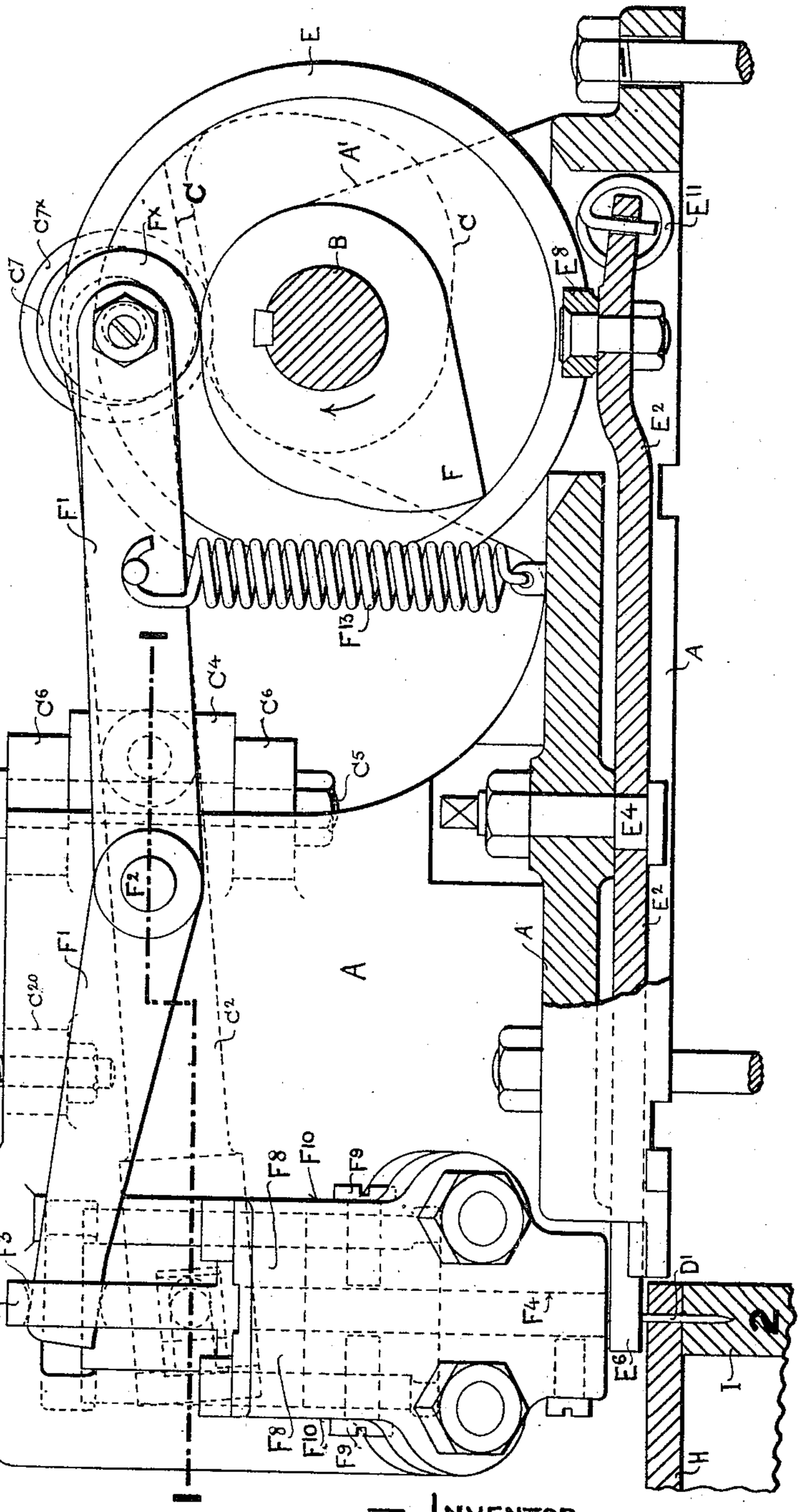
(No Model.) 5 Sheets—Sheet 1.

# H. CAMPBELL.

## WIRE NAIL AND MACHINE FOR MAKING THE SAME.

No. 450,990. Patented Apr. 21, 1891.

FIG. 1.

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# H. CAMPBELL.

## WIRE NAIL AND MACHINE FOR MAKING THE SAME.

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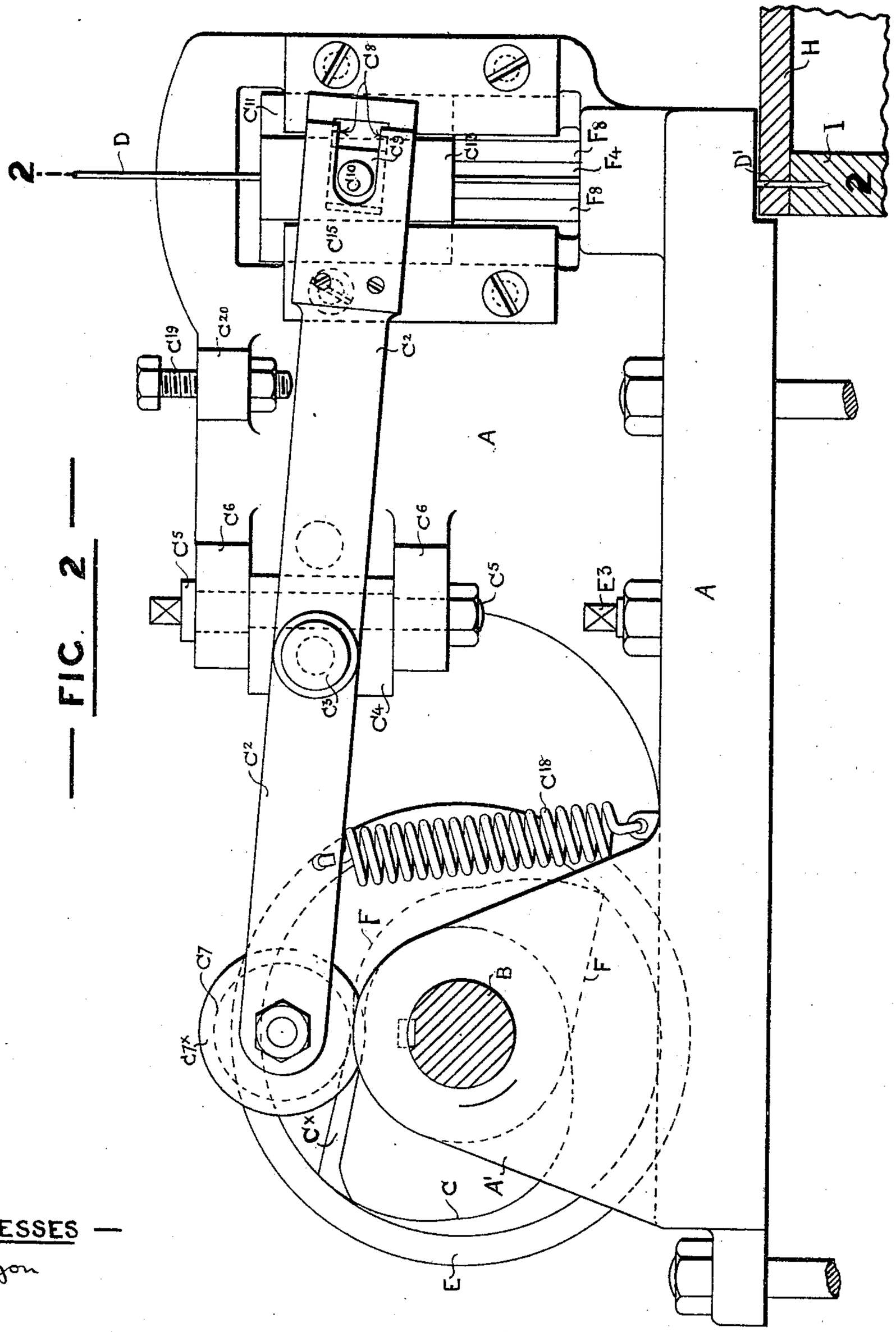


FIG. 2.

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## WIRE NAIL AND MACHINE FOR MAKING THE SAME.

No. 450,990. Patented Apr. 21, 1891.

FIG 3

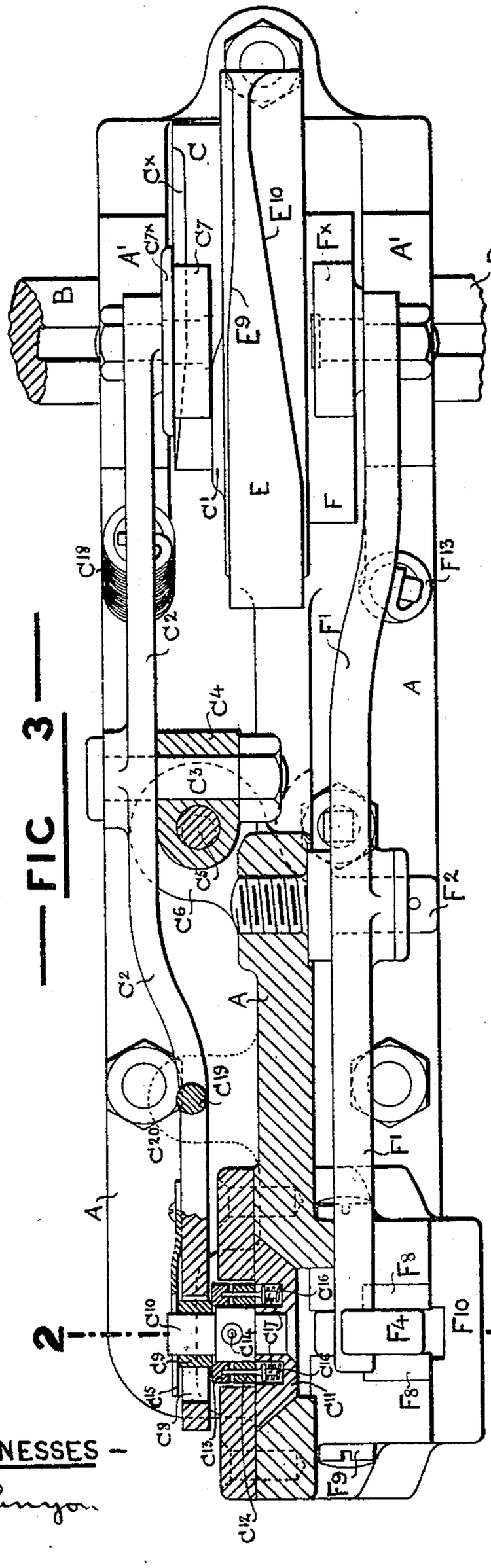
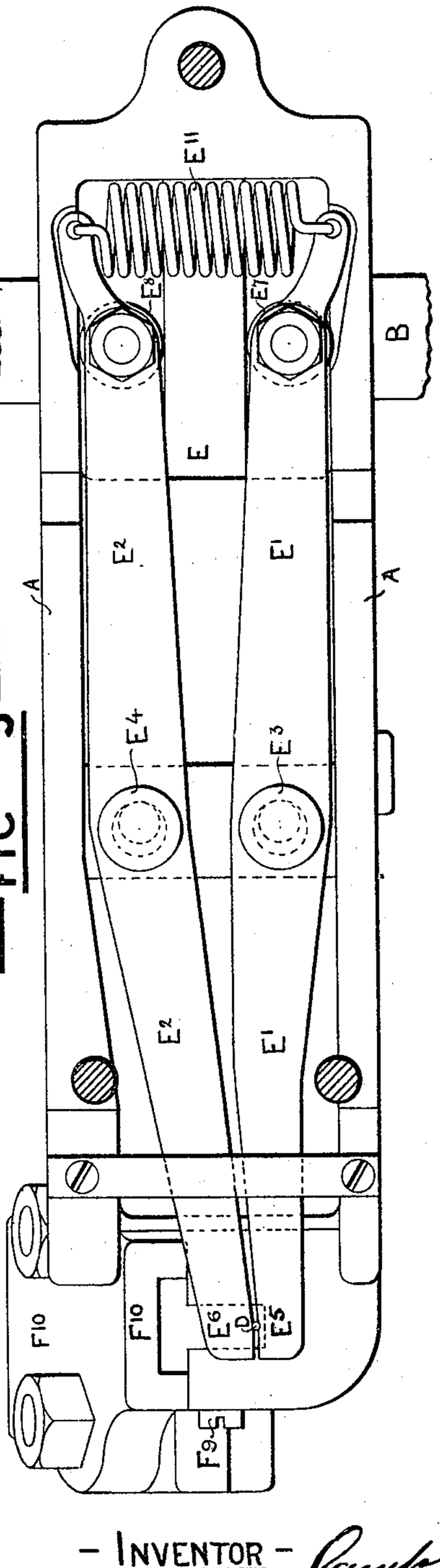



FIG 5

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## WIRE NAIL AND MACHINE FOR MAKING THE SAME.

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FIG. 8

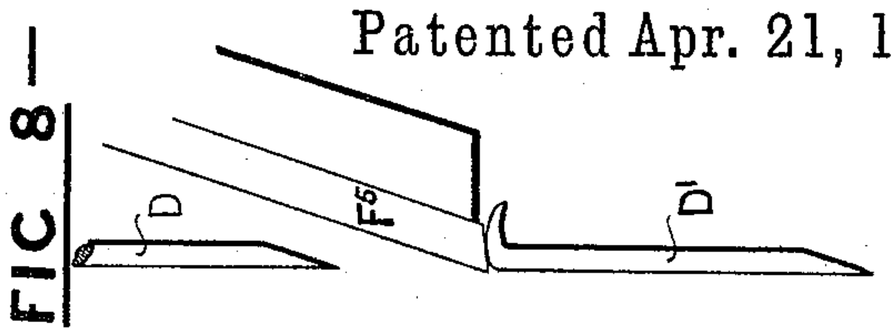



FIG. 9

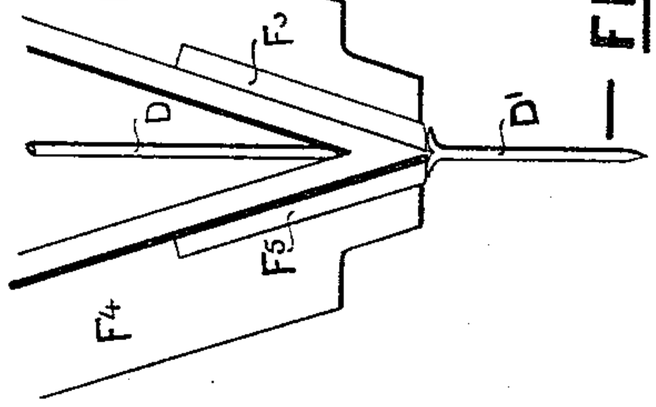



FIG. 7

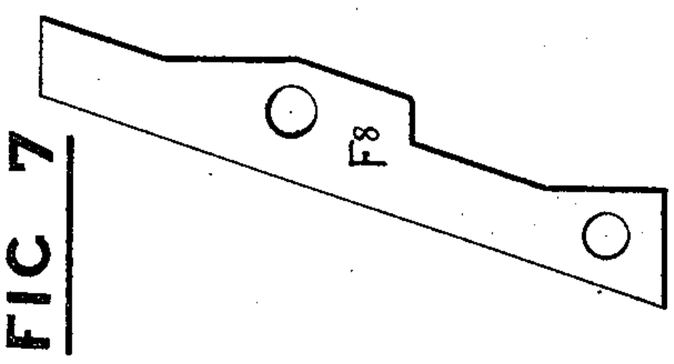



FIG. 6

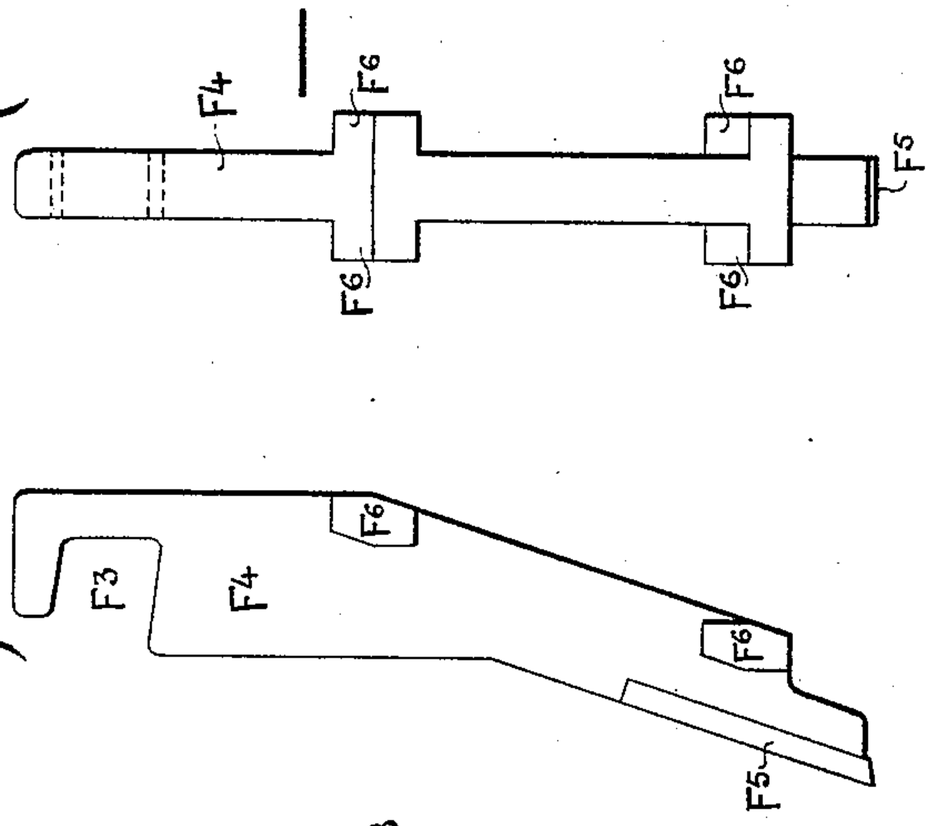
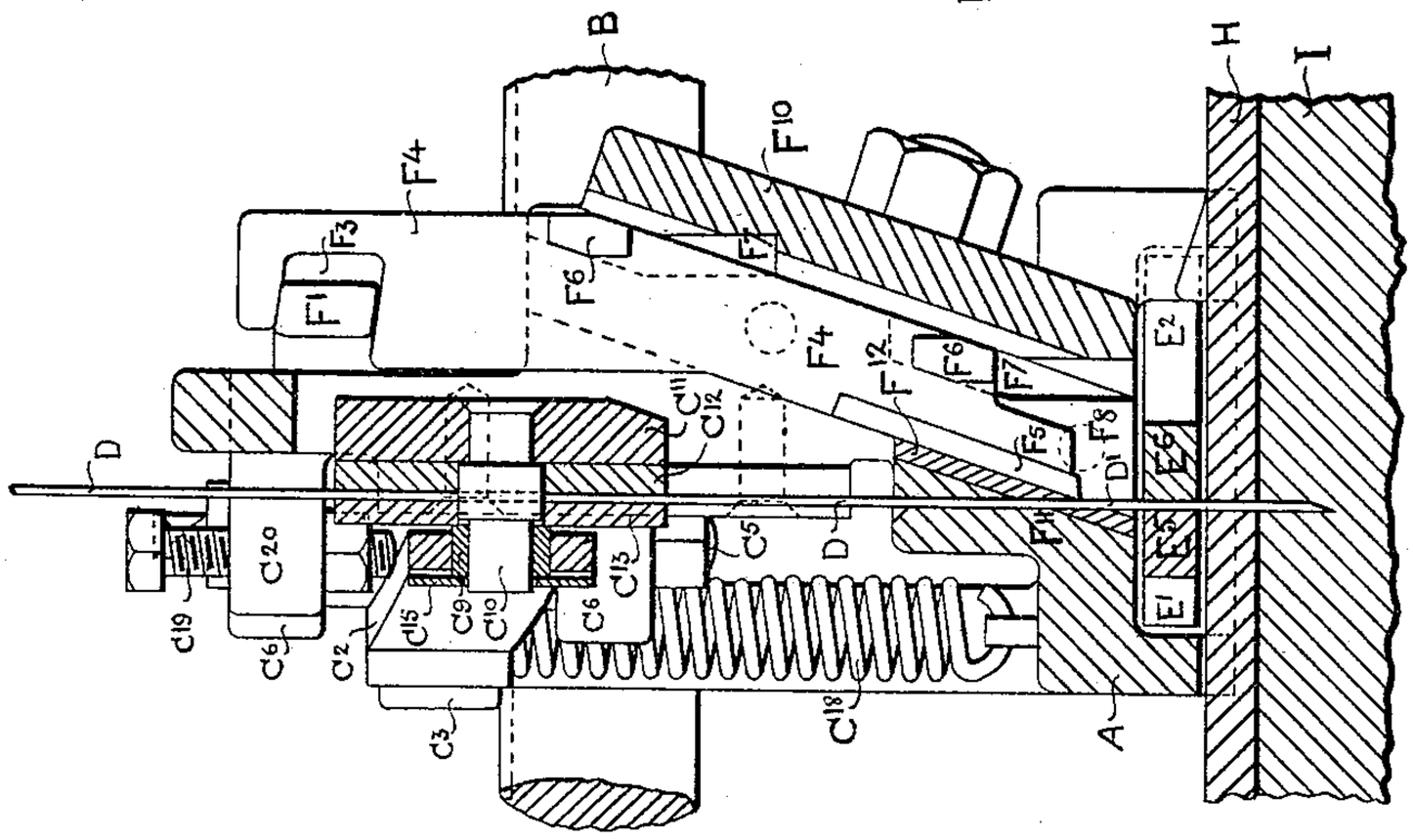



FIG. 4

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## WIRE NAIL AND MACHINE FOR MAKING THE SAME.

No. 450,990. Patented Apr. 21, 1891.

FIG 12

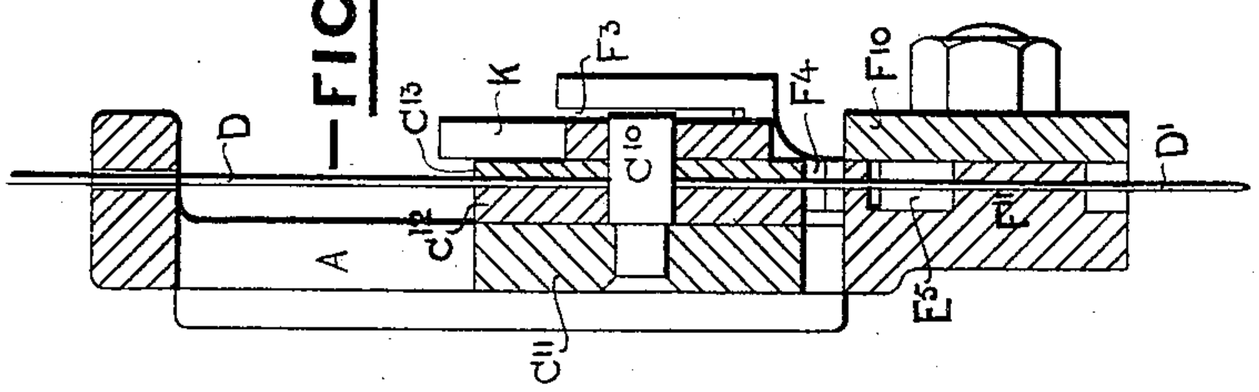



FIG 10

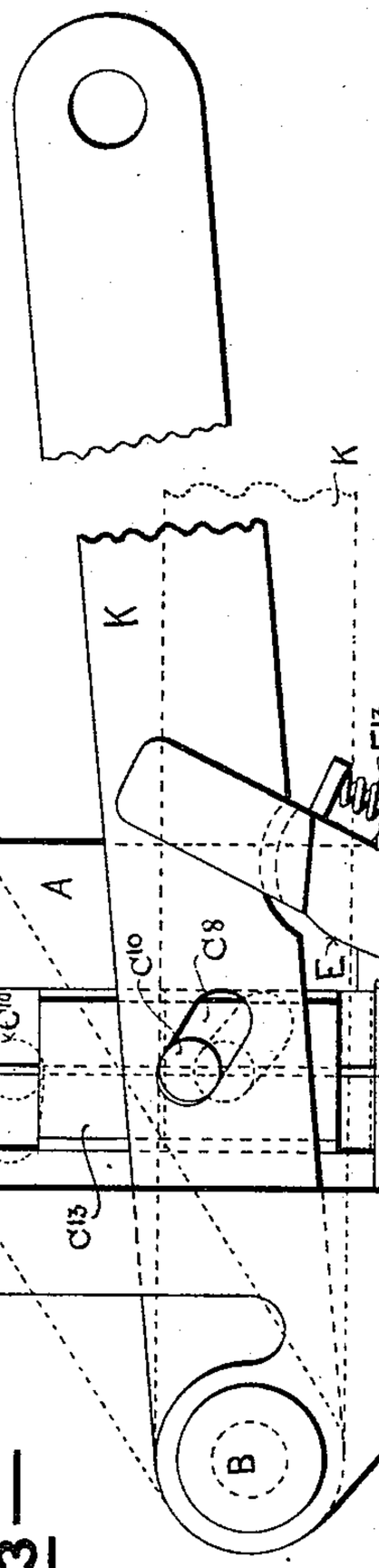



FIG 11

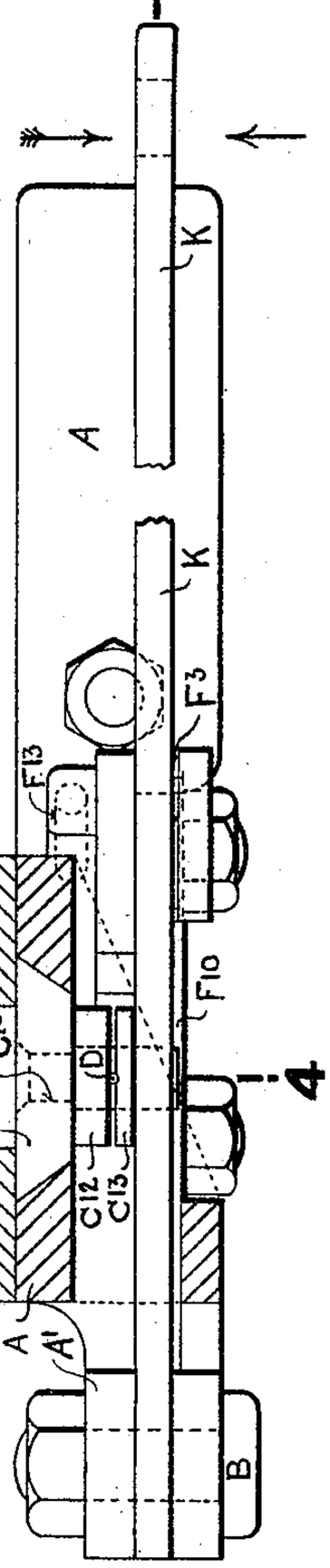
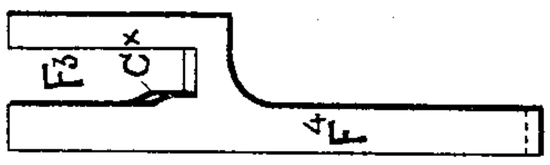



FIG 13

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Henry Campbell

# UNITED STATES PATENT OFFICE.

HENERY CAMPBELL, OF LONDON, ENGLAND, ASSIGNOR TO THE BOX MACHINERY COMPANY, OF BALTIMORE, MARYLAND.

## WIRE NAIL AND MACHINE FOR MAKING THE SAME.

SPECIFICATION forming part of Letters Patent No. 450,990, dated April 21, 1891.

Application filed June 3, 1890. Serial No. 354,113. (No model.)

*To all whom it may concern:*

Be it known that I, HENERY CAMPBELL, mechanical engineer, a citizen of the United States of America, and at present residing at 115 Cannon Street, in the city of London and Kingdom of Great Britain, have inverted a certain new and useful improved wire nail or brad and machinery for making the same, and for nailing or bradding together the parts of wooden boxes or other articles with such nails or brads, of which the following is a specification.

This invention relates to an improved wire nail or brad and to machinery for making the same and for applying them as they are made to the purpose of connecting together the parts of wooden boxes or other articles.

The improved nail or brad consists of a length of wire cut off from a coil, reel, or other continuous length of wire by a cut made obliquely to the center line or axis of such wire the point of the one nail or brad and the head of another nail or brad being produced or formed by the said oblique cutting of the wire.

For the purposes of making and applying these nails or brads I employ arrangements of mechanism of the following character: On a suitable frame or bed is mounted a driving-shaft turning in bearings and carrying suitable cams, cranks, or arms for giving motion to the various operative parts of the machine. A coil or reel of wire is mounted so that it can unwind freely, and one end of this wire is fed forward into the machine by any suitable wire-feeding apparatus The end of the wire intended to form a nail is fed forward to a certain distance between the jaws of a pair of grippers. These jaws close and hold the wire firmly, while a cutter moves in a direction oblique to the length of the wire and cuts the same through diagonally, thereby forming a beveled point for the next nail or brad and a corresponding beveled end on the portion of wire cut off and intended to form a nail or brad. This beveled end on the portion of wire thus cut off is bent outward more or less at right angles to the body of the nail or brad by the action of the cutter and forms a head thereto somewhat like that of an ordinary wrought-iron brad. The nail or brad having been thus cut off and the point and head formed, a further movement of the cutter forces the nail or brad into the parts of the box or other article intended to be nailed or bradded together, such parts having previously been placed and held in position, in order to receive the nail or brad as soon as it has been cut off and the head formed, and in most cases I prefer that the feeding apparatus which feeds the wire forward shall force the point of the wire which has been beveled by the preceding cutting-off operation above described more or less into the parts of the box or other object to be connected before the aforesaid grippers are closed and before the nail or brad is severed from the wire. By this means the severed nail or brad is supported with certainty in a position suitable for being forced home into the parts of the box or other article after the head has been made.

In the accompanying drawings, Figure 1 is a side elevation, partly in vertical section, of one arrangement of machinery constructed in accordance with my invention. Fig. 2 is an elevation of the side of the machine opposite to that shown in Fig. 1. Fig. 3 is a plan, partly in horizontal section on the lines 1 1 of Fig. 1. Fig. 4 is a front elevation, partly in vertical section on lines 2 2 in Figs. 1, 2, and 3. Fig. 5 is a view of the under side of the machine. Figs. 6 and 7 are detail views of certain parts to be hereinafter described. Fig. 8 is a view of the improved nail or brad as made by the machine. Fig. 9 is a diagram illustrating a slightly-modified form of the nail or brad and of a modified arrangement of parts for making the same. Fig. 10 is a side elevation of a machine constructed in accordance with my invention, but arranged to be operated by a hand-lever instead of by a shaft and rotating cams. Fig. 11 is a plan of same, partly in section on line 3 3 of Fig. 10. Fig. 12 is a vertical sectional elevation taken on line 4 4 of Figs. 10 and 11; and Fig. 13 is an end elevation of the part marked $F^4$ in Figs. 10, 11, and 12.

Referring to Figs. 1 to 8, A is the frame or bed of the machine; B, a driving-shaft turn-

ing in bearings in the standards A′, cast with or secured to the bed A. The shaft B has secured upon it the edge cam C and the side cam C′ for actuating the apparatus for feeding forward the wire D, from which the nails or brads are to be made, the cam E for operating the gripping-jaws, which hold the wire D while the nail or brad is being cut off, and the cam F for operating the cutter, which cuts off the nail or brad and afterward forces it home into the parts to be nailed or bradded together.

The machine may be fitted with any suitable wire-feeding apparatus; but I consider the one shown in the drawings very suitable for the purpose. It consists as follows: $C^2$ is a lever oscillating in a vertical plane on a fulcrum-pin $C^3$, secured in a piece $C^4$, which is free to oscillate in a horizontal plane on a fulcrum-pin $C^5$, passing through lugs $C^6$, cast on the frame or bed A. The rear end of the lever $C^2$ is provided with a friction-roller $C^7$, which is acted upon at the proper times by the cams C C′, as will be hereinafter described. The front end of the lever $C^2$ has formed in it a slot $C^8$, in which is fitted a sliding block $C^9$. A pin $C^{10}$ is riveted or otherwise secured at one end in a bar $C^{11}$, fitted to slide vertically in dovetail or other suitable guides formed in or secured to the frame A. The other end of the pin $C^{10}$ takes into a hole in the sliding block $C^9$. $C^{12}$ and $C^{13}$ are steel plates through which the pin $C^{10}$ passes. A hole $C^{14}$ is made in the said pin $C^{10}$, and a groove is made in each of the opposed faces of these plates, forming between them a continuation of the hole $C^{14}$, through which the wire D is passed, the said grooves in the plates $C^{12}$ $C^{13}$ being preferably roughened to secure better hold of the wire. The plates $C^{12}$ $C^{13}$ are moved up and down by the lever $C^2$ with the pin $C^{10}$ and form a pair of nippers or clamps, between which the said wire D is gripped and held firmly when the plate $C^{13}$ is pressed toward the plate $C^{12}$. This pressure of the plate $C^{13}$ toward the plate $C^{12}$ is effected by the outer edge of the cam C acting on the flange $C^{7\times}$ of the friction-roller $C^7$, whereby the rear end of the lever $C^2$ is pressed outward, causing the said lever to oscillate horizontally on the fulcrum-pin $C^5$, so that its front end is moved inward and the spring $C^{15}$ thereon presses the plate $C^{13}$, by means of the block $C^9$, toward the plate $C^{12}$, nipping or clamping the wire D firmly between them, and when the periphery of the cam C acts upon the friction-roller $C^7$ the slide $C^{11}$, pin $C^{10}$, and plates $C^{12}$ and $C^{13}$ are pressed downward and the wire D is carried therewith to the required distance. When the cut-away portion $C^\times$ of the cam C releases the flange $C^{7\times}$ of the roller $C^7$, and thereby the rear end of the lever $C^2$, springs $C^{16}$ and pins $C^{17}$ press the plate $C^{13}$ and the front end of the lever $C^2$ outward, thereby releasing the wire D, so that when the periphery of the cam C allows the rear end of the lever $C^2$ to be drawn down by the spring $C^{18}$ the front end rises and the plates $C^{12}$ $C^{13}$ slide up on the wire D, in readiness to take a fresh grasp thereof at the next movement of the machine. The side cam C′, Fig. 3, is arranged to act on the face of the roller $C^7$ at the time when the flange $C^{7\times}$ of the said roller is about to be acted upon again by the outer edge of the cam C when the cut-away part $C^\times$ of that cam is passing away from the said flange, the object of the said cam C′ being to hold the flange of the roller free until the edge of the cam C has come to act against it, so that there may be no chance of the said flange riding up onto the periphery of the cam C. The length of wire fed forward by the feeding apparatus at each operation can be regulated by the set-screw $C^{19}$, which stops the upward movement of the front end of the lever $C^2$ sooner or later, according as the said set-screw $C^{19}$ is screwed up or down in the lug $C^{20}$.

E′ $E^2$ are levers placed below the bed of the machine and oscillating, respectively, on fulcrum-pins $E^3$ $E^4$. The front ends of these levers form a pair of gripping-jaws $E^5$ $E^6$, which close at the proper time and hold firmly between them the part of the wire D intended to form the next nail or brad. The rear ends of these levers carry friction-rollers $E^7$ $E^8$, which are respectively acted upon by the cam-surfaces $E^9$ $E^{10}$ of the cam E being pressed against those surfaces by the spring $E^{11}$.

F′ is a lever oscillating on a fulcrum-pin $F^2$, fixed to the frame A. It is provided at its rear end with a friction-roller $F^\times$, which is acted upon at the proper time by the cam F. The front end of the lever F′ engages in the notch $F^3$ of a sliding piece $F^4$, with which is formed or to which is secured the cutter $F^5$. This sliding piece $F^4$ is furnished with laterally-projecting studs $F^6$, which take into guide-grooves $F^7$. One side of each of these guide-grooves is formed in the movable side plates $F^8$, which are held in place by the screws $F^9$ and the other side of each of the grooves by the cover-plate $F^{10}$. The upper part of each of these guide-grooves $F^7$ is formed obliquely, as shown, and the lower part of each is formed vertically, so that when the sliding piece $F^4$ is forced down by the lever F′ it is caused to move first in a direction oblique to the wire D and then in a vertical direction.

$F^{11}$ is a part of the frame A faced with a steel facing-piece $F^{12}$, against which the cutter $F^5$ works. The wire D is led through a hole formed in the part $F^{11}$ of the frame and in the steel facing-piece $F^{12}$ and then between the gripper-jaws $E^5$ $E^6$.

The action of the machine is as follows: The coil or reel of wire intended to form the nails or brads is mounted in any convenient position, so that it can be readily unwound. The end is passed through the feeding apparatus and through the guide-hole in the pieces $F^{11}$ and $F^{12}$ and between the gripper-jaws $E^5$ $E^6$, as shown in Fig. 4. In the position of the parts of the machine shown in the

drawings the gripper-jaws $E^5$ $E^6$ are closed onto the wire which has just been fed forward, the feeding apparatus is returning to take a fresh grasp of the wire, and the cutter $F^5$ is about to move downward in an oblique direction to cut off the part D′ of the wire as soon as the plates $C^{12}$ $C^{13}$ have again grasped the wire. While the jaws $E^5$ $E^6$ and nippers $C^{12}$ $C^{13}$ still grasp and hold the wire D D′ tightly the cutter $F^5$ descends obliquely by the movement of the studs $F^6$ in the oblique parts of the grooves $F^7$, cutting off the part D′ of the wire from the part D and bending the upper end of the part D′ outward somewhat, as shown in Fig. 8, forming a kind of brad-head, as already explained. The gripper-jaws $E^5$ $E^6$ then open, the first-named $E^5$ moving aside only a short distance just clear of the cut-off piece of wire D′ now formed into a nail or brad, but the second named $E^6$ being moved farther aside by reason of the greater inclination of the cam-surface $E^{10}$ of the cam E, in order to give room for the farther descent of the cutter $F^5$ into the space between the said jaws. When the said jaws are wide open the cutter $F^5$, descends vertically by reason of the movement of the studs $F^6$ in the vertical parts of the guide-grooves $F^7$, and the lower face of the said cutter pressing on the head of the cut-off nail or brad forces the latter downward into the parts H I of the box or other article to be nailed or bradded together, such parts being supported on a suitable adjustable bracket or table. (Not shown in drawings.) The cutter $F^5$ then retires again into the position shown in Figs. 1 and 4, being drawn up by the spring $F^{13}$. The feeding apparatus then feeds forward another length of wire sufficient to make another nail or brad, forcing the beveled end of such wire to enter more or less into the parts H I, as shown in Figs. 1, 2, and 4, for the purpose hereinbefore explained. The gripper-jaws $E^5$ $E^6$ then close on and grasp tightly the part D′ of the wire, the plates or clamps $C^{12}$ $C^{13}$ of the feeding apparatus close on and grasp tightly the upper part of the wire D, the cutter $F^5$ descends, cuts off the part D′ of the wire, bends down its upper beveled part to form the head, as shown in Fig. 8, and then when the jaws $E^5$ $E^6$ have again opened forces the nail or brad home into the parts H I. These parts are then moved by hand, so as to bring another point on them where it is desired to insert a nail or brad in line with the wire, and on turning the shaft B another similar cycle of operations is performed.

The shaft B may be caused to rotate continuously by any suitable means at such a speed as will give the operator time to move the parts H I into the required position between the end of one cycle of operations and the beginning of the next; or it may be connected, when required, with a continuously-rotating wheel or shaft by means of a suitable clutch thrown into gear therewith when it is required to make and insert a nail or brad, and thrown out of gear therewith when such nail or brad is made and inserted; but I sometimes arrange so that the shaft B can be rotated by hand by means of a crank-handle (not shown in the drawings) actuated by the operator himself at pleasure, after he has adjusted the parts H I to the correct position to receive the next nail or brad.

Instead of employing a single cutter to cut off the nail or brad, as shown in Figs. 1, 3, and 4, I sometimes employ two obliquely-acting cutters, one on each side of the wire, and arrange them so that each cuts half-way through the wire and meets the other cutter in the middle thereof, as shown diagrammatically in Fig. 9, whereby the point of the nail or brad is made with a bevel on each side—that is to say, is chisel-pointed—and the head with a fin-like tapered portion projecting on each side, each fin-like portion being bent more or less at right angles to the body of the nail or brad, so as to form a head somewhat like that of an ordinary wrought-iron brad at each side of the nail or head. In this arrangement both cutters may co-operate to force the nail or brad home into the parts to be united, the gripper-jaws being in that case arranged to open, so as to admit both cutters between them.

The mechanism may be so arranged that two or more nails or brads are made and driven into place for each revolution of the driving-shaft B by arranging and shaping the cams accordingly; but so far as I am at present aware the arrangement shown in the drawings, in which one nail or brad is driven into place for each revolution of the shaft, is preferable.

Instead of the driving-shaft being caused to make a complete revolution for each cycle of operations, it may be arranged to make rocking movements, a single nail or brad being in that case also preferably made and driven into place at each such rotary oscillation.

Referring now to Figs. 10, 11, 12, and 13, which illustrate a machine having operative parts analogous to those described in reference to Figs. 1 to 6, but so adapted that they can be operated by a simple lever-arm instead of by cams, A is the frame or bed of the machine, as before. B is either a short rocking shaft turning in holes or bearings in the jaws of the bracket A′ and having secured thereto the lever-arm K, or a fulcrum-pin passing through holes in the jaws of the bracket A′ and having the lever-arm K turning loosely thereon. The wire-feeding mechanism shown is similar to that described in reference to Figs. 1, 2, 3, and 4; but instead of being actuated by a lever $C^2$, having vertical and lateral movements imparted to it by cams, as shown in Figs. 1, 2, and 3, it is actuated by the lever K, moved by hand, a slot $C^8$ therein taking over the pin $C^{10}$, secured in the sliding bar $C^{11}$. The lever K engages in a slot $F^3$ at the upper end of the sliding piece $F^4$, with

which is formed or to which is secured the cutter $F^5$. This sliding piece $F^4$ and cutter $F^5$ move obliquely with reference to the wire D in a recess $F^{7\times}$, formed in the frame A, being retained in such recess by the cover-plate $F^{10}$, which is removed in Fig. 10 for the sake of clearness. The sliding piece $F^4$, with the cutter $F^5$, is pressed down by the action of the under side of the lever K upon the curved bottom of the slot $F^3$, and is raised again to its normal position by the spring $F^{13}$. $F^{11}$ is a part of the frame A, faced with a steel facing-piece $F^{12}$, against which the cutter $F^5$ works, the wire D, being led through a hole formed in the said part $F^{11}$, and in the steel facing-piece $F^{12}$, all as described in reference to Fig. 4. $E^3$ is a wedge-piece, which grips the wire D firmly between itself and the upper portion of the part $F^{11}$ when it is acted on by the inclined part E of the sliding cutter-piece $F^4$ as the latter descends.

The operation of this machine is as follows: The wire is supplied from a coil or reel, as described in reference to the machine shown in Figs. 1 to 5. The end of the wire is passed through the feeding apparatus, then between the gripping-wedge $E^5$ and the upper part $F^{11}$ of the frame A, and then through the guide-hole in the pieces $F^{11}$ and $F^{12}$. In the position of the parts of the machine, as shown in full lines in the drawings, an operation has just been completed—that is to say, a nail or brad D′ has been cut off and driven home into the parts H I to be joined together, and the lever K is being raised into the higher position shown in dotted lines, carrying with it the feeding apparatus, which, being at that time released from the wire, slides up over it to take a fresh grip thereof. Assuming now that the lever K is in the upper position, (indicated by dotted lines,) and which position is in this case limited by the lower end of the slot $C^8$ in the lever K coming against the pin $C^{10}$, the operator presses the outer end of the lever K sidewise in the direction of the plain arrow in Fig. 11. This presses the plate $C^{13}$ against the plate $C^{12}$, grasping the wire D firmly between those plates. He then presses the lever K downward, still holding it pressed laterally in the direction of the plain arrow, Fig. 11, and the wire D is thereby fed downward a sufficient distance to leave sufficient wire projecting beyond the hole in the plate $F^{12}$ to form a fresh nail or brad, the lower end of which is forced by the operation a certain distance, as before explained, into the parts H I to be united, such parts having in the meantime been adjusted into proper position to receive the nail or brad. When the lever K has been pressed downward, so that its under side comes in contact with the bottom of the notch $F^3$ of the sliding cutter-piece $F^4$, the operator moves the lever K sidewise in the direction of the feathered arrow, Fig. 11, whereby the grasp of the plates $C^{12}$ $C^{13}$ on the wire D is released and the feed of the wire ceases. Instead of the lateral movement of the lever K in the direction of the feathered arrow to release the feeding apparatus from the wire being effected by hand, it may be effected mechanically by means of a wedge-shaped projection $C^\times$, formed on one side of the notch $F^3$, as shown in Fig. 13, which projection forces the lever K in the desired lateral direction automatically as it approaches the bottom of the notch. Further downward movement of the lever K, after it has reached the bottom of the notch $F^3$, forces the sliding cutter-piece $F^4$ downward also. The inclined part E of the sliding piece $F^4$ then presses the gripping-piece $E^5$ against the wire D, holding the latter firmly between itself and the part $F^{11}$ of the frame A, so that the said wire cannot slip down during the cutting-off operation. The sliding cutter-piece $F^4$ then continues its downward movement, the inclined part E sliding down behind the gripping-pieces $E^5$, still pressing the latter firmly against the wire D, while the cutter $F^5$ cuts off the piece D′ from the wire, bends down the upper end of the latter, so as to form the head of the nail or brad, and then presses the nail or brad so formed into the parts H I to be joined together, as shown in Fig. 10. The downward movement of the lever K is limited by the upper end of the slot $C^8$ coming against the pin $C^{10}$, whereby the cutter $F^5$ is prevented from being pushed down too low, so as to injure the parts H I, which are being nailed. The lever K is then raised again into its highest position, the plates $C^{12}$ $C^{13}$ sliding up on the wire D, (the latter being still held by the gripping-piece $E^5$,) ready to take another grip of the said wire for the next feeding operation. The cutter sliding piece $F^5$ being thus released from the action of the lever K, is pressed up by the spring $F^{13}$ into the position shown in Fig. 10, in readiness for the next cutting-off operation, the inclined part E rising clear of the gripping-piece $E^5$, which is thereby released from the wire D, leaving the latter free to be fed down by the feed-clamps $C^{12}$ $C^{13}$, when they are next pressed together and downward by the lever K.

Similar letters of reference relate to like parts in all the figures of the drawings, and it will be seen that the lever K in Figs. 10, 11, and 12 performs functions analogous to those performed by the levers $C^2$, F′, and E′ or $E^2$ of Figs. 1, 2, 3, 4, and 5—that is to say, it performs the functions of the lever $C^2$ in effecting the feeding forward of the wire, of the lever F′ in effecting the cutting off of the nail or brad, the formation of the head, and the forcing of the nail or brad into the parts to be united, and of the lever E′ or $E^2$ in effecting the grasping and holding of the wire while the same is being cut.

It is obvious that the apparatus above described may be employed for the manufacture of nails or brads of the kind described and shown in Figs. 8 and 9, when such nails or brads are not intended to be used immediately, and as they are made for the purpose

of joining parts of material together, as instead of being so used immediately and as they are made they may be allowed to drop out of the machine into a suitable receptacle and be stored for future use or be sold as nails or brads.

I do not confine myself to the particular arrangements and combinations of mechanical parts for effecting the various operations involved in the practical carrying out and application of my invention, as they may be varied in a great variety of ways without departing from the essential feature of the said invention.

I would have it understood that I make no claim to the parts separately; nor do I claim separately the wire-feeding mechanism described and shown, as I am aware that similar mechanism for feeding wire and metal strips into certain other machinery is already known and in use; but

What I do claim is—

1. As a new article of manufacture, the herein-described wire nail having a beveled point formed by a single oblique cut, and a head consisting of a beveled end of the nail formed by a single oblique cut, the beveled portion only being bent at a substantially right angle to the body of the nail, substantially as set forth.

2. In a machine for making nails, the combination of the means for feeding the wire forward, means for grasping and holding the wire, a cutter arranged at an oblique angle to the wire for severing the latter upon an oblique angle, and means for giving the cutter a continuous forward movement as it cuts the wire in order to form the nail-head, substantially as set forth.

3. In a machine for making nails, the combination of means for feeding forward the wire, a cutter for severing the wire, means for grasping and holding the wire during the cutting operation, means for forming the head of the nail and by a continuation of the cutter's motion forcing it into the parts to be united thereby, and means for moving the nail grasping and holding devices after the heading operation and before the nail is driven or forced into the parts it unites, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

HENERY CAMPBELL.

Witnesses:

STEPHEN EDWARD GUNYON,
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WILLIAM ANDERSON SMITH,
73 *Sydner Road, London, N.*