T. E. HOLMES.

STEAM HAMMER.

APPLICATION FILED JUNE 24, 1908.

929,433.

Patented July 27, 1909.

3 SHEETS—SHEET 1.

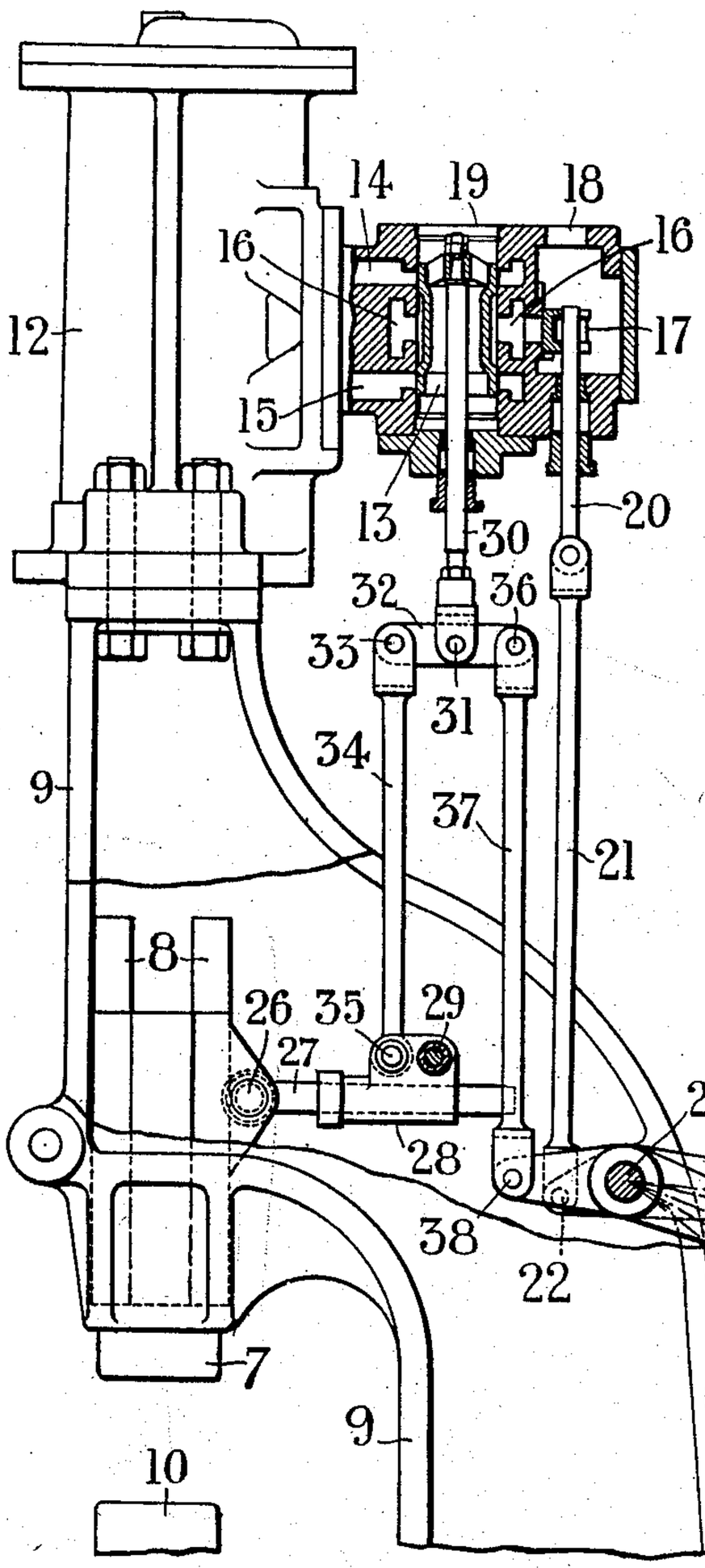
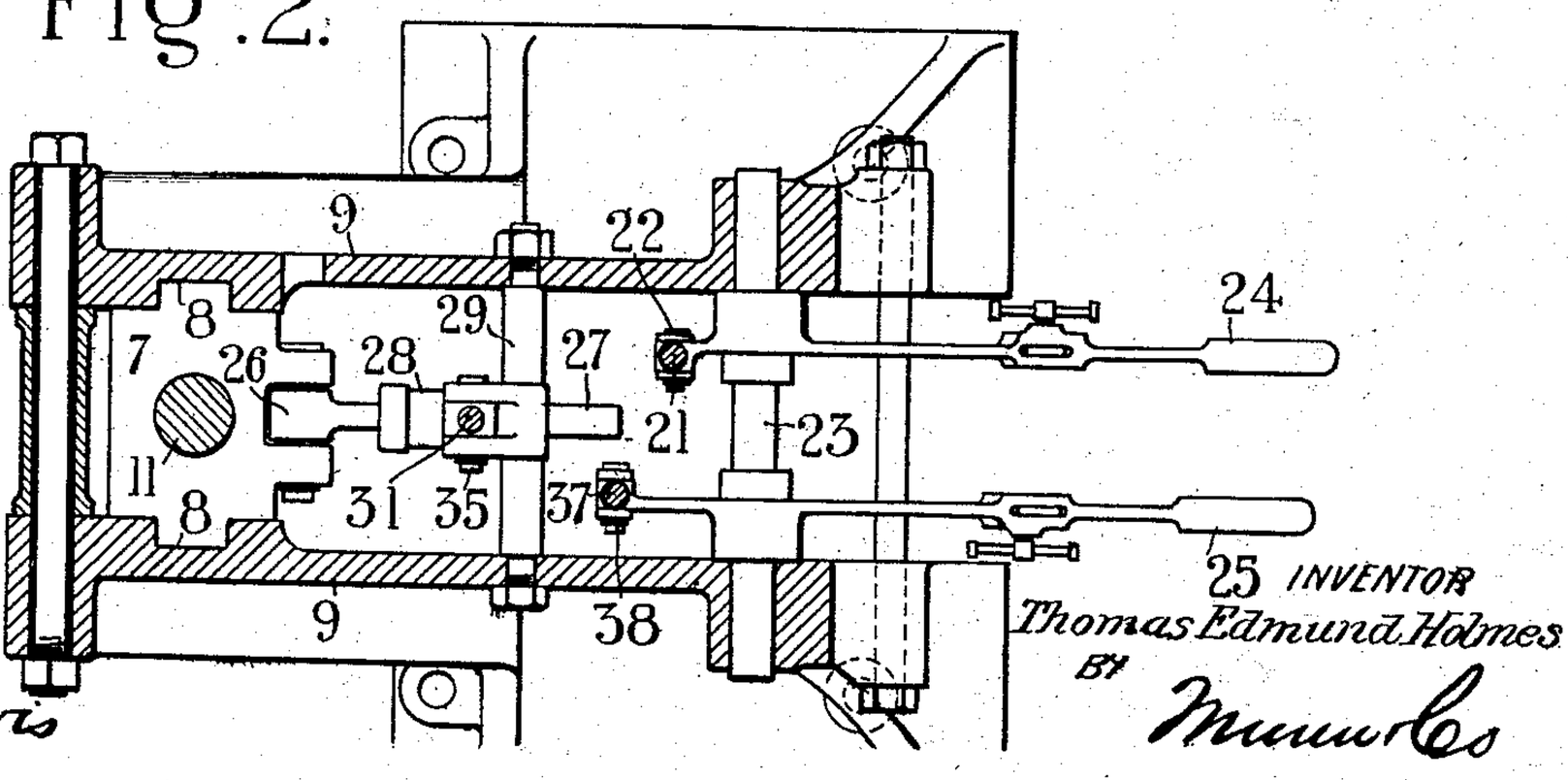


Fig. 1.

Fig. 2.



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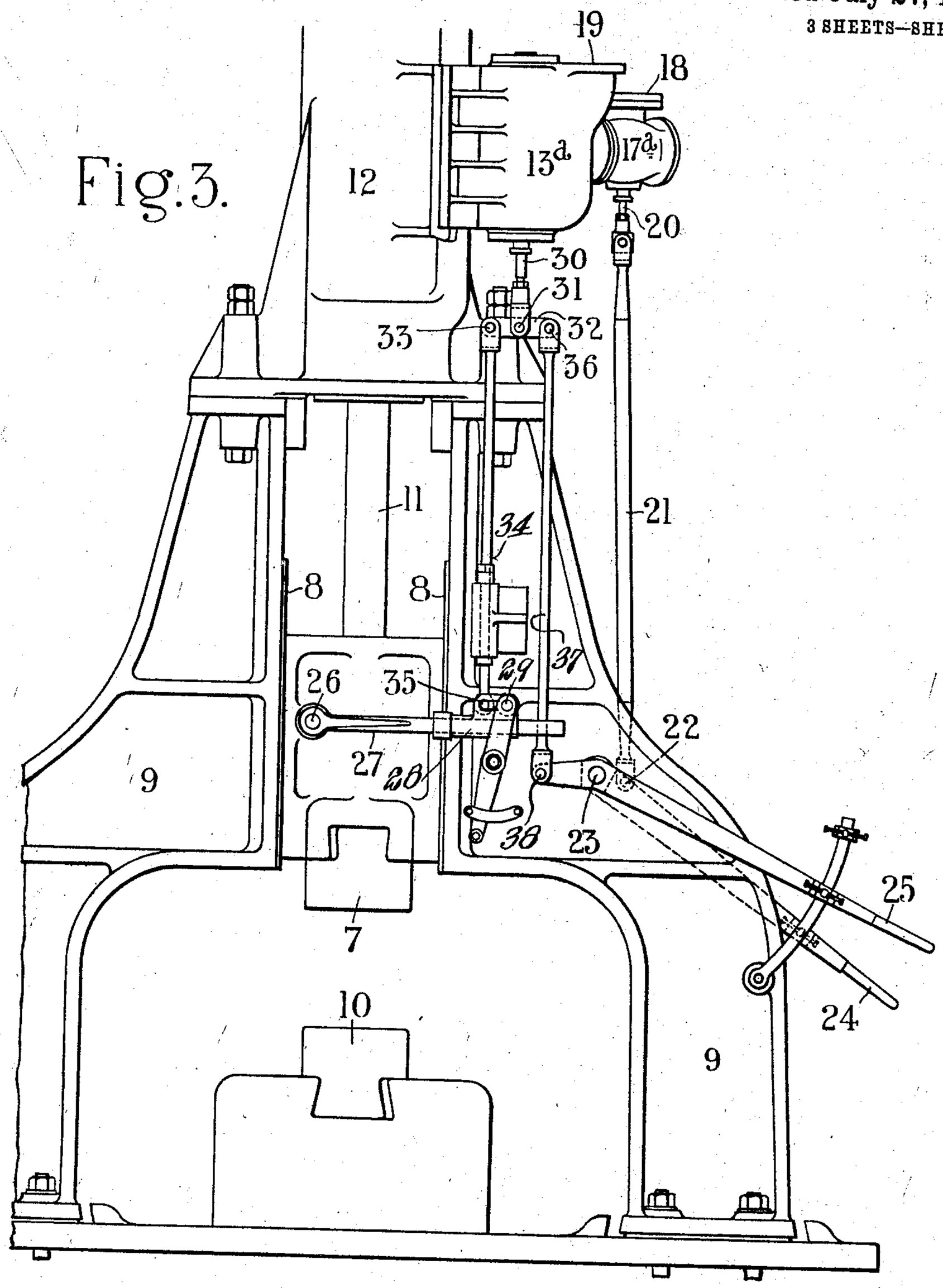
3 SHEETS—SHEET 2.

Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

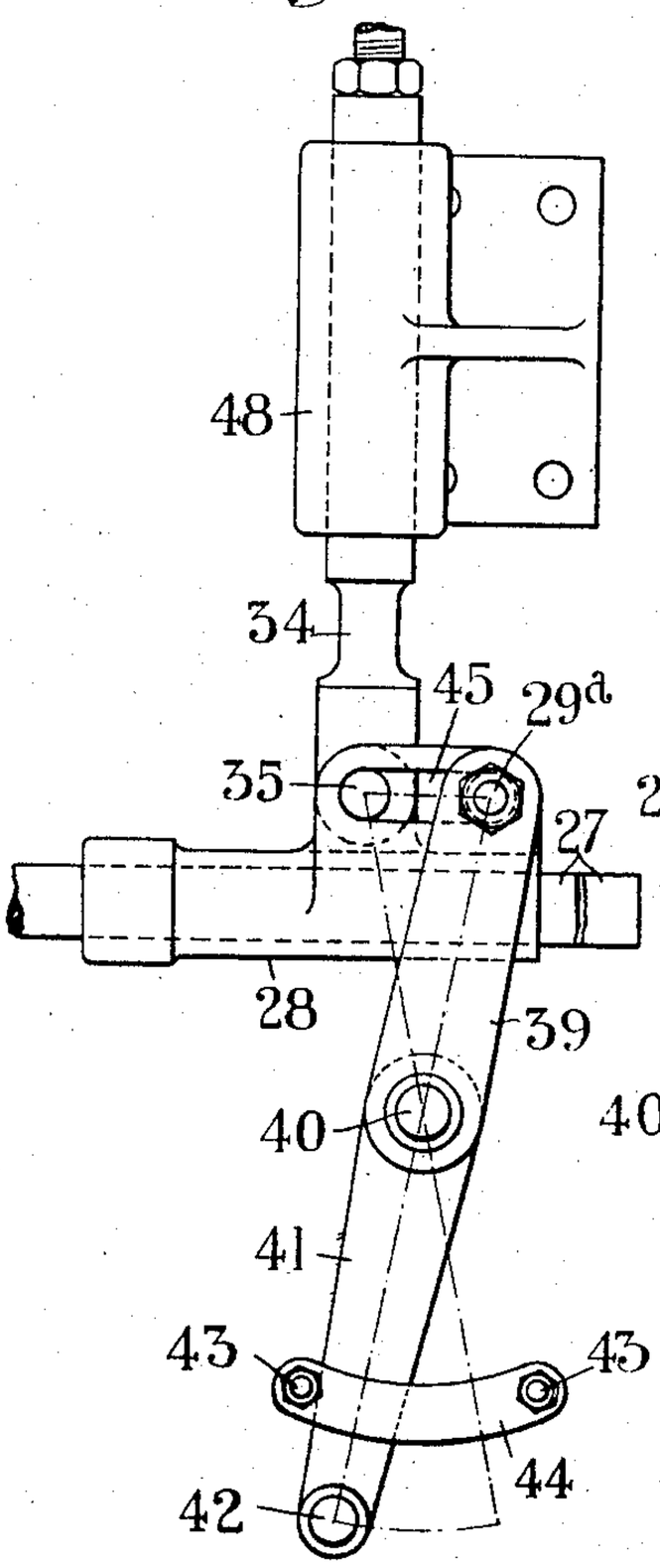
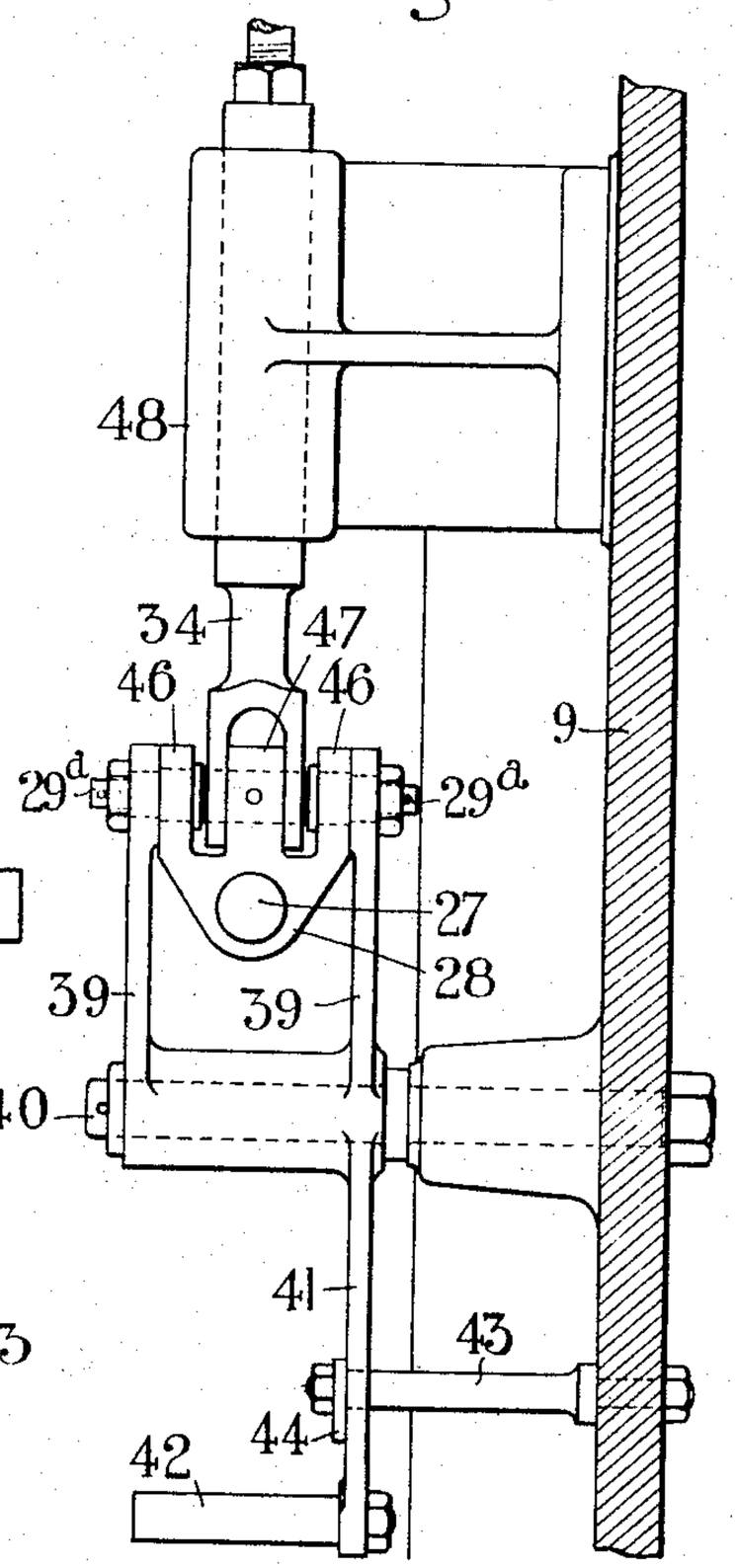


Fig. 5.



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UNITED STATES PATENT OFFICE.

THOMAS EDMUND HOLMES, OF SHEFFIELD, ENGLAND, ASSIGNOR TO DAVY BROTHERS LIMITED, OF SHEFFIELD, ENGLAND, AN INCORPORATED COMPANY.

STEAM-HAMMER.

No. 929,433. Specification of Letters Patent. Patented July 27, 1909.

Application filed June 24, 1908. Serial No. 440,119.

To all whom it may concern:

Be it known that I, THOMAS EDMUND HOLMES, a subject of the King of Great Britain, and resident of 8 Oakdale road, Sheffield, in the county of York, England, engineer, have invented certain new and useful Improvements in or Relating to Steam and other Fluid-Pressure Hammers, of which the following is a specification.

This invention relates to steam and other fluid-pressure hammers of the combined handing and self-acting type, that is to say wherein the reciprocations of the hammer-tup can, at will, be controlled either manually or automatically, or both manually and automatically at once, and the invention has for its object to provide improved controlling gear whereby to render a self-acting hammer more perfectly amenable than heretofore to the will of the operator, so that the latter will be enabled to regulate, with greater certainty than has been possible hitherto, the frequency, intensity and length of stroke of individual blows.

For the sake of simplicity in the following description the motive fluid will be referred to as steam.

In hammers of the self-acting type as usually constructed, the reciprocations of the tup are transmitted (with the necessary reduction in amplitude, or reversal of direction, or both) to the working valve, whereby steam is distributed to the opposite ends of the steam cylinder respectively, through the medium of what may be termed a driving lever which is pivoted to the tup and extends transversely of the path thereof, this lever having a telescopic or equivalent connection with the points at which it is fulcrumed and at which it is coupled to the spindle of the working valve respectively. The telescopic connection in question, according to a well known method of construction, is constituted by a guide sleeve through which the driving lever slides longitudinally as the virtual length of the lever alters with the varying level of the tup. The guide sleeve, which constitutes in effect a portion of the driving lever, receives therefrom vibratory movement about a point forming a fulcrum in common for the lever and sleeve, the oscillations of the guide sleeve being transmitted to the working valve whose spindle is coupled to the sleeve at a point near said fulcrum. This fulcrum is not fixed, but is carried by or connected to a handing lever, whereby the position of the fulcrum can be adjusted at will in a direction corresponding to that in which the working valve itself moves, so that the movements of the valve and therefore also the operations of the hammer-tup itself are under the control of this handing lever.

According to the present invention, the guide sleeve (or its equivalent) has a stationary fulcrum, and the guide sleeve and handing lever are coupled by separate links to the respective ends of a floating lever, whereof an intermediate point is pivotally attached to the spindle of the working valve. In consequence of this arrangement, the influence of the movements of the hammer-tup upon the working valve can with great ease be modified to any extent between the maximum and minimum, at will, by means of the handing lever; what may be termed the increased flexibility of control secured by the invention resulting apparently from the fact that the pressure exerted by the driving lever is not transmitted so directly as heretofore to the handing lever, which is therefore more free from the disturbing influence of the moving hammer-tup and is consequently capable of being more easily and quickly controlled by the hand of the operator in accordance with momentary requirements.

In the case more particularly of hammers which are liable to be called upon to act with more than the usual rapidity under manual control, provision may further be made for entirely eliminating, when desired, the influence of the moving hammer-tup upon the working valve, so that the latter will then respond directly (as in an ordinary manually controlled hammer) to the movements imparted to the handing lever by the operator. For this purpose the fulcrum of the driving lever and guide sleeve is made capable of being shifted at will from its usual position to one wherein it coincides with the point of attachment (actual or virtual) between the guide sleeve and the link, whereby said sleeve is coupled to the floating lever already mentioned, so that when the fulcrum is in this latter position the vibrations of the driving lever will cease to affect the working valve in any way.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of a steam

hammer of the overhung Rigby type to which the present invention is applied, and Fig. 2 is a broken horizontal section of the same through the fulcrums of the driving and handing levers respectively. Fig. 3 is an elevation of a steam hammer of the double standard or A-frame type, embodying a modification of the invention designed to enable the effect of the self-acting gear to be eliminated at will. Fig. 4 is a part side elevation of the guide sleeve and associated parts, showing the said modified construction for enabling the effect of the self-acting gear to be eliminated at will, and Fig. 5 is an end elevation of the same.

Similar reference numerals denote corresponding parts throughout the drawings.

7 represents the hammer-tup, which reciprocates vertically in guides as at 8 provided on the frame 9; 10 being the anvil. The tup 7 is connected by the piston rod 11 to a piston which reciprocates within the steam cylinder 12, to the opposite ends of which steam is distributed by means of the working valve 13 (shown in Fig. 1 as being of the piston type) whereby the ports 14, 15 can be alternately put in communication with the steam supply ports 16, the latter being independently controlled by a separate stop valve 17. The steam supply and exhaust pipes are connected at 18 and 19 respectively.

The arrangement of all the above parts may be as usual. Fig. 1 shows a sectional view of the valves 13 and 17, whereas in Fig. 3 only the outer casings 13^a and 17^a of these valves are shown. The stop-valve 17 (which may be a slide-valve as shown in Fig. 1) is controlled directly by hand in the usual manner, the valve-spindle 20 being for this purpose coupled, through the medium of a link 21, to a point 22 near the fulcrum 23 of a hand lever 24. The fulcrum 23 is a fixed horizontal axis upon which the handing lever 25, for controlling the working valve 13, is mounted to work alongside of the lever 24 as usual, and connections between the valve 13 and the lever 25 and hammer-tup 7 respectively being as follows.

To the tup 7 is pivoted at 26 the driving lever 27, which extends transversely with reference to the path of the tup, and has a sliding connection with the guide sleeve 28 whereby the free end of the lever 27 is supported; the guide sleeve 28 which is pivoted to rock about a stationary fulcrum 29, constituting in effect a portion of the driving lever 27.

To the spindle 30 of the working valve 13 is pivoted an intermediate point 31 in the length of a floating lever 32, whereof one end 33 is coupled by a connecting rod or link 34 to a point 35 in the guide sleeve 28 near to the fulcrum 29 of the latter and between said fulcrum and the point 26; the opposite end 36 of the floating lever 32 being coupled by a connecting rod or link 37 to a point 38 in the handing lever 25 near the fulcrum 23 of the latter.

When the hammer is required to act automatically, the handing lever 25 for controlling the working valve 13 is held (or clamped by the usual means) in the angular position corresponding to the length of stroke required in the hammer-tup 7, and the stop valve 17 is then opened by means of the hand-lever 24 to an extent corresponding to the force of blow required. The tup 7 will thereupon be automatically reciprocated in consequence of steam being admitted to the opposite ends of the cylinder 12 alternately, as the result of the movement imparted to the working valve 13 by the tup through the medium of the sleeve 28, link 34 and floating lever 32, which latter will for the time being be rocked about the point 36 as a stationary fulcrum. The length of stroke, as well as the violence of the blow delivered by the tup, can be modified as usual by shifting the levers 25 and 24 respectively.

When the hammer is required to work non-automatically, *i. e.* to strike separate blows each under the direct control of the operator, the stop valve 17 is opened by means of the lever 24 to an extent corresponding to the force of blow required, and the handing lever 25 is moved to and fro through an arc corresponding to the length of stroke required in the tup 7 which will thereupon be reciprocated in accordance with such movement of the lever 25; this result being consequent on the combined movement imparted to the working valve 13 by the tup 7 and lever 25 through the rods 34 and 37 which concurrently but independently control the floating lever 32 from opposite ends and (it may be) opposite directions.

It will be observed that while the hammer is working automatically the length of stroke of the tup can be varied at will by correspondingly altering the position of the handing lever 25, precisely as is the case when the hammer is working non-automatically, so that (apart from intensity of steam pressure, which is regulated by means of the lever 24) all the operations of the hammer, whether automatic or non-automatic, are equally and entirely under the control of the same handing lever 25.

If it be required to make provision for very rapid non-automatic working, the disturbing influence exercised upon the working valve 13 by the tup 7 during the movements of the latter, may be entirely eliminated by then causing the fulcrum 29 of the guide sleeve 28 to coincide axially with the points 35 at which the link 34 is pivotally connected to the sleeve 28. Such an arrangement is illustrated in Fig. 3 and in detail in

Figs. 4 and 5, which show a construction wherein the fulcrum 29 is constituted by a pair of studs 29ª, 29ª mounted in axial alinement with one another on the limbs 39, 39 of the forked arm of a lever which is mounted to rock about a fixed fulcrum 40, the other arm 41 of this lever having a handle 42 whereby it may be shifted as required between the proper limits determined by stops 43 43 at the ends of a quadrant 44. The studs 29ª engage in slots 45 provided in a pair of lateral wings 46 integral with the guide sleeve, the wings extending at opposite sides of the lug 47 which carries the pivot pin 35 forming the connection between the sleeve 28 and rod 34, and the slots 45 being of such length as to permit of the studs 29ª being shifted from the normal position shown in Fig. 5 to a position wherein they are in axial coincidence with the pivot pin 35.

In order to insure that the movement of the lever 39, 41 shall actually alter the position of the fulcrum studs 29ª relatively to the sleeve 28, and shall not merely cause the latter to swing with the link 34 about the point of suspension 33 thereof, the link 34 is fitted to slide longitudinally through a fixed guide 48.

It will be obvious that when the fulcrum studs 29ª are brought into axial coincidence with the pivot pin 35, the sleeve 28 will rock idly about this axis without transmitting movement through the link 34 to the working valve 13 which consequently, will be controlled solely by movement transmitted to it from the handing lever 25 through the link 37.

Claims.

1. In a fluid-pressure hammer of the combined self-acting and manually-controlled type, the combination with a so-called driving lever pivoted by one of its ends to the hammer-tup, a support for the other end of said lever adapted to permit of the latter oscillating about a stationary fulcrum with the movements of the tup, a slidable valve for distributing motive fluid to the respective ends of the working cylinder, and a handing lever for controlling said valve manually, of a floating lever pivoted to the slide valve spindle, and connecting rods coupling the driving and handing levers respectively to two points in the length of the floating lever separate from one another and from the connection of said lever with the slide valve spindle, substantially as and for the purpose set forth.

2. In a fluid-pressure hammer of the combined self-acting and manually-controlled type, the combination with a so-called driving lever pivoted to the hammer-tup, a slide valve for distributing motive fluid to the respective ends of the working cylinder, and a handing lever for controlling said valve manually, of a floating lever pivoted at an intermediate point of its length to the slide valve spindle, a guide sleeve fulcrumed at a stationary point so as to constitute a combined telescopic and swinging support for the driving lever, and connecting rods coupling the opposite ends of the floating lever to the guide sleeve and handing lever respectively, substantially as and for the purpose specified.

3. In a fluid-pressure hammer of the combined self-acting and manually-controlled type, the combination with a so-called driving lever pivoted to the hammer-tup, a slide valve for distributing motive fluid to the respective ends of the working cylinder, a handing lever for controlling said valve manually, a floating lever pivoted at an intermediate point of its length to the slide valve spindle, a guide sleeve for the driving lever fulcrumed at a stationary point, and connecting rods coupling the opposite ends of the floating lever to the guide sleeve and handing lever respectively, of means for causing at will the fulcrum of the guide sleeve to coincide axially with the pivotal connection between said sleeve and the connecting rod whereby it is coupled to the floating lever, substantially as and for the purpose set forth.

4. In a fluid-pressure hammer of the combined self-acting and manually-controlled type, the combination with a so-called driving lever pivoted to the hammer-tup, a slide-valve for distributing motive fluid to the respective ends of the working cylinder, a handing lever for controlling said valve manually, a floating lever pivoted at an intermediate point of its length to the slide valve spindle, a guide sleeve for the driving lever fulcrumed at a stationary point, and connecting rods coupling the opposite ends of the floating lever to the guide sleeve and handing lever respectively, of a pair of slotted lateral wings on the guide sleeve, a pair of fulcrum studs in axial alinement with one another and engaging the slots of the respective lateral wings, a pair of radius arms carrying the respective fulcrum studs and together capable of angular movement as one about a common axis, means for shifting said arms at will so as to transfer the fulcrum studs from normal position to one wherein they coincide axially with the pivotal connection between the guide sleeve and the connecting rod coupled thereto and vice versa, and a guide for said connecting rod, substantially as and for the purpose specified.

THOMAS EDMUND HOLMES.

Witnesses:

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CHAS. N. DANIELS.