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METAL BENDING APPARATUS.

No. 345,444. Patented July 13, 1886.

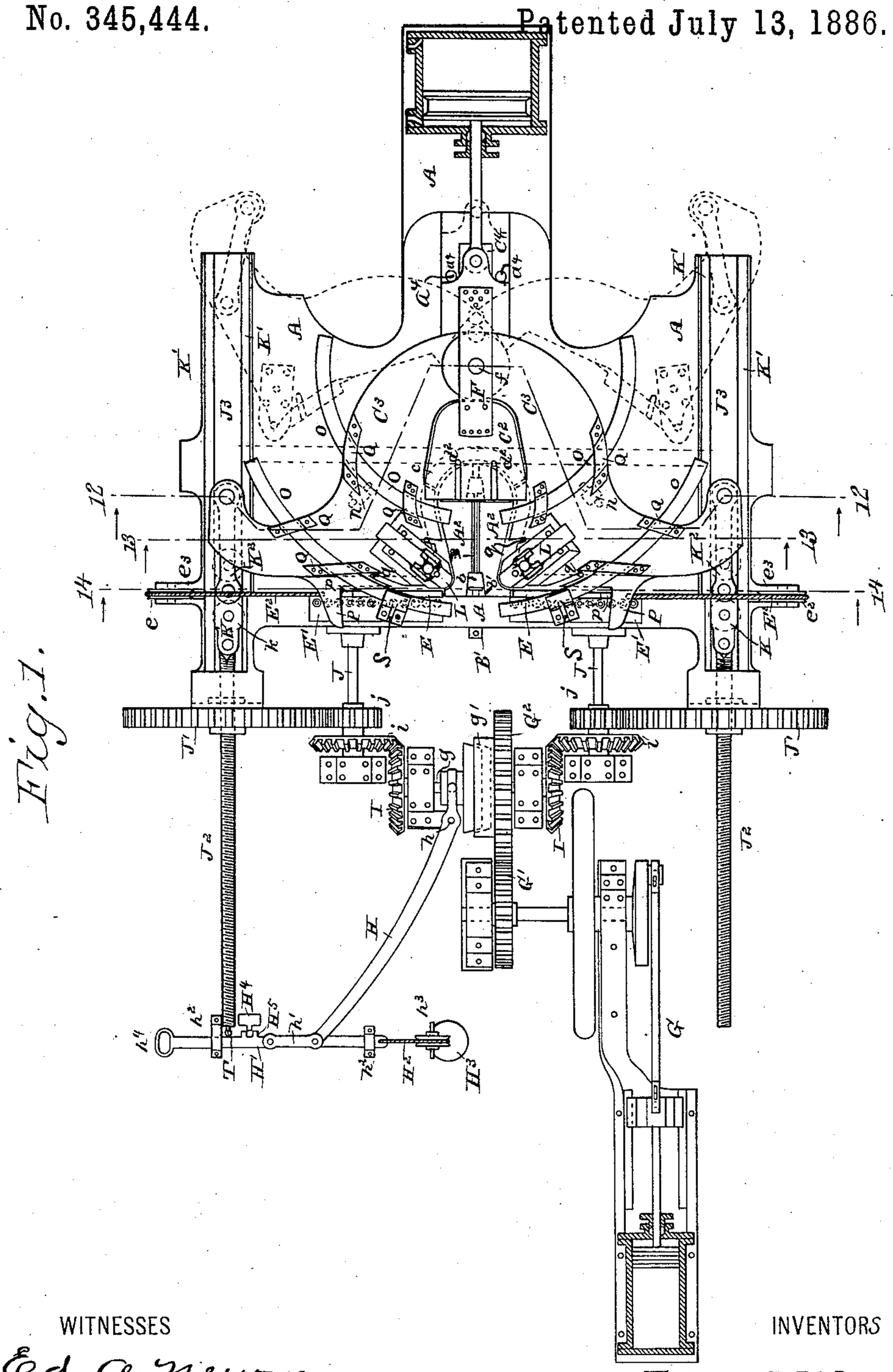

Fig. 1.

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Fig. 2.

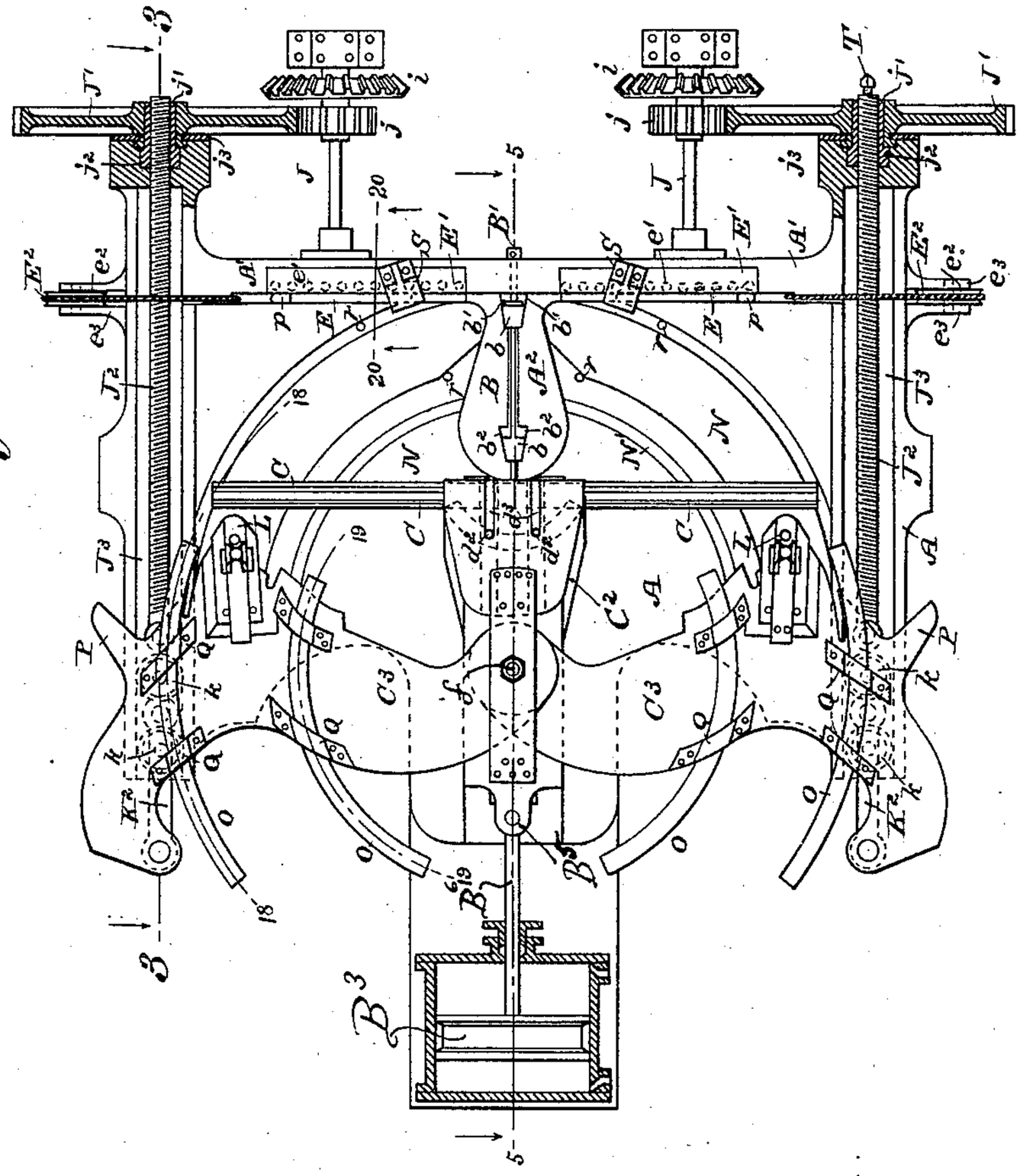

Fig. 6.

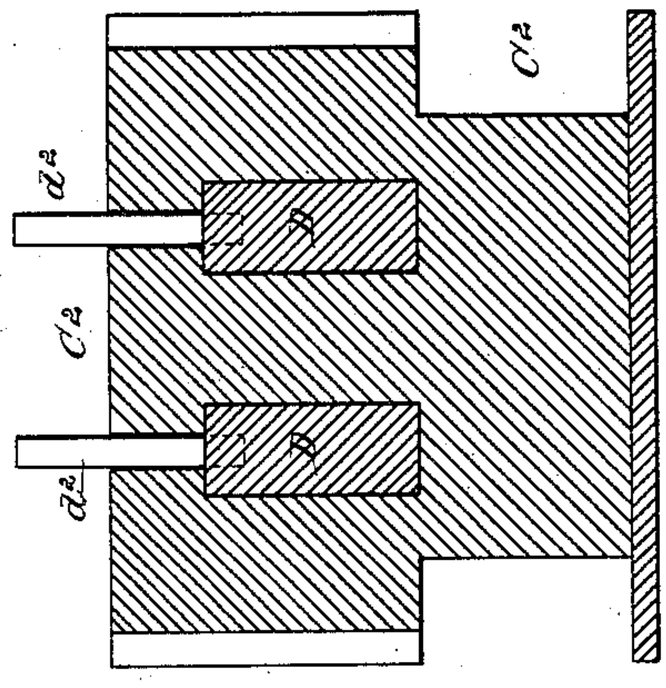

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Fig. 3.

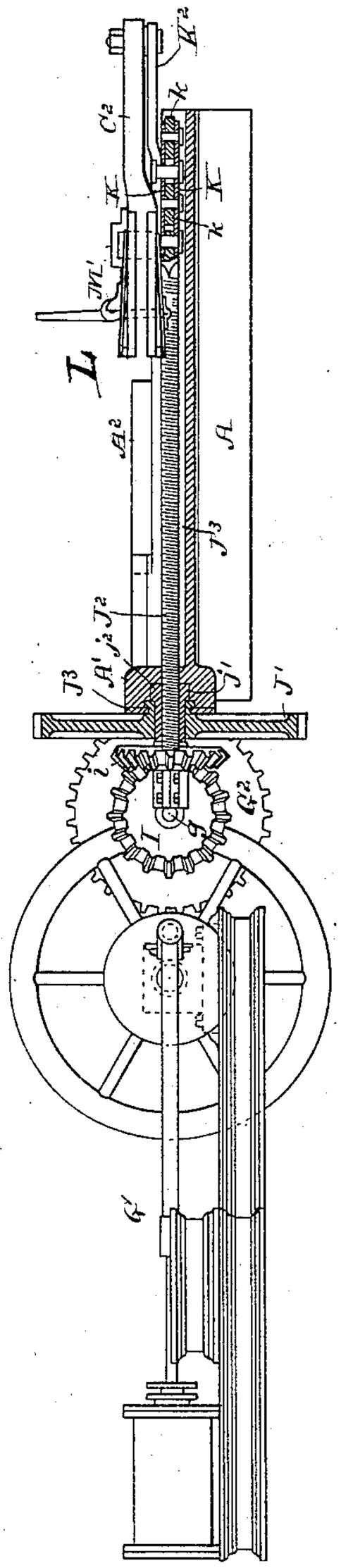

Fig. 4.

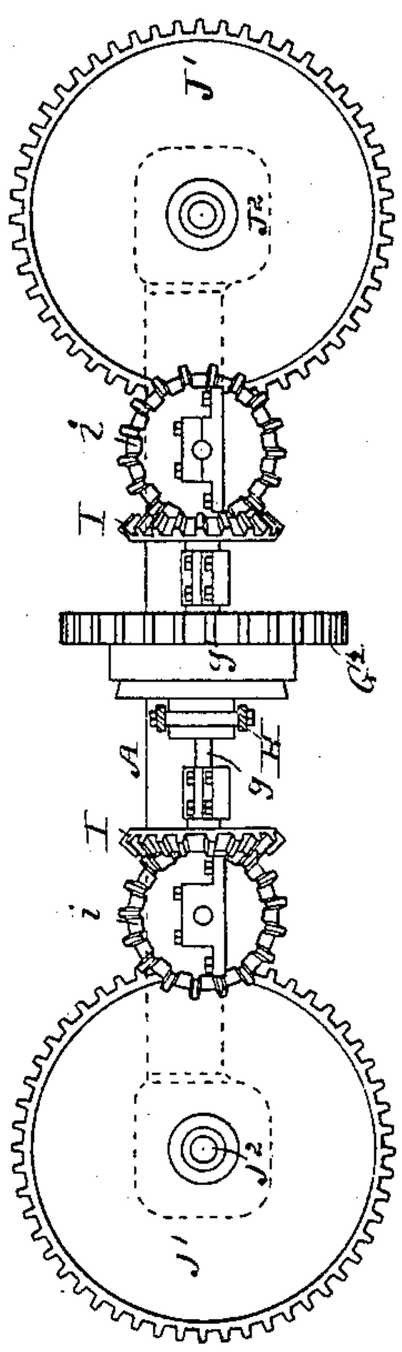

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Fig. 5.

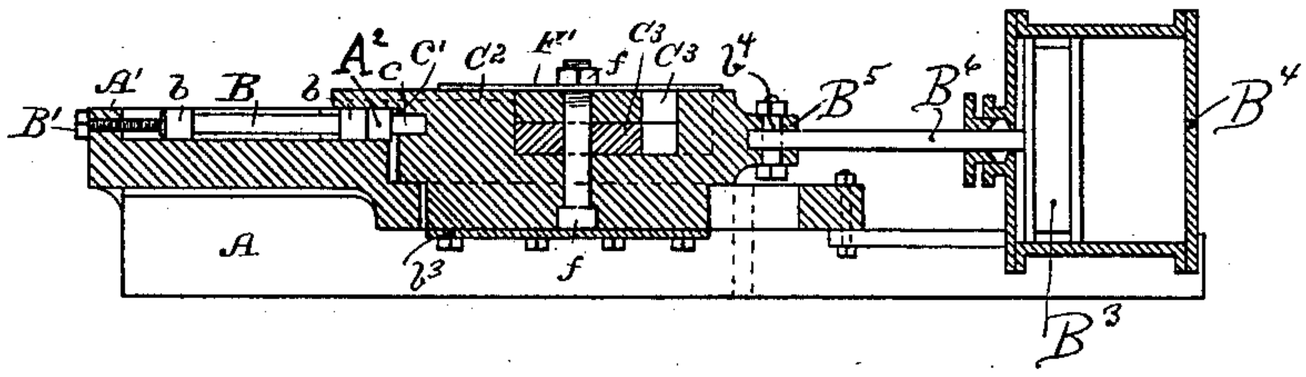

Fig. 21.

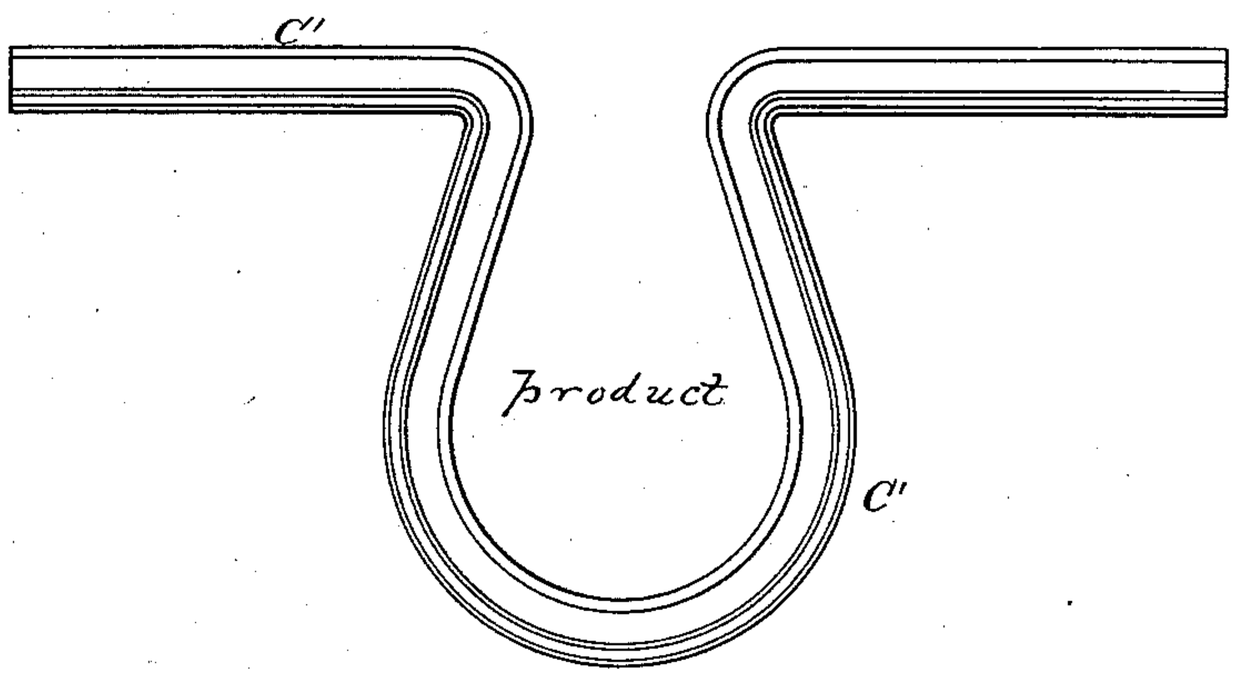

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Fig. 7.

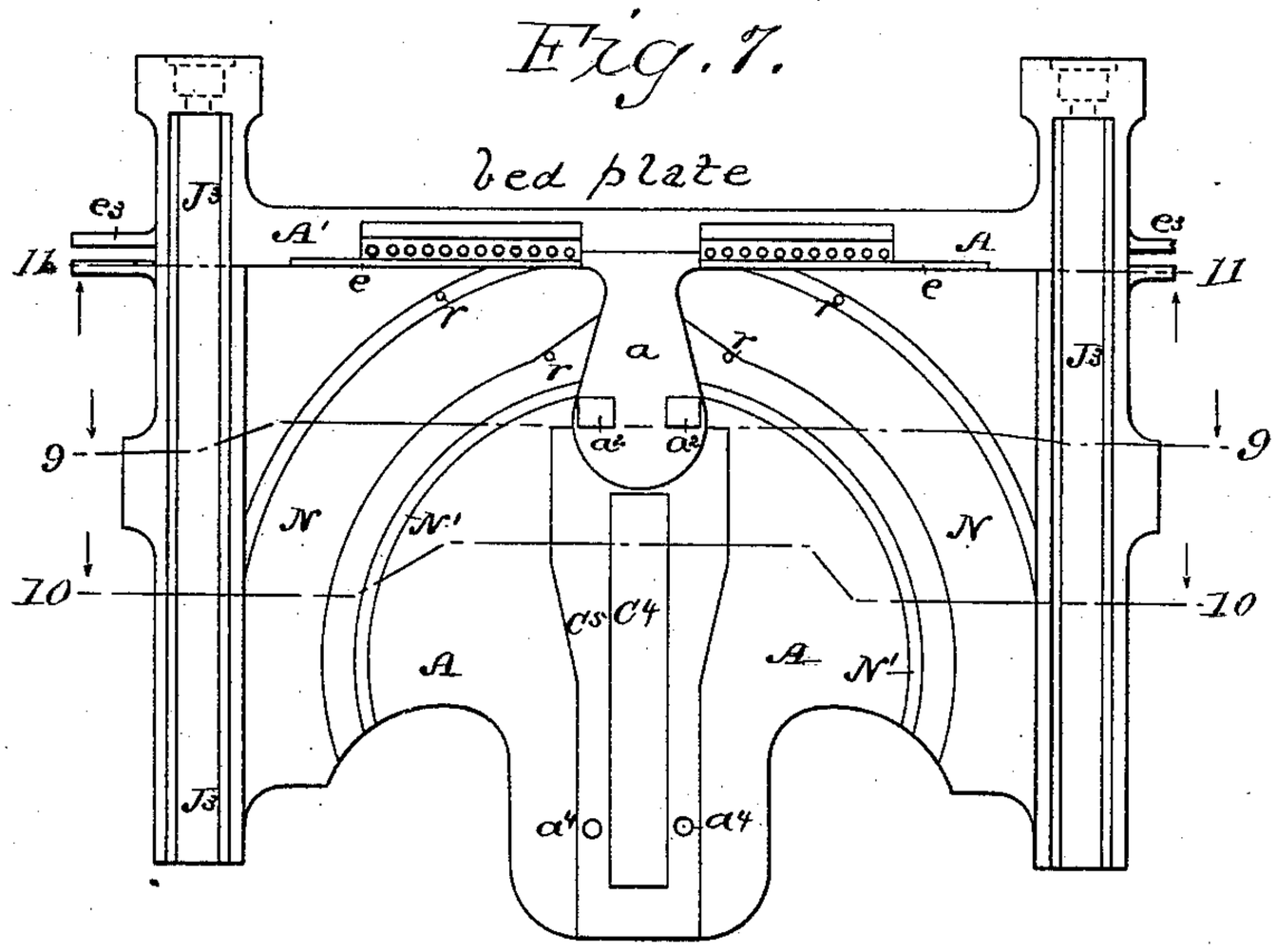

Fig. 8.

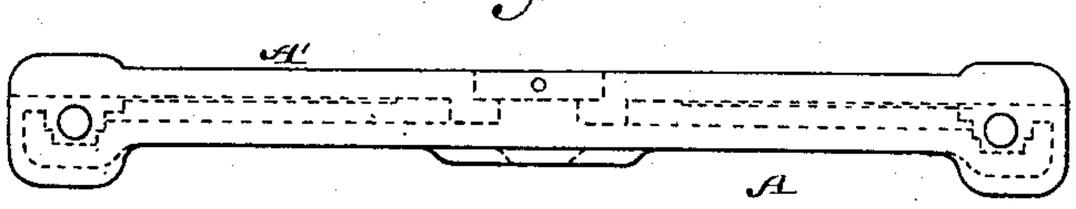

Fig. 9.

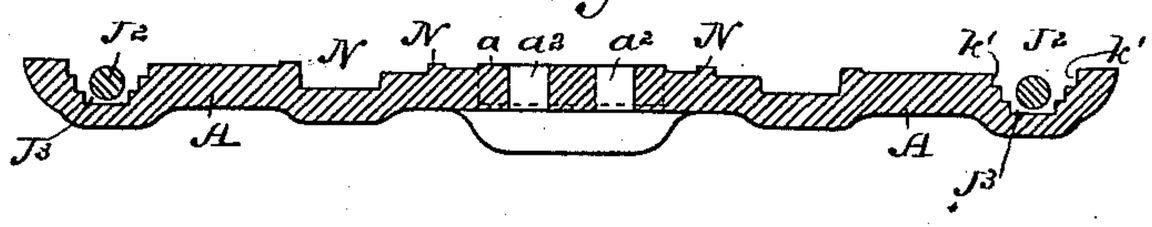

Fig. 10

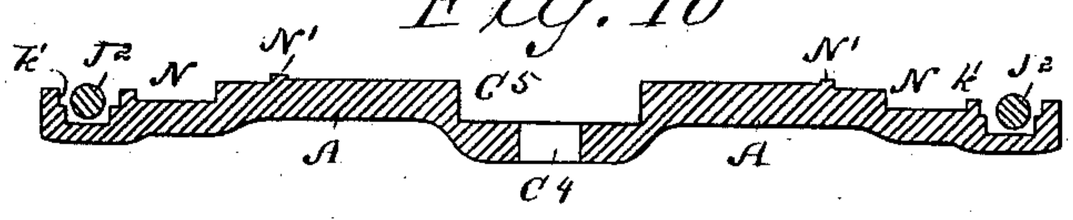

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Fig. 15.

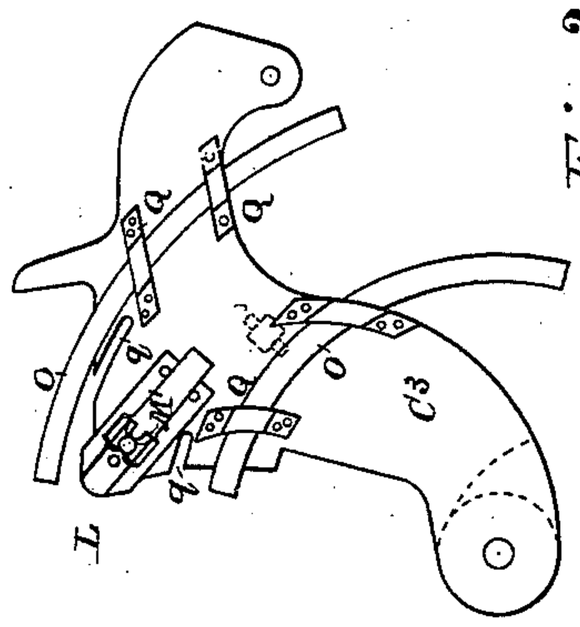

Fig. 14.

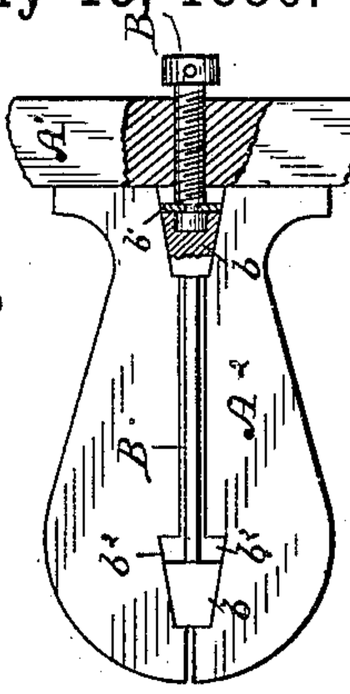

Fig. 11.

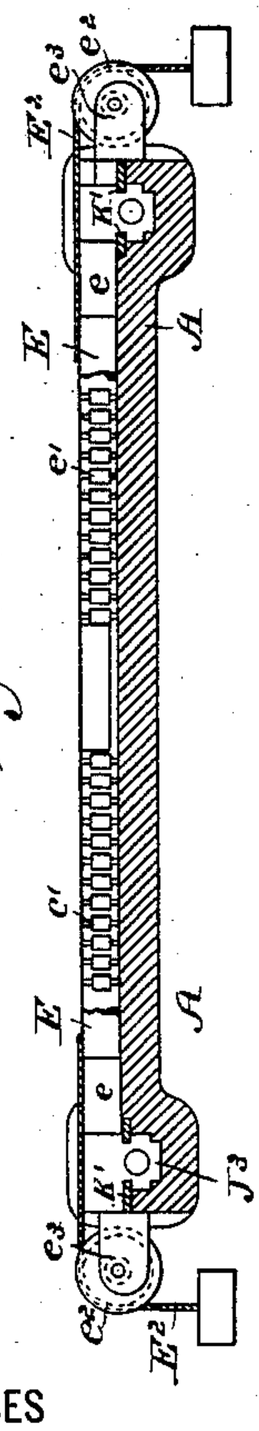

Fig. 12.

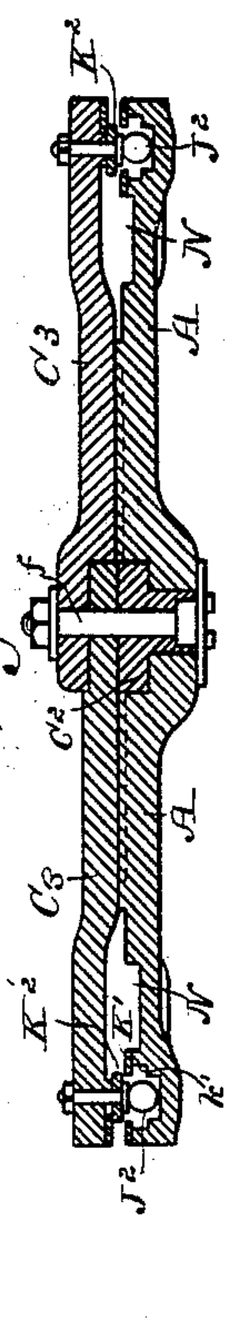

Fig. 13.

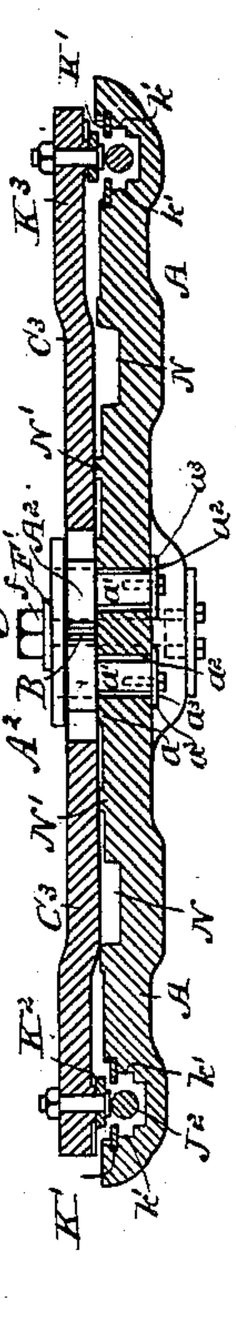

Fig. 14.

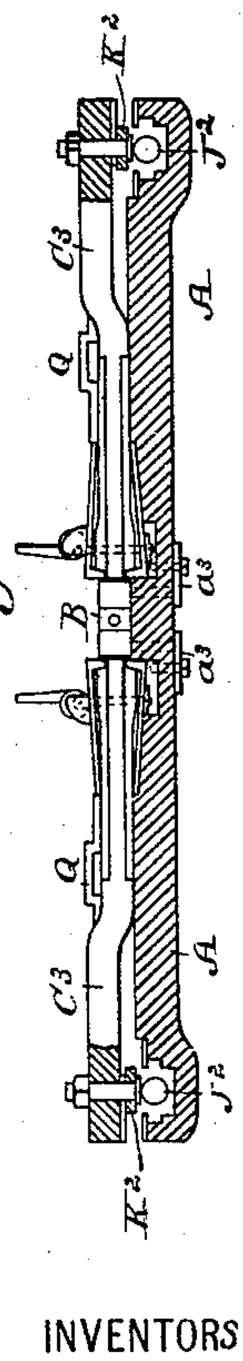

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Fig. 20.

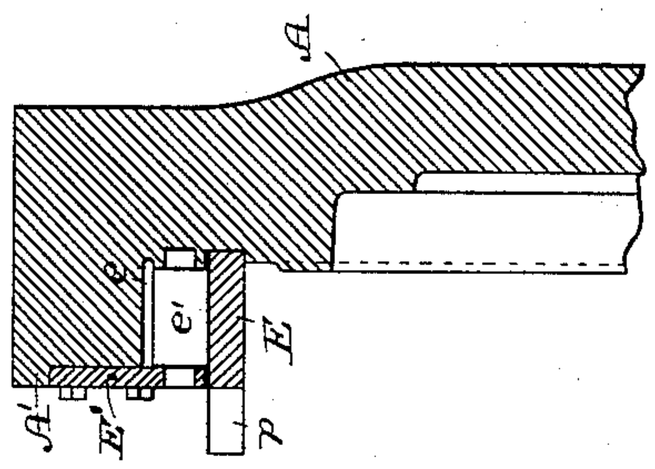


Fig. 19.

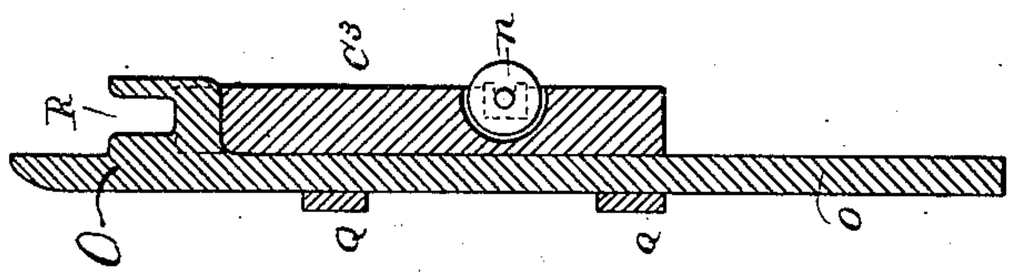


Fig. 18.

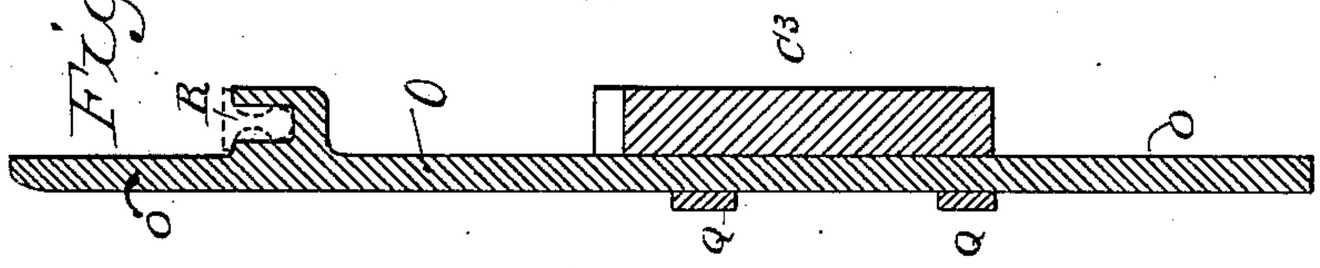


Fig. 17.

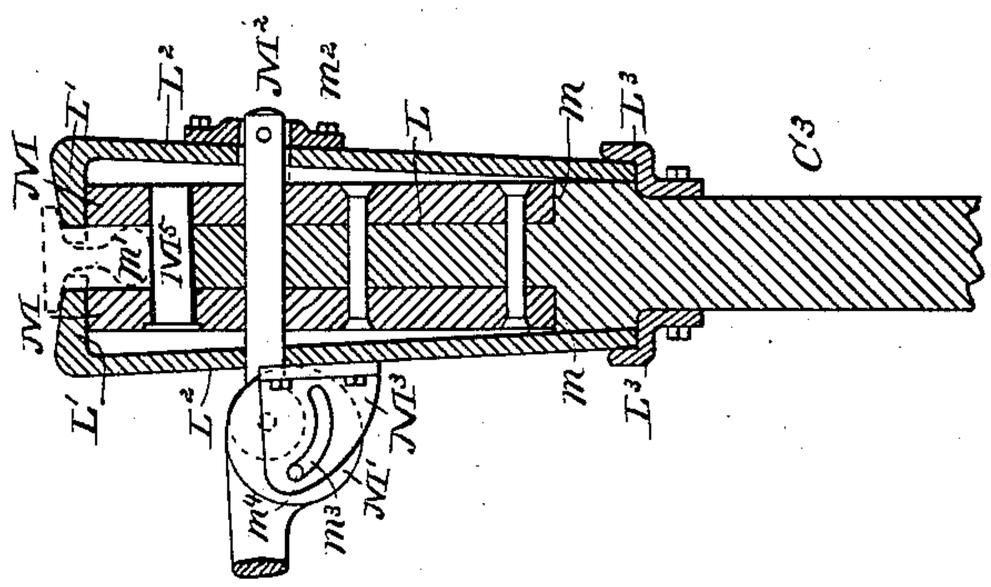
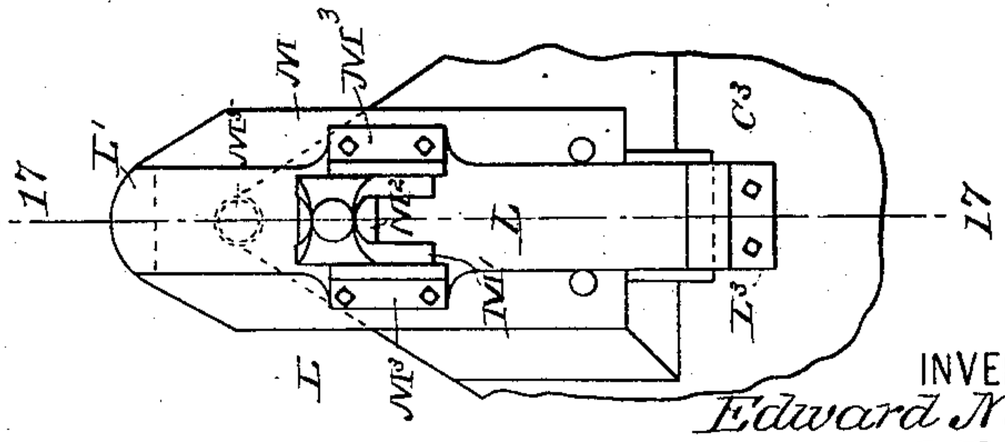


Fig. 16.



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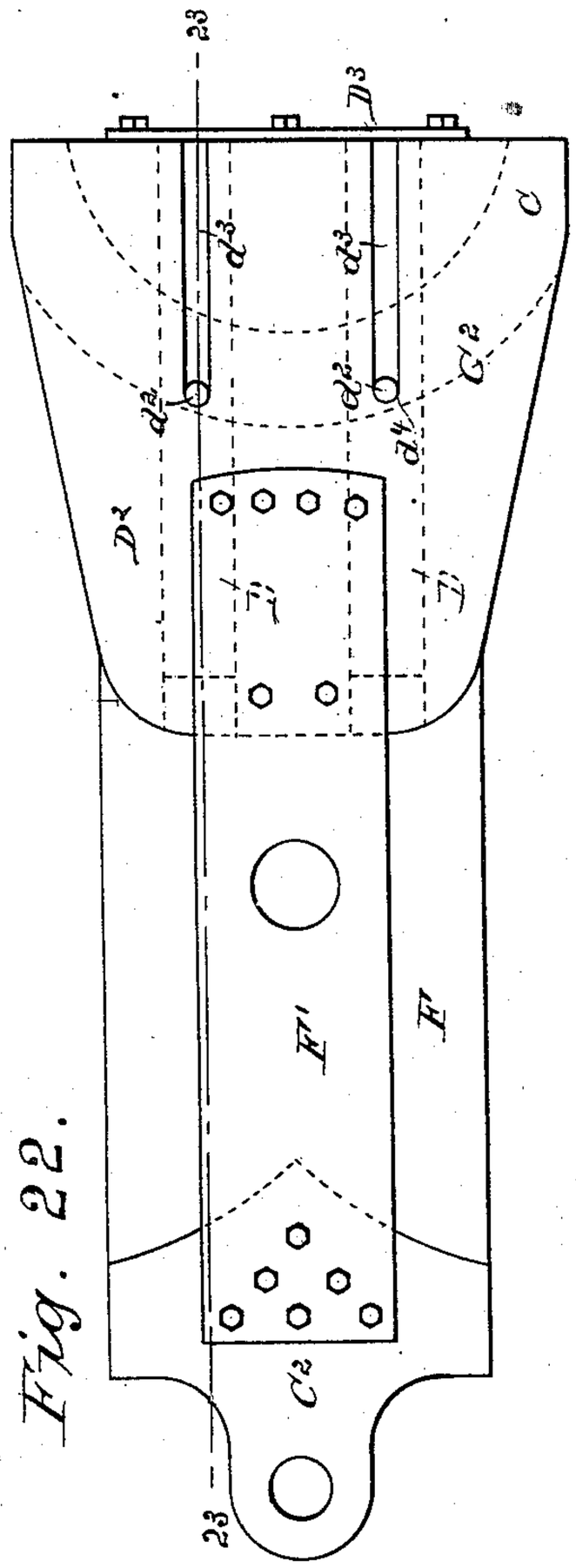

Fig. 22.

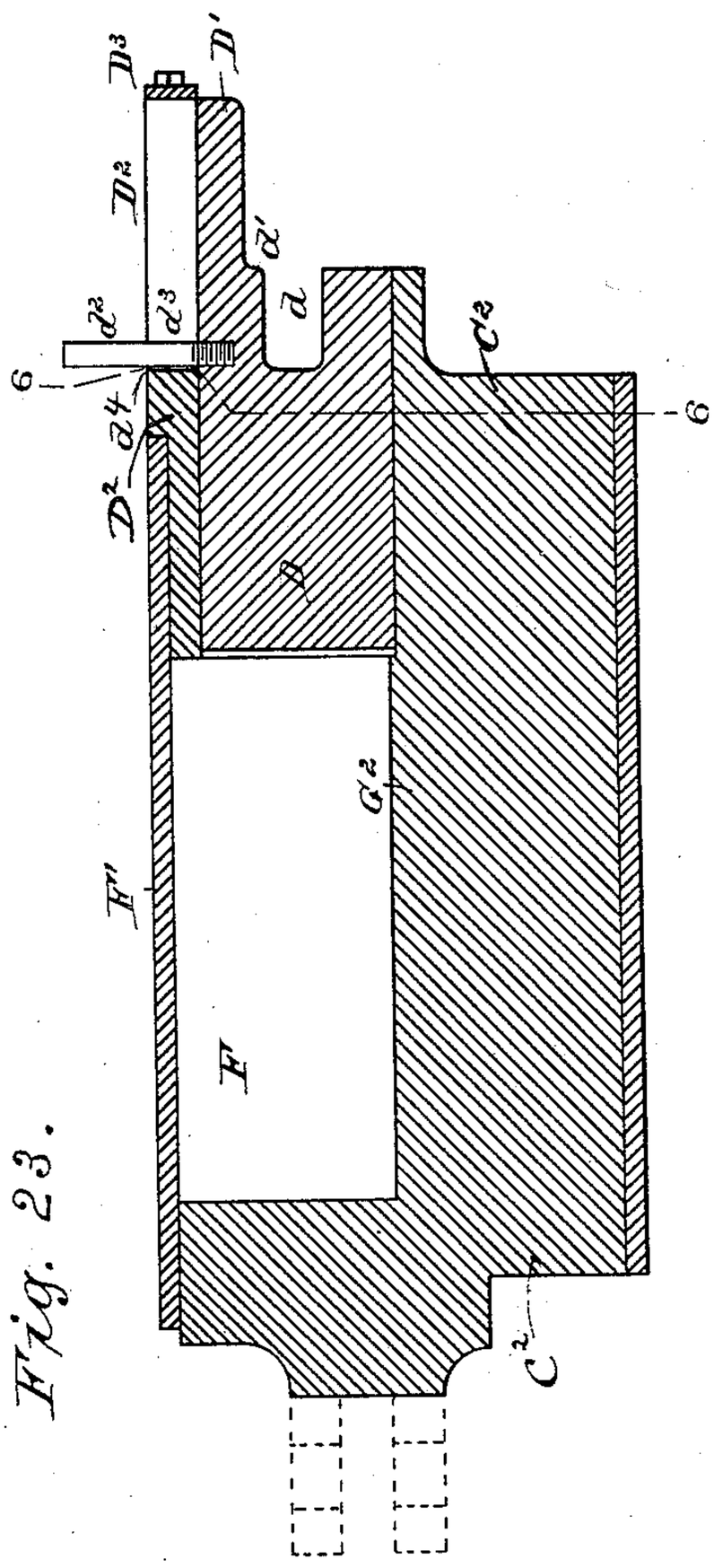

Fig. 23.

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UNITED STATES PATENT OFFICE.

EDWARD NOBLE, JR., OF ST. LOUIS, MISSOURI, AND GEORGE F. BRANHAM, OF INDIANAPOLIS, INDIANA.

METAL-BENDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 345,444, dated July 13, 1886.

Application filed April 20, 1886. Serial No. 199,498. (No model.)

To all whom it may concern:

Be it known that we, EDWARD NOBLE Jr., of the city of St. Louis, in the State of Missouri, and GEORGE F. BRANHAM, of Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Metal-Bending Apparatus, of which the following is a specification.

Our invention relates to metal-bending apparatus especially adapted to the formation from railway-rails of yokes for use in the construction of conduits for endless cables employed in propelling street-cars; and our object is to provide apparatus for this purpose which shall be strong and durable, and efficient in operation.

In the accompanying drawings, Figure 1 is a plan or top view, with some parts in section, showing the mechanism in the position assumed upon the completion of a bending operation, or with the bending-arms closed, these arms being also represented in their open or retracted position by dotted lines. Fig. 2 is a view, partly in plan and partly in section, with portions of the actuating mechanism omitted, showing the bending-arms as retracted. Fig. 3 is a view, partly in side elevation and partly in section, on the line 3 of Figs. 1 and 2. Fig. 4 is an end elevation showing details of the actuating gearing. Fig. 5 is a section on the line 5 of Fig. 2. Fig. 6 is a transverse section of the head-block, on the line 6 of Fig. 23. Fig. 7 is a plan view of the frame or bed plate, and Fig. 8 a front elevation thereof. Figs. 9, 10, and 11 are sections on the lines 9, 10, and 11, respectively, of Fig. 7, the cords, pulleys, weights, and anti-friction rollers for the sliding plates against which the ends of the yoke bear being represented by Fig. 11, with the greater portions of the sliding bearing-plates broken away. Figs. 12, 13, and 14 are sections on the lines 12, 13, and 14, respectively, of Fig. 1, some parts being omitted. Fig. 15 is a plan view of one of the bending-arms. Fig. 16 is a plan view showing an adjustable support for the base of the rail, this support engaging the rail at the bend or knee of a bending-arm, and Fig. 17 is a section on the line 17 of Fig. 16. Figs. 18 and 19 are sections on the lines 18 and 19, respectively, of Fig. 2, showing the preferred construction of the outer and inner sliding rail-engaging arms of the bending-arms. Fig. 20 is a section on the line 20 of Fig. 2, showing the manner of sustaining the sliding plates against the pressure of the yoke ends. Fig. 21 shows one of the yokes. Fig. 22 is a plan view of the head-block. Fig. 23 is a section on the line 23 of Fig. 22, and Fig. 24 shows on an enlarged scale, partly in plan and partly in section, the sectional former and means for spreading it.

The apparatus, as in this instance shown, is adapted to bend lengths of the ordinary T-rail into yokes, such as shown by Fig. 21, but obviously sections of rails of other forms, and metallic bars of different shapes in cross-section may be bent into yokes by slight modification of the apparatus. A strong metallic base-frame or bed-plate, A, is formed with a cross-rib or "fence," A′, at its front end, against which abuts the front end of a longitudinally and centrally divided former, A^2, about which the rail is bent. The two similar sections of the former rest upon a slightly-raised portion or seat, *a*, of the bed-plate, and are provided with lugs a' a', which pass through slots a^2 a^2 of the bed-plate, and have head-plates a^3 a^3 detachably secured to them, to hold the former down to its seat. The lugs a' a' do not fit tightly in their slots in a direction crosswise of the former, the slots being made of proper size to allow of desired movement of the former-sections toward and away from each other, for a purpose further on to be explained. Spreading-wedges *b b* on an endwise-moving rod, B, serve to spread apart the former-sections. These wedges work against the walls of inclined recesses b' b' and b^2 b^2 in the ends of the former-sections next the fence and near their opposite or rounded ends. In order to separate the former-sections or allow them to close together, proper movement is imparted to the spreading-wedges by an adjusting-screw, B′, having swiveling connection with them and passing through and working in a female screw provided in the fence, as will readily be understood by inspection of Fig. 24. A piece of rail, C, of the proper length to form a yoke, C′, is bent about the former by a reciprocating

head-block, C^2, having a concave or curved recess, *c*, at its front end, the radius of curvature somewhat exceeding that of the rear end of the former, and by a pair of vibrating bending-arms, C^3 C^3, reciprocating with the head-block. The curved recess *c* is shouldered at *c'* to constitute a seat for the base of the rail, as will become apparent further on. The head-block C^2 is reciprocated in a suitable guideway, shown as formed by a slot, C^4, in the bed-plate, by means of a properly-actuated connecting-rod, B^5, which in this instance is the piston-rod of the piston B^3, moved back and forth in its cylinder B^4 by steam or by water under pressure in well-known way. The accidental displacement of the head-block by upward movement is prevented by means of a head-plate, b^3, detachably secured to the underside of the head-block. The connecting-rod is jointed to the head-block by a pivot, b^4, passing through the rod and through the lugs B^5 of the head-block. The head-block has shoulders b^5 b^5 at the opposite sides of its lugs, and the bed-plate is provided with holes a^4 a^4, in which pins are placed behind the shoulders of the head-block, when the head-block has been advanced, for a purpose further on to be explained. The head-block is shouldered, as shown, and its reduced bottom portion works in the guideway-slot C^4. A depression, C^5, is provided in the bed-plate, to accommodate the upper widened portion of the head-block. Sliding rail-engaging blocks D D are carried by the head-block in guideway-slots therein, and have curved recesses *d*, shouldered at *d'*, corresponding with the shouldered recess *c c'* of the head-block. Instead of two rail-engaging blocks, one only may be used, and when only one is employed it may obviously be arranged centrally in the head-block, instead of at one side of its longitudinal center, as now shown. Each of the blocks has a forwardly-projecting finger, D', provided with a stop-pin, d^2, working in a slot, d^3, in the corresponding upper portion, D^2, of the head-block. A bar, D^3, secured to the front end of the head-block across the slots d^2, arrests the forward movement of the blocks when their stop-pins come against it. Rearward movement of the blocks is limited by the stop-shoulder d^4, or it may be by the stop-pins. Rearward movement is allowed to the blocks to an extent sufficient to carry them slightly back of the point at which their shouldered recesses would register with the recess of the head-block, and in this way the blocks are relieved of unnecessary strain during the bending operation, as the rail is not allowed to find its bearing against them during this operation. Reciprocating bearing-plates E E, against which the ends of the rail are forced during the formation of a yoke, are supported at the inner side of the fence A' at opposite sides of the former in guideways formed by grooves *e e* of the bed-plate. As the pressure against these bearing-plates is very great, they are provided with anti-friction rollers *e' e'*, against which they bear, so that they may readily slide inward with the ends of the rail which are being forced toward the former and constitute the arms of the yoke. The two series of rollers are received in recesses in the fence and are mounted by their journals in bearings in the bed-plate and in the supporting-plates E E', detachably fastened upon the fence. Cords or chains E^2 E^2, attached at their inner ends to the outer ends of the bearing plates, pass over pulleys e^2 e^2, and are provided with weights E^3 E^3. The pulleys are mounted in bearing-brackets e^3 e^3 of the bed-plate. It will be seen that the cords and weights serve to retract the bearing-plates or move them outward to the limit of their movement after they have been moved inward with the yoke ends and then released by the removal of a completed yoke. The bending-arms C^3 C^3 vibrate about a pivot-bolt, *f*, by which they are strongly jointed to the reciprocating head-block in its recess F. This recess is spanned by the top plate, F', strongly attached at front and rear to the head-block, and the pivot-bolt passes through and is supported at top by this plate. Excepting the slight difference in their inner or pivot ends to adapt them to be secured one above the other, the bending-arms are precisely alike, and their attachments are in all respects similar. As in this instance shown, the bending-arms are vibrated by mechanism such as next to be described. An engine, G, imparts motion by way of its crank-shaft and the gears G' G^2 to a driving-shaft, *g*. The driving-gear G^2 has clutch-connection with the driving-shaft, and the clutch *g'*, by which this shaft is thrown into and out of connection with its gear, is controlled by a shifting-lever, H, forked to engage the clutch-collar and pivotally supported at *h* upon a bracket attached to one of the bearings of the driving-shaft. The supporting frame or portion of the bed-plate to which these bearings and other parts of the actuating mechanism are attached is omitted, illustration and description of it not being required, as any suitable support may be provided for these parts. At its outer end the shifting-lever has connection by a link, *h'*, with a shifter-bar, H', sliding endwise in bearings h^2 h^2, and acted upon by a cord, H^2, and weight H^3, the cord passing over a pulley, h^3, and acting in obvious way upon the sliding shifter-bar. Suitable detent devices for the clutch-shifting mechanism are provided, as follows: A detent-notch or forked lug, H^5, of the shifter-bar, and its engaging detent formed by a lug on the upright H^4, serve to hold the shifter against the force of the weighted cord, with the clutch in position for connecting the driving-shaft and driving-gear. A handle, h^4, enables an attendant to pull the shifter-bar outward against the force of the weighted cord, to throw the driving-shaft into action and to engage the shifter-bar with its detent. The

wide outer bearing, h^2, admits of the necessary sidewise movement of the shifter-bar in its movement toward and away from its detent. Bevel-gears I I, fast on the opposite ends of the driving-shaft, engage corresponding gears, *i i*, on shafts J J, rotating in suitable bearings and having pinions *j j* fast on them. These pinions engage actuating-gears J′ J′ for rotating screw-rods J^2 J^2, which are reciprocated by alternating the direction of rotation of their respective actuating-gears. The screw-rods pass through openings in the front ends of the opposite sides of the bed-plate, and during their reciprocations move in grooves J^3 J^3 at the opposite sides of the bed-plate, by which they are partially inclosed or housed. The hubs of the actuating-gears J′ J′ have their bearings in the solid portions of the bed-plate at the front ends of the housing-grooves. Each of these gears has a female screw in its hub, these screws being provided in headed sleeves *j′ j′*, fitted in the hubs and projecting therefrom at their headed ends, which have bearings in the bed-plate, and abut at their ends against annular shoulders j^2 j^2, formed about the holes through which the screw-rods pass. Annular grooves in the gear-hubs and divided retaining-rings j^3 j^3, secured to the bed-plate and engaging these grooves, prevent outward movement of the gears. At their rear ends the screw-rods have jointed connection with the bending-arms by way of carriages and links. Each of the carriages consist of top and bottom plates, K K, with two rollers, *k k*, mounted between them. The carriages reciprocate in guideways at the opposite sides of the bed-plate, their rollers traveling between shoulders *k′ k′* of the grooves J^3 J^3 and bars K′ K′, secured in place in suitable way, as by screws. The screw-rods are connected to the front ends of their respective carriages, and links K^2 K^2 are pivoted at their opposite ends to the rear ends of the carriages and outer ends of the bending-arms, respectively. The bending-arms are so formed as to give the desired shape to the yokes, and at the angles or knees L L of these arms, where the greatest pressure upon the rail is required for abruptly bending it at the junctures of the arms of the yoke with the central curved portion thereof, adjustable supports L′ L′ are provided for the base or foot of the rail to prevent it from being twisted or otherwise misshaped by the great strain to which it is subjected. These supports L′, as shown by Figs. 16 and 17, are formed by adjustable jaws L^2 L^2, fitted at their inner ends loosely enough to vibrate in sockets L^3 L^3, secured to the bending-arms. At their outer or front ends the jaws are bent, projecting inwardly or toward each other, and bear upon the ends of side plates, M M, riveted to the bending-arm and sustained against thrusting-strain by the shoulders *m m*. A groove or socket, *m′*, to receive the rail is provided at the knee of each bending-arm between the outer ends of its side plates, M. The head and web of the rail project into the socket, while the base is supported against the suitably-shaped outer surfaces of the bent ends of the jaws. The jaws are rendered adjustable, so that their bent ends may be brought against the web of the rail, to adapt them to most effectually support the base of the rail by a lever and eccentric, M′, and a pin or link, M^2, passing through the jaws, the bending-arm, and its plates, and pivotally connected at its opposite ends to the eccentric and the under jaw. A bracket, m^2, on the under jaw receives the pivot-pin, which passes through the lower end of the link, and its upper end is pivoted directly to the eccentric, which is forked to receive it. Brackets M^3 M^3, each provided with a curved slot, m^3, engaged by a pin, m^4, of the eccentric, serve to limit the forward movement of the eccentric-lever, and thus prevent it from getting into a position such as to be broken by coming in contact with the fence. A roller, M^5, at the point of the knee of the bending-arm, and mounted in the side plates, is borne upon the head of the rail in the socket m^2, and in this way friction against the rail is lessened to facilitate the sliding movement of the rail when being bent. The bed-plate is provided with curved recesses, N N, to admit of the proper movement of the under jaws of the rail-supports L′, and is also formed with curved tracks N′ N′, for supporting-rollers *n n* of the bending-arms to travel upon. The bending-arms are provided with curved sliding arms O for holding the rail down to its place, and with lugs P for engaging studs *p* on the reciprocating bearing-plates E, to force these plates inward with the rail ends, as will readily be understood. The studs *p* may obviously be provided with anti-friction rollers. Four sliding arms, O, are shown as provided two for each bending arm, one inside of and the other outside of the knee of the bending-arm. These sliding arms are carried in guides Q, two for each arm secured to the bending-arms, and may be made of plain bars of metal, which, by crossing above the rail, prevent its upward movement, and the sliding arms, represented elsewhere than in Figs 18 and 19, are intended to be of this construction; but by preference both the inner and the outer sliding arms are formed with rail-engaging sockets R, Figs. 18 and 19, instead of being plain-surfaced bars. The ends of the outer sliding arms pass beneath guides S, attached to the fence, when the bending-arms are completing their movement. Each bending-arm is provided with two slots, *q*—one inside and the other outside of its knee—in order that yoke-retaining pins may be inserted in holes *r* in the bed-plate.

The operation of the apparatus is as follows: The head-block and bending-arms being in their retracted positions, and the sections of the former separated by their spreading-wedges, a properly-heated piece of rail is placed in position beneath the fingers of the

sliding rail-engaging blocks and in the recesses of these blocks, and the sliding arms are pushed forward in their guideways, so as to reach across the rail and preferably engage it by their recesses or sockets. The head-block is next set in motion and the screws actuated to move the bending-arms about their pivotal connection with the head-block. The rail is first acted upon by the head-block to bend it at its middle, thus forcing its ends upward until they strike against the bearing-plates. Before the forcible action of the bending arms at their knees upon the rail, the jaws of the rail supports are brought into position by means of the levers and eccentrics. At the completion of the advance movement of the bending-arms the shifter-bar is tripped or disengaged from its detent by one of the screw-rods, a stud, T, in the end of the rod striking the shifter-bar. The cord and weight then slide the shifter-bar, unclutching the driving-shaft and its actuating-gear and stopping the working of the apparatus. At the completion of the advance movement of the head-block pins are inserted in the holes a^4 to guard against the possibility of rearward movement of the head-block during the time the bending-arms are exerting their greatest force upon the rail. To guard against the movement of the bent rail or yoke backward with the bending-arms when they are retracted, and to forcibly clear them from the recesses of the head-block, the rail-engaging blocks, the sliding arms, and the rail-supports, when these parts are retracted, yoke-retaining pins are inserted through the slots q in the bending-arms behind the yoke into the holes r in the bed-plate. To retract the bending-arms, the engine is reversed, and the shifter-bar slid outward by the attendant to start the screw-rods in motion, and the pins having been removed from behind the head-block it is retracted by the action of the steam or the water under pressure upon the front face of the piston by the rod of which the head-block is reciprocated. After retraction of the bending-arms and head-block, removal of the yoke-retaining pins, and actuating the spreading-wedges to allow the former sections to close together to facilitate removal of the yoke, the yoke is removed, another hot piece of rail is placed in position, and the above-described operations repeated.

We claim as of our own invention—

1. The combination of the divided former having the inclined recesses b' b^2, and the wedges, and their connecting-rod, substantially as and for the purpose set forth.

2. The combination of the bed-plate, the divided former having the inclined recesses, and the lugs engaging slots in the bed-plate, the connected spreading-wedges, and their adjusting-screw working through the fence of the bed-plate, substantially as and for the purpose set forth.

3. The combination, substantially as set forth, of the bed-plate, the sectional adjustable former, the reciprocating head-block, and the vibrating bending-arms, for the purpose described.

4. The combination of the bed-plate having the pin-holes a^4 a^4, the reciprocating head-block having the shoulders b^5 b^5, the former, and the bending-arms, substantially as and for the purpose set forth.

5. The combination of the reciprocating head-block and the sliding rail-engaging block or blocks carried by the head-block, substantially as and for the purpose set forth.

6. The combination of the reciprocating head-block, the sliding rail-engaging blocks carried in guideway-slots of the head-block, and having the forwardly-projecting fingers, and the stop-pins working in slots of the head-block, substantially as and for the purpose set forth.

7. The combination of the bed-plate, the former, the reciprocating head-block, the bending-arms, and the reciprocating bearing-plates, substantially as and for the purpose set forth.

8. The combination of the bed-plate having the fence, the former about which the rail is bent, the rollers in recesses of the fence, the bearing-plates, and their guideways and retracting devices, substantially as and for the purpose set forth.

9. The combination, substantially as set forth, of the bed-plate, the sectional adjustable former, the reciprocating head-block, the vibrating bending-arms reciprocating with the head-block, and the mechanism for vibrating the bending-arms, for the purpose described.

10. The combination of the driving-shaft, the driving-gear having clutch-connection therewith, the clutch-shifting mechanism, the detent devices therefor, the bed-plate, the screw-rods, the pivoted bending-arms vibrated by connection with the screw-rods, the actuating-gears of the screw-rods, and gearing connecting these gears with the driving-shaft, substantially as and for the purpose set forth.

11. The combination of the bed-plate, the screw-rods, the bending-arms vibrated by connection with the screw-rods, the actuating-gears of the screw-rods by alternating the direction of rotation of which the screw-rods are reciprocated, the driving-shaft, gearing connecting it with the actuating-gears of the screw-rods, the driving-gear, the clutch connecting it with the driving-shaft, the clutch-shifting lever, and the sliding shifter-bar provided with detent devices and actuated by one of the screw-rods upon the completion of its movement, substantially as and for the purpose set forth.

12. The combination of the bed-plate, the screw-rods reciprocating in grooves at the opposite sides of the bed-plate, the carriages to which the screw-rods are connected, the pivoted bending-arms, and the links connecting them with the carriages, substantially as and for the purpose set forth.

13. A bending-arm constructed substantially as set forth, with the knee and the slots at the opposite sides thereof, for the purpose described.

14. The combination of a bending-arm having the knee and its adjustable supports for the base of the rail, substantially as and for the purpose set forth.

15. The combination of a bending-arm, its adjustable upper and lower jaws having the inwardly-bent outer ends, the link passing through the jaws, and the lever provided with the eccentric, to which and to the under jaw the link is pivotally connected, substantially as and for the purpose set forth.

16. The combination of a bending-arm, its upper and lower adjustable jaws having the inwardly-bent outer ends, the link passing through the jaws and pivotally connected with the under jaw, the lever having the eccentric, to which the link is pivoted, the brackets having the curved slots, and the pin of the eccentric engaging the slots, substantially as and for the purpose set forth.

17. The combination of a bending-arm, the side plates at its knee, and the roller for supporting the head of the rail, substantially as and for the purpose set forth.

18. The combination of the vibrating bending-arms having the lugs P, and the reciprocating bearing-plates having studs acted upon by said lugs, substantially as and for the purpose set forth.

19. The combination of the vibrating bending-arms and the curved sliding arms, substantially as and for the purpose set forth.

20. The combination of the bed-plate having the pin-holes *r*, the former, and the vibrating bending-arms having slots *q*, substantially as and for the purpose set forth.

In testimony whereof we have hereunto subscribed our names.

EDWARD NOBLE, JR.
GEORGE F. BRANHAM.

Witnesses:
S. H. COBB,
E. V. SPRINGER.