rollers d^5. It is desirable that the rollers d^5 shall be capable of yielding somewhat, as well as capable of exerting considerable friction upon the spiral; and rubber answers the desired purpose admirably. The slide d^3 is secured upon its guide by clamping plates d^{20}, so that the mechanism D may be adjusted with relation to the mandrel, at will. As doubtless has been understood, the adjustment of the slide c^1 in its guides provides for the alinement of the mechanism C with the forming rolls B^1, B^2 and B^3 in a lateral direction. The frame-section A^1 may be adjusted vertically with relation to the main frame by means of an adjusting screw a as shown in Figs. 1 and 4, it being observed that said frame-section A^1 is connected with a guide a^1 of the main frame, which guide is provided with removable clamping plates a^2, as most clearly shown in Fig. 2.

The operation of the machine will be readily understood from the foregoing detailed description. A strip of metal 1 of the flat shape shown in Fig. 21 is fed into the guide B of the machine, whence it passes through the forming rolls B^1, thence through the guide B^4, thence through the forming rolls B^2, thence through the guide B^5, thence through the forming rolls B^3, thence through the guide B^6, thence through the guide formed by the bar c^{12} and the members connected therewith, where the end of the tape is entered in the slot c^{32} of the removable collar c^5 of the mandrel. The collar is then turned upon its axis to cause the tape to wind thereon, the tape at the same time being deflected from a straight course by the oblique surface c^{11} of the hub c^9 of the disk c. When the tape is wrapped about the mandrel it is brought into engagement with the rollers c^6, c^7 and c^8, being confined between said rollers and the collar c^5 of the mandrel. The machine, the operation of which is supposed to have been temporarily suspended to permit the end of the tape to be connected with the collar c^5, is again set in operation, and the formation of the flexible tubing is then proceeded with, the tubing being gripped by the rollers d^5, which tend to rotate the tubing and at the same time to compress the flanges of the convolutions upon each other. During the formation of the first portion of the flexible tubing or armor, the mandrel is moved longitudinally a short distance till it occupies the position indicated by the dotted lines in Fig. 4, after which the collar c^5 is carried by the armor away from the mandrel as the armor issues through the tubular hub d^1. The collar may be removed from the end portion of the armor and may be employed in successive operations of the machine.

The foregoing detailed description has been given for clearness of understanding only, and no undue limitation is to be understood therefrom. So far as I am aware, it is novel to pass a metal tape through forming rolls which serve to form flanges thereon adapted to interlock with each other in the formation of the spiral, to then deflect the preparatorily formed tape from a direct course, and form it into a spiral, and finally to pass the spiral through a device which serves to grip and rotate it and compress the interlocking flanges of the convolutions upon each other.

What I regard as new, and desire to secure by Letters Patent, is—

1. In a machine of the character set forth, the combination of a mandrel, a plurality of rolls grouped about the mandrel and serving to form a spiral from a flanged strip of metal, a curved finger adjacent to the mandrel adapted to extend into a channel in the flanged strip as it travels, and a guide-device in advance of said finger extending into the said channel in the strip.

2. In a machine of the character set forth, the combination of a mandrel, a plurality of rolls grouped about the mandrel and serving to form a spiral from a flanged strip of metal, a rotary member having its axis substantially in alinement with the axis of the mandrel, and a plurality of spiral-engaging rolls

carried by said rotary member and having their axes at an angle to the axis of the rotary member.

3. In a machine of the character set forth, the combination of a frame-member, a mandrel supported thereon and having a projected end, rolls grouped about the projecting end of said mandrel and serving to form a spiral from a flanged strip of metal, a rotary member having an opening at its axis in alinement with the mandrel, and spiral-engaging means carried by said rotary member.

4. In a machine of the character set forth, the combination of a frame-member, a mandrel supported thereon and having a projecting end, rolls grouped about the projecting end of said mandrel and serving to form a spiral from a flanged strip of metal, a rotary member having an opening at its axis in alinement with the mandrel, and spiral-engaging rolls carried by said rotary member and having axes substantially at right angles to the axis of said rotary member.

5. In a machine of the character set forth, the combination with mears for forming a flanged strip of metal into a spiral, of spiral-gripping and rotating means comprising a rotary member having an axial opening therethrough, and adjustable spiral-engaging means carried by said rotary member.

6. In a machine of the character set forth, the combination with means for forming a flanged strip of metal into a spiral, of spiral-gripping and rotating means comprising a rotary member having an axial opening therethrough, and adjustable spiral-engaging rolls carried by said rotary member and having their axes at an angle to the axis of said rotary member.

7. In a machine of the character set forth, the combination with means for forming a strip of metal into a spiral, of a rotatable member equipped with spiral-engaging rolls, driving means therefor, and means for connecting and disconnecting said rotatable member with said driving means at will.

8. In a machine of the character set forth, the combination of a stationary member equipped with a plurality of rolls grouped about an axis, a mandrel projecting through said stationary member between said rolls and having a detachable end-section provided with means for engaging the end of a strip of metal, and a rotary member having an axial opening therethrough and equipped with spiral-engaging rolls grouped about the axis of said mandrel.

9. In a machine of the character set forth, the combination of a main frame, a plurality of pairs of rolls mounted thereon and serving to feed a strip of metal and form flanges on opposite sides thereof, a frame-section adjustably connected with said main frame, and spiral-forming means mounted on said adjustable frame-section.

10. In a machine of the character set forth, the combination of a plurality of pairs of forming rolls adapted to feed a strip of metal and form flanges on opposite sides thereof, and spiral-forming means being adjustable with relation to said forming rolls.

11. In a machine of the character set forth, the combination of a plurality of pairs of forming rolls adapted to feed a strip of metal and form flanges on opposite sides thereof, spiral-forming means adjustable crosswise of the path of the metal strip, and spiral-rotating and compressing means beyond said spiral-forming means and adjustable with relation thereto.

12. In a machine of the character set forth, the combination of a main frame, a plurality of pairs of forming rolls mounted thereon, a frame-section connected with and vertically adjustable with relation to the main frame, a slide mounted on said frame-section and adjustable transversely with relation to the main frame, a member carried by said slide and equipped with a plurality of rolls grouped about an axis, a mandrel projecting between said last-named rolls, a second slide mounted on said frame-section and adjustable toward and away from said first-named slide, and a rotary member mounted on said second-named slide and equipped with spiral-engaging means, for the purpose set forth.

13. In a machine of the character set forth, the combination of a plurality of alined pairs of forming rolls adapted to feed a strip of metal and form flanges thereon, a mandrel extending across the path of the strip of metal, spiral-forming rolls grouped about said mandrel, an oblique surface adjacent to said mandrel coacting with said spiral-forming rolls, and a rotary member having an axial opening in alinement with said mandrel and equipped with spiral-engaging rolls.

14. In a machine of the character set forth, the combination of a plurality of alined pairs of forming rolls adapted to feed a strip of metal and form flanges thereon, a mandrel extending across the path of the strip of metal, spiral-forming rolls grouped about said mandrel, an oblique surface adjacent to said mandrel coacting with said spiral-forming rolls, a rotatable member having an axial opening in alinement with said mandrel and equipped with spiral-engaging rolls, and a shaft located beneath said rotatable member and geared thereto.

15. In a machine of the character set forth, the combination of a plurality of alined pairs of forming rolls adapted to feed a strip of metal and form flanges thereon, a mandrel extending across the path of the strip of metal, spiral-forming rolls grouped about said mandrel, an oblique surface adjacent to said mandrel coacting with said spiral-forming rolls, a rotatable member having an axial opening in alinement with said mandrel and

equipped with spiral-engaging rolls, a rotary shaft located beneath said rotatable member, a wheel loose on said rotary shaft and geared to said rotatable member, and means for fixing said wheel on said rotary shaft to cause it to rotate therewith.

16. In a machine of the character set forth, the combination with a frame-member, of a mandrel extending therethrough and equipped at one end with a hand-wheel and at the opposite end with a removable section, said removable section being provided with means for engaging the end of a strip of metal, rolls grouped about said mandrel and serving in the formation of a spiral, and spiral-rotating and compressing means comprising a rotary member having an axial opening and equipped with spiral-engaging means located adjacent to the removable section of said mandrel.

17. In a machine of the character set forth, the combination with rolls adapted to feed a strip of metal and form flanges on opposite sides thereof, of a stationary member equipped with a hub having an oblique surface adapted to deflect the strip of metal from its direct course, rolls grouped about said hub, and a guide having a curved finger extending about a portion of said hub and adapted to engage a flange of the strip of metal.

18. In a machine of the character set forth, the combination with means for feeding a strip of metal and forming flanges on opposite sides thereof, of a stationary member equipped with a hub provided with an oblique surface adapted to deflect the strip of metal from a direct course, rolls grouped about said hub, and adjustable strip-guiding means located adjacent to said hub.

19. In a machine of the character set forth, the combination with means for forming a flanged strip of metal into a spiral with the flanges of adjacent convolutions interlocking, of spiral-rotating and compressing means comprising a rotary member, and a plurality of yielding spiral-engaging rolls carried by said rotary member.

20. In a machine of the character set forth, the combination with means for forming a flanged strip of metal into a spiral with the flanges of adjacent convolutions interlocking, of spiral-rotating and compressing means comprising a rotary member and a plurality of yielding spiral-engaging rolls mounted on said rotary member with their axes at an angle to the axis of said rotary member.

21. In a machine of the character set forth, the combination with means for forming a flanged strip of metal into a spiral with the flanges of adjacent convolutions interlocking, of spiral-rotating and compressing means comprising a rotary member, a plurality of adjustable brackets mounted on said rotary member, and spiral-engaging rolls mounted on said brackets and composed of yielding material.

22. In a machine of the character set forth, the combination of a main frame, a plurality of alined pairs of forming rolls located at one side of the main frame and having shafts extending across and supported on the main frame, one of said shafts projecting beyond the others and equipped with driving means, means gearing said shafts together, an adjustable frame connected with the main frame, spiral-forming means mounted on said adjustable frame, spiral-rotating and compressing means located adjacent to said spiral-forming means, and a shaft serving to rotate the spiral-rotating and compressing means, said last-named shaft being geared to one of said first-named shafts.

23. In a machine of the character set forth, the combination with means for feeding a flanged strip of metal, of means for forming the strip into a spiral, and rotary coil-gripping rollers having their peripheries formed of rubber and adapted to engage with the coil, for the purpose set forth.

JACOB UHRI.

In presence of—
L. HEISLAR,
R. A. SCHAEFER.