June 19, 1923.

1,459,592

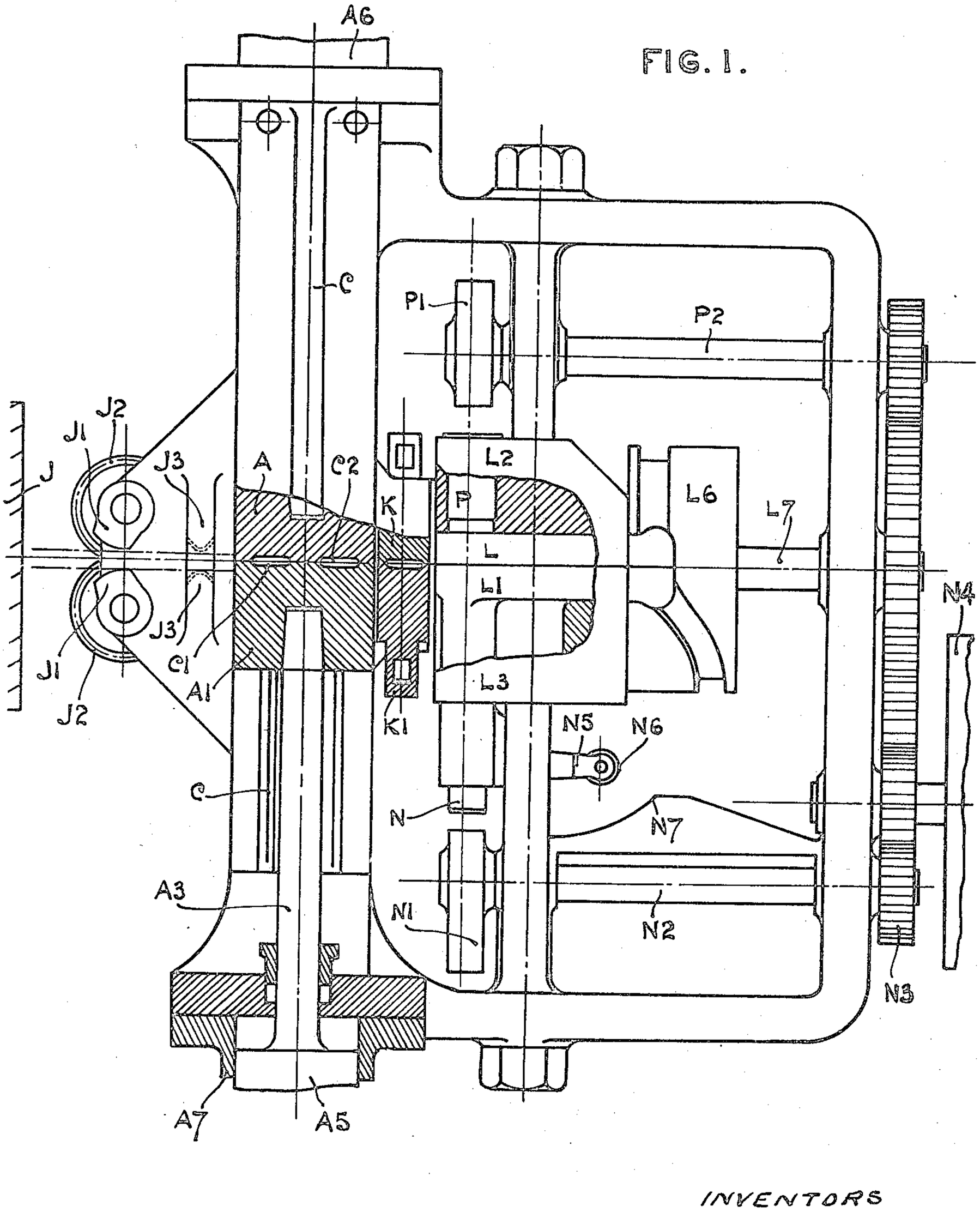
J. LATTA ET AL

DIE FORGING HAMMER

Filed Sept. 1, 1921

5 Sheets-Sheet 1

FIG. 1.



INVENTORS
JOHN LATTA
JAMES D. LATTA
BY Strauss and Strauss
ATTORNEYS

June 19, 1923.

1,459,592

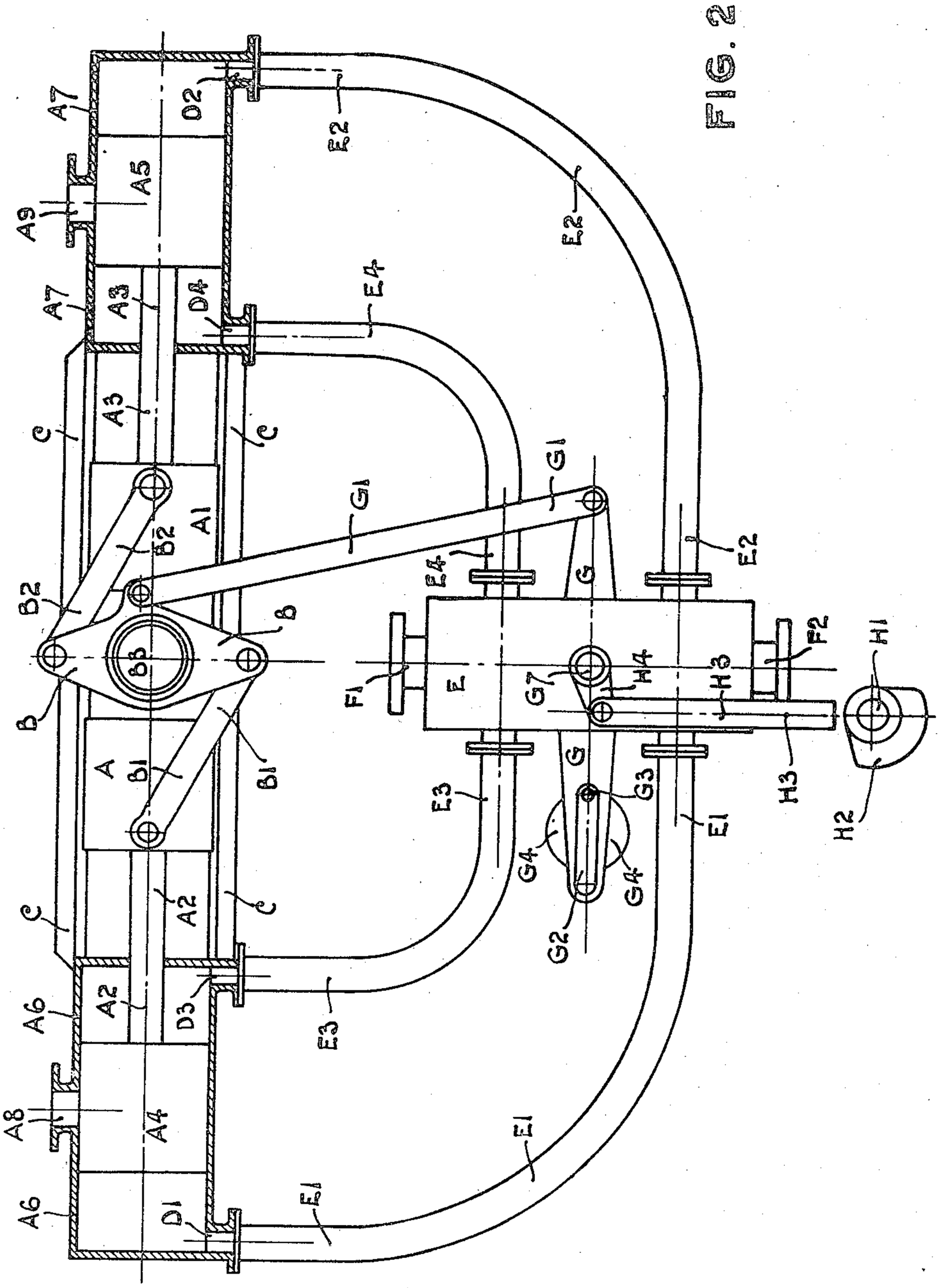
J. LATTA ET AL

DIE FORGING HAMMER

Filed Sept. 1, 1921

5 Sheets-Sheet 2

FIG. 2.



INVENTOR
JOHN LATTA
JAMES D. LATTA
BY Howson and Howson
ATTORNEYS

June 19, 1923.

J. LATTA ET AL

1,459,592

DIE FORGING HAMMER

Filed Sept. 1, 1921

5 Sheets-Sheet 3

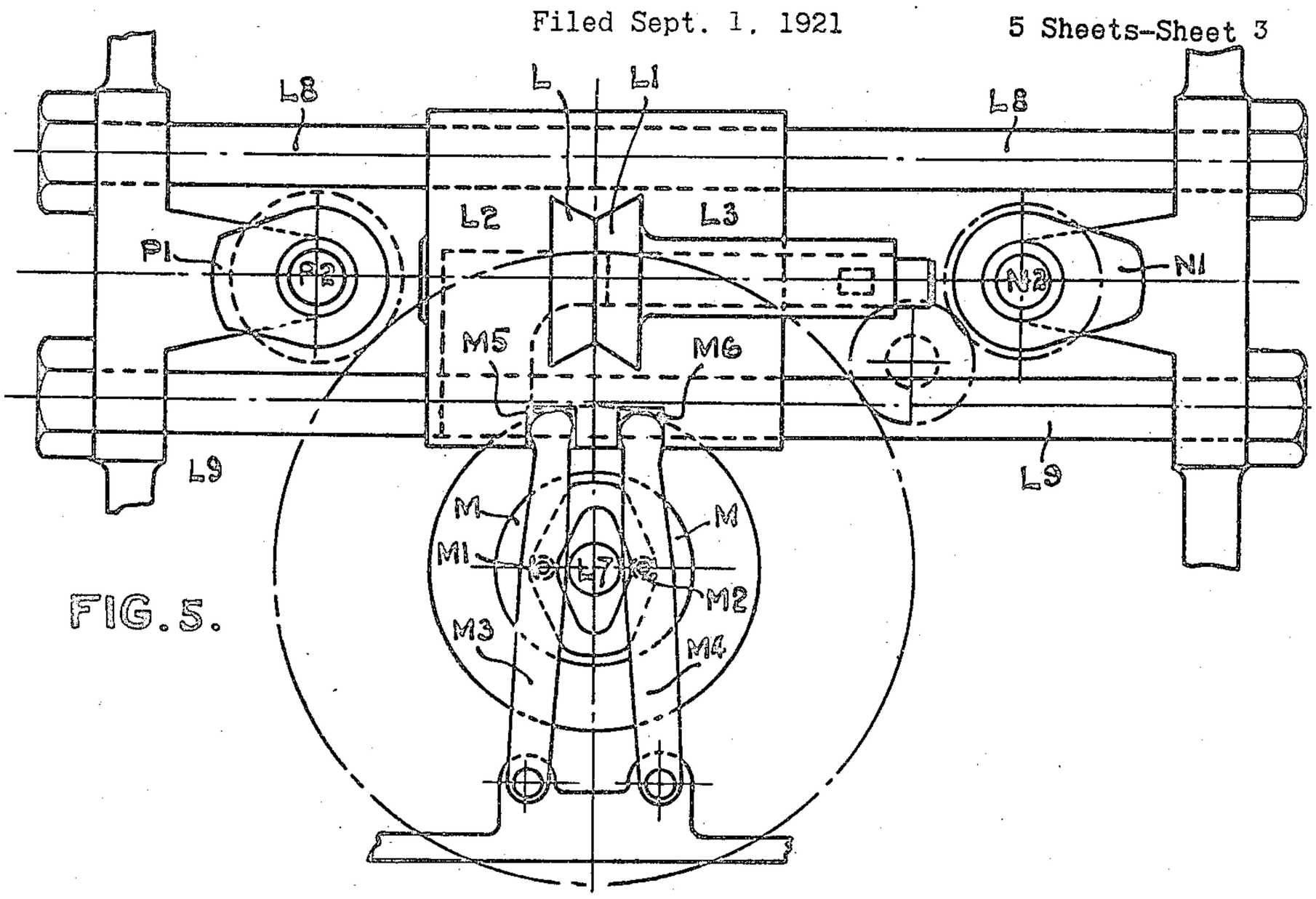


FIG. 5.

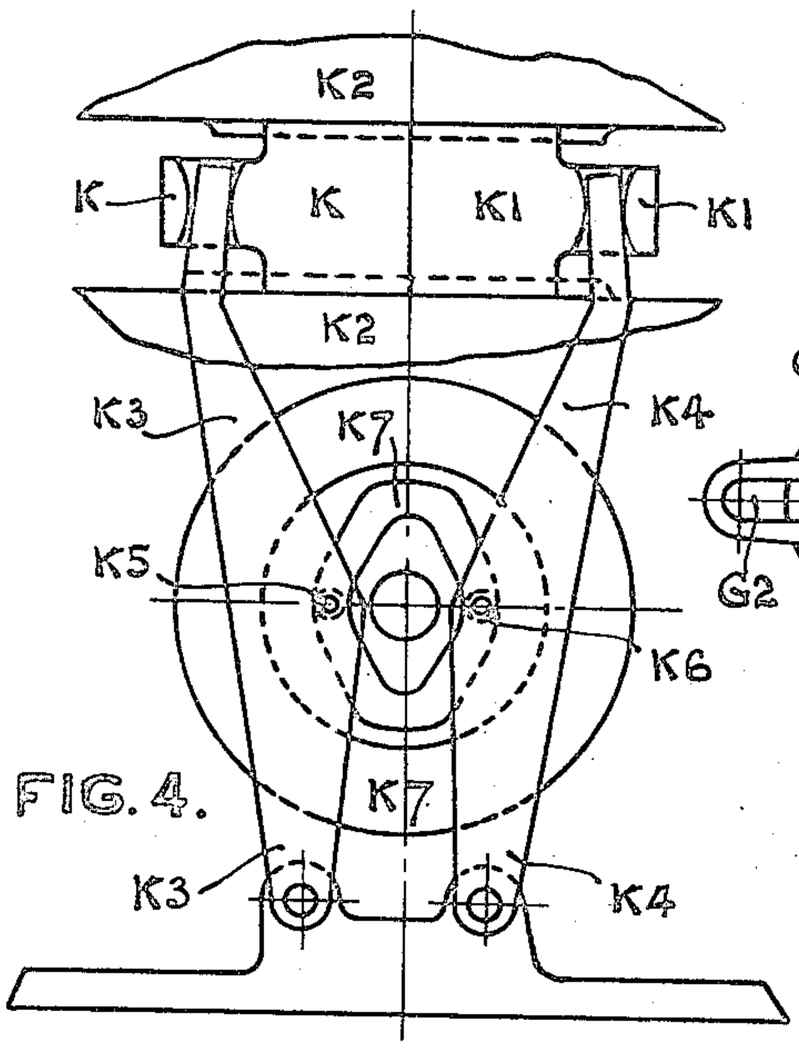


FIG. 4.

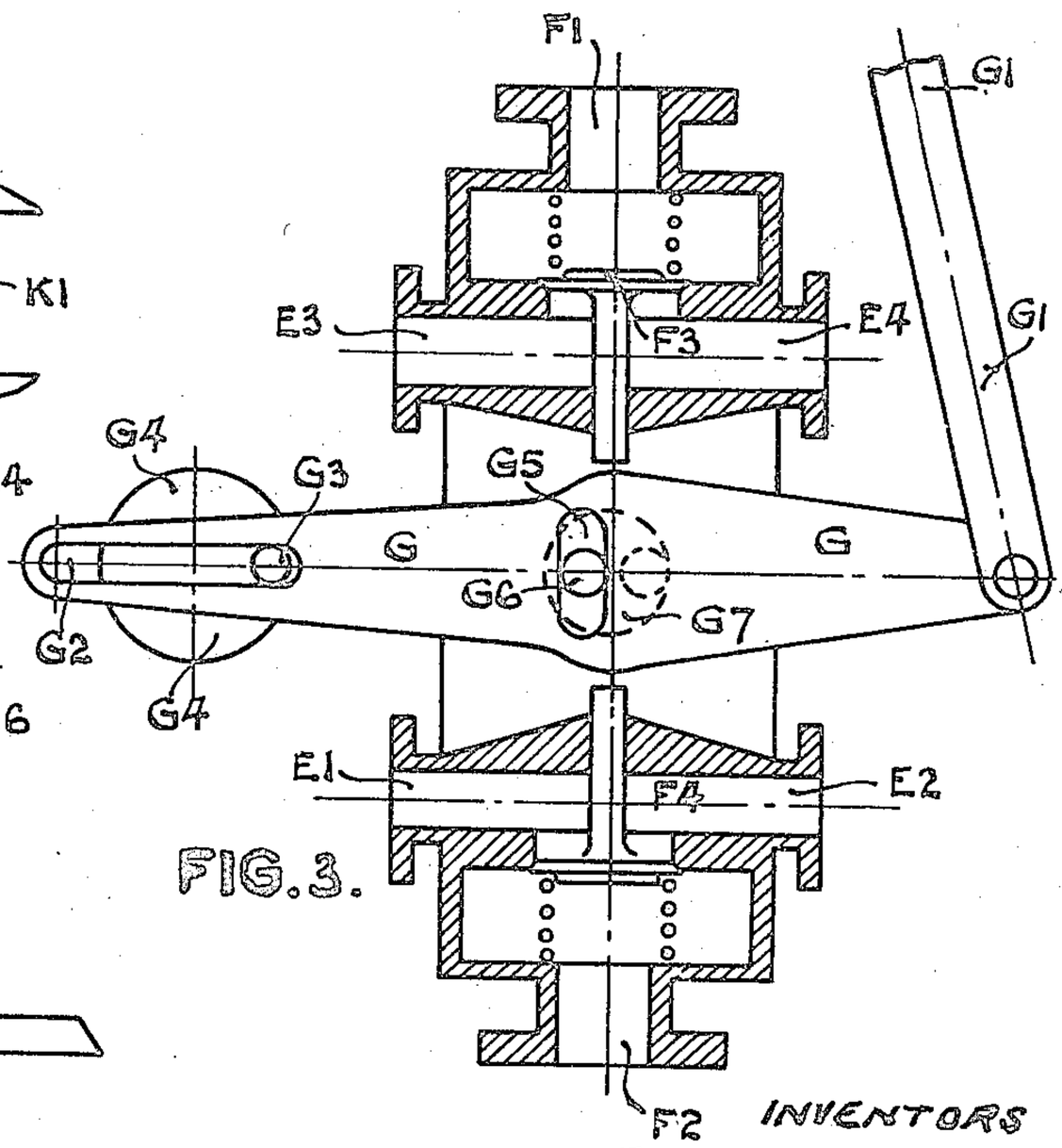


FIG. 3.

INVENTORS
JOHN LATTA
JAMES D. LATTA
BY Storm and Storm
ATTORNEYS

June 19, 1923.

1,459,592

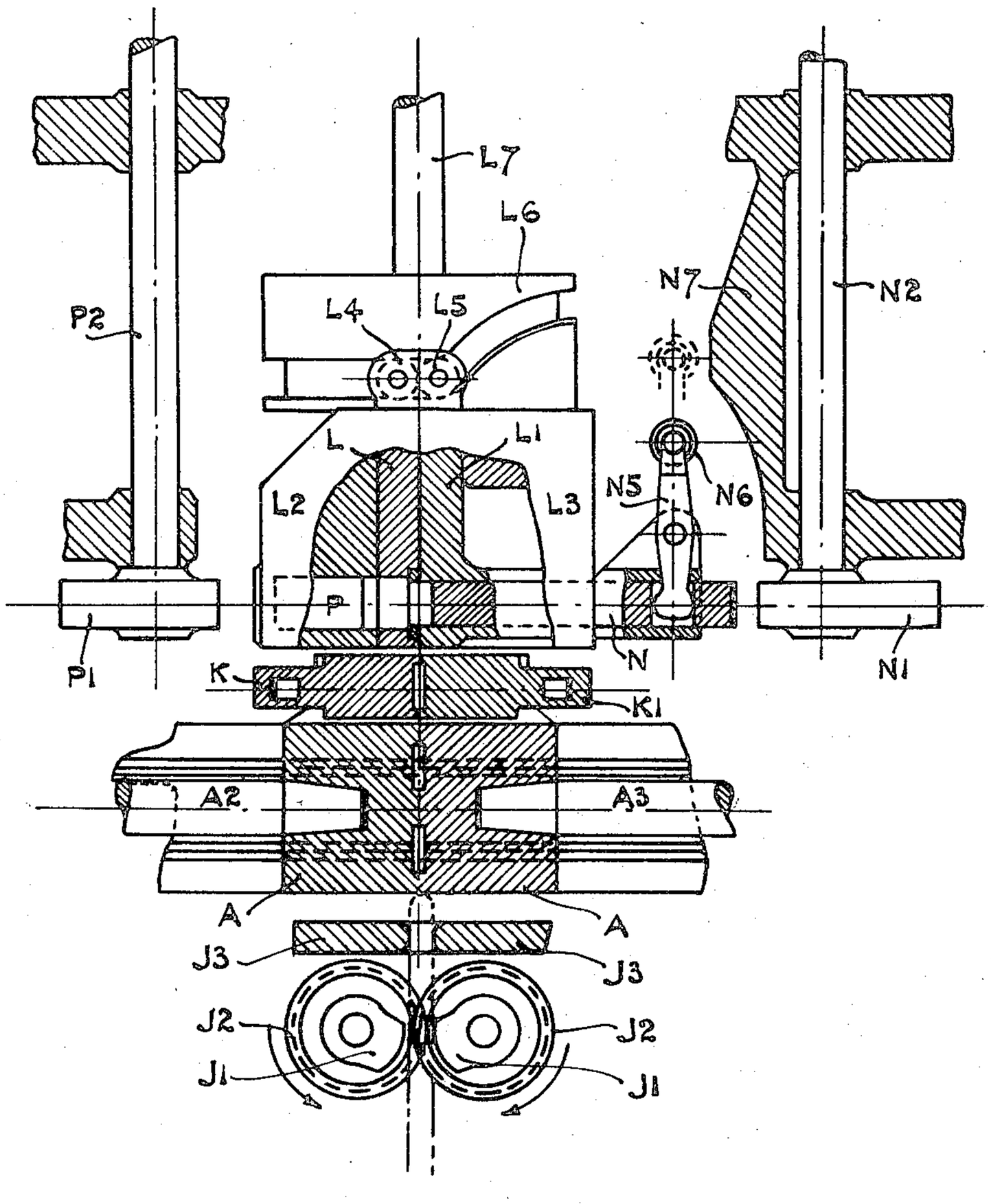
J. LATTA ET AL

DIE FORGING HAMMER

Filed Sept. 1, 1921

5 Sheets-Sheet 4

FIG. 6.



INVENTORS
JOHN LATTA
JAMES D. LATTA
BY Strauss and Strauss
ATTORNEYS

June 19, 1923. 1,459,592

J. LATTA ET AL

DIE FORGING HAMMER

Filed Sept. 1, 1921 5 Sheets-Sheet 5

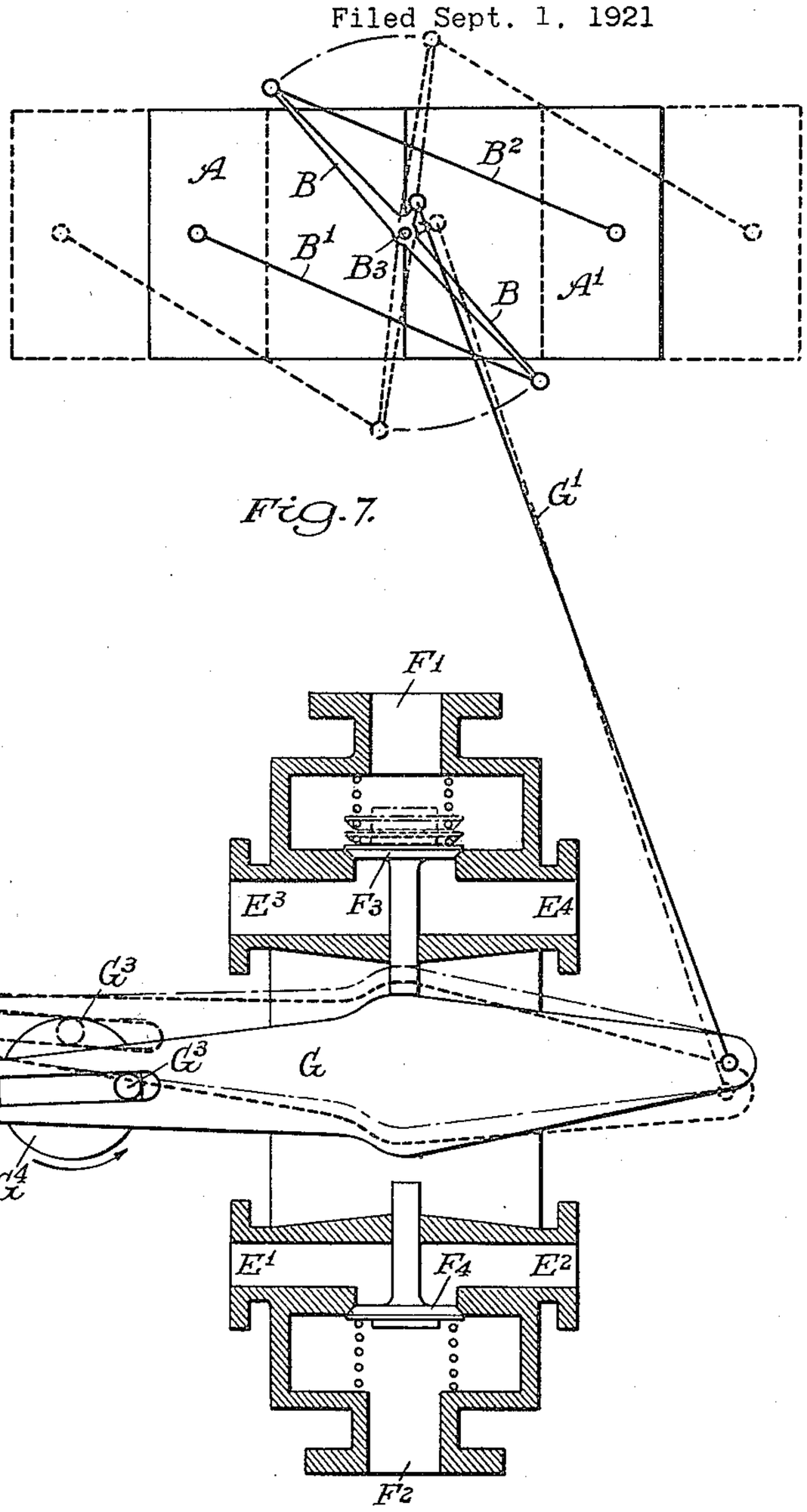


Fig. 7.

Fig. 8.

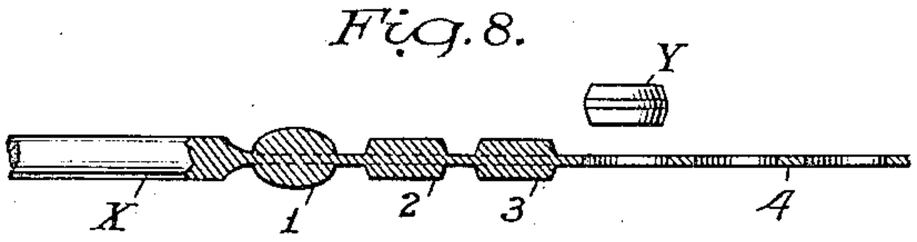
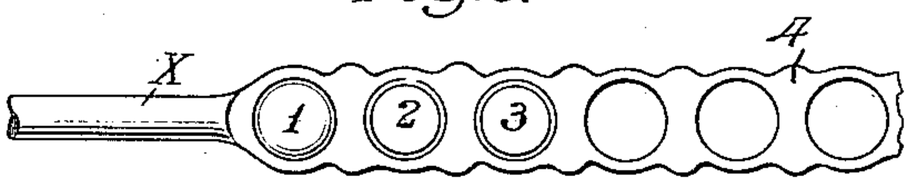


Fig. 9.



INVENTORS
JOHN and JAMES B. LATTA
BY
Howson and Howson
ATTORNEYS

Patented June 19, 1923. 1,459,592

UNITED STATES PATENT OFFICE.

JOHN LATTA AND JAMES DOUGLAS LATTA, OF AYR, SCOTLAND.

DIE-FORGING HAMMER.

Application filed September 1, 1921. Serial No. 497,565.

To all whom it may concern:

Be it known that we, JOHN LATTA and JAMES DOUGLAS LATTA, both subjects of the King of Great Britain and Ireland, and residents of Ayr, Scotland, engineers, have invented certain new and useful Improvements in Die-Forging Hammers, of which the following is the specification.

The invention has for its object an improved impact hammer for forging machine of the type wherein are used oppositely moving die heads between which forging of the piece takes place.

A machine made according to the invention is adapted to produce successive forgings automatically from the bar, and is preferably arranged in proximity to a furnace through which the bar is passed to the machine. Means are provided for automatically moving the bar step-by-step from the furnace to the machine, the operation of the heads being meanwhile interrupted. Means are provided for withdrawing the forged bar with the forgings still connected by fins and delivering them to a gripping device in which it is held. The bar then passes to dies adapted to trim the forgings and separate them from the strip of fin which latter, along with the untrimmed forgings, is held in position by continued closure of the trimming dies which then move with the bar, bringing a new portion into forging position. The finished forging is discharged through the trimming die which thereafter opens.

The oppositely moving dies which are connected together by a linkage in substantially known manner, are directly operated by fluid pressure actuated pistons, as in certain known machines, and improved simple and effective valve mechanism is provided for the control of the operating fluid.

An illustrative example of the improved machine is shown to some extent diagrammatically on four accompanying sheets of drawings, in which Figure 1 is a sectional plan, Figure 2, a sectional elevation of the die heads and their operating means, Figure 3 a sectional elevation of the valve device controlling these means, Figure 4 an elevation of a holding device, Figure 5 a like view of a feeding device and Figure 6 a sectional elevation of the same feeding device. Fig. 7 is a more or less diagrammatic view illustrative of the valve control; Fig. 8 is a partial side elevation of the blank illustrating successive forming operations; and Fig. 9 is a corresponding plan thereof.

In this example, the die heads A, A^1 Figures 1 and 2, are carried on the rods A^2, A^3 of pistons A^4, A^5 operating in cylinders A^6, A^7 having central exhaust ports A^8, A^9 overrun by the pistons. The die heads are connected by links B^1, B^2 to an oscillating equalizing lever B pivoted on a hollow trunnion B^3 through which the stock operated on passes to the dies. The die heads operate in slides C carried on the framing of the machine and are formed with a series of impression faces C^1, C^2 performing successive operations on the stock.

Ports D^1, D^2, D^3, D^4 in the opposite ends of the cylinders A^6, A^7 are connected by pipes E^1, E^2, E^3, E^4 with ports in a valve chest E, Figures 2 and 3, to which steam or other pressure fluid is admitted by ports F^1, F^2, communication between which and the ports E^1, E^2, E^3, E^4 is controlled by poppet valves F^3, F^4 held upon their seats by springs.

The valves F^3, F^4 are operated by a floating lever G pivoted at one end on a link G^1 which is attached to the die-head equalizing lever B and at its other end having a slot G^2 which is engaged by a crank pin G^3 on a shaft G^4 rotated by any convenient means from the main shaft H′ (Figure 1) of the machine. Near the centre of the lever G is a second slot G^5 at right angles to the slot G^2, and this is engaged by a crank pin G^6 on a shaft G^7. Owing to the shape of the edges of the lever G which engage the stems of the valves F^3, F^4 at this point, rotational adjustment of the crank pin G^6 and the lateral motion consequently given to the lever, varies the lift of the valves and so the amount of pressure fluid admitted to the cylinders A^6, A^7.

Upon the shaft G^4 being rotated, the crank pin G^3 by engagement with the slot G^2, rocks the floating lever G about its point of pivoting on the link G^1, alternately operating the valves F^3, F^4 and alternately admitting pressure fluid to the outer ends and to the inner ends of the cylinders A^6, A^7 and so causing the pistons therein and the die heads A, A^1 to reciprocate. Movement of the die heads, however, causes the link G^1 to be reciprocated through the oscillating lever B, so oppositely displacing the point of pivoting of the floating lever G upon the link G^1 and causing its central portion to retire from the

stems of the valves F^3, F^4 which thereupon close, cutting off pressure fluid. The pistons A^4, A^5 exhausing through the exhaust ports A^8, A^9 meanwhile come together on the work and rebound, their further movements being controlled by the displacement of the floating lever G by the crank pin G^3.

This action is modified in accordance with the energy absorbed by the piece being forged, for, when the material being forged is almost fully shaped by repeated blows of the die heads, it absorbs less energy from them and they accordingly rebound more rapidly, so more rapidly replacing the lever G and allowing the valves F^3, F^4 to close, cutting off the pressure fluid.

Operation of the shaft G^7 with its crank pin G^6 by moving the lever G laterally, further modifies the action, finally throwing the die heads out of operation notwithstanding continued rotation of the crank shaft G^4. When this action takes place, the die heads remain apart, thus allowing free access between them of the stock.

The object of connecting one end of the lever G to the die equalizing lever B through link G', is to modify the amount of steam supplied to the cylinders A^6 and A^7, by the rotation of the crank G^4 in such a manner as to keep the strokes of the dies in phase with the revolutions of the crank shaft G^4

Referring now to the diagram, Fig. 7, this shows diagrammatically the die blocks, valves and various connecting levers.

The slot G^5 and crank pin G^6 shown in Fig. 3, are not shown, in order to make the drawing more clear.

Assume now that the die blocks A and A' have struck together upon the piece to be forged, and that crank pin G^3 is in the position shown in full lines in Fig. 7. It will be seen that valves F^3 and F^4 are closed so that no steam or other pressure fluid can pass to the cylinders A^6 and A^7.

If now the crank shaft G^4 continues to revolve in the direction of the arrow until the crank pin G^3 reaches the position shown in dotted lines, and assume the die blocks A and A' to remain stationary meantime, the position of the parts will be as shown by the dot and dash lines in Fig. 7. It will be seen that the valve F^3 is now full open, thereby admitting steam or other pressure fluid, to act on pistons A^4 and A^5 through ports D^3 and D^4.

If, however, when the crank pin G^3 reaches the position shown in dotted lines, the dies A and A' had receded from each other, and they occupied positions shown by the dotted lines in the diagram, it will be seen that valve F^3 is now only about half as far open as it was when the dies were assumed to have remained stationary, thereby throttling the pressure fluid on its way to the cylinders.

It will be clear that as crank pin G^3 rotates in the direction of the arrow from its initial position, valve F^3 is raised from its seat by an amount which will vary according to the position of the dies A and A', and as the speed with which the dies recede from each other depends mainly on the amount of pressure fluid admitted through ports D^3 and D^4 by the valve F^3, the tendency is for the dies A and A' to reciprocate to and fro in phase with the revolutions of the crank G^4, irrespective of whether they rebound from each other with more or less energy than usual.

The proportions of the levers may be varied so as to diminish or increase the controlling effect of the link G' on lever G, as may be deemed necessary.

With regard to the bars L and L', the groove in the cam L^6 is slightly wider than the rolls L^4 and L^5, so that when the cam L^6 draws back the bars L and L' (which are locked together by the punch N which has previously entered the trimming die P), the cam acts on the roller L^5 only. The width of the groove in the cam L^6 at that point being such that the movement of the roller L^4 is not interfered with. It is true that when the bars L and L' return they are no longer locked together by the punch, and therefore do not move back exactly together, but it is not essential that they should do so, as they are apart and not gripping the strip of forgings.

Figs. 8 and 9 show in part, sectional elevation and plan, a piece of the bar blank on its way through the machine. At X is seen the hot bar as it comes to the machine from the furnace, and which is acted upon by the interrupted rolls J'.

At 1 is seen the shape of the stock when in the first impression of the dies. This is generally made a roughing impression. The excess metal squeezed from the impressions forms the fin as seen.

At 2 is the finishing impression which brings the article to its final shape and size.

At 3 is the finished piece still on the fin and which would be held between blocks K and K'.

At Y the finished piece has been punched from the fin by the punch N, leaving a hole in the fin as shown.

At 4 is seen the perforated fin as it comes from the machine.

Stock is fed through the machine automatically and step-by-step by mechanism hereinafter explained, and in order that the action of the die heads may be interrupted to permit of this step-by-step feed after a predetermined number of blows have been given by the die heads, there is provided on a shaft H^1, driven through any convenient and preferably change-gearing from the main shaft H, a cam H^2 adapted to engage

a tappet rod H^3 engaging a lever H^4 on the shaft G^7 on which is the crank pin G^6 and so laterally displacing the floating lever G so that it ceases to operate the valves F^3, F^4 as just described.

The stock to be forged (indicated by chain lines) is withdrawn from the furnace J (indicated in Figure 1) step-by-step, and is fed into the machine at regular intervals as required by a pair of interrupted rolls J^1, carried on vertical shafts geared together by a pair of pinions J^2 and driven in any convenient manner from the main shaft H. Its entry between the dieheads is guided by any convenient device—for example, by means of the guiding die J^3, Figure 6.

Whilst being forged between the die heads A, A^1, the stock with the successive forgings still connected together by fins, is supported by a die like gripping device (Figures 1 and 4) consisting of a pair of blocks K, K^1 having formed in their abutting faces impressions counterpart to the forging. These blocks are carried by horizontal guides K^2 and are operated by a pair of levers K^3, K^4 pivoted to the framing of the machine and the upper ends of which engage lugs on the blocks. Pins K^5, K^6 on the levers are engaged by a face cam K^7 driven from the main shaft, and rotation of which causes the levers and blocks to be oppositely vibrated at the desired intervals.

The strip of forgings still connected together by fin, is fed forward by devices shown in Figures 5 and 6 and consisting of a pair of slide bars L, L^1 in the adjacent faces of which are, as in the blocks K, K^1, impressions counterpart to the forgings. These bars L, L^1 are carried in V guides in heads L^2, L^3 and are reciprocated in the direction of their length and for feeding purposes by rollers L^4, L^5 on their extended ends which engage a cam groove in a cam L^6 on a shaft L^7 driven from the main shaft. The heads L^2, L^3 carrying the bars L, L^1 are mounted on transverse guide rods L^8, L^9 carried on the machine framing, and are reciprocated transversely to the forging bearing strip by a face cam M on the shaft L^7 the groove of which engages rollers M^1, M^2 on levers M^3, M^4 pivoted at their lower ends and at their upper ends engaging recesses M^5, M^6 in the heads L^2, L^3. There is thus imparted to the feed bars L, L^1 a compound motion which first causes them to advance towards one another and seize in their compressions a forging thereafter moving together at right angles and drawing the strip with them.

The feed bar L^1 is provided with a punch N for trimming the fin from each successive forging. This is operated by a cam N^1 on a shaft N^2 driven by gearing N^3 from the main shaft H on which there is provided a flywheel N^4 to supply energy for the blow of the punch. On completion of the rearward movement of the heads L^2, L^3 carrying the bars L, L^1 and as they move laterally apart, the punch is retracted by a lever N^5 pivoted on a bracketed extension on the bar L^1 and carrying a tappet roller N^6 which when that movement takes place, engages an abutment N^7 on the framing of the machine.

A trimming die P registering with the punch N is located in the other bar L, and a cam P^1, on a shaft P^2 also driven by gearing from the main shaft, is adapted to engage the rear of the die and take thrust of the punch.

In operation, the interrupted feed rollers J^1, withdraw step-by-step from the furnace J, the heated strip of stock, each step withdrawing an amount sufficient to contain with adequate margin, one of the particular forgings being made. From the feed-rollers, the stock passes through the guide die J^3 between the die heads, A, A^1 the sequence of the gearing being such that the die heads lie apart during this feeding movement. Between the die heads, a sufficient number of blows are given to form the forging, either at one operation or several (where there are several progressive impressions in the die heads). The number of blows given is, of course, determined by the proportioning and setting of the gearing operating the floating lever G which in turn controls the operation of the pistons A^4, A^5 which carry the die heads A, A^1. The motion of the die heads is then interrupted by the action of the cam H^2 on the tappet rod H^3, and feed of the stock again takes place and the finished forging still attached to its neighbour by fin passes to the die-like gripping blocks K, K^1 open to receive it and which then seize and hold it firmly so supporting the stock while the die heads are operating upon the next subsequent forging.

At the next step, the gripping blocks open and the finished but still finned forging is seized between the slide bars L, L^1 by the closing action of the heads L^2, L^3 and drawn rearward with the slide bars by the action of the cam L^6, the punch N having meanwhile been operated by the cam N^1 to force the finished forging through the die P, which action separates it from the fin and delivers it into a convenient receptacle.

The punch N remains in the die P thereby retaining the fin in the feed slides until the heads L^2, L^3 again open and the punch is withdrawn by the action of the lever N^5, the fin then passing from the machine at the next forward movement.

What we claim is:—

1. In a machine for automatically producing forgings and the like from bar or other stock, and having a pair of fluid pressure operated oppositely moving interconnected die heads in combination, means for

delivering the stock between the die heads for guiding thereto and therefrom, for seizing, drawing it forward beyond the die heads, and for there separating the forging from the stock and delivering it, valve gear for the fluid pressure operation of the die heads and means for controlling that valve gear in the manner and for the purposes set forth.

2. In the forging machine forming the subject-matter of claim 1 hereof, fluid pressure means controlling the die heads comprising pistons carrying them, cylinders within which the pistons operate and exhaust ports therein overrun by the pistons and controlled by the poppet valves serving the cylinders with pressure fluid, a floating lever controlling said valves, means connecting one end of said floating lever to the interconnected die heads and crank operated means acting upon the other end of the lever the parts operating as set forth.

3. In the valve gear devices forming the subject-matter of claim 1 hereof for forging machines, a floating lever the edges of which act upon the valves controlling the supply of pressure fluid, said edges being so contoured that they go out of and into engagement with the valves upon endwise movement of the lever and means for so moving the lever in consonance with the other operations of the machine.

4. In the forging machine forming the subject-matter of claim 1 hereof, means for seizing the forged stock beyond the dies and holding it during the formation of a subsequent forging comprising die-like gripping blocks moved to and fro by a cam, as set forth.

5. In the forging machine forming the subject-matter of claim 1 hereof, means for finally drawing through the forged stock and for separating the formed forging therefrom consisting of slide bars bearing counterpart impressions adapted to engage the forging and carried in transversely movable heads in which they are longitudinally slidable, cams operating the heads to advance towards and retire from one another and the slide bars to reciprocate longitudinally, a die carried in one slide bar and a punch in the other and means for their operation in the manner set forth.

In testimony whereof we have signed our names to this specification.

JOHN LATTA.
JAMES DOUGLAS LATTA.