No. 677,568. Patented July 2, 1901.

E. F. GIRAUD.

CHAIN MAKING MACHINE.

(Application filed Feb. 12, 1900.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

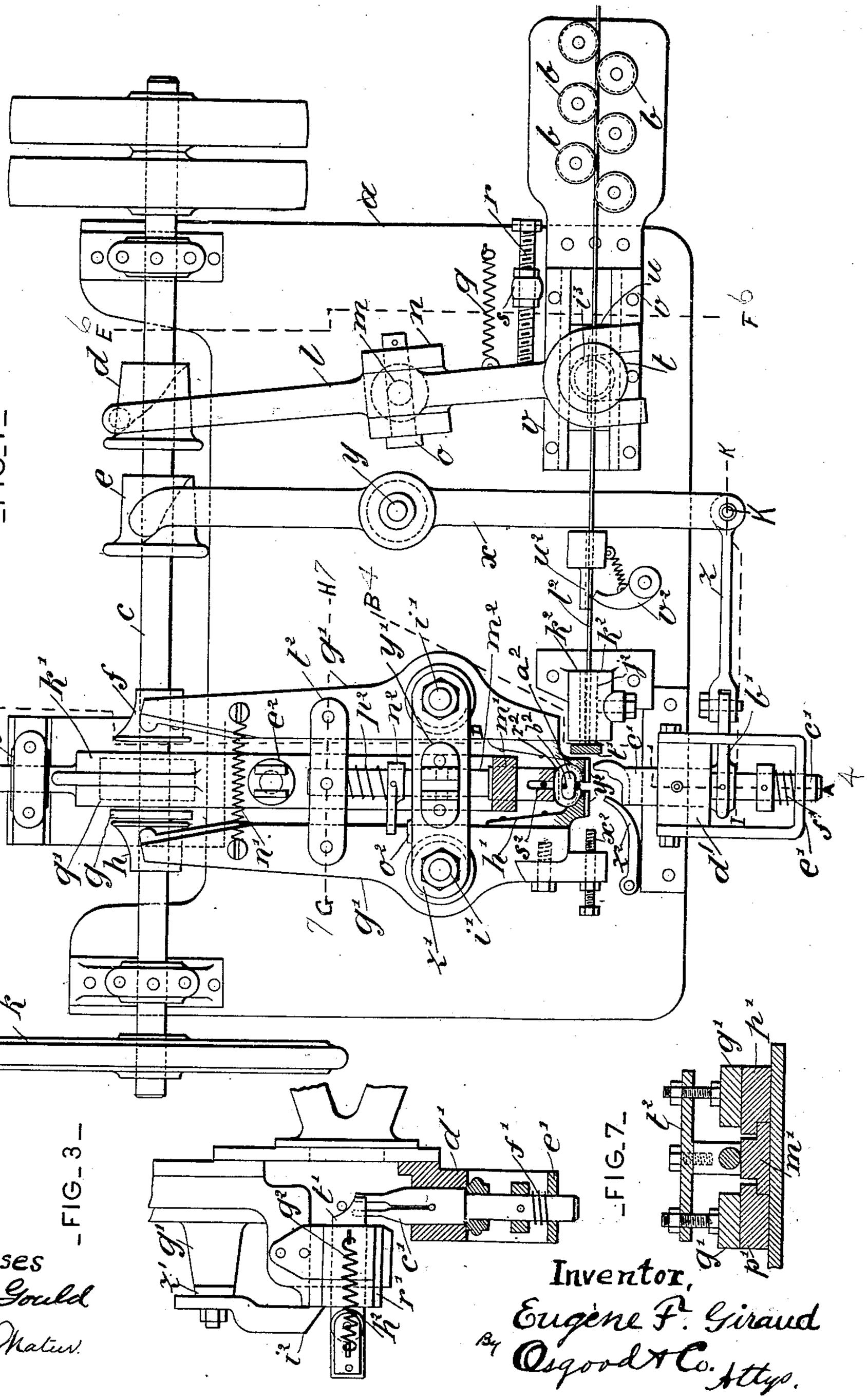

FIG. 3.

FIG. 7.

Witnesses
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(No Model.) 2 Sheets—Sheet 2.

_FIG_2_

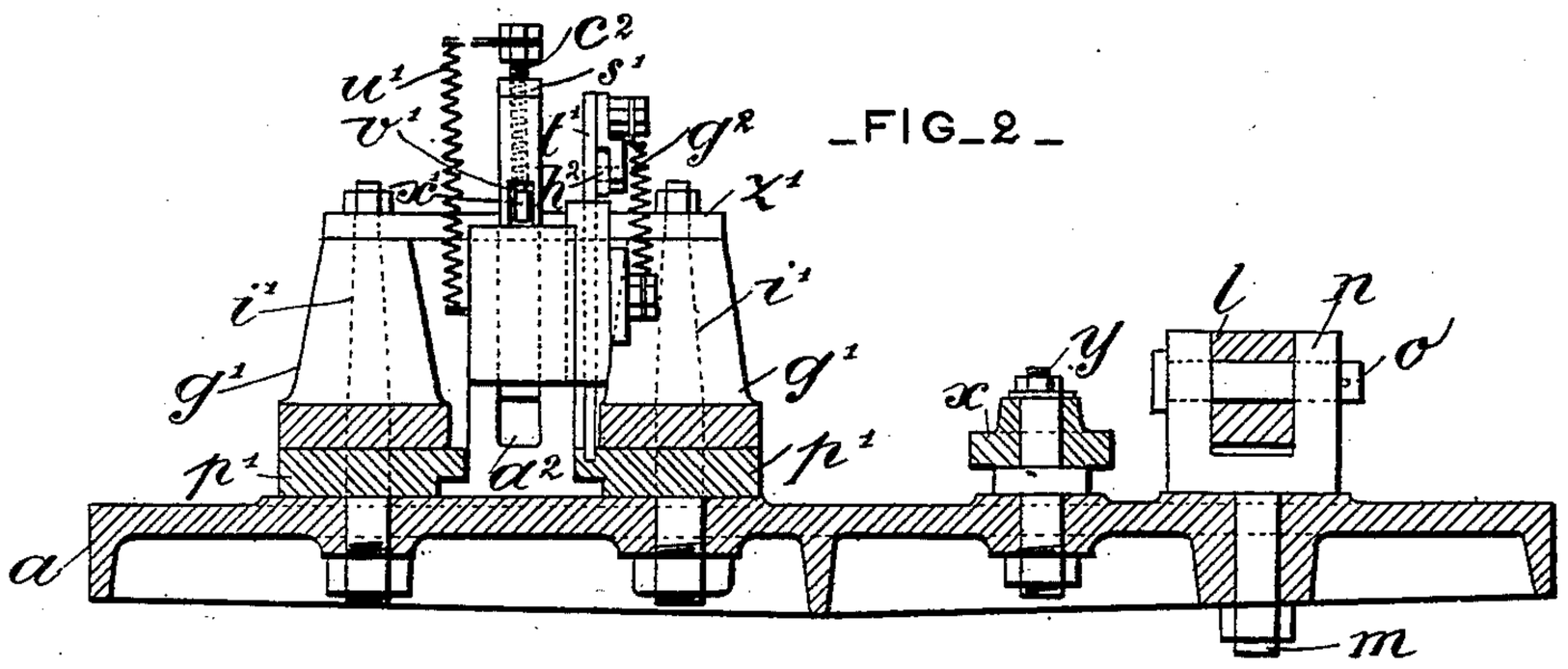


_FIG_4_

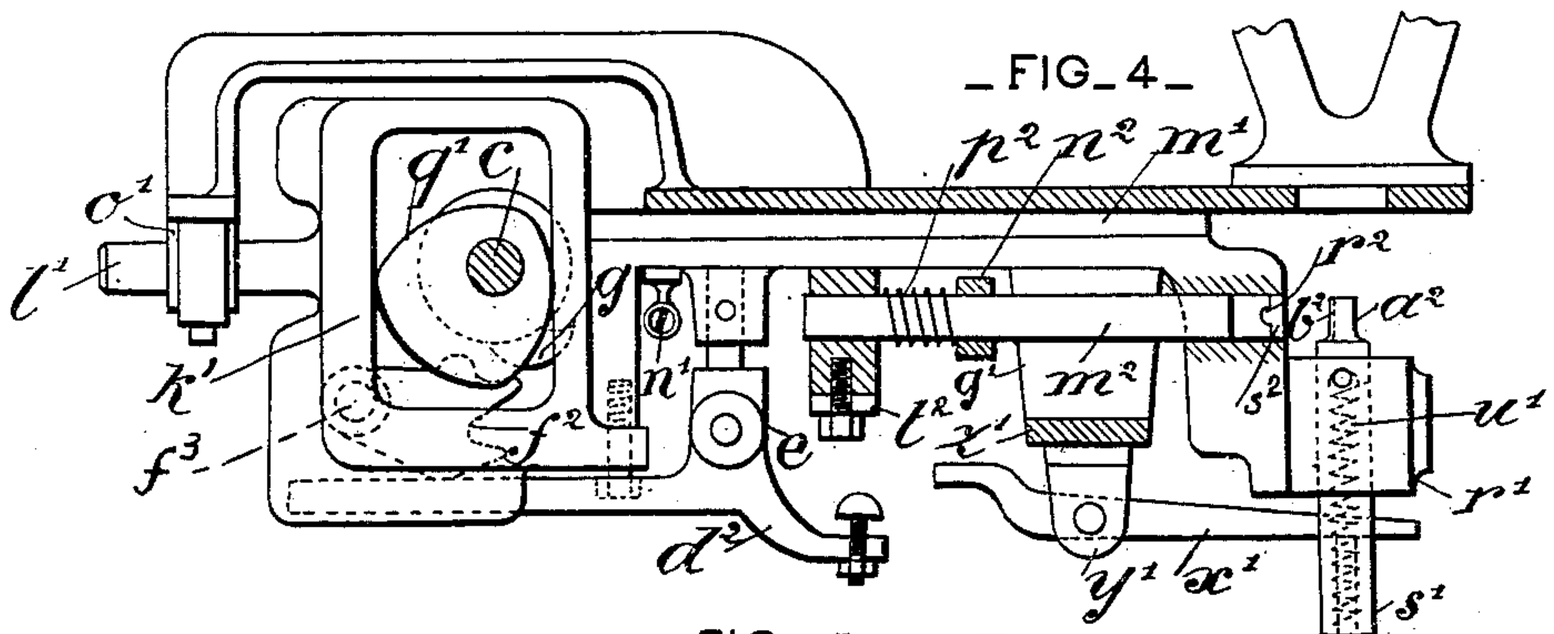


_FIG_5_

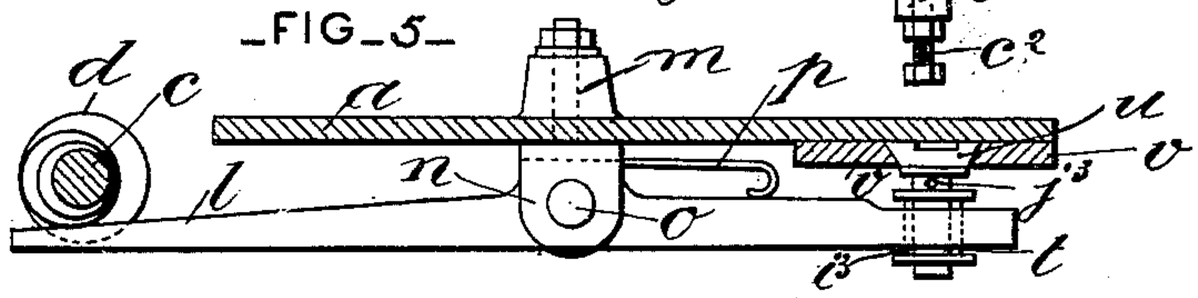


_FIG_6_

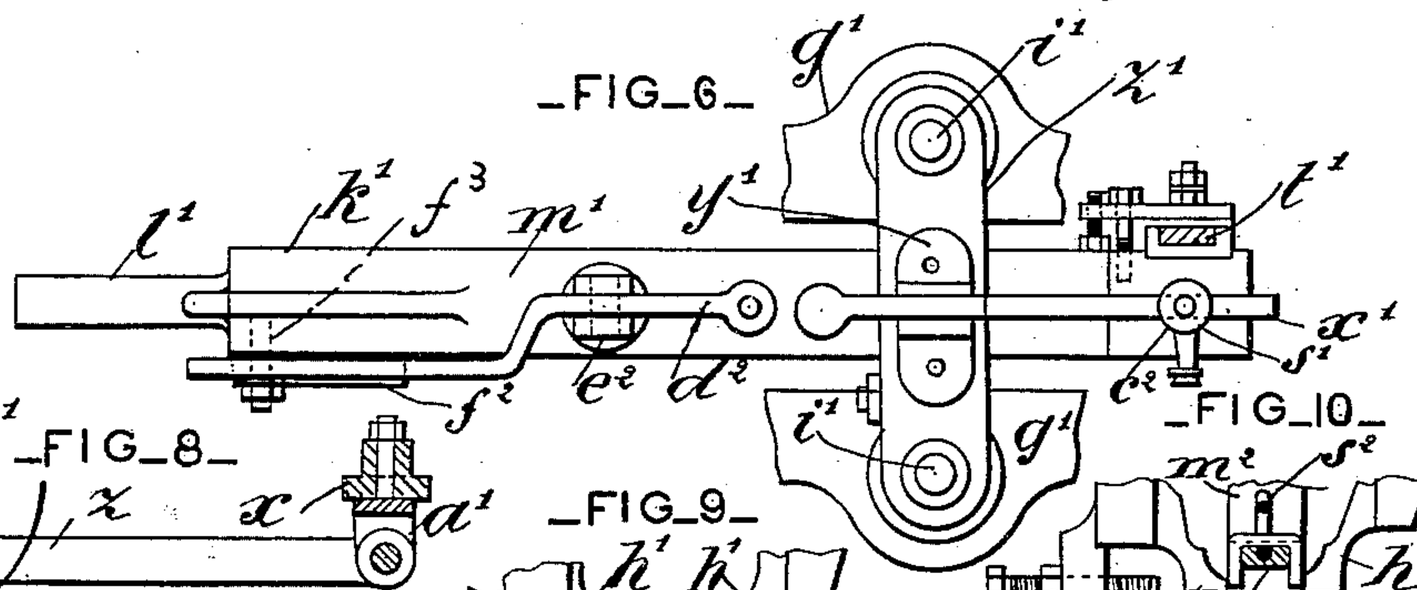


_FIG_8_

_FIG_9_

_FIG_10_

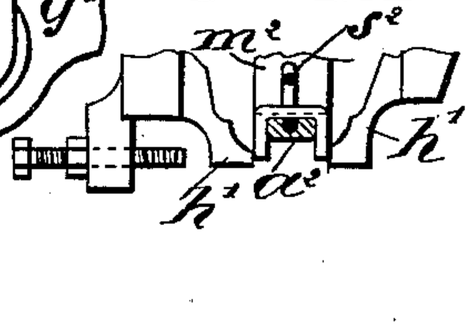
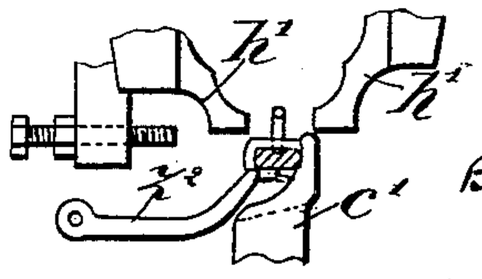


_FIG_11_



Witnesses
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A. H. Matier.

Inventor,
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UNITED STATES PATENT OFFICE.

EUGÈNE FRANÇOIS GIRAUD, OF DOULAINCOURT, FRANCE.

CHAIN-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 677,568, dated July 2, 1901.

Application filed February 12, 1900. Serial No. 4,869. (No model.)

To all whom it may concern:

Be it known that I, EUGÈNE FRANÇOIS GIRAUD, mechanical engineer, a citizen of the Republic of France, residing at Doulaincourt, (Haute-Marne,) France, have invented certain new and useful Improvements in or Relating to Chain-Making Machines, of which the following is a specification.

The present invention relates to a machine for making metallic chains, by means of which the links are made and linked together as the chain is being formed, the work being continuous.

In the accompanying drawings, Figure 1 is a plan view of the machine; Fig. 2, a vertical section. Figs. 3, 4, and 5 are sections of the machine, respectively, on the lines A B, C D, and E F of Fig. 1. Fig. 6 is a partial plan view representing the working of the mandrel. Fig. 7 is a longitudinal section on the line G H of Fig. 1. Fig. 8 is a section on the line I K of Fig. 1. Figs. 9, 10, and 11 represent the link and the different positions of the various parts during the different phases of the work.

a is the frame of the machine and supports the mechanism, of which c is the main shaft, on which at one end are fast and loose pulleys and at the other end is a fly-wheel k. On said shaft c are several cams d, e, f, g, q', and h, fixed to the shaft, so as to rotate with it, said cams being of proper form and location to operate several parts of the mechanism at the proper times. The links of the chain being made are formed from a long wire l^2, which passes between guide-rollers b b, through the wire-feeding device, &c., to the wire-cutting and link-forming devices. The wire-feeding device, operated by cam d, consists of a lever l, adapted to swing horizontally on a stud m of a block n. Lever l is also adapted to swing vertically on pin o, mounted in the same block n. A spring p holds lever l against its cam, and spring q normally holds said lever against the adjustable regulating-screw r in support s. The end of lever l remote from the cam terminates in a fork-like part, between the arms of which is a flanged roller t, with one flange above and one flange below the supporting-lever.

i^3, Fig. 5, is a spindle or pin, on which roller t is loosely mounted. The pin is firmly connected to a slide u, adapted to move in a direct line between guides v v, fixed to frame a. Pin i^3 has a perforation j^3 below the roller and through which wire l^2 passes and from which the wire extends to a fixed guide u^2.

v^2 is a pawl normally drawn against the wire by a spring to prevent reverse movement of the wire, but adapted to yield to allow the wire to advance. From this device the wire is passed through a fixed guide-sleeve j^2, secured in a support k^2 on frame a. As shown in Fig. 1, the wire terminates at the left end of sleeve j^2.

x^2 is an adjustable stop in line with wire l^2, against which the wire will or may abut when advanced to supply wire for the next length to be formed, as shown in Fig. 9.

l' is a cutter movable in its support, and g^2 is a spring which tends to pull it downward. The cutter is located just beyond the sleeve j^2, the cutter sliding when reciprocated with slight friction against the end of said sleeve j^2, the wire thus being cut close to the wire-supporting sleeve.

m' is a slide guided to move straight back and forth by guide-bars p' and by the extension-rod l' in bearing or support o', said movement being given by a suitable cam q' on shaft c, the cam turning in a rectangular frame k', between parts m' and l' and rigid therewith. Slide m' has at its forward end a head r', extending at right angles from the body of the slide and terminating in a part projecting parallel with said body, through which passes vertically a mandrel s' and the cutter t', at a suitable distance from and parallel to each other. Mandrel s', which is constantly urged downward by spring u', is provided with a slot v', Fig. 2, in which is arranged an end of lever x', pivoted in a bracket y' on the fixed cross-bar z', which connects the pivots of the levers g'. The lower end of the mandrel has a point a^2, the section of which corresponds to the inside of a link. On one side of this point is a groove b^2, Figs. 4 and 9, which serves to receive a side of the last link before the one being made. The upper end of the mandrel is provided with a regulating-screw c^2, which presses against the end of lever x', Figs. 2, 4, and 6, the other end of which lever comes at intervals under

the end of a double lever d^2, which is pivoted on a block e^2 on slide m' and is actuated by cam g by means of an intermediate swinging arm f^2, pivoted at f^3 to frame k', Figs. 4 and 6.

The cutter has secured to it near its upper end a roller h^2, Fig. 3, in front of which is a stationary inclined side of a cutter-raising device i^2, fixed to cross-bar z'.

m^2 is a spring-operated rod supported in projections of the slide.

n^2 is a stop-finger fixed on the rod and pressed toward a fixed stop o^2 by a spring p^2.

The end of rod m^2 near the link-wire is provided with two link-wire-receiving grooves, one, r^2, Fig. 4, horizontal, and the other, s^2, vertical, Fig. 1. A cross-bar l^2 is fixed on slide m' and has at its ends adjustable bolts, the heads of which bear with small friction on the tops of levers g' to prevent vertical movement of the levers. Levers g' are pivoted at i' in frame a so as to swing horizontally, and each lever has a link-forming jaw h', having on its forward end a groove y^2, adapted to admit wire l^2 when the latter is advanced. Jaws h' have on their rear sides link-shaping grooves, which form the link, as shown in Fig. 1. Levers g' on the opposite side of the pivots terminate in coöperative relation with two like cams f h of suitable shape and location on the shaft to swing arm g' at the proper time and to the necessary extent. Spring n' holds the arms against the cams, but yields when the cams operate to swing the levers.

c' in Figs. 1 and 3 is a gripper normally held in a fixed support d' and stirrup e', being pressed forward by spring f'. The rod or body of the gripper at the end adjacent to the cutter and the link-forming devices is slit, forming two spring-arms, adapted to receive between them a side of the last-formed link when the link is forced into the slit. Secured to the gripper is an arm b', pivoted to a link z, which is pivoted at K to lever x, pivoted at y and terminating adjacent to cam e.

The operation is as follows: The wire is inserted as above described. The shaft C turns all the cams thereon. Cam d swings lever l vertically, carrying roller i^3 against the wire with sufficient force to prevent slipping on the wire, except as described below. The same cam swings lever l horizontally to advance the wire a distance equal to the length of wire in one link, the parts in advance of sleeve j^2 leaving a free path for the wire. If owing to slight maladjustment lever l tends to advance the wire too far, its forward end will strike screw x^2, arresting the wire, when the clamping-roller may slip slightly on the wire. The forward end of the advanced wire passes into grooves y^2 of the jaws h', and slide m' is moved back by cam q', and the cutter cuts the wire. Slide m' continuing to move, roller h^2 rides up the inclined end of part i^2, raising the cutter against tension of its spring and moving the cutter back, so that it will not interfere with the operation of jaws h'. This last movement of the slide moves the mandrel c, carried thereby, to a point such that when lowered it will be on the opposite side of the link-blank from jaws h', as shown in Fig. 9. Slide m' when in its forward position carries the mandrel a^2 beyond the line of wire l^2. When slide m' is retracted by its cam q', it carries the central part of the cut-off portion of link-wire with it, the ends of the wire being held back by the jaws, thus bending the wire as shown in Fig. 10, after which levers g' are moved by their cams f h, bending the ends of the wire together, as seen in Fig. 1. The jaws are then separated and the slide advanced so as to carry the link just formed into the gripper. Spring f' of the latter gives way until one side of the link is placed under the finger z^2, fixed on the frame, Fig. 11. The mandrel is then raised out of the link in consequence of the combined action of levers x' and d^2 of the pivoted arm f^2 and of the cam g. The finger z^2, which is above the link, prevents the mandrel from carrying the link with it as it rises. As soon as the link is free of the mandrel the spring f' expands and pushes the gripper back into its normal position, into which it can pass, together with the link which has become free from the finger z^2, owing to the forward movement of the gripper through a quarter-turn, effected by the cam e, the lever x, rod z, and lever b' turning in the direction indicated by arrow a^3, Fig. 8. In consequence of this quarter-turn the opening of the link is placed so as to be in line with the central passage of socket j^2 in such manner that as the feeding device moves forward the fresh supply of wire for the next link the wire will pass through the link which has just been formed. The mandrel s' now descends, and in its vertical groove b^2 receives the corresponding outer part of the finished link. The slide recedes again, the knife cuts the wire, and the mandrel bends it in the shape of a **U**, as described above. The link previously formed becomes engaged during this part of the work in the vertical groove s^2 of the rod m^2. The work proceeds as before. With every turn of the cam-shaft c a new link is formed and connected with the previously-made link. The ends of the links may be welded by electric or other means.

What I claim is—

1. In a chain-making machine the combination of a slide m' perpendicularly arranged in relation to the movement of the wire from which the chain is being made, a mandrel and a cutter both vertically movable and supported in a projecting head of the slide, two jaws mounted on levers pivoted so that each jaw terminates adjacent to the line of movement of said wire beyond the cutter and capable of oscillating in a horizontal plane, a rod m^2 having a groove in its outer end to receive the link-wire, a gripper for the formed link, means for giving the gripper a quarter-turn, whereby the formed link is held and given a quarter-turn before it is released so that when

the wire is advanced it will pass through the link thus formed, linking the next link with it.

2. In a chain-making machine the combination of a slide m', a mandrel and a cutter both vertically movable and supported in a projecting head of the slide, two jaws mounted on levers pivoted so that each jaw terminates adjacent to the line of movement of said wire beyond the cutter and capable of oscillating, a rod m^2 having a groove in its outer end to receive the link-wire on the near side of the mandrel, a gripper for the formed link, means for giving the gripper a quarter-turn before the link-forming wire is again advanced, and an adjustable stop x^2 in line with said wire to exactly limit the feed of the wire.

3. In a machine for making chains the combination of a mandrel the point of which has the shape of the inside of the links of the chain, a movable slide supporting the mandrel, means for actuating the mandrel, comprising a cam q', said slide, a cam g, an intermediate pivoted lever f^2, levers d^2 and x', and a spring u' normally holding said end a^2 in operative position, two link-forming jaws h', means for moving the jaws to bend the wire around the mandrel, a gripper c' adapted to seize the link just formed, and means for giving the gripper holding the link a quarter-turn.

4. In a machine for making chains the combination of a fixed socket j^2, means for feeding wire therethrough, link-forming jaws, slide m', means for moving the slide, a cutter, a roller h^2 on the cutter, an inclined plane i^2 in position to enter in advance of the roller when the slide is advanced for raising the cutter after the wire has been cut to leave a free space for movement of the link-forming jaws.

5. In a machine for making chains the combination of means for feeding a wire, means including a cutter for cutting the wire, a mandrel, means for bending the wire around said mandrel, a rod m^2, a stop n^2, a spring p^2 pressing against the stop, whereby said rod m^2 can yield allowing the shaping-jaws to close the link around the outer side of the mandrel, a slide carrying the mandrel, cutter, rod m^2, stop n^2 and the spring p^2, and means for reciprocating the slide.

6. In a machine for making chains the combination of a frame a, a driven shaft c, lever l, a horizontal pivot and a vertical pivot therefor, cam d on shaft c formed to move lever l in a vertical plane and then to swing said lever horizontally, means at one end of lever l operated by the vertical movement of lever l to clutch the link-forming wire, means for returning lever l to its original position, means for preventing the wire being retracted by such return movement, a support for the end of the wire to be cut, cutter t', slide m', means for moving the slide, means controlled by movement of slide m' for reciprocating the cutter, slide m' having a head r' forming a guide for the cutter, a mandrel s' parallel with the cutter and guided in said head r', the mandrel having an end a^2 the transverse cross-section of which is of the shape of the inside of the link to be formed, there being a longitudinal groove b^2 in one side of said end adapted to receive one side of the preceding link, lever x', lever d^2 pivoted on slide m', one end of lever x' engaging the mandrel, the other end being in the path of movement of lever d^2 at intervals, cam g for moving lever d^2 to retract the mandrel, pivoted levers g', g' having jaws h', and cams on shaft c to swing levers g', g' on their pivots.

Signed at Paris, France, this 26th day of January, 1900.

EUGÈNE FRANÇOIS GIRAUD.

Witnesses:
EDWARD P. MACLEAN,
GEORGE E. LIGHT.