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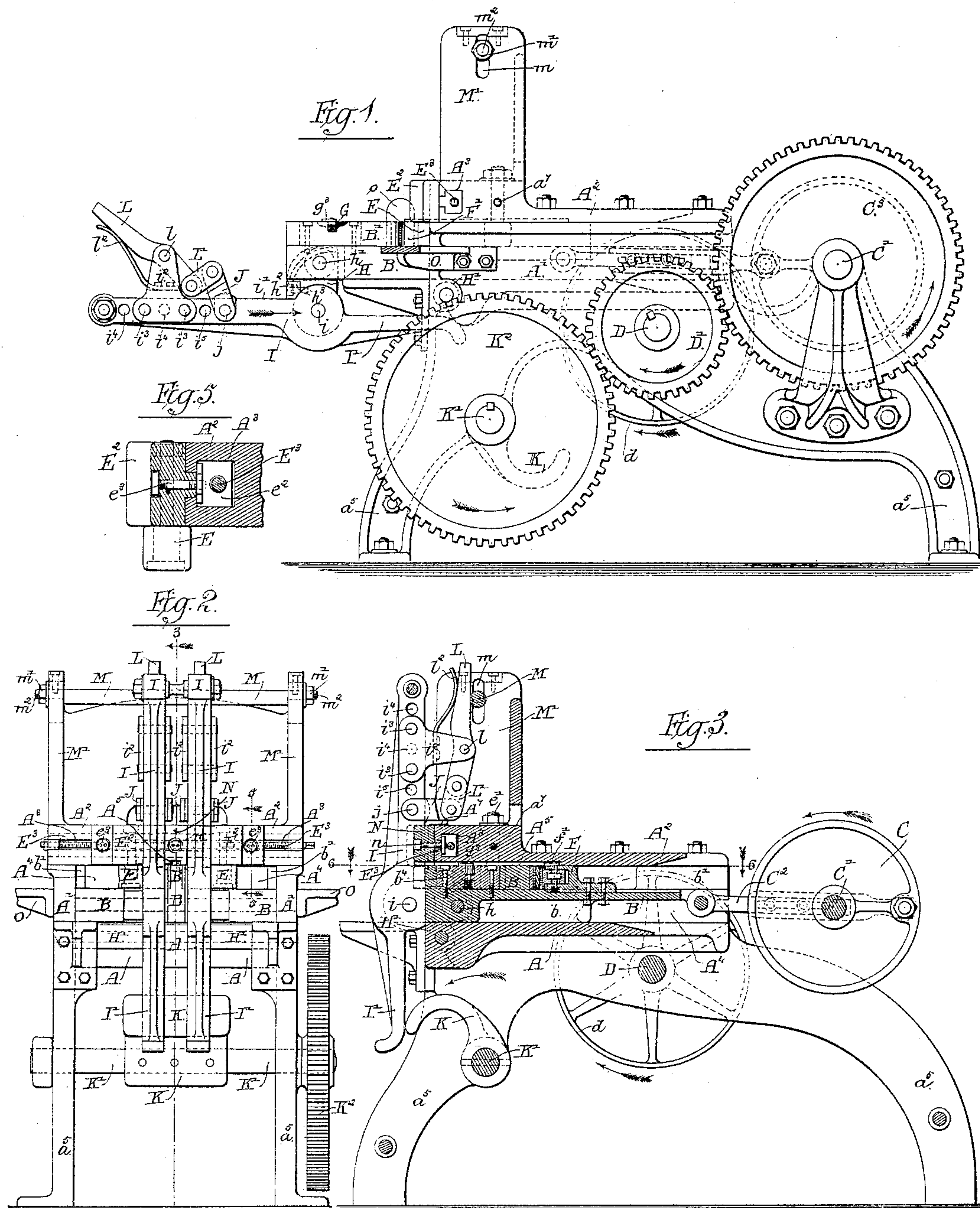
3 Sheets—Sheet 1.

J. GRANT,

MACHINE FOR MAKING TIMBER HANGERS.

No. 445,149.

Patented Jan. 20, 1891.



Witnesses:-

Louis H. Whitehead.

Wm. F. Hemming.

Inventor:-
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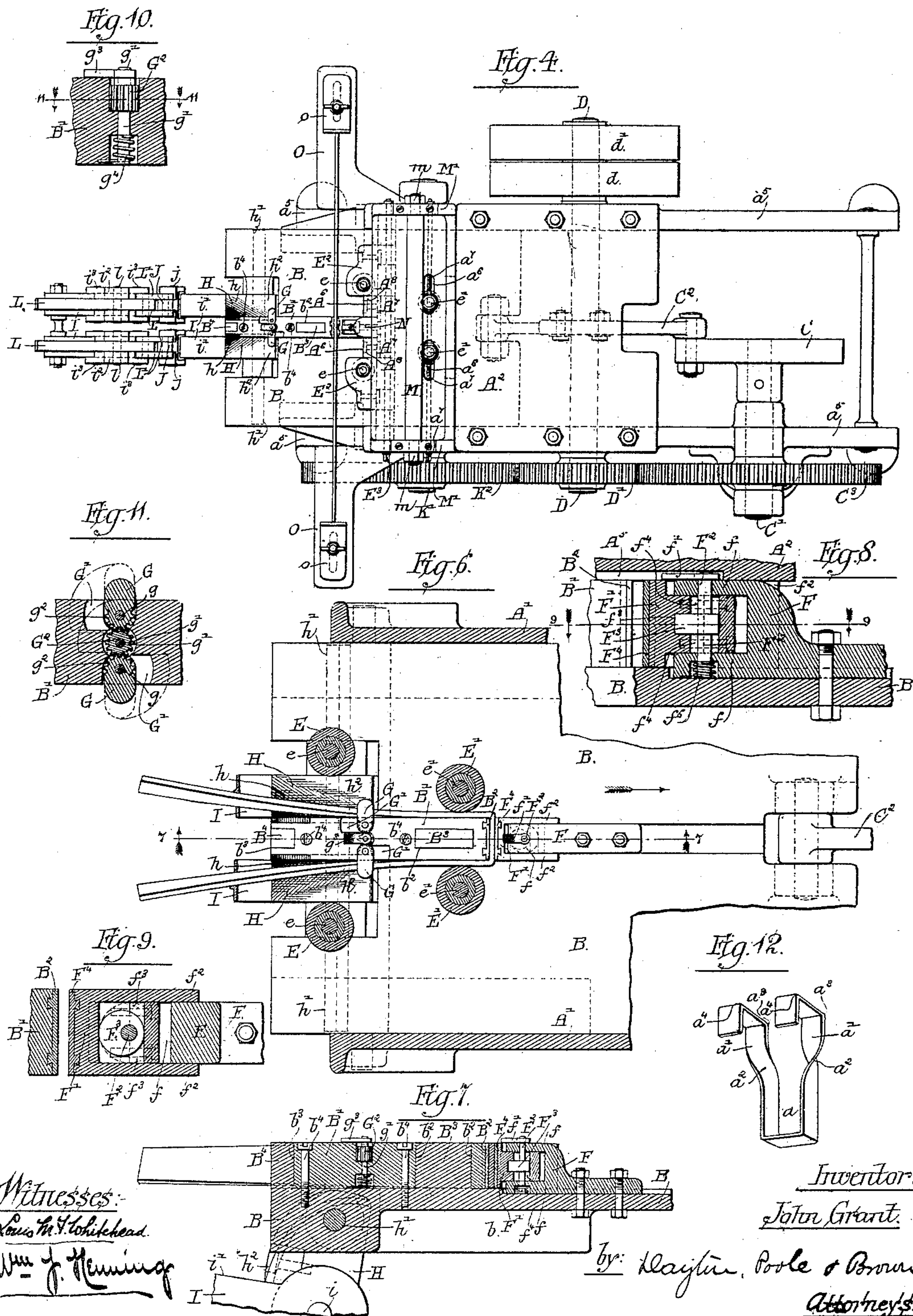
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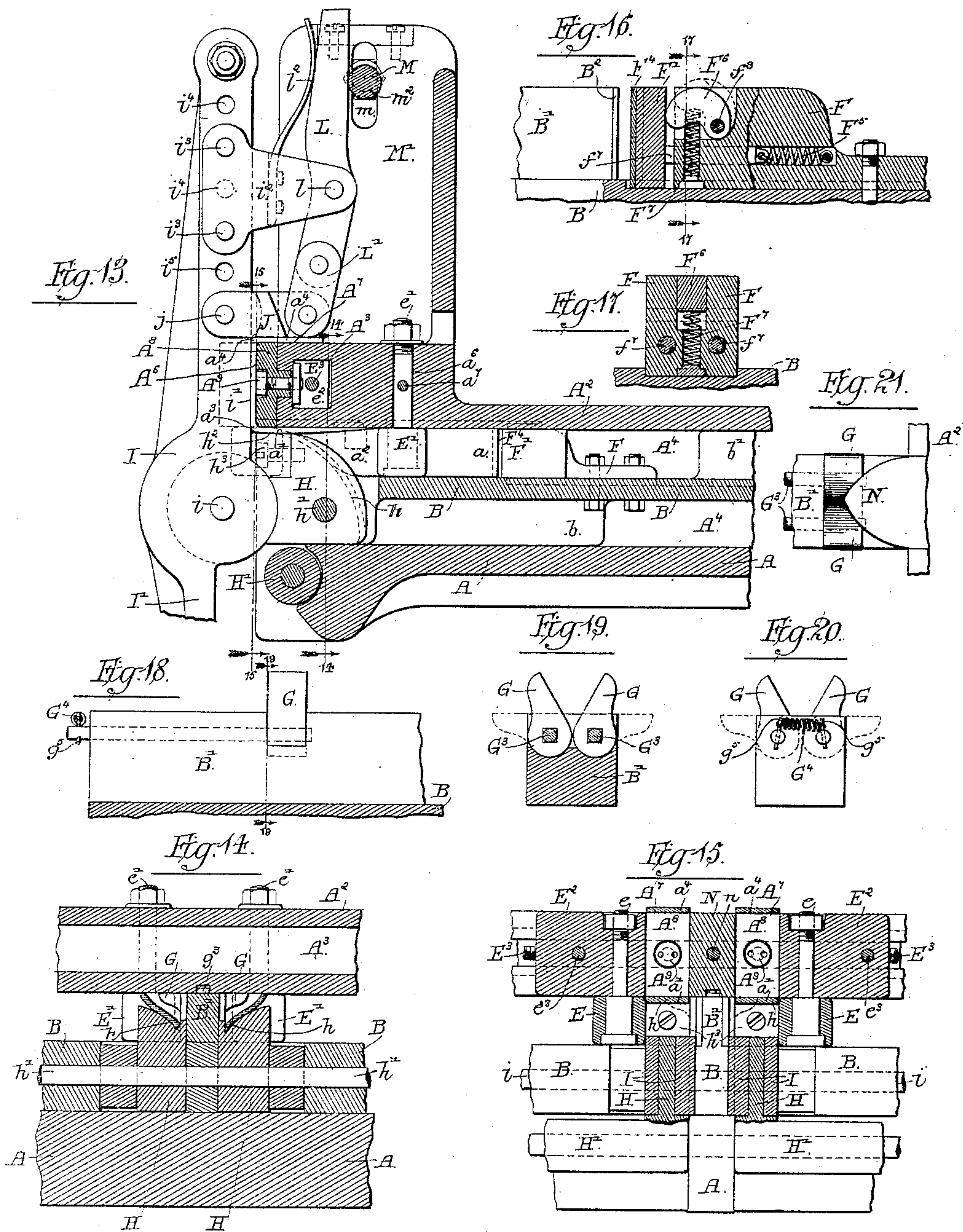
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UNITED STATES PATENT OFFICE.

JOHN GRANT, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE GRANT
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MACHINE FOR MAKING TIMBER-HANGERS.

SPECIFICATION forming part of Letters Patent No. 445,149, dated January 20, 1891.

Application filed April 17, 1890. Serial No. 348,362. (No model.)

To all whom it may concern:

Be it known that I, JOHN GRANT, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful
5 Improvements in Metal-Bending Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked
10 thereon, which form a part of this specification.

This invention relates to machines for making stirrup-irons or timber-hangers, such as are used for connecting ceiling-joists with the
15 timbers which sustain the same.

The invention consists in the matters hereinafter described, and pointed out in the appended claims.

In the accompanying drawings, illustrating
20 a machine embodying my invention, Figure 1 is a side view of the machine ready for insertion of the blank or bar. Fig. 2 is an end elevation thereof, showing machine in position after completion of the hanger. Fig. 3
25 is a central longitudinal section thereof, taken upon line 3 3 of Fig. 2. Fig. 4 is a plan thereof, showing machine in same position as in Fig. 1. Fig. 5 is an enlarged detail section taken upon line 5 5 of Fig. 2. Fig. 6 is an enlarged sectional plan view showing working-
30 table nearly at the limit of its backward movement, taken upon line 6 6 of Fig. 3. Fig. 7 is a detail section taken upon line 7 7 of Fig. 6. Fig. 8 is a still further enlarged section of movable clamping device. Fig. 9 is a sectional plan view of same, taken upon line 9 9
35 of Fig. 8. Fig. 10 is a detail sectional view of device for operating the movable forming-dies. Fig. 11 is a sectional plan view on line
40 11 11 of Fig. 10. Fig. 12 is a perspective view of a finished hanger made by the machine. Fig. 13 is an enlarged detail section showing finished hanger and parts of the machine engaged therewith. Fig. 14 is a detail section on
45 line 14 14 of Fig. 13. Fig. 15 is a detail section on line 15 15 of Fig. 13. Fig. 16 illustrates a modification of the construction of the clamping device. Fig. 17 is a detail section on line
50 17 17 of Fig. 16. Fig. 18 illustrates a modification of the construction of the forming-dies. Fig. 19 is a detail section on line 19 19

of Fig. 18. Fig. 20 is an end view of the parts shown in Fig. 18. Fig. 21 is a plan view of the forming-dies shown in Fig. 18 and a projection on the frame which actuates said dies. 55

The main frame of the machine illustrated consists of a bed-plate A, provided with legs or standards $a^5 a^5$, sustaining it in horizontal position. The bed-plate A is provided at its side margins with upwardly-extending flanges
60 $A' A'$, to the upper edges of which is secured a flat top plate A^2 , the flanged bed-plate and top plate together forming a rectangular guide-passage, Fig. 2, open at both ends. Within said guide-passage is located a slid-
65 ing plate or carriage B, which is given a longitudinal reciprocatory motion by the device hereinafter described. In the particular construction shown the carriage B is provided at its side margins with downwardly-extending
70 flanges $b b$, Fig. 3, which rest upon the bed-plate A, thereby lessening the area of the parts in frictional contact. Said carriage is also provided in its rear or inner part with upwardly-extending flanges $b' b'$, which rest
75 and slide in contact with the top plate A^2 , and thereby hold the carriage from being lifted above the bed-plate during the operation of the machine. Reciprocatory motion is given to the carriage by means of a crank-
80 disk C, which is mounted on a shaft C' at the rear end of the machine, and is connected with the said carriage by means of a pitman C^2 . Said shaft C' is driven from a pulley-shaft D by means of gear-wheels D'
85 C^3 on said shafts D and C' , said shaft D being provided with belt-pulleys $d d'$, by means of which motion is communicated to the working parts of the machine.

By reference to Fig. 12 it will be seen that
90 the stirrup iron or hanger consists of a piece of bar-iron of greater width than thickness, and which is bent twice at right angles near its middle to form a loop a and two parallel
95 arms $a' a'$, each of which has a quarter-twist $a^2 a^2$, bringing the flat faces of the upper parts of the arms in the same plane with the loop a . The said arms at their upper ends are each provided with two right-angled bends
100 $a^3 a^4$, giving a hooked form thereto. The hanger, constructed as described, is suspended from the top of a beam by means of its

hooked ends and supports a second beam located at right angles to the first one by the insertion of the end of the second beam within the loop *a*.

5 The means employed for making the two right-angled bends forming the loop *a* of the hanger will now be described.

Upon the upper surface of the carriage B near the front end of the machine is located
10 an elevated projection or form-block B', having the same width as the said loop *a* of the hanger.

E E are two bending-rollers mounted upon studs *e e*, supported upon the top plate A²,
15 and extending downwardly therefrom at either side of the path of the form-block, said rollers being located at some distance laterally from the form-block.

E' E' indicate another pair of bending-rollers mounted on vertical studs *e' e'*, which are
20 also supported upon the top plate A², said rollers E' E' being arranged at opposite sides of the path of the form-block at a distance from the latter equal to the thickness of the
25 bar of metal to be operated upon. The lower end faces of the rollers E E E' E' are located adjacent to the flat top surface of the carriage B, which slides freely beneath the same. The said carriage B is reciprocated through
30 such distance that the rear or inner end of the form-block B' is carried outwardly past the rollers E E and inwardly past the rollers E' E', and in making the central bend in the bar the latter is placed across the end of the
35 form-block when it is at the outward limit of its movement with the center of the bar resting in contact with the end face of the form-block, and the loop is formed by the conjoint action of said rollers and the form-block in
40 the rearward or inward movement of the carriage. During such movement of the carriage the end portions of the bar or blank are first brought against the rollers E E, by which the ends of the bar are bent to an angular position
45 relatively to the sides of the form-block, and as soon as the rear end of the form-block reaches and passes between the rollers E' E' the end portions of the bar are pressed flat against the sides of the form-block, thereby
50 making two right-angled bends in the bar.

In order to prevent displacement of the blank during the movement of the carriage and form-block in the manner described, a clamp device is preferably employed to hold
55 or clamp the middle part of the bar against the end face of the form-block. This clamp device is herein shown in Figs. 1 to 9 made as follows: F is a metal block or bar bolted to the top surface of the carriage at the rear
60 of and in line with the form-block, said bar being provided at its end adjacent to the form-block, with two guide-arms *f f*, between which slides a longitudinal clamping-jaw F', Figs. 8 and 9, said clamping-jaw being provided
65 with a working-face opposite and parallel with the inner end of the form-block, and preferably of the same width as the said

end face of the form-block. In connection with such clamping-jaw a device is provided for throwing and holding the same against
70 the blank, so as to clamp the latter between the clamping-jaw and the end of the form-block, the same consisting, as herein shown, of a rock-shaft F², mounted in the casting F,
75 and provided with an eccentric F³, arranged to engage the clamping-jaw F' in such manner as to move the same toward and from the form-block when the rock-shaft is turned, said rock-shaft being provided at one end with a
80 lever *f'*, by which it may be rotated for tightening and loosening the clamping-jaw. In the particular construction of the parts herein illustrated the clamping-jaw is held in place
85 vertically by contact with the guide-arms *f f*, and is held from lateral displacement by means of two parallel arms *f² f²*, which extend rearwardly from the body of the clamping-jaw and engage the opposite parallel side
90 faces of the casting F, Fig. 9. The rock-shaft F² is herein shown as arranged vertically and mounted at its ends in the guide-arms *f f*, the eccentric F³ being located at the middle of the rock-shaft in a rectangular recess *f³*, formed
95 in the body of the clamping-jaw, said jaw being provided with slots *f⁴ f⁴*, through which the rock-shaft passes at either side of the said recess *f³*. The engagement of the eccentric with opposite sides of the said recess *f³*, as
100 shown in Fig. 9, gives positive movement to the clamping-jaw during both its forward and backward movement and holds it at all times positively in position. The opposing faces of the form-block in the clamping-jaw F' are preferably provided with lining-plates B² F⁴,
105 which are conveniently held in position by dovetailed tongues engaging corresponding grooves in said parts. By using thicker or thinner lining-plates provision may be made for operating upon metal bars or blanks of greater or less thickness, as desired.
110

The lever *f'* may be moved by hand to effect the engagement of the clamp-jaw with and its disengagement from the blank. As a means of insuring the clamping of the blank during the bending operation, I so arrange the
115 lever *f'* that it will stand parallel with the path of the carriage when the clamp-jaws are closed, and place the said lever above the level of the top of the form-block, so that it will enter and pass through a longitudinal
120 groove A⁵, formed in the lower face of the top plate A², Fig. 8, for the reception of said lever during the back and forward movement of the carriage. In a construction of this kind the lever *f'* will be actuated to automatically
125 close the clamp-jaw against the blank, and said lever may be moved to release the blank either by hand or by an automatic actuating device. When actuated by hand the lever may be thrown around to release the jaw by
130 a hand tool; but a similar movement may be automatically accomplished by means of a spring suitably applied for the purpose. In the drawings, Fig. 8, *f⁶* indicates a spiral

spring encircling the rock-shaft F^2 and connected with said shaft and with the casting F , said spring being so arranged as to tend to hold the eccentric in position to retract the clamp-jaw.

In Figs. 16 and 17 I have shown another device for automatically actuating the clamp-pin F' . In this instance the clamp-jaw is provided with two guide-rods f^7 f^7 , which slide in the casting F , and springs F^5 F^5 are applied to said rods in such manner as to retract the clamp-jaw or draw it toward the said casting F . F^6 is a cam-plate which is adapted to swing on a transverse pivot f^8 , secured in the casting F , said cam-plate being adapted to engage at its free end with the rear or inner face of the jaw in such manner as to advance the jaw when the cam-plate is depressed. A spring F^7 is applied to lift said cam-plate, and the latter is so arranged that when in its elevated position its upper surface stands above the level of the top of the form-block and in position to engage the top plate A^2 . In the operation of the machine when thus made, when the blank is placed across the rear end of the form-block and the carriage begins its backward movement, the cam-plate F^6 will strike the top plate A^2 , and will be thrust downwardly thereby so as to advance a clamp-jaw and clamp the blank. When the carriage returns to its original position, however, the cam-plate will rise under the action of the spring F^7 as soon as it is free from the top plate, and the clamp-jaw will thereby become automatically released from the blank.

The form-block B' may be cast integral with the carriage B , or otherwise permanently secured thereto, in case the machine is intended for making only one size of hanger. Preferably, however, said form-block is removably secured to the carriage, whereby form-blocks of different widths may be employed when it is desired to vary the size of the loop a of the hanger. A device for detachably securing the form-block to the carriage herein shown consists of heavy integral lugs or posts B^3 B^4 , extending upwardly from the top surface of the carriage and passing through sockets or recesses b^2 b^3 in the form-block, the latter being held downwardly in place by means of screws b^4 b^4 passing through the form-block and into the carriage. The recess b^2 is conveniently formed near the rear or inner end of the form-block, while the recess b^3 has the form of a notch in the outer or front end of the said form-block.

The means employed for making the quarter-twists a^2 a^2 in the bar or blank will now be described. Said twists are made, generally speaking, by the conjoint action of two laterally-projecting forming-dies G G , extending laterally outward from the upper part of the form-block, and two cam-arms H H , which are pivotally supported in the carriage below the form-block, and are adapted to rise toward the forming-dies G G in the act

of making the twist in the bar. Said forming-dies are beveled or inclined on their rear and under surfaces to correspond generally with the inclination or curvature of the finished hanger at a point adjacent to the twist. The cam-arms H H are similarly beveled or inclined upon their upper and outer surfaces h h to correspond with the curved surface of the hanger. Said beveled surfaces h h are furthermore arranged eccentrically with the pivots h' h' of the cam-arms, as clearly shown in Fig. 7. Said cam-arms H swing through a distance approximately equal to a quarter of a rotation during the operation of forming the twists in the hanger, the curvature of the working-faces h h of the cam-arms being such that when said cam-arms are swung downwardly and are out of action the cam-surfaces are entirely below the level of the top of the carriage, so that the ends of the bar or blank may swing freely over the cam-arms when said ends of the blank are brought against the sides of the form-block in the preliminary bending of the same. Said cam-faces are so shaped, furthermore, that when the cam-arms are swung upwardly and rearwardly they will come approximately parallel to the inclined under surface of the forming-dies G G , thereby acting, in connection with said dies, to give the desired shape or twist to the blank. It will of course be understood that the working-faces h h of the cam-arms are inclined inwardly and downwardly toward the form-block, so that their outer margins are highest, and thereby act to bend or carry upwardly the outer margins of the blank, as is clearly shown in the sectional view, Fig. 13. Said cam-surfaces h h terminate in flat surfaces h^2 h^2 , which, when the cam-arms H H are swung upwardly to the upward limit of their movement, are horizontal and stand at a distance below the under surface of the top plate A^2 of the machine equal to the thickness of the metal blank, Fig. 13. These flat surfaces h^2 h^2 serve to bring the flat parts of the hanger above the twists a^2 a^2 in the same plane with the inner edge of the loop a , so that when the hooks are engaged with the timber the loop of the hanger will rest against the side of the timber both above and below the twists therein.

In order to provide for working upon metal of different thicknesses, removable blocks h^3 h^3 are secured to the cam-arms, so as to form the flat surfaces h^2 h^2 , which blocks may be removed and replaced by others of greater or less thickness, as necessary in operating the machine with thicker or thinner blanks. The said cam-arms H H are lifted for the purpose of forming the twist in the blank during the rearward or inward movement of the carriage, by contact of a roller H' upon the bed-plate A with the said cam-arms, the top of said roller being arranged on a level with the top of the bed plate, so that the roller will lift the arms into a horizontal position and the latter will be sustained in such position dur

ing the free inward movement of the carriage by resting upon said bed-plate. The roller H' is arranged beneath the forward end of the top plate A^2 , so that when the cam-arms are thrown upwardly the flat surfaces $h^2 h^2$ thereof will come beneath the top plate and will thereby bring the parts of the blank adjacent to the twists therein in the same plane with each other and with the inner edge of the loop a . Flanges $h^4 h^4$ at the inner edges of the cam-faces $h h$ are desirably employed to engage the inner edges of the blank, and thereby prevent the same from becoming caught between the cam-arms and the form-block as the cam-arms rise.

The bending-rollers $E E$, hereinbefore described, aid in the bending of the blank by acting against the outer edges thereof to hold the same against the form-block. Said rollers E for this purpose are located at a distance from the sides of the form-block equal to the width of the blank. During the inward movement of the carriage, after the cam-arms have been lifted to form the twists in the blank, the end portions of the blank adjacent to the twists will be confined above and below by the cam-arms and top plate and at their inner and outer edges by contact with the form-block and rollers $E E$, Fig. 15, so that these portions of the blank will be closely confined or held during the inward movement of the carriage.

For the purpose of allowing adjustment of the rollers $E E$ toward and from the form-block in operating upon wider or narrower blanks the pivot-studs $e e$ of said rollers are mounted in blocks $E^2 E^2$, Fig. 15, secured to the front edge of the top plate A^2 by adjustable attaching devices adapted for conveniently shifting the position of said blocks horizontally. As herein shown, the top plate A^2 is provided with a T-groove A^3 , Fig. 13, in which fit and slide T-shaped projections $e^2 e^2$ upon the said blocks $E^2 E^2$, and an oppositely-screw-threaded shaft E^3 is engaged with the projections of both blocks, said shaft having a squared end by which it may be conveniently turned for adjusting the blocks. As an additional means of rigidly securing in place the said blocks $E^2 E^2$ after the same have been adjusted by means of the shaft, bolts $e^3 e^3$, Fig. 5, having heads engaging the T-slot $A^3 A^3$, are inserted through the said blocks and provided with nuts by which the blocks may be clamped against the end of the top plate.

The forming-dies $G G$, instead of being rigidly attached to the form-block, are preferably mounted thereon, so that they may be swung inwardly to allow the finished hanger to be lifted from the form-block. For the purpose stated said dies $G G$ may be mounted in any one of a great variety of ways. One desirable construction in said dies is herein shown, Figs. 10 and 11, which is as follows: Said dies are pivoted at their inner ends upon vertical pivots $g g$, secured in the form-block, the dies

being arranged with their upper surfaces flush with the top of the form-block, which latter is provided with recesses $G' G'$, adapted to receive the dies when the latter are swung about the pivots $g g$.

G^2 is a gear-pinion mounted upon a vertical shaft g' between the pivots $g g$ of the dies, and intermeshing with gear-segments $g^2 g^2$, formed upon the inner end of the dies, concentric with the pivots $g g$, in the manner illustrated, Fig. 11. By reason of the engagement of both of the arms with the pinion G^2 when the shaft g' is rotated said arms are turned or moved in opposite directions so that one arm swings toward the outer end and the other arm toward the inner end of the form-block when said arms are swung inwardly into their folded position, as clearly shown in the drawings. To the upper end of the shaft g' is secured an actuating-lever g^3 , which may be moved either by hand or automatically by contact with a part of the machine to turn the dies $G G$. As herein shown, the lever g^3 is adapted to enter the groove A^5 in the under surface of the top plate, and said lever is so arranged with reference to the dies that the latter will be held in their extended or operative position when the lever is within the groove. The lever may be turned by hand to close the dies inwardly, and thus permit the finished hanger to be lifted from the form-block; but in order to make the operation of these parts entirely automatic a spring g^4 may be applied to turn the shaft g' in a direction to close the dies. Such spring is shown as made of the form of a coil surrounding the shaft g' and connected at one end with the shaft and at its opposite end with the form-block.

In Figs. 18, 19, and 20 I have shown another construction in means for actuating the forming-dies $G G$. In this instance $G^3 G^3$ are two rock-shafts mounted in the form-block B' parallel with each other and with the sides of the form-block. The dies $G G$ are rigidly secured to the rock-shafts, so as to turn with the latter, said dies in this construction swinging in a plane at right angles to the sides of the form-block and being adapted to move through a quarter of a circle or from a position standing horizontally out from the sides of the form-block to a vertical position extending upwardly from the top of the form-block. The rock-shafts $G^3 G^3$ extend at their ends outwardly past the end of the form-block, and are there provided with rigid arms $g^5 g^5$, to which are connected the opposite ends of a spring G^4 , acting to turn the rock-shaft in opposite directions and to hold the dies in their closed or vertical position. In a construction of this kind the dies $G G$ are held outwardly or in position for operation by contact of their upper surfaces with the under surface of the top plate A^2 , said dies being located beneath said top plate at the time the upward pressure comes thereon in the act of bending or forming the

hanger. The dies are opened or spread by means of a wedge-shaped or pointed projection N, located on the top-plate A² above the form-block, the point of the projection entering between the dies and forcing the same apart as the carriage moves inwardly or rearwardly, as clearly shown in Fig. 21.

The construction in the parts by which the double bends $a^3 a^4$ of the hanger are formed will now be described. Generally speaking, the said bends are formed by bending the end portions of the blank over surfaces or dies, Figs. 4 and 13, attached to or formed on the end of the top plate A² and having flat vertical faces A⁶ A⁶ and horizontal top surfaces A⁷ A⁷ by means of bending-levers I I, hinged to the cam-arms H H, and other bending-arms J J, which are hinged to the bending-levers I I, the bending-levers I I being arranged to press the blank against the surfaces A⁶ A⁶, while the bending-arms J J are adapted to bring the ends of the blank against the horizontal surfaces A⁷ A⁷. To first describe the construction and operation of the bending-levers I I, said levers are hinged by means of horizontal pivots $i i$ to the outer or forward ends of the cam-arms H H, the said bending-levers being provided adjacent to the said cam-arms with flat working-faces $i' i'$, adapted to come into position parallel with the vertical faces A⁶ A⁶ of the top plate when the said bending-levers are swung upwardly into vertical position or at right angles to the cam-arms, the said bending-surface being extended outwardly past or above the said surface $i' i'$, for the purpose hereinafter described. The said bending-levers I are furthermore provided with arms I' I', extending from the lower or inner sides of the pivots $i i$, and adapted for engagement with a cam or wiper K, which is mounted upon a horizontal shaft K', located beneath the bed-plate of the machine. Said shaft K' is driven by a spur-wheel K², intermeshing with the gear-wheels D', heretofore described. The cam or wiper K is so located and actuated as to strike the arms I' I' of the bending-levers and throw said bending-levers upwardly into a vertical position after the inward movement of the carriage B has ceased. When said carriage has completed its inward movement and twists have been formed in the blank by the action of the cam-arms H H and forming-dies G G, as hereinbefore described, the flat parts of the hanger will be held by the said cam-arms, the top plate, the form-block, and the rollers E E in position parallel with each other, with their flat sides horizontal and projecting outwardly from beneath the top plate, their ends at this time standing over the surfaces $i' i'$ of the bending-levers. When said bending-levers are thrown upwardly, therefore, they will act upon the ends of the blank, to bend the same upwardly and bring them into contact with the flat vertical faces A⁶ A⁶ of the opposing dies in an obvious manner. By the movement of

the bending-levers in the manner described, the right-angled bends $a^3 a^3$ will be formed.

The final movement by which the bends a^4 are made is accomplished by means as follows: The bending-arms J J are connected by pivots $j j$ with the bending-levers I I, and said bending-arms are adapted to swing upon the said pivots in such manner that they may be placed either at right angles to the levers or thrown outwardly at an angle thereto and into the position shown in Fig. 1. During the upward movement of the bending-levers I I the said arms J J stand at an angle to the arms, as shown in Fig. 1; but when said bending-levers are near the end of their movement said arms J J are thrust downwardly into position at right angles to the bending-levers and above and parallel with the top surfaces A⁷ A⁷ of the dies, so as to bring the extreme ends of the blank against the said top surfaces.

The movement of the arms J J in the manner described is accomplished by means as follows: L L are levers pivoted at points between their ends, by means of pivot-pins l , to laterally-projecting lugs $i^2 i^2$ on the levers I. Said levers L are connected with the free ends of the arms J by means of links L'. Springs l^2 are applied to throw the outer ends of the levers L L away from the bending-levers I I, so as to hold the arms J J normally outward or at an angle with the bending-levers, this position of the parts being shown in Fig. 1. M is a horizontal bar mounted upon standards M' M' at a considerable distance above the top plate A² of the machine, said bar M being so located that it will be encountered by the outer ends of the levers L L when the bending-levers I I are swung upwardly into a vertical position. The said bar M is disposed in such position relatively to the said levers L L that said levers will strike the bar shortly before the bending-levers I I reach their vertical position, so that said levers L will be actuated to thrust the bending-arms J J downwardly during the last part of the movement of the said bending-levers, and so as to bring the said arms J J into a horizontal position at the termination of the movement of said bending-levers.

It follows from the construction described that when the bending-levers I I are thrown upwardly by the action of the cam or wiper K both of the right-angled bends $a^3 a^4$, forming the hooks, will be automatically made.

After the bending of the blank has been accomplished in the manner above described, the wiper K will pass the arms I' I' of the bending-levers I I, thereby allowing the said bending-levers to fall in the horizontal position shown in Fig. 1, after which the return movement of the carriage will take place, allowing the cam-arms H H to fall into a vertical position, and thereby releasing the finished hanger, which at the termination of the forward movement of the carriage may be lifted from the form-block after the die G G

have been turned or moved to free the hanger, in the manner hereinbefore described.

In order to enable the machine to be adjusted for making the distance between the bends $a^3 a^4$ greater or less, and thereby making the hooks wider or narrower, the parts are constructed as follows: The lugs $i^2 i^2$, instead of being permanently secured to the levers I I, are connected therewith by means of bolts $i^3 i^3$, and the levers are provided with additional bolt-holes, as i^4 , and one or more additional apertures $i^5 i^5$ are provided for receiving the pivots $j j$ of the arms J J. By the construction described the said hooks may be made of as many different widths as there are sets of bolt holes and apertures for securing the lugs i^2 and pivots $j j$ to the bending-arms. When the position of the bending-arms J J is changed in the manner described, it is obviously necessary to change the width of the vertical faces $A^6 A^6$, over which the ends of the blank are bent. For this purpose said surfaces $A^6 A^6$ are formed on or by removable die-blocks $A^8 A^8$, held in place by the bolts A^9 , which enter and engage the T-grooves A^3 of the top plate A^2 , Fig. 15. When the said bending-arms J J and levers L L are shifted in position in the manner described, it is further necessary to change the vertical position of the bar M, and for this purpose said bar is held at its ends in the vertical slots $m m$ by means of clamp-nuts $m' m'$, which may be loosened to allow the bar to be shifted vertically. In order to provide an accurate adjustment of the parts, so that the bending-arms J J may be moved to exactly the right extent, the bar M is preferably provided with eccentric ends or trunnions $m^2 m^2$, engaging the slots $m m$, so that by turning the bar its part or surface which strikes the levers L L may be shifted back or forth as desired.

In order to hold the ends of the blank accurately in vertical position during the time they are being bent upwardly by the action of the bending-levers, vertical guide-surfaces are located at the opposite sides of the working-faces $A^6 A^6$ in such position as to engage the side edges of the blanks, said guide-surfaces being arranged at a distance apart equal to the width of the blank. The guides for the outer edges of the blank are herein shown as formed by the inner surfaces of the blocks $E^2 E^2$, which support the rollers E E. Said inner faces of the blanks are of course located vertically in alignment with the inner surfaces of the said rollers E E, it obviously being necessary that the said guide-surfaces should be located the same distance from the vertical side faces of the form-block as the said rollers—to wit, a distance equal to the width of the blank. The guide-surfaces for the inner edges of the blank are formed by the side of the projection or guide-block N, Figs. 2, 3, 4, and 15, which is preferably made separate from the top plate and secured to the said top plate between the said sur-

faces $A^6 A^6$, the side faces of the said block being desirably curved or rounded in the manner shown. When the form of movable forming-dies G G shown in Figs. 18, 19, 20, and 21 is used, said projection N will be made of wedge shape and pointed at its lower part, so as to enter between and open the dies, as hereinbefore set forth.

In order to provide for making hangers having central loops of different widths, it is obviously necessary that the projection or guide-block N should be changed to correspond in width with the form-block B', and when the said form-block is changed or when a wider or narrower blank is used it is necessary that the external guide-surfaces formed by the blocks $E^2 E^2$ should also be moved. I provide for change in the width of the guide-block N by making said block detachable, the same being secured in place, as herein shown, Fig. 3, by means of a bolt passing through the block and having a head at its inner end which engages the T-groove A^3 of the top plate A^2 . Said guide-block can therefore be removed and a wider or narrower one substituted, as may be necessary or desirable. The external guide-surfaces formed by the blocks $E^2 E^2$ will of course come in proper position for engagement with the said edges of the blank when the rollers E E are placed at a proper distance from the form-block to also engage the external side edges of the blank in the manner heretofore described.

In operating upon blanks of different thicknesses it is obviously necessary to shift the rollers $E' E'$ toward and from the form-block, and for this purpose I adjustably secure the studs $e' e'$ of said rollers in transverse slots $a^6 a^6$ in the top plate A^2 , Fig. 4, and in order to enable said studs to be easily shifted, a screw-shaft a^7 is inserted through the top plate and provided with oppositely-directed screw-threads engaging the said studs, said shaft having a squared end at one side of the top plate by which it may be turned by the application of a suitable tool.

It is obviously desirable that means should be provided for accurately determining the position of the straight blank when putting the same in the machine, so that the ends of the same will come in proper position after the blank is bent. For this purpose I attach to the sides of the frame two outwardly-extending horizontal arms O O, Fig. 4, and place upon the same two adjustable gages $o o$, which extend vertically upward in position to engage the ends of the straight blank when the latter is placed across the rear end of the form-block in the manner hereinbefore described. The position of the said blank when placed in the machine is indicated in full lines in said Fig. 4.

I claim as my invention—

1. The combination, with a reciprocating form-block, of two stationary bending-rolls located at opposite sides of the form-block and two other bending-rolls located at oppo-

site sides of the form-block and at a distance therefrom equal to the thickness of the bar to be bent, substantially as described.

2. The combination, with a reciprocating form-block, a movable carriage supporting the latter, and bending-rollers located at opposite sides of the form-block, of forming-dies mounted upon the part of the form-block remote from the carriage and movably connected with said form-block, and means upon the carriage acting in connection with said forming-dies to give a twisted form to the blank, substantially as described.

3. The combination, with a reciprocating form-block, a movable carriage supporting the latter, and bending-rollers located at opposite sides of the form-block, of two forming-dies mounted upon the part of the form-block remote from the carriage and extending laterally at opposite sides of the form-block, said forming-dies being pivotally connected with the form-block, and means upon the carriage acting in connection with said forming-dies to give a twisted form to the blank, substantially as described.

4. The combination, with a reciprocating carriage and a form-block thereon, of stationary bending-rollers, forming-dies mounted on the form-block and extending laterally from opposite sides thereof, and cam-arms pivotally supported upon the carriage and operating in connection with the said forming-dies to give a twisted form to the blank, substantially as described.

5. The combination, with a reciprocating carriage, a form-block thereon, and stationary bending-rollers, of forming-dies mounted on the block and extending laterally at opposite sides thereof, cam-arms mounted on the carriage and operating in connection with the said forming-dies to give a twisted form to the blank, and a stationary part or roller adapted for contact with the said cam-arms, by which the latter are actuated during the movement of the carriage, substantially as described.

6. The combination, with a form-block and bending-rollers operating in connection therewith to make a central bend or loop in the blank, of forming-dies mounted on the form-block and extending laterally from opposite sides thereof, cam-arms operating in connection with said forming-dies to give a twisted form to the blank, bending-levers pivoted to the ends of said cam-arms, and stationary surfaces or dies opposed to said bending-levers, substantially as described.

7. The combination, with a form-block and bending-rollers operating in connection therewith to make a central bend or loop in the blank, of forming-dies mounted on the form-block and extending laterally from opposite sides thereof, cam-arms operating in connection with said forming-dies to give a twisted form to the blank, bending-levers pivoted to the ends of said cam-arms, bending-arms pivoted to the said bending-levers, and stationary

surfaces or dies opposed to said bending-levers, substantially as described.

8. The combination of a form-block, bending-rollers operating in connection therewith to make a central bend or loop in the blank, forming-dies mounted on the form-block and extending laterally from opposite sides thereof, cam-arms operating in connection with said forming-dies to give a twisted form to the blank, bending-levers pivoted to the ends of said cam-arms, and a revolving cam or wiper for actuating said bending-levers, substantially as described.

9. The combination of a reciprocating carriage, a form-block mounted thereon, stationary bending-rollers operating in connection with the form-block to make a central loop in the blank, forming-dies mounted upon the form-block and extending laterally at opposite sides thereof, cam-arms mounted upon the carriage and operating in connection with said forming-dies to give a twisted form to the blank, stationary parts or rollers for actuating said cam-arms, bending-levers pivoted to the ends of said cam-arms, and a revolving cam or wiper actuating said bending-levers, substantially as described.

10. The combination of a reciprocating carriage, a form-block mounted thereon, stationary bending-rollers operating in connection with the form-block to make a central loop in the blank, forming-dies mounted upon the form-block and extending laterally at opposite sides thereof, cam-arms mounted upon the carriage and operating in connection with said forming-dies to give a twisted form to the blank, stationary parts or rollers for actuating said cam-arms, bending-levers pivoted to the end of said cam-arms, a revolving cam or wiper actuating said bending-levers, bending-arms pivoted to the outer parts of said bending-levers, actuating-levers pivoted upon the bending-levers and connected with the said bending-arms, and a stationary part or bar upon the machine-frame adapted for contact with said actuating-levers, whereby the said bending-arms are moved, substantially as described.

11. The combination, with a reciprocating carriage and a form-block mounted thereon, of stationary bending-rollers located at opposite sides of the form-block at a distance therefrom equal to the thickness of the blank, forming-dies mounted upon the form-block and extending laterally from opposite sides thereof, cam-arms pivoted to the carriage and operating in connection with said forming-dies to give a twisted form to the blank, and other stationary bending-rollers located at opposite sides of the form-block at a distance therefrom equal to the width of the blank, substantially as described.

12. The combination, with a reciprocating carriage and a form-block mounted thereon, of stationary bending-rollers located at opposite sides of the form-block at a distance therefrom equal to the thickness of the blank,

forming-dies mounted upon the form-block and extending laterally from opposite sides thereof, cam-arms pivoted to the carriage and operating in connection with said forming-dies to give a twisted form to the blank, other stationary bending-rollers located at opposite sides of the form-block at a distance therefrom equal to the width of the blank, and bending-levers pivoted to the ends of the cam-arms, substantially as described.

13. The combination, with a reciprocating form-block and bending-rollers operating in connection therewith to form a central loop in the blank, of a clamping device for holding the blank against the end of the form-block, a lever for actuating said clamping device, and a stationary part of or upon the machine-frame adapted for engagement with said lever during the reciprocatory movement of the block, whereby the clamp is automatically actuated, substantially as described.

14. The combination, with a reciprocating form-block and bending-rollers operating in connection therewith to form a central loop in the blank, of a clamping device for holding the blank against the end of the form-block, a lever for actuating said clamping device, and a stationary part of or upon the machine-frame adapted for engagement with said lever during the reciprocatory movement of the block, whereby the clamp is automatically actuated, and a spring for releasing the clamp, substantially as described.

15. The combination of a reciprocating form-block, bending-rollers operating in connection therewith, forming-dies mounted on and extending laterally from opposite sides of the form-block, and cam-arms operating in connection with said forming-dies, said forming-dies being movably connected with the form-block, and a stationary part of or upon the machine-frame engaging said forming-dies or a part connected therewith during the reciprocation of the form-block, whereby said forming-dies are moved or shifted into operative position, substantially as described.

16. The combination, with a machine-frame, a reciprocating form-block, and bending-rollers operating in connection therewith, of forming-dies pivotally connected with the form-block, cam-arms operating in connection with said forming-dies to give a twisted form to the blank, an actuating-lever connected with said forming-dies, and a part of or upon the machine-frame adapted to engage said actuating-lever to move the forming-dies during the reciprocation of the form-block, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

JOHN GRANT.

Witnesses:

C. CLARENCE POOLE,
GEORGE W. HIGGINS, Jr.