(No Model.) 4 Sheets—Sheet 1.

G. V. SHEFFIELD.

POWDER MOTOR.

No. 485,989. Patented Nov. 8, 1892.

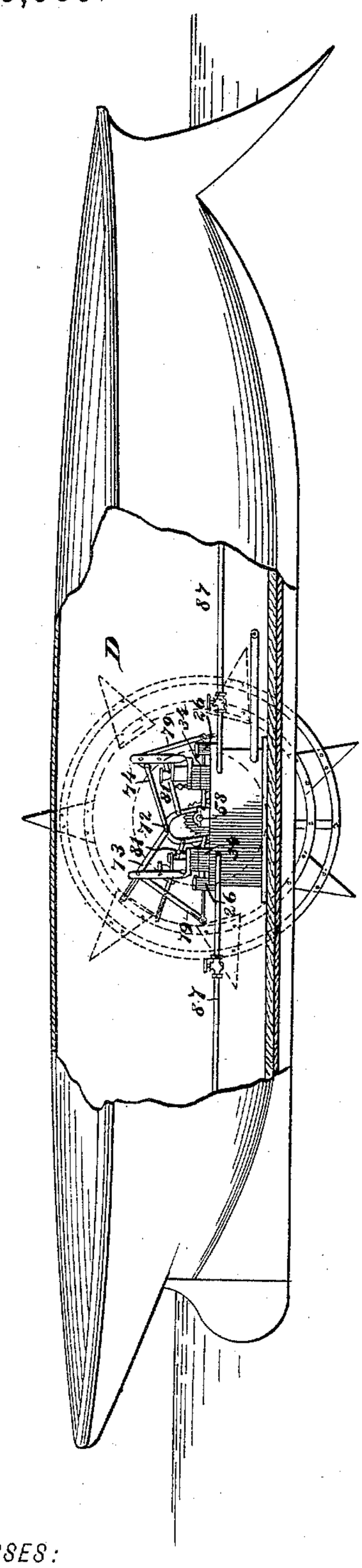

Fig 1.

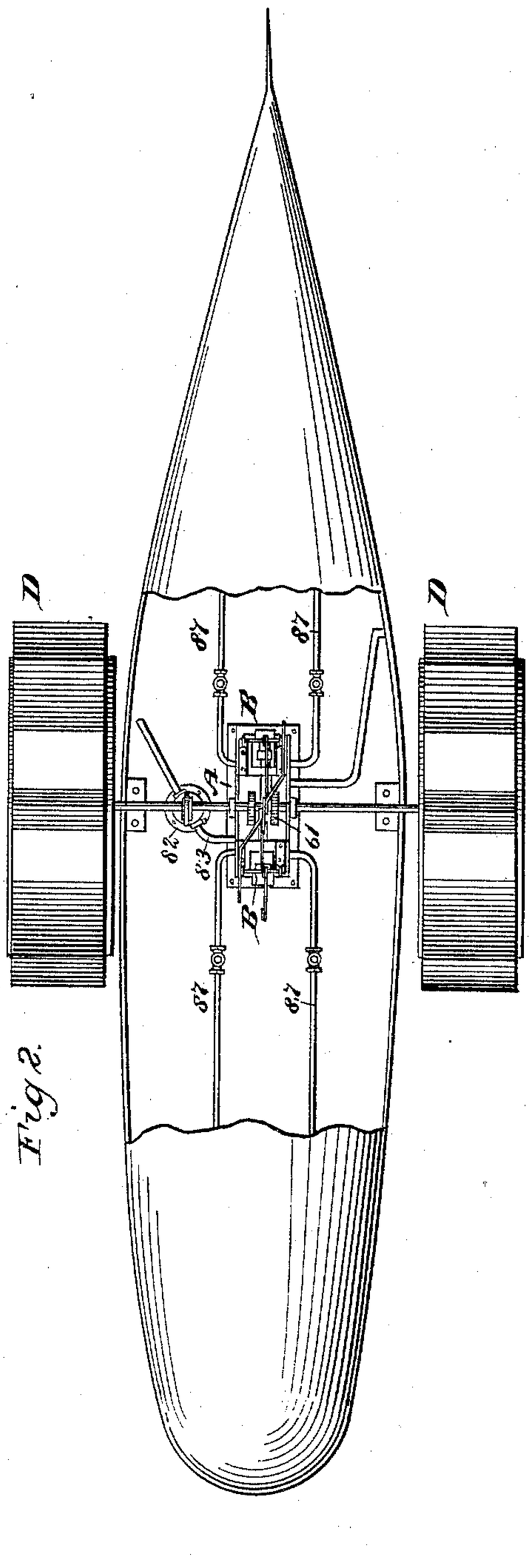

Fig 2.

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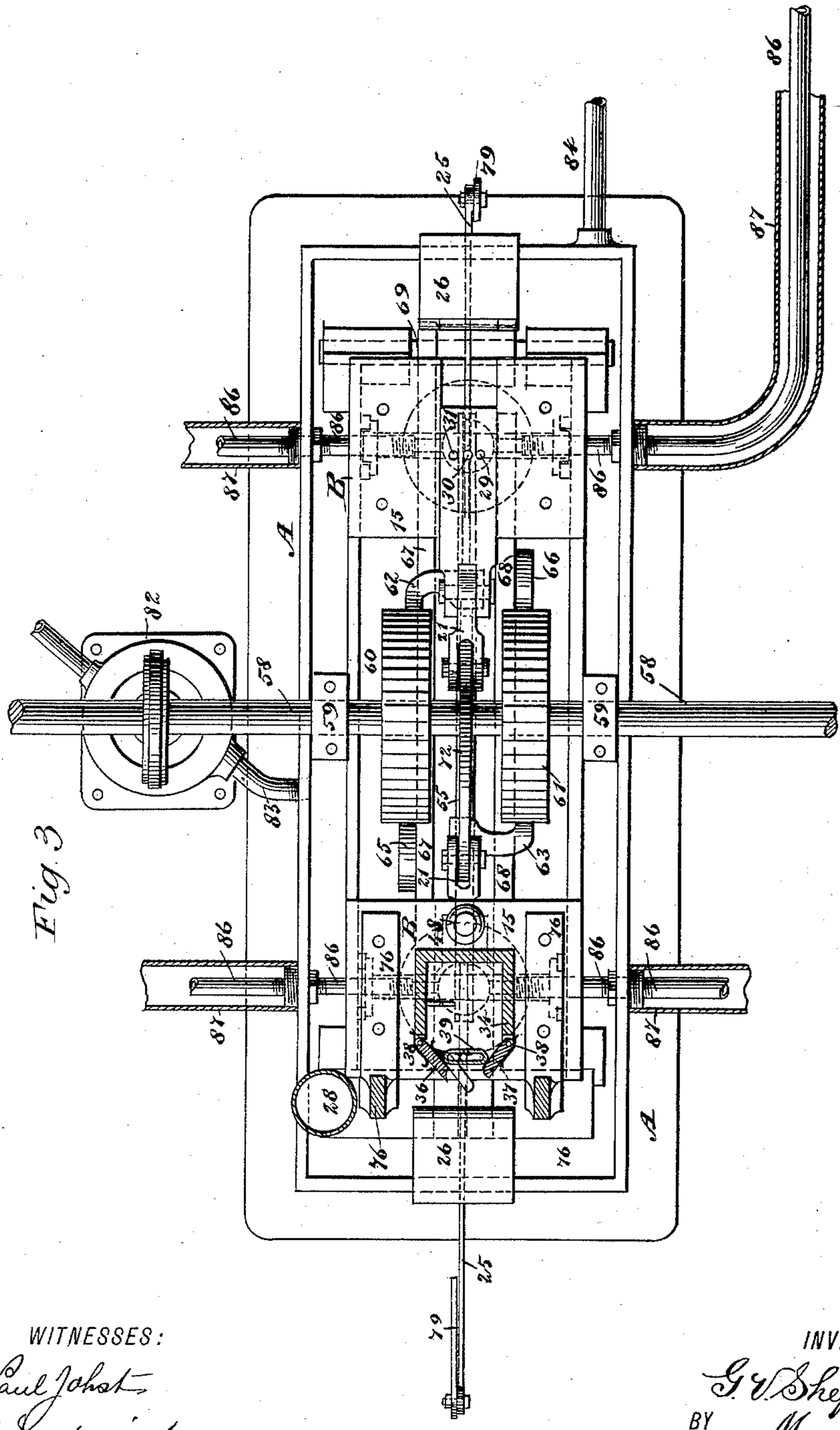

Fig. 3

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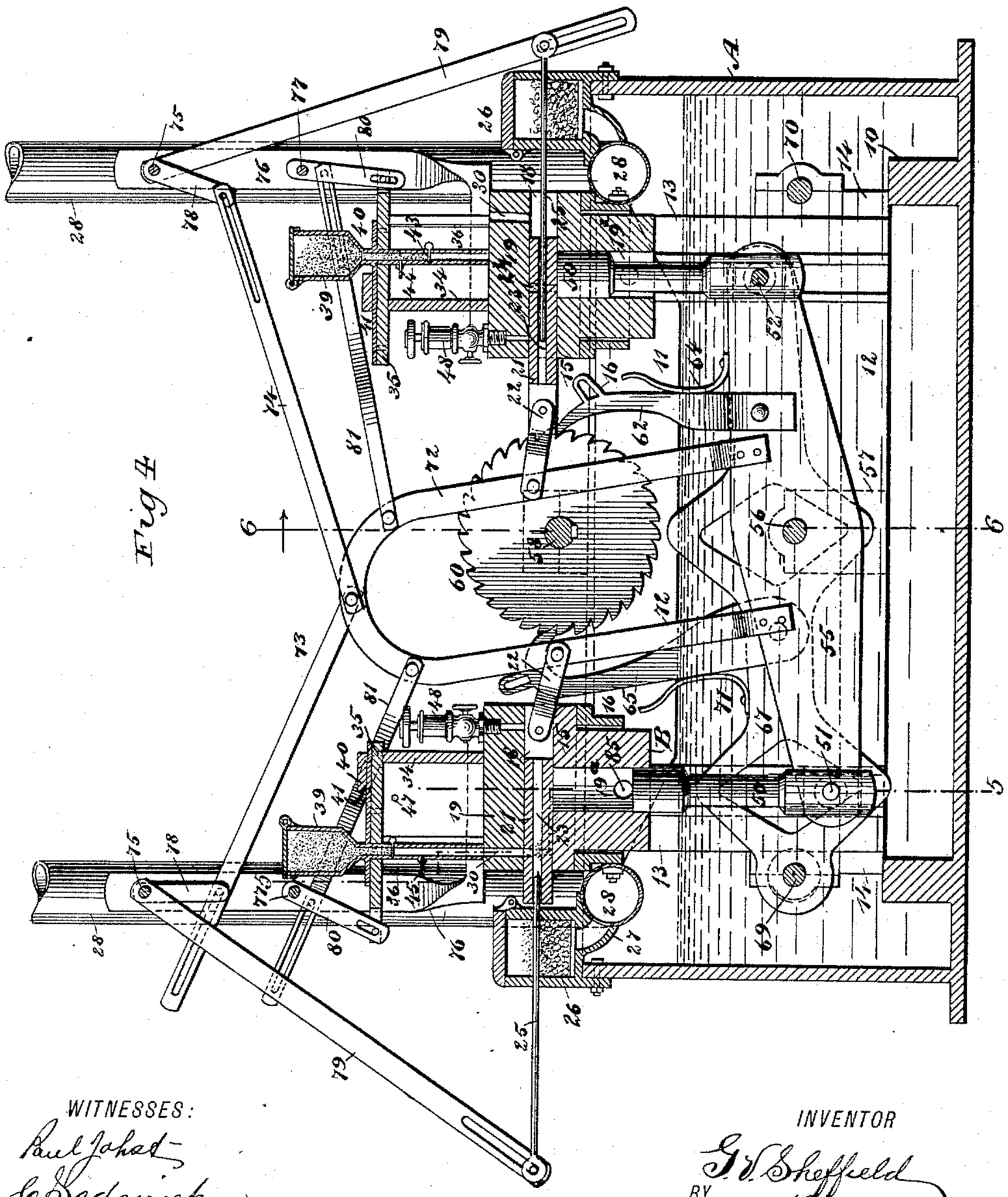

Fig 4

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Fig. 6.

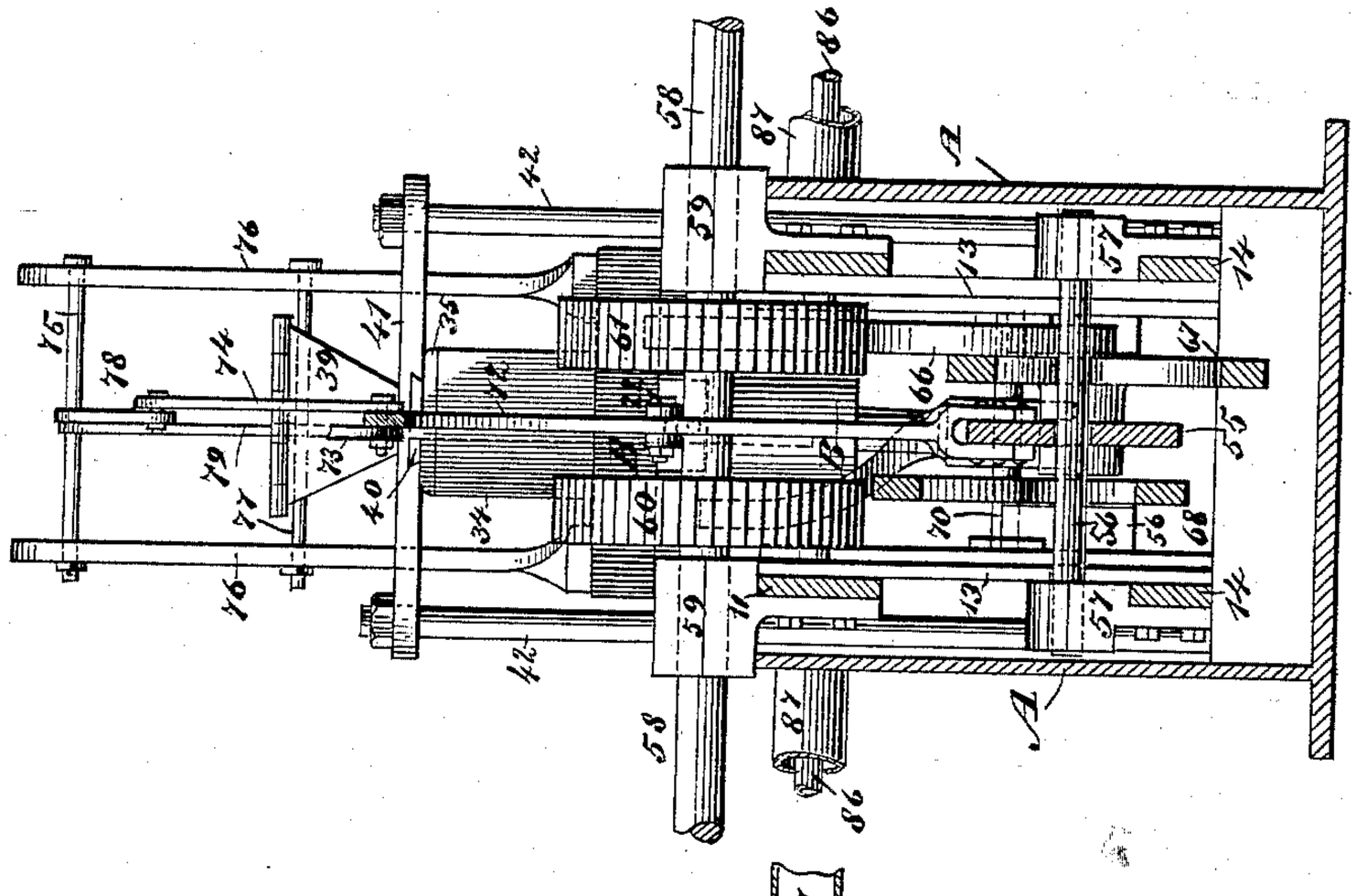

Fig. 5.

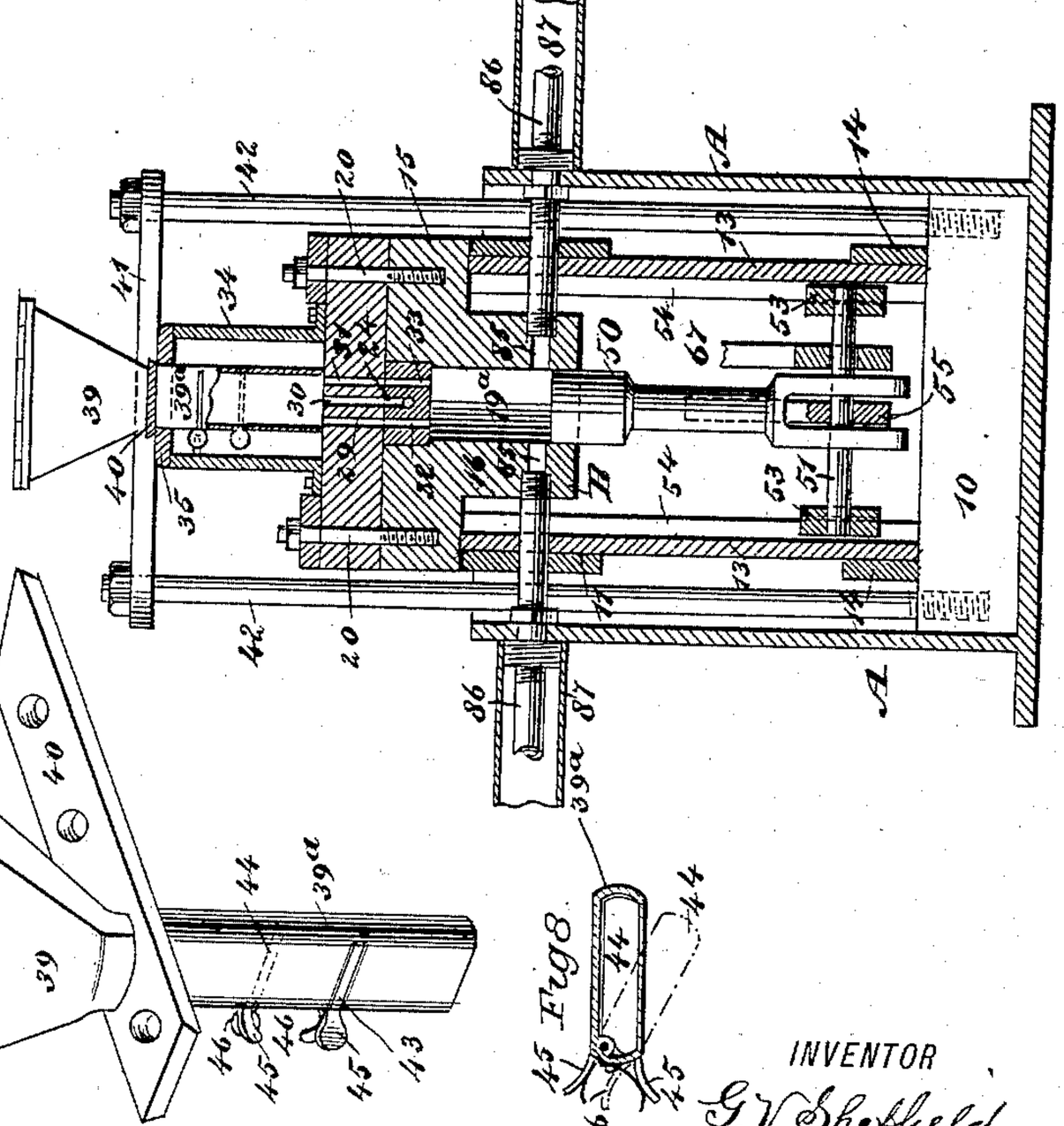

Fig. 4.

Fig 8.

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UNITED STATES PATENT OFFICE.

GEORGE V. SHEFFIELD, OF NEW YORK, N. Y., ASSIGNOR TO THE AMERICAN RAPID MOTOR COMPANY.

POWDER-MOTOR.

SPECIFICATION forming part of Letters Patent No. 485,989, dated November 8, 1892.

Application filed October 30, 1891. Serial No. 410,330. (No model.)

To all whom it may concern:

Be it known that I, GEORGE V. SHEFFIELD, of New York city, in the county and State of New York, have invented a new and Improved Powder-Motor, of which the following is a full, clear, and exact description.

My invention relates to an improvement in motors, and has for its object to provide a motor in which powder of an explosive character will be the prime factor of power.

A further object of the invention is to so construct the motor that the application of the power of the powder will be made to the pistons in a safe and effective manner, and whereby the charge of powder for each explosion will be of uniform bulk.

Another object of the invention is to so construct the motor that it will be simple, compact, durable, and economic.

The invention consists in the novel construction and combination of the several parts, as will be hereinafter fully set forth, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures and letters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the motor applied as the propelling-power for a boat. Fig. 2 is a plan view of the motor, also illustrated in connection with a boat. Fig. 3 is a partial plan and a partial horizontal section of the motor, the powder-box being removed from over one of the cylinders. Fig. 4 is a vertical longitudinal section through the motor. Fig. 5 is a vertical transverse section taken practically on the line 5 5 of Fig. 4. Fig. 6 is a similar section taken on the line 6 6 of Fig. 4. Fig. 7 is a detail perspective view of the powder box or hopper; and Fig. 8 is a transverse section through the spout of the hopper, taken above one of the valves.

The motor is adapted to sit within a box or casing A, the said casing being open at the top and adapted to contain water, as shown in Fig. 4. The casing is usually provided with a boss or bosses 10, located upon its bottom a slight distance from the sides and ends or from the ends only. Upon these bosses the motor rests.

What may be termed the "base-frame" of the motor consists of two upper parallel side plates 11, two bottom parallel side plates 12, and uprights or standards 13, connecting the upper and lower side plates, the said side plates being transversely united by bars 14, which bars are located at the bottom, and at the top the sides are united at each end by plates 15, which plates have integral with their under sides rings or collars 16 and are provided with openings registering with and of the same diameter as the said collars, as is best shown in Fig. 4. The collars 16 are adapted to clamp the lower circular portions of the cylinders B, which circular portions of the cylinders are introduced into the openings in the plates 15 through the top thereof. The upper portions of the cylinders are square and extend from side to side of the frame over the plates 15, the top of one of these cylinders being shown at the right in Fig. 3.

In the top of each cylinder, transversely thereof, yet longitudinally of the machine, a channel 18 is produced, and the circular portion of each cylinder is provided with a chamber 19^a, circular in cross-section and extending through the lower end and into the channel 18, and the channeled portion of each cylinder is covered by a top plate 19, which plate is preferably made of equal size and shape as the top of the cylinder proper, the cover-plate 19 being attached to the body of the cylinder through the medium of screws 20 or the equivalent thereof, as is best shown in Fig. 5.

In the channel 18 of each cylinder a block 21 is held to slide, the said blocks being loosely fitted in the channels, the opposing ends of the blocks being bifurcated to pivotally receive links 22. Each block has longitudinally produced therein a through bore or aperture 23, and a vertical bore or aperture 24 is made in the top of each sliding block, leading downward into the longitudinal bore 23, this vertical aperture 24 being located between the center and the rear end of each block.

The longitudinal bores of the blocks are adapted to receive firing-pins 25 which pins are loosely fitted in the bores of the blocks and are never fully withdrawn therefrom.

These pins also pass through fire-boxes 26, one of which is located at each end of the casing A, as is best shown in Fig. 4, the said fire-boxes being provided with a grate to support the fuel and with chutes 27, extending from beneath the grate to a connection with offtake-flues 28, which flues extend from within the casing A out through one or both sides and up some distance above the casing.

The cover-plate 19 of each cylinder is provided with three apertures 29, 30, and 31, adapted to register at predetermined intervals, the center one with the vertical bore or aperture 24 in the sliding block and the outer ones 29 and 31 with through-bores 32 and 33, located in the sliding blocks, one at each side of the partial bore 24, as is best shown in Fig. 5. The through apertures or bores 29, 30, and 31 in the covers of the cylinders are located near the outer ends of the latter, as is best shown in Fig. 4, and that portion of the covers of the cylinders containing the through apertures or bores is covered by a box-like structure 34, the tops 35 of which structures are capable of a laterally-sliding movement, and at the rear of each structure two doors 36 and 37 are located, (best shown in Fig. 3,) which doors are adapted to open outward, but are normally held closed through the medium of springs 38. The through apertures or bores 29, 30, and 31 in the cover-plates of the cylinders are located very near to or almost upon a line with the doors when the latter are closed.

A hopper 39, adapted to receive the powder or equivalent explosive material, is connected with the sliding top 35 of each box-like structure upon the cylinders, and to that end the hopper has usually attached to its shank-section 39^a a plate 40, somewhat dovetail-shaped in cross-section, the said plates being adapted to be screwed or otherwise attached to the sliding tops 35 of the boxes 34, the said plate being provided with apertures through which the shank-sections 39^a of the hopper extend downward. If in practice it is found desirable, the plates 40 may form an integral portion of the hoppers, and the plates serve, also, as guides for the tops of the boxes 34, as the said plates pass through dovetail slots in cross-bars 41, located above the boxes 34 and supported by uprights 42, said uprights being screwed into or otherwise attached to the bosses 10 of the casing, as is best shown in Fig. 5.

The shank-sections of the hoppers are of sufficient length to engage with the top surfaces of the covers of the cylinders, as is shown in Fig. 4, and likewise in Fig. 5, and the shank of each hopper is preferably provided with two valves 43 and 44, located one above the other. The function of these valves is to operate—*i. e.*, open—the valves of the powder-hopper, and they move in slots produced in the shanks of the hoppers and open in opposite directions, each valve being provided with an attached handle 45, against which springs 46 bear, attached to the shanks, as shown in Fig. 7, the said springs normally maintaining the valve in a closed position—that is, transversely across the shanks of the hoppers.

As heretofore stated, the valves are opened from opposite directions and from opposite sides of the hopper-shank and the lower valve is opened by its handle 45 coming in engagement with the doors 36 of the boxes 34, as is illustrated in Fig. 3. When the doors 36 and 37 have been pressed open to a certain extent, the lower valve will also be opened, as shown in said Fig. 3, and whatever charge of powder that had been contained in the shank of the hopper between the lower and upper valves will be discharged through the lower end of the hopper, and this discharge will take place the moment that the hopper has been moved a sufficient distance outward over the cylinders to bring it in registry with the three apertures 29, 30, and 31 in the cover of the cylinder over which it has movement. At this time, also, the sliding block 21 contained in that cylinder will have moved outward a sufficient distance to cause its three bores or apertures 24, 32, and 33 to register with the apertures 29, 30, and 31 in the cylinder-cover, as shown at the left in Fig. 4, and likewise in Fig. 5.

Upon the inward movement of the powder-hopper, as soon as the hopper is relieved from pressure by the doors 36 and 37 of the boxing surrounding it, the lower valve will automatically close, and when the hopper has advanced inward a certain distance the handle of the upper valve will be brought to an engagement with a pin 47, located in the boxing, preferably at one side, and the upper valve will be opened and a charge of powder will fall downward in the shank of the hopper upon the lower valve. At the next outward movement of the hopper the upper valve will be released from the pin 47 and will close, and the next charge to be fired will be contained between the two valves.

At the right in Fig. 4 the hopper is illustrated as delivering a charge to its shank-section, and this is done by the hopper over one cylinder while the hopper over the other cylinder is discharging its charge into the sliding block.

The sliding blocks 21 are lubricated, preferably, through the medium of oil-cups 48, carried by the covers of the cylinders and communicating with the slideways or channels in the latter.

Pistons 50 are held to slide in the cylinders B, moving in their chambers 19^a only. The lower ends of the pistons are slotted or bifurcated, and are each attached to a transverse rod, (designated, respectively, as 51 and 52,) the rods having attached to their extremities blocks 53, which blocks slide in ways 54, produced in the inner faces of the uprights 13 of the frame. By this means the pistons are compelled to move in a true vertical plane.

The ends of the walking-beam 55 are secured to the guide-rods 51 and 52, preferably between the members of the pistons, and the said walking-beam is fulcrumed at its center upon a fixed shaft 56, located transversely of the central lower portion of the frame; but if in practice it is found desirable the shaft may be free to revolve, in which event it is journaled at its ends in boxes 57, as shown in Fig. 6, and the walking-beam is secured to the shaft.

The drive-shaft 58, adapted to transmit power, is journaled, preferably, in bearings 59, secured to the frame at its upper central portion, and the shaft within the frame has keyed or otherwise secured thereon one or more, preferably two, ratchet-wheels 60 and 61. Each ratchet-wheel is engaged by a dog having an upward or pushing movement, the said dogs being designated as 62 and 63, as best shown in Fig. 3. The dogs are secured to the walking-beam, one at each side of its fulcrum, the attachment being made at opposite sides of the beam, and the dogs are so shaped that one engages with each ratchet-wheel, but at opposite sides, and consequently the teeth of the ratchet-wheels are pitched in reverse directions. The dogs are normally held in engagement with the ratchet-wheels by means of suitable springs 64.

As the dogs 62 and 63 act upon the ratchet-wheels at intervals only and tend to but partially revolve the shaft, it is necessary that other dogs be employed to engage with the ratchet-wheels when the lifting-dogs are idle or not acting upon the wheel. To that end each ratchet-wheel is engaged by pulling-dogs—that is, dogs exerting downward pressure upon the teeth of the ratchet-wheels—and these dogs are designated, respectively, as 65 and 66. The lifting-dogs engage with the ratchet-wheels at one side and the pulling-dogs engage with said wheels at the diametrically-opposite side.

The pulling-dogs 65 and 66 are attached to levers 67 and 68, one lever being located at each side of the walking-beam, as shown in Fig. 6. The lever 67 has one end pivotally attached to the piston guide-rod 52, the other end being pivoted upon a cross-bar 69, located outside of the opposite piston, as shown in Fig. 4, and the lever 68 has one end pivotally attached to the piston guide-rod 51, and its opposite end is pivoted to a cross-bar 70, located outside of the piston to which the guide-rod 52 is attached. In Fig. 4 this lever is omitted in order to more clearly show the walking-beam. Each lever is provided with openings through which the guide-rod of the piston passes and with a second opening through which the shaft 56 extends, the openings being of sufficient length to admit of vertical movement of the levers. The pulling-dogs are attached to the levers 67 and 68, the attachment being made between the center of the levers and the end pivoted upon the cross-bar. These pulling-dogs are held in engagement with the ratchet-wheels through the medium of suitable springs 71, as shown in Fig. 4, and the upper ends of the dogs are curved downward or are hook-shaped, as is likewise shown in said figure.

Through the medium of the walking-beam motion is communicated to the sliding covers 35, carrying the powder-hoppers, and likewise to the firing-pins 25 and the sliding blocks 21, communication being established by attaching to the walking-beam a vertically-disposed yoke 72, the members whereof are attached to the beam, one at each side of the center, as illustrated in Fig. 4. The links 22, attached to the sliding blocks 21, are pivotally attached, also, to opposite sides of the yoke 72, and at the central upper portion of the yoke two links 73 and 74 are pivoted, extending upward and outward in opposite directions, the outer ends of which links are slotted. These links extend beyond fixed shafts 75, secured at their ends in standards 76, two of which standards are secured to the upper faces of the cylinder-covers, a second shaft 77 being also secured in the standards below the upper shaft 75. Each upper shaft 75 has pivoted thereon a short link 78, and these links 78 are connected with the long links 73 and 74 by pins passed through slots in the latter links. The upper ends of the short links 78 are connected in any approved manner with downwardly-extending links 79, slotted at their lower ends, the lower portions of these links being pivotally connected with the firing-pins 25, a bolt or the equivalent thereof being passed through the outer ends of the pins and through the slots in the said links 79.

Short links 80 are pivoted upon the lower shaft 77 at their upper ends, and the lower ends of these short links are connected with the tops 35 of the box-like structure 34, the said covers carrying the powder-hoppers by passing a pivot-pin from the outer ends of the covers through slots in the lower ends of the links, as is likewise best shown in Fig. 4, and the short links are given movement from the yokes 72 through the medium of longer links 81, pivotally secured at their inner ends to opposite sides of the yoke at the arched portion thereof, and the outer ends of these links 81 are slotted and connected with the shorter links 80 by means of pins attached to the latter and passed through the slots in the former.

A pump 82 is operated by the revolution of the drive-shaft in any suitable or approved manner, but ordinarily through the medium of an eccentric, as shown in Fig. 3, and this pump through the medium of a tube 83 is connected with the casing, supplying water thereto, the said casing being provided with an outlet-tube 84, whereby a circulation of water in the casing is constantly obtained. It is necessary that the smoke from an explosion be carried away from the cylinders, and this is effected by producing in opposite sides of the cylinders openings 85, said open-

ings leading into the chambers 19ª, and connecting with the openings are offtake-pipes 86, leading out through the casing A at opposite sides, and these pipes, being more or less heated, are surrounded, preferably, by jackets 87, so that the heat generated by the pipes may be conveyed to any desired point by the jackets and utilized—as, for instance, for heating a boat or a vehicle in which the motor is employed as the propelling medium.

In the operation of the motor one piston is always up fully within a cylinder when the other one is at its lowest position, as shown in Fig. 4, and as soon as a piston reaches its uppermost position in a cylinder the sliding block of that cylinder, with its charge of powder, will have moved inward a sufficient distance to bring the charge directly over the piston-head, and the heated portion of the firing-pin will be forced at that time in engagement with the charge, exploding the same, and as a solid wall is above the charge while being exploded the force of the explosion must necessarily be downward, and the result is that the piston receiving the shock is forced to its lowermost position and the opposite piston is forced upward. While one piston is being acted upon the sliding block in the opposite cylinder is receiving its charge in the manner heretofore described, and the moment that one piston is thrown down the piston carried up will be immediately forced downward again, as an explosion will at that time take place. Thus as the pistons are being constantly acted upon and carried alternately in opposite directions, the walking-beam 55 is kept in constant motion and the yoke 72 is given lateral movement in the direction of the ends of the motor, and this movement of the yoke, through the medium of the links above described, operates the firing-pin, moves the sliding blocks, and likewise moves the covers carrying the powder-hoppers. The power is communicated to the drive-shaft through the ratchet-wheels 60 and 61, which are kept constantly revolving through the medium of their engaging dogs, and by reason of the peculiar location of the dogs—that is, upon the walking-beam—and the levers 67 and 68 when the push-dogs are not operating upon the ratchet-wheels the pulling-dogs are exerting tension thereon.

It will be observed that the motor is exceedingly simple, durable, and economic in construction and that it will at a minimum of cost and through the medium of explosive compounds thoroughly protected convey to the drive-shaft a steady and continuous rotary motion.

In Figs. 1 and 2 I have illustrated the application of the motor to a vessel in which the paddle-wheels D are attached to opposite ends of the drive-shaft.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a motor, the combination, with a piston and a chambered carrier-block sliding over the same, of a firing-pin contained in the carrier-block, a feed-hopper adapted to contain an explosive compound, and a time connection between the carrier-block and the hopper, substantially as described.

2. In a motor, the combination, with a driving-shaft, a cylinder, a piston held to slide in the cylinder, and an actuating mechanism connecting the piston and the driving-shaft, of a carrier-block sliding over the piston in an inclosed chamber within the cylinder, the said block being provided with a central chamber and a series of passages, a furnace, a firing-pin passing through the furnace and into the carrier-block, and a reciprocating hopper located above the carrier-block for containing an explosive compound, the said hopper having a time connection with the chambers of the carrier-block, as and for the purpose specified.

3. In a motor, the combination, with a driving-shaft, a cylinder, a piston held to slide in the cylinder, lever-arms connected with the piston, dogs carried by the lever-arms, and toothed wheels secured upon the driving-shaft with which the dogs engage, of a carrier-block held to slide above the piston and having chambers therein, a heating device, a firing-pin passing through the heating device into the carrier-block, a hopper having time connection with the chambers of the carrier-block, and link connections between the hopper-supports, the carrier-block, the firing-pin, and the lever-arms, as and for the purpose specified.

4. In a motor, the combination, with a driving-shaft, a cylinder, a piston held to slide in the cylinder, an actuating mechanism connecting the piston and the drive-shaft, and a carrier-block provided with a series of chambers and held to slide above the piston, of a cover-plate located above the slideway of the carrier-block and provided with a series of channels, a hopper held to slide above the cover-plate and adapted to allow discharge of an explosive powder into the chambers of the carrier-block, a firing device having movement in the carrier-block, and a propelling mechanism connecting the actuating mechanism with the support of the hopper, the carrier-block, and the firing device, as and for the purpose specified.

5. In a motor, the combination, with a driving-shaft, a cylinder, a piston held to slide in the cylinder, an actuating mechanism connecting the piston and the driving-shaft, and a carrier-block held to slide in the cylinder above the piston, the said carrier-block being provided with chambers and the cylinder with channels communicating with said chambers, of a valved hopper having a sliding movement over and in engagement with the cylinder and adapted for containing and discharging an explosive compound, a trip mechanism adapted to engage with the valves of the hopper, a firing device entering the chambers of the carrier-block, a heating device surround-

ing the firing device, and means, substantially as shown and described, for moving the carrier-block, the hopper, and the firing device, as and for the purpose specified.

6. In a motor, the combination, with a driving-shaft, cylinders located at opposite sides of the driving-shaft, pistons having movement in said cylinders, a walking-beam pivotally connected at its ends with the pistons, levers also connected with the pistons, and a driving mechanism connecting the driving-shaft, the walking-beam, and levers, of carrier-blocks held to slide in the cylinders over the pistons and beneath channels in the cylinders, the said carrier-block being provided with chambers, a hopper having sliding movement over the cylinders and upon them, heating devices, firing-pins passing through the heating devices into the carrier-blocks, and link connections between the walking-beam, the supports for the hoppers, the carrier-blocks, and the firing-pins, as and for the purpose specified.

7. In a motor, the combination, with a driving-shaft, cylinders arranged at each side of the driving-shaft, pistons held to slide in the cylinders, a walking-beam connecting the pistons, levers connected at one end with the pistons, ratchet-wheels attached to the driving-shaft, and dogs carried by the walking-beam and levers and engaging with said ratchet-wheels, of carrier-blocks provided with chambers and held to slide in the cylinders above the pistons and beneath channels in said cylinders, said channels being adapted for registry at times with the chambers of the carrier-blocks, slides located above the cylinders, hoppers carried by said slides, the lower ends of which hoppers register at intervals with the channels in the cylinders, valves controlling the supply of an explosive compound carried by the hopper, trip devices adapted for engagement with the valve, a firing-pin having movement in the carrier-blocks, and a driving connection between the walking-beam, the firing-pins, the carrier-blocks, and the slides for the hoppers, substantially as shown and described.

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