H. C. GRANT.

SHEET METAL BENDING MACHINE.

APPLICATION FILED NOV. 14, 1908.

935,906.

Patented Oct. 5, 1909.

4 SHEETS—SHEET 1.

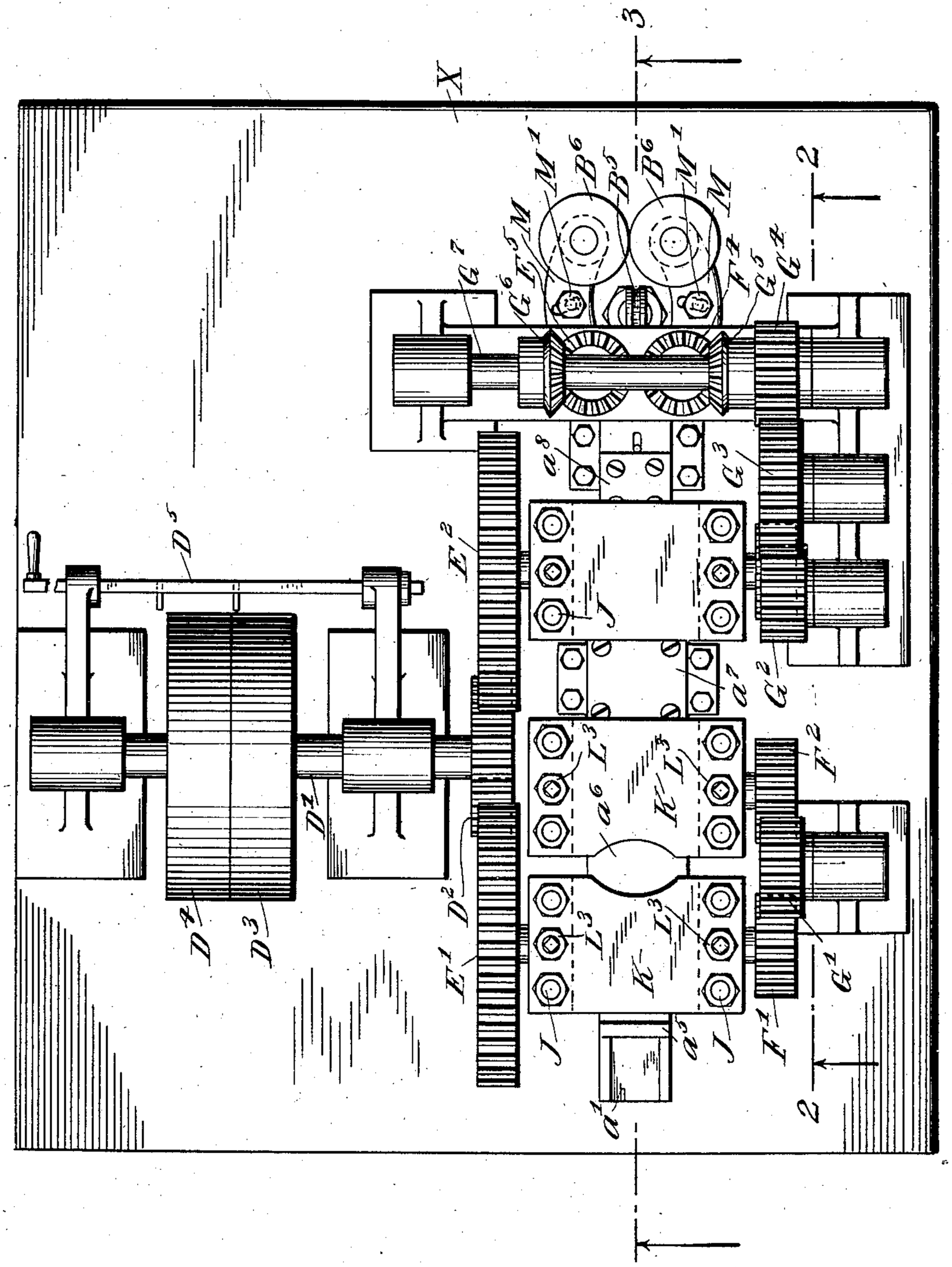

Fig. 1.

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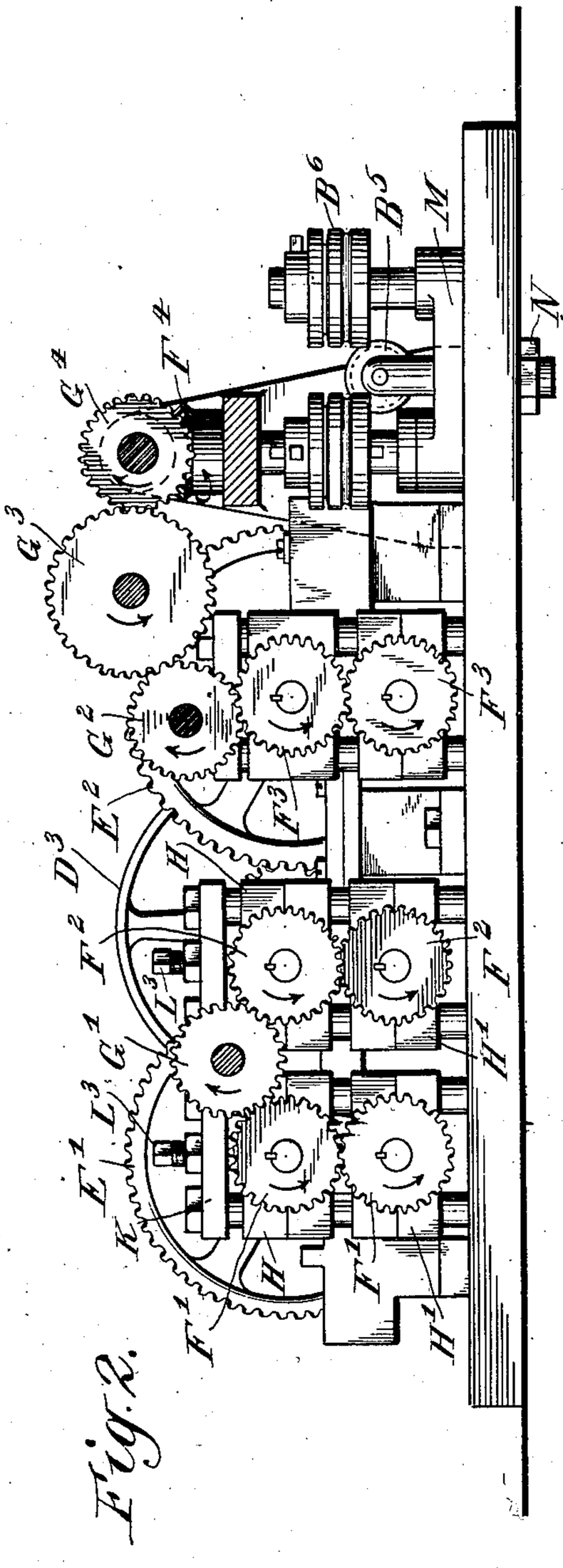

Fig. 2.

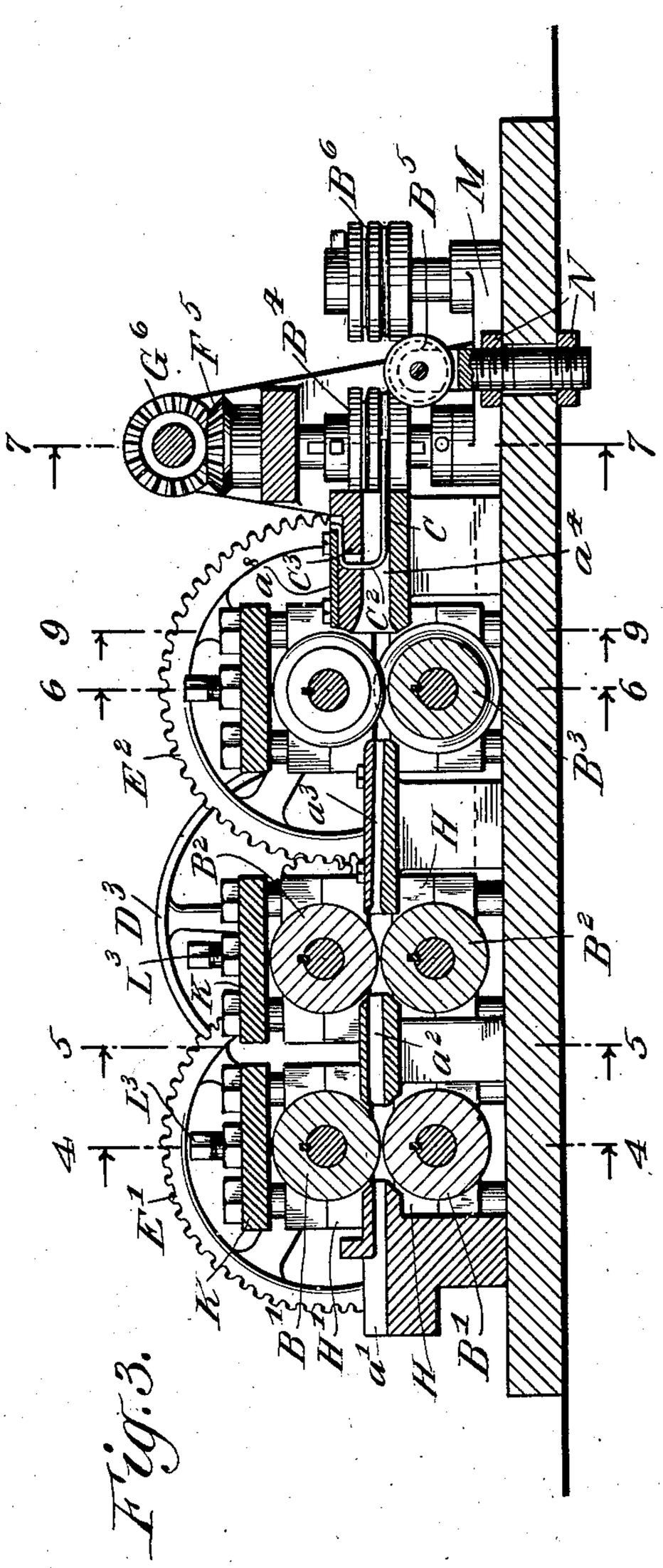

Fig. 3.

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4 SHEETS—SHEET 3.

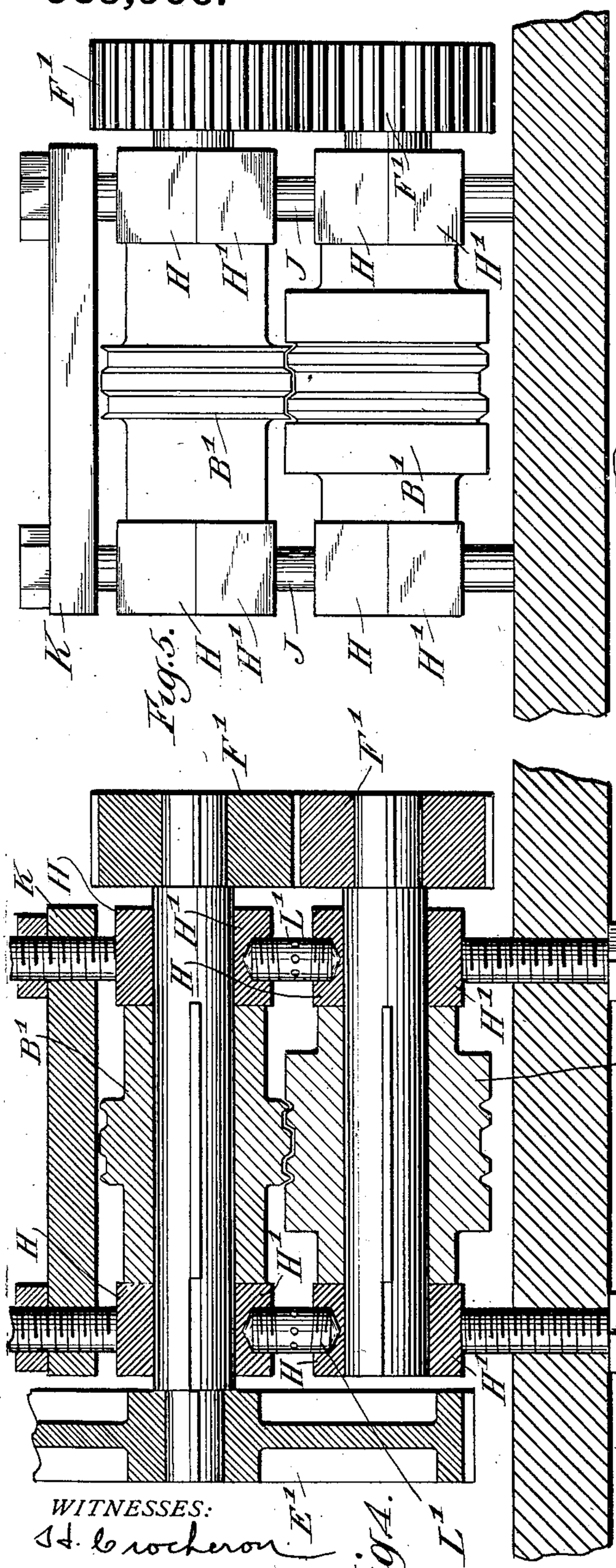

Fig. 5.

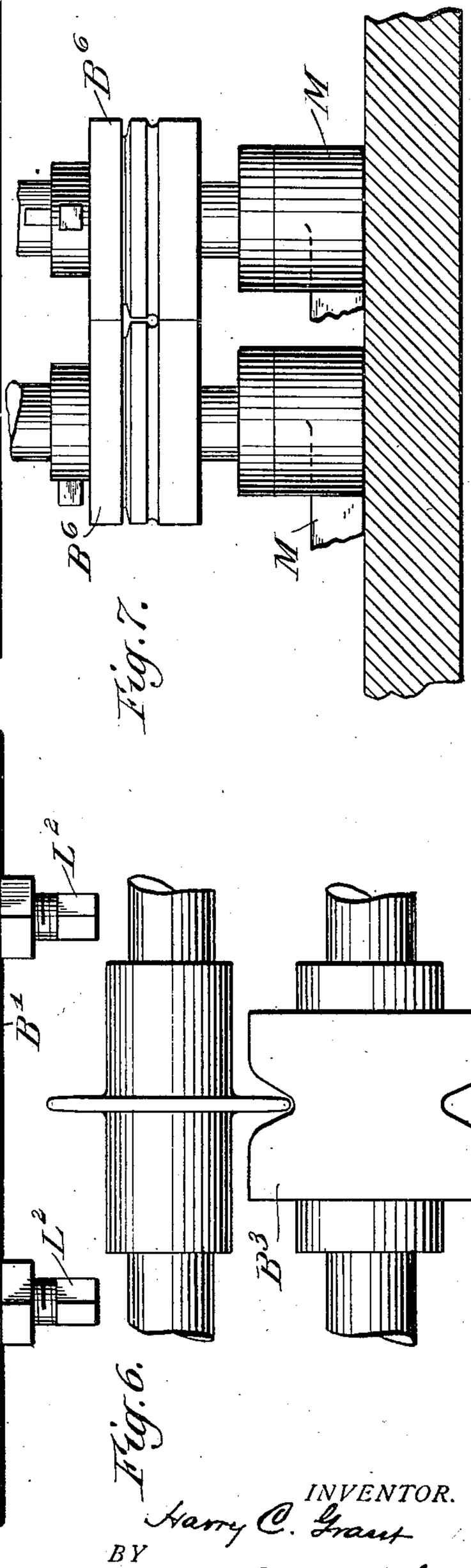

Fig. 7.

Fig. 4.

Fig. 6.

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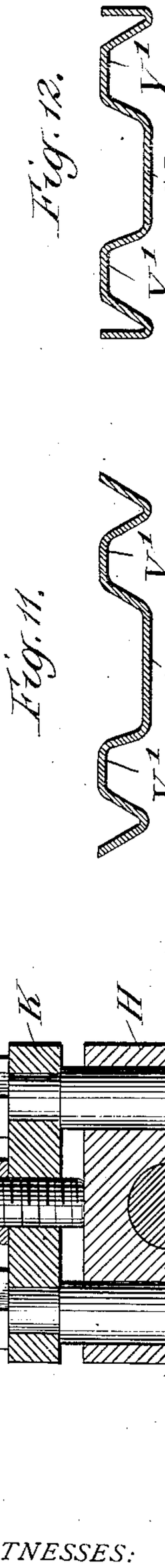

Fig. 12.

Fig. 11.

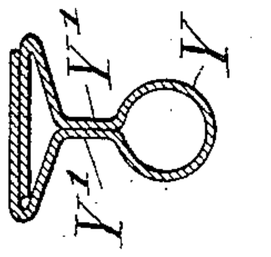

Fig. 15.

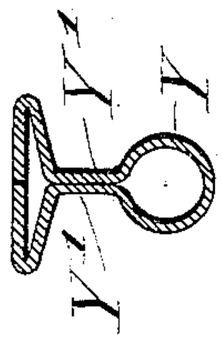

Fig. 14.

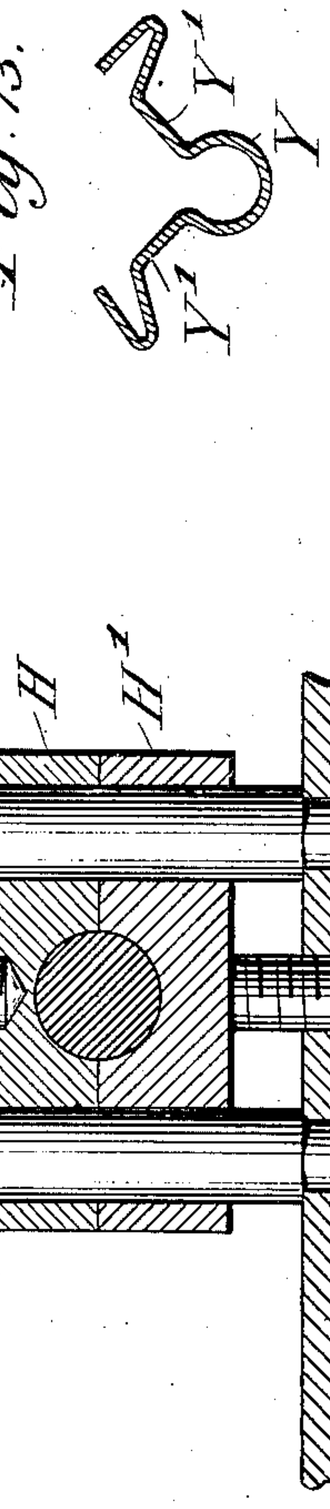

Fig. 13.

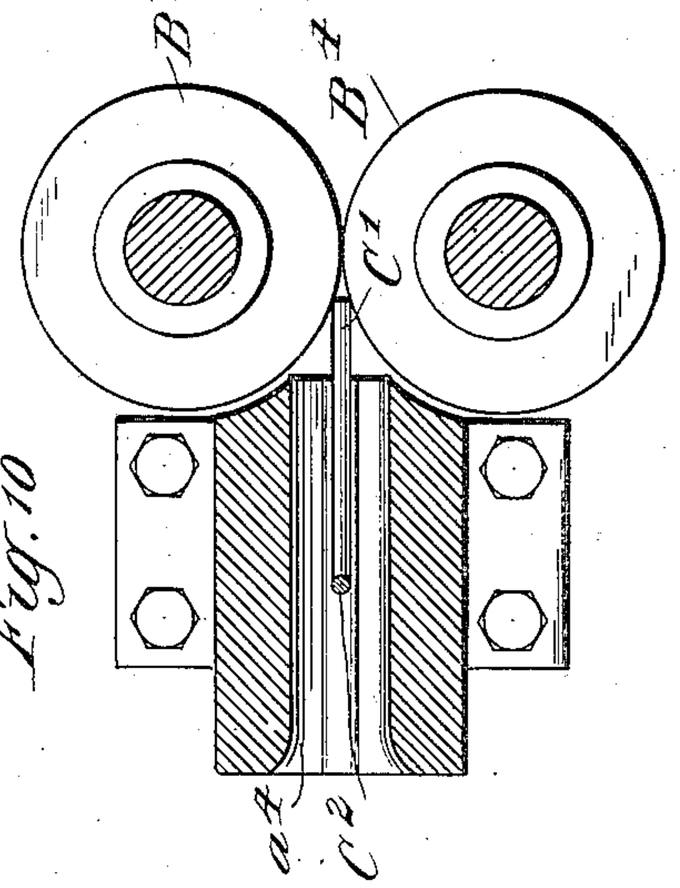

Fig. 10

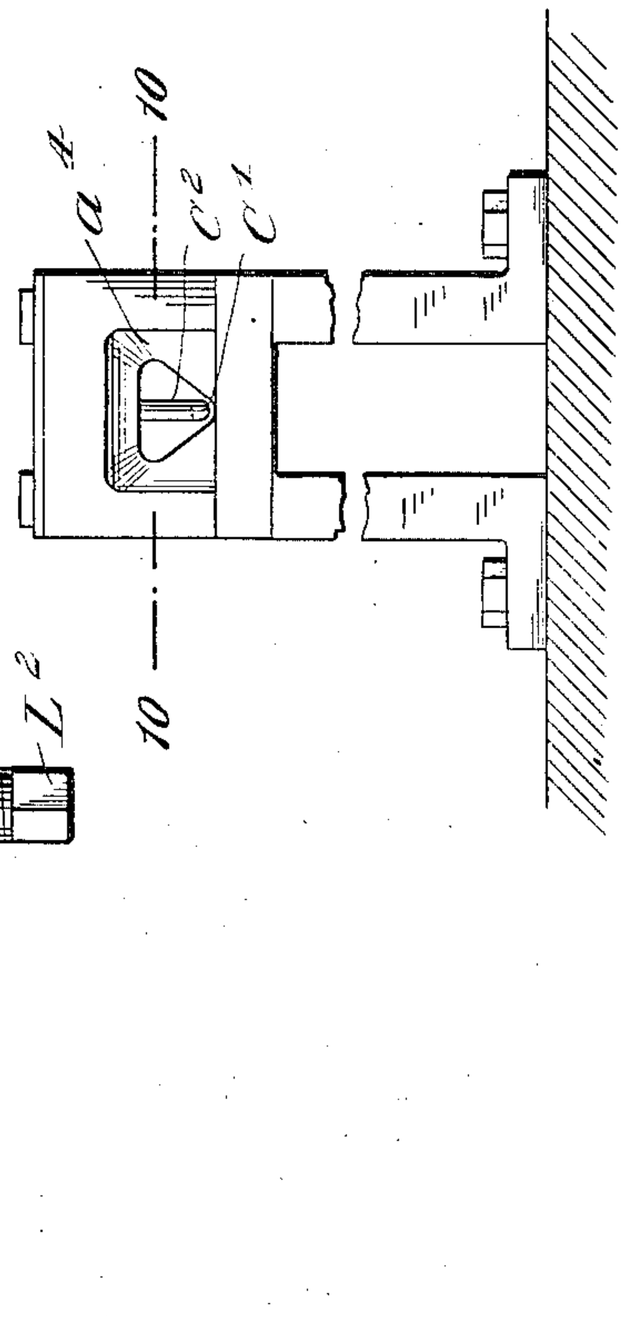

Fig. 9.

Fig. 8.

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UNITED STATES PATENT OFFICE.

HARRY C. GRANT, OF BAYONNE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE LIONEL MANUFACTURING COMPANY, A CORPORATION OF CONNECTICUT.

SHEET-METAL-BENDING MACHINE.

935,906. Specification of Letters Patent. Patented Oct. 5, 1909.

Application filed November 14, 1908. Serial No. 462,539.

To all whom it may concern:

Be it known that I, HARRY C. GRANT, a citizen of the United States, and resident of Bayonne, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Sheet-Metal-Bending Machines, of which the following is a specification.

This invention relates to improvements in sheet metal bending machines.

In the drawings:—Figure 1 is a plan view of a machine embodying the present invention. Fig. 2 is a side elevation of the same; the outer bearing standards being removed to show the gear arrangement. Fig. 3 is a longitudinal section of the machine taken on the line 3—3 in Fig. 1. Fig. 4 is a vertical cross section taken on the line 4—4 of Fig. 3 of the first pair of rolls, the shafts and adjustment screws being shown in elevation. Fig. 5 is a front elevation taken on the line 5—5 of Fig. 3 of the second pair of rolls. Fig. 6 is a detail view of the third pair of rolls taken on the line 6—6 of Fig. 3. Fig. 7 is a detail view of the fourth pair of rolls taken on the line 7—7 of Fig. 3. Fig. 8 is a vertical section across the bearing blocks for the rolls showing in elevation the tie rods and adjusting screws. Fig. 9 is a detail view from the entering end of the guide block carrying the mandrel on which the track is formed, the view being taken on the line 9—9 of Fig. 3. Fig. 10 is a horizontal section, taken on the line 10—10 in Fig. 9 of the guide block. The fourth pair of rolls and mandrel are shown in full view. Fig. 11 is a cross section of the metal after passing the first pair of rolls. Fig. 12 is a cross section of the metal after passing the second pair of rolls. Fig. 13 is a cross section of the metal after passing the third pair of rolls. Fig. 14 is a cross section of the metal after passing the fourth pair of rolls; and Fig. 15 is a view in cross section of an alternative form of the rail formed by these rolls wherein the flange of the rail is strengthened.

The invention consists primarily in gradually forming by successive steps the metal as shown in the drawings, and freely but firmly guiding the metal to insure perfect alinement, and in supporting the metal while being shaped. And to so conduct the machine that the operation is rapid and certain. And to so arrange the power-transmitting parts that they balance the strain and operate the rolls synchronously, thus avoiding any curling or jamming of the metal.

The product of the operation of this machine is a sheet metal railroad rail used principally for toys. In cross section it is shaped as seen in Fig. 14. In Fig. 14 the rail is inverted, as thus, it comes from the machine. The blanks are formed of flattened sheets of proper width and determined length. The width is the same as the guide a'. It is then passed to the first pair of rolls B′, the faces of which are shaped to bend the metal as shown at Fig. 11. This pair of rolls are not drawn close nor are the flanges or shapes sharp, it being the design to give the metal a preliminary shape. From the rolls B′, the metal is received by the second section a^2, of the guide which has substantially the outer shape of the metal delivered to it. The metal shaped as in Fig. 11 is delivered to the second pair of rolls B^2, which sharpen all the angles and define the curves to the cross section shown at Fig. 12. From the rolls B^2, B^2, the metal is delivered to the guide section a^3, which corresponds to the outer shape of the metal which is delivered to it. The guide section a^3, delivers the metal to the third pair of rolls B^3, where it is bent upward as shown in Fig. 13. From the rolls B^3, the metal is delivered to the guide section a^4, and from thence to the vertically arranged rolls B^4, where the metal is pressed to the completed form shown at Fig. 14. In the passage through the guide a^4 and rolls B^4, the tread Y of the completed rail is formed. In this construction the tread is circular in shape. To prevent the metal collapsing while being formed, I introduce the mandrel C′, which is loosely mounted in the guide section a^4. It is loosely mounted to slide forward when the end of the rail is between the rolls B^4, and grips the mandrel under the strain. In its normal position it is positioned so that its end does not rest between the rolls on the center or grip line. By holding the mandrel thus, the metal being formed is allowed easy access between the rolls, the mandrel coming forward only when gripped by the metal. The

shoulder C^3 prevents the mandrel being pulled forward beyond the center line of the rolls.

When the rail is shaped, as shown, it is delivered over the supporting roll B^5 to the bending rolls B^6, B^6, which are formed as are the rolls B^4. They are provided with means to give them a lateral offset and thereby curve the rail as the same is delivered from the shaping rolls B^1, B^2, B^3, B^4.

The rolls are driven synchronously to avoid stretching or crowding the metal. To balance the strain of operation the power is transmitted from the pulley shaft D′ by the gear pinion D^2 to the two equal and large gear wheels E′, E^2. These two wheels are mounted on the shafts that carry the upper rolls of the pairs designated heretofore as B′ and B^3. The four pairs of rolls are thus arranged in two sets in each of which the power and action is transmitted by the chains of gears substantially as shown at Fig. 2 of the drawings. In the rolls B′, B^2, B^3, the upper and lower shafts are each provided with a gear wheel F′, F^2, F^3, which are equal in size and engaged, thus securing the synchronous action of the two rolls. Between the gears F′ and F^2 on the upper rolls B′ and B^2 is interposed a transmission gear G′, which is provided with an independent bearing on a standard as shown at Fig. 1.

As stated the rolls B^4 are mounted vertically having vertical shafts which are mounted in the frame and are provided with suitable miter gears F^4 and F^5, which are equal, and which are geared with the equal miter gears G^5, G^6 on the shaft G^7. The shaft G^7 is provided with a pinion G^4, in line with and engaged by the pinion G^3, which in turn is engaged by the pinion G^2, that is engaged with the gear F^3. The pinion G^4 and gear F^3 are equal in diameter thereby securing the same revolutions to the roll B^3 and shaft G^7, which transmits the same revolution to the roll B^4. In the drawings at Fig. 2, the various gear pinions etc. are shown with arrows showing their direction of rotation.

By providing the shaft D′ with the driving and loose pulleys D^3, D^4 and belt shifter D^5, the operation of the rolls may be controlled. While shown in this application as being arranged for power drive, I may use hand or foot power. All the parts shown are mounted on the bed plate X. The machine here described may be constructed very small and light enough to be portable.

The rolls B′, B^2, B^3, have similar mounting and adjustment. The shafts of the rolls pass through split boxes H and H′. These are provided with perforations through which are passed the tie bolts J, J, on which the boxes are free to move. The tie bolts pass through a plate K, above the boxes, and through the bed plate X, below the boxes and are provided with set nuts on the outside of each and shoulders on the inside of each as shown, Fig. 8, of drawings. When bolted firm the boxes are held from any lateral movement.

The adjustment of the upper and lower rolls of each pair is accomplished by the screw L′. This screw is threaded at each end and mounted in tapped holes in the abutting bearing blocks. The threads at either end of the screw and the holes to receive same are threaded at opposite pitch, whereby the threaded ends are inserted in or withdrawn from the holes by the same rotation of the screw. The outer halves of the bearings are held in place by the screws L^2, L^3, which are threaded in perforations in the bed plate X, and the plate K, respectively to bear upon the bearing as shown in Figs. 4 and 8 of drawings.

The guide sections a', a^2, a^3, are shaped to conform substantially to the shape of the metal as it is delivered to each section. While serving the purpose of a guide the sections further serve to prevent the metal becoming twisted in front of the rolls. For this purpose the sections are provided with covers a^5, a^6, a^7. The guide section a^4, is provided with the top plate a^8, the office of which is to maintain the mandrel C, in position. This section a^4, receives the metal from the rolls B^3, in an angular shape, which shape may vary. To catch and guide inward any flared portion I have flared the opening into the guide a^4, as shown at Figs. 3 and 9. While the metal is passing through this guide a^4, it is formed from the shape shown at Fig. 13 to the shape shown at Fig. 14. This is accomplished by drawing the sections Y′, Y′, together to form the web of the rail. The hanger C^2, of the mandrel C′, extends down into the guide at that portion where the metal is not closed, while the mandrel C′, is extended forward to receive the metal which forms the tread Y of the rail, and thus prevents the metal at this point collapsing. In the operation of the machine the metal slides over the mandrel C′, but leaves it only where the forming pressure is passed.

As stated the guide rolls B^6, may be used to bend the rail. These rolls are vertically mounted in swinging arms M, as shown at Figs. 1, 2, 3 and 7. These arms are pivoted on the shafts that carry the rolls B^4 and are secured in their operative position by cap screws M′, which are mounted in quadrant slots formed in the arms M, and secured in the bed plate X. By reason of this construction these rolls may be thrown to one side and the rail be thus forced around to the desired curve.

The rail is supported from the rolls B^4, to the rolls B^6, over the guide roll B^5. The guide roll B^5 is adjustably mounted on a

threaded standard, which is engaged by suitable nuts N, as shown at Figs. 2 and 3.

The standards carrying the bearings for the various shafts, pulleys, and bearings, I have not detailed either in the drawings or in this specification. Any suitable construction will do. In the machine as at present constructed the simplest and most durable forms and materials are used.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is,

1. In a machine of the character specified, the combination of a series of shaping rolls to operate by successive steps, with a series of guide channels having the form of the metal as shaped by the rolls said guides being interposed between the rolls, and a movable mandrel mounted in the guide channel preceding the final shaping rolls to rest between the sides of the metal to receive the same, and adapted to be drawn by the metal between the shaping rolls, substantially as set forth.

2. In a machine of the character specified, the combination of a series of horizontally mounted shaping rolls to operate by successive steps to develop a predetermined shape, with a pair of shaping rolls mounted vertically, guide channels interposed between the said horizontal rolls and vertical rolls to guide the metal in passing, a mandrel loosely mounted in said channel adapted to rest between the sides of the metal to receive the same and adapted to be drawn by the metal between the vertically mounted shaping rolls, substantially as set forth.

Signed at New York in the county of New York and State of New York this 12th day of November A. D. 1908.

HARRY C. GRANT.

Witnesses:

FRANK M. ASHLEY,

A. T. SCHARPS.