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GAS EXPLOSIVE ORDNANCE.

APPLICATION FILED MAR. 24, 1910.

993,983.

Patented May 30, 1911.

7 SHEETS—SHEET 1.

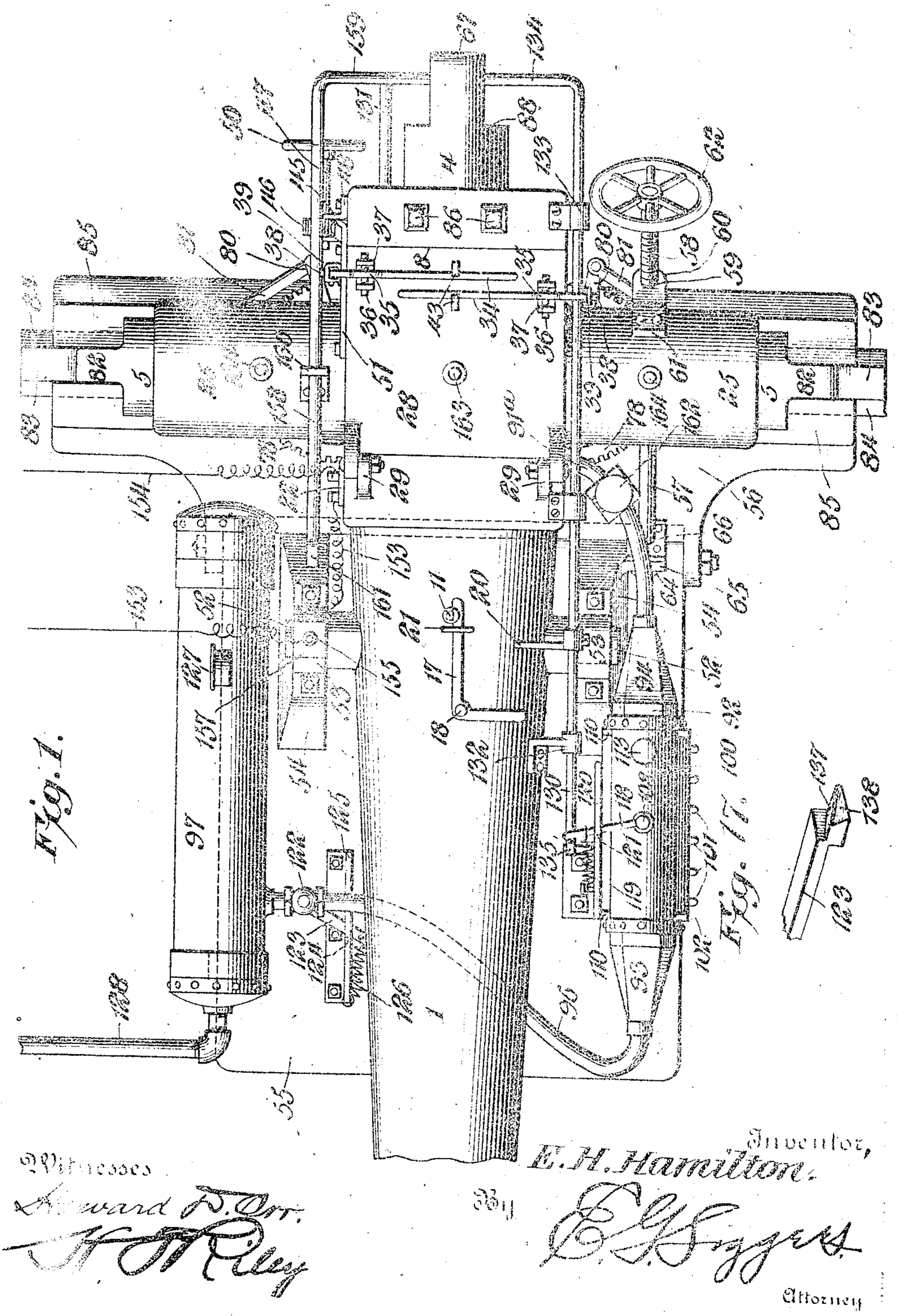

Fig. 1.

Fig. 17.

Witnesses

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7 SHEETS—SHEET 2.

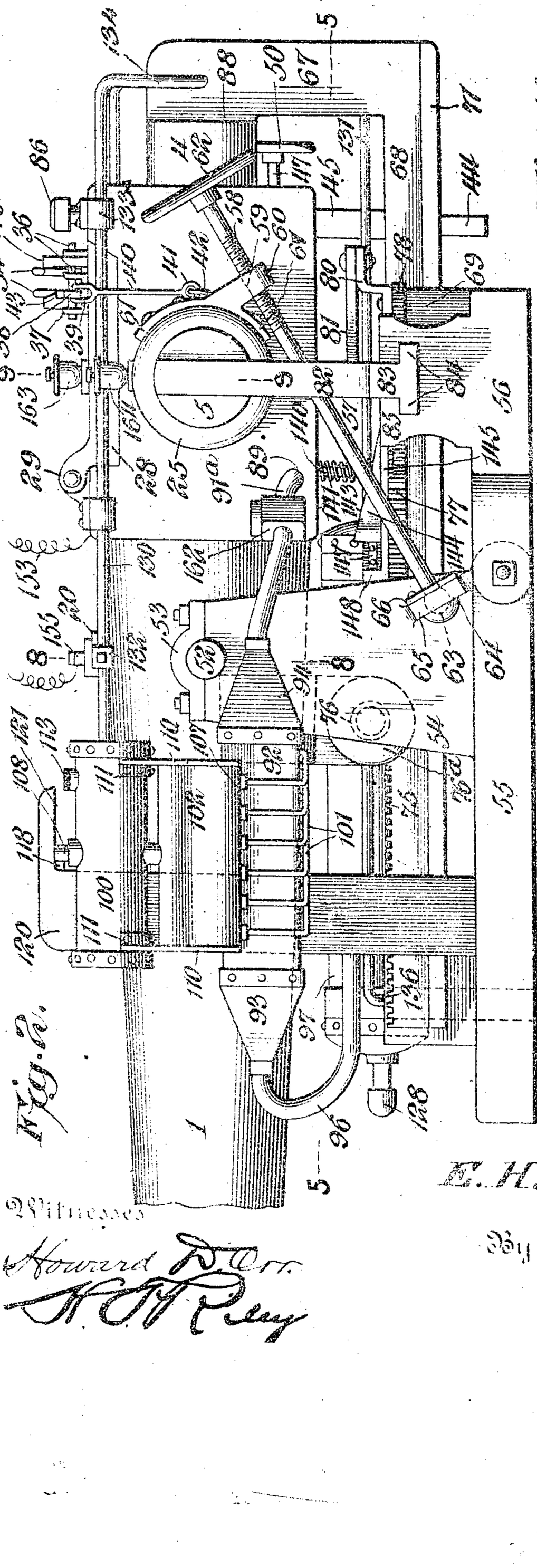

Fig. 2.

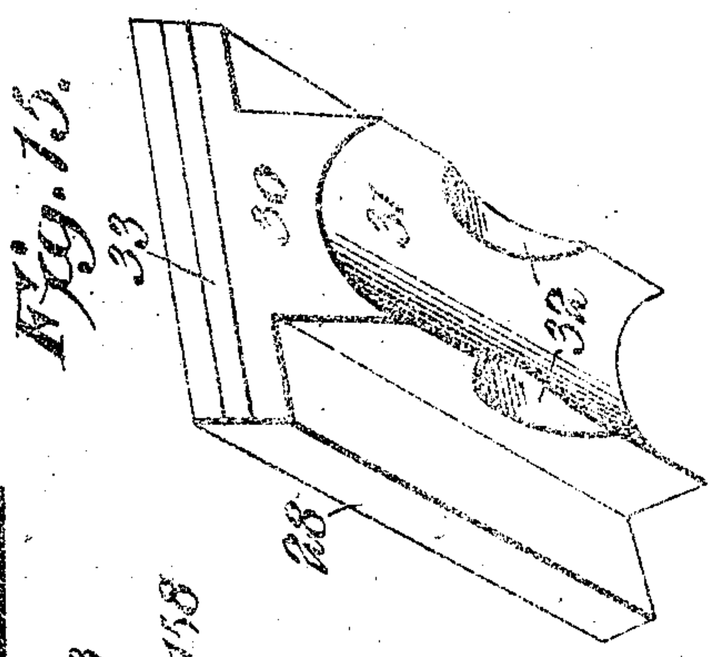

Fig. 3.

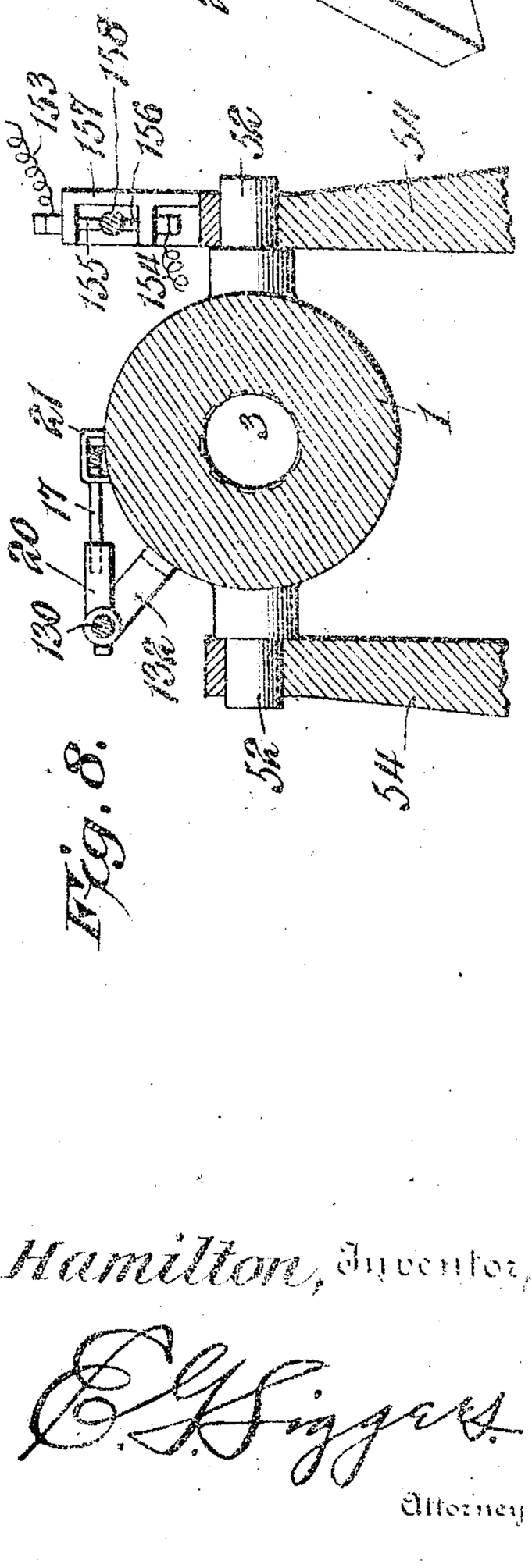

Fig. 8.

Witnesses

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7 SHEETS—SHEET 3.

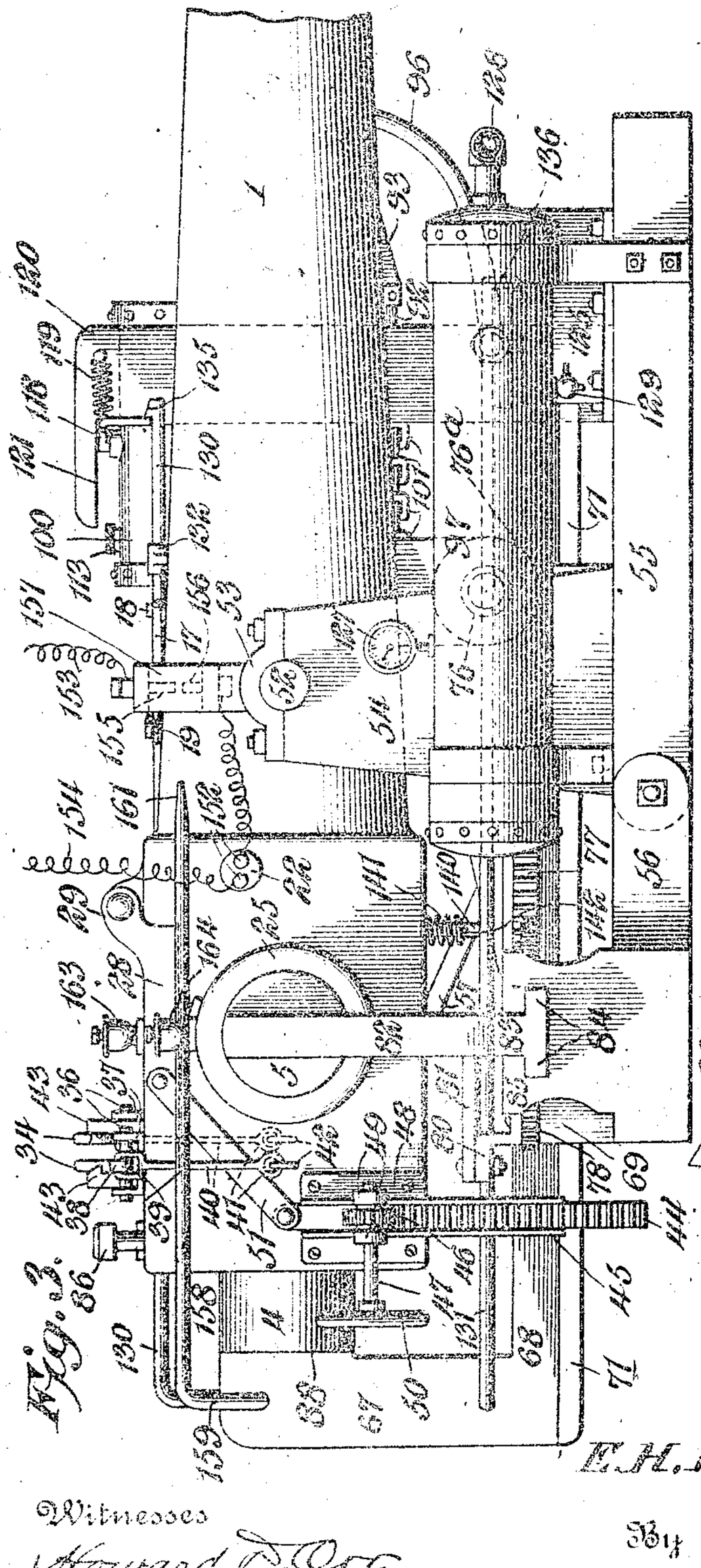

Fig. 3.

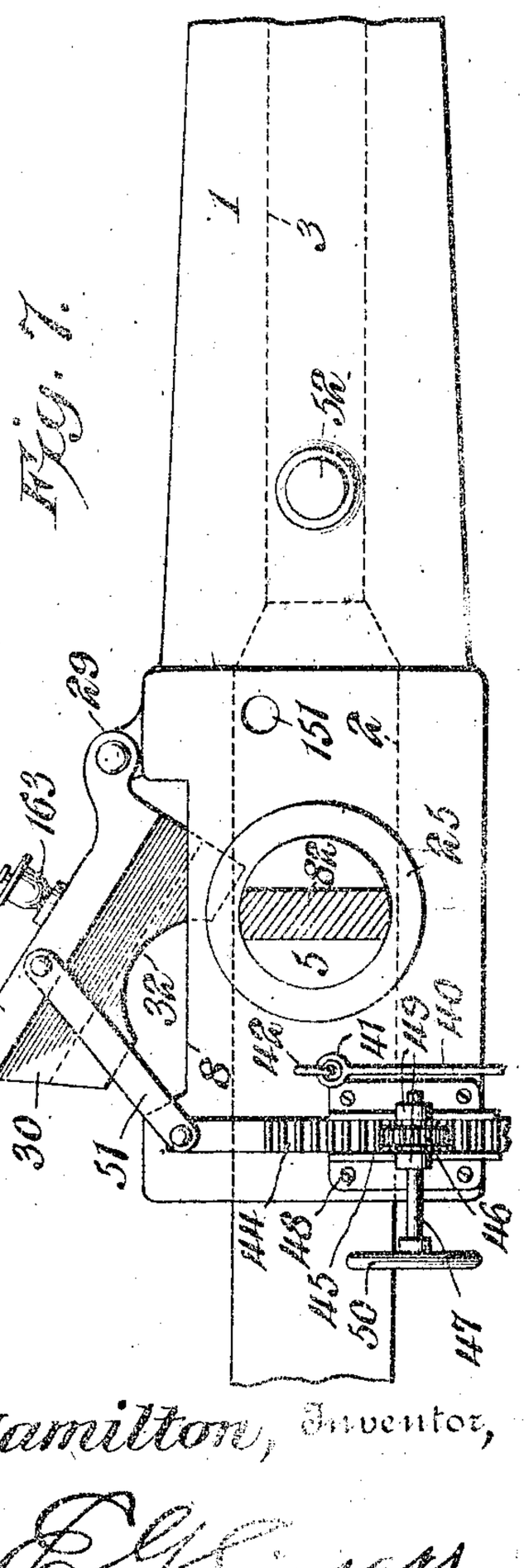

Fig. 7.

Witnesses

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7 SHEETS—SHEET 4.

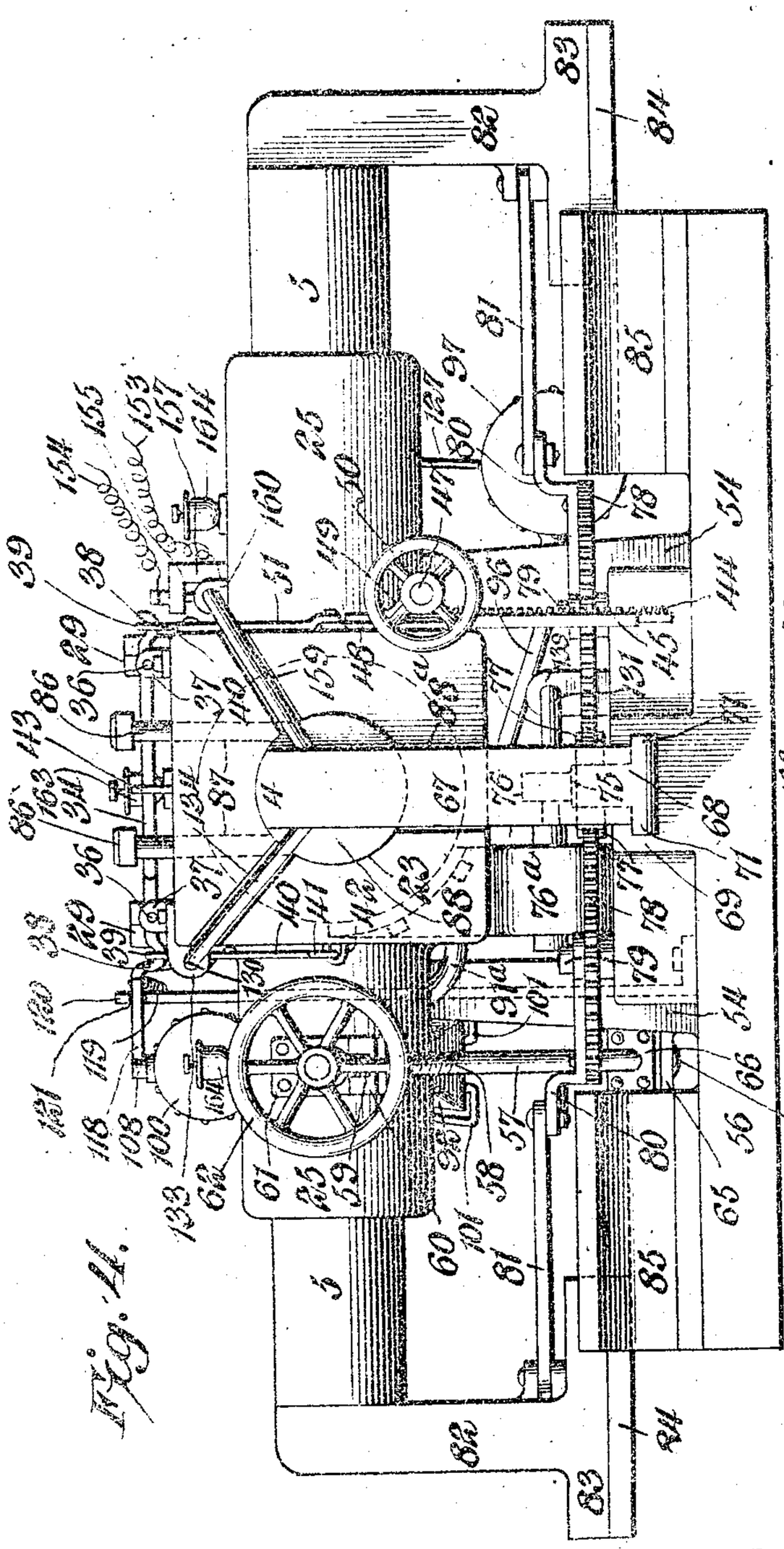

Fig. 4.

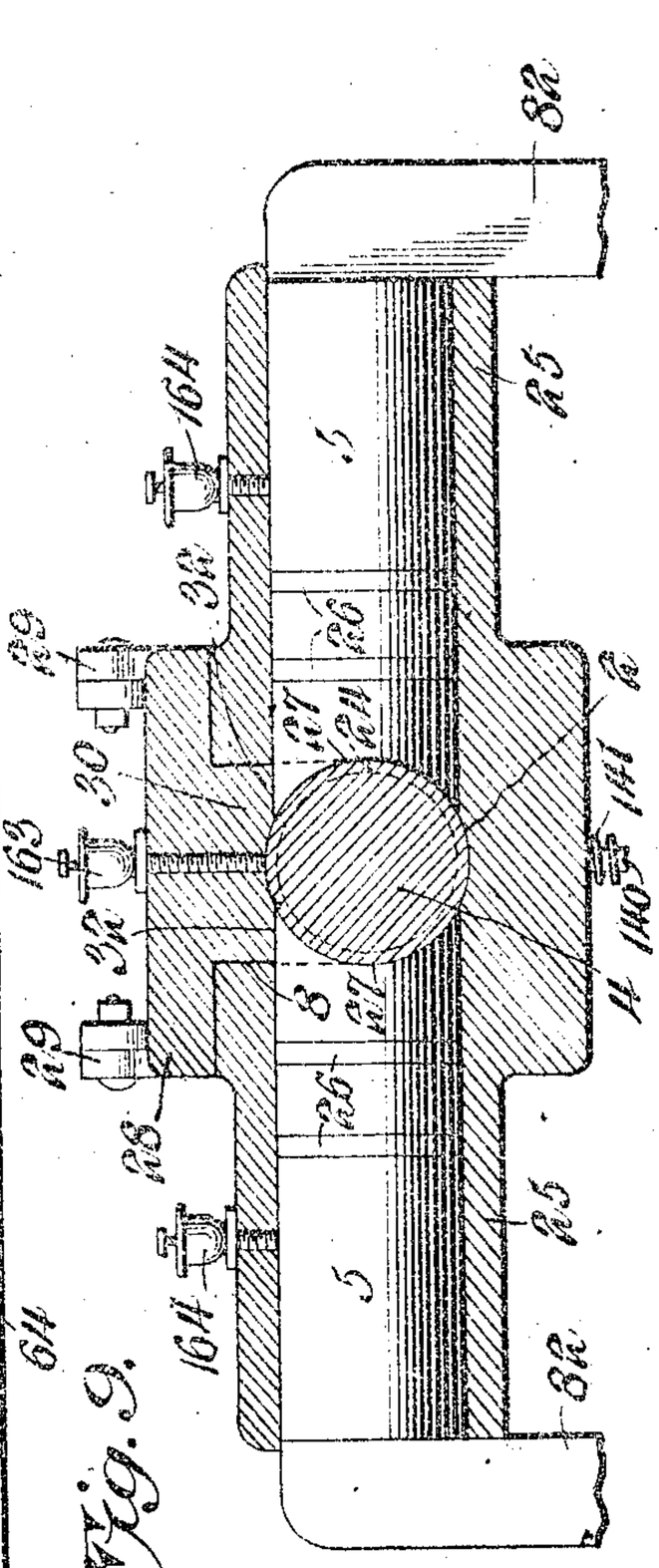

Fig. 9.

Witnesses

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APPLICATION FILED MAR. 24, 1910.

Patented May 30, 1911.

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Fig. 10.

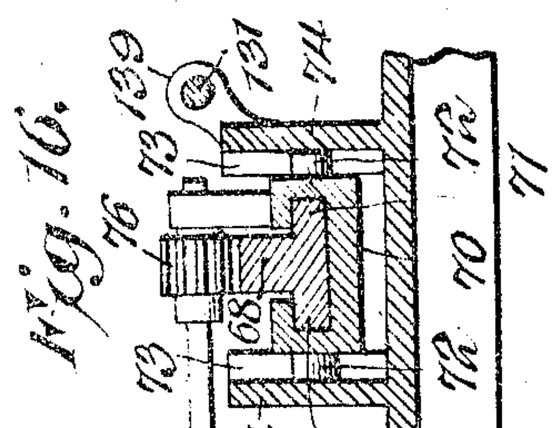
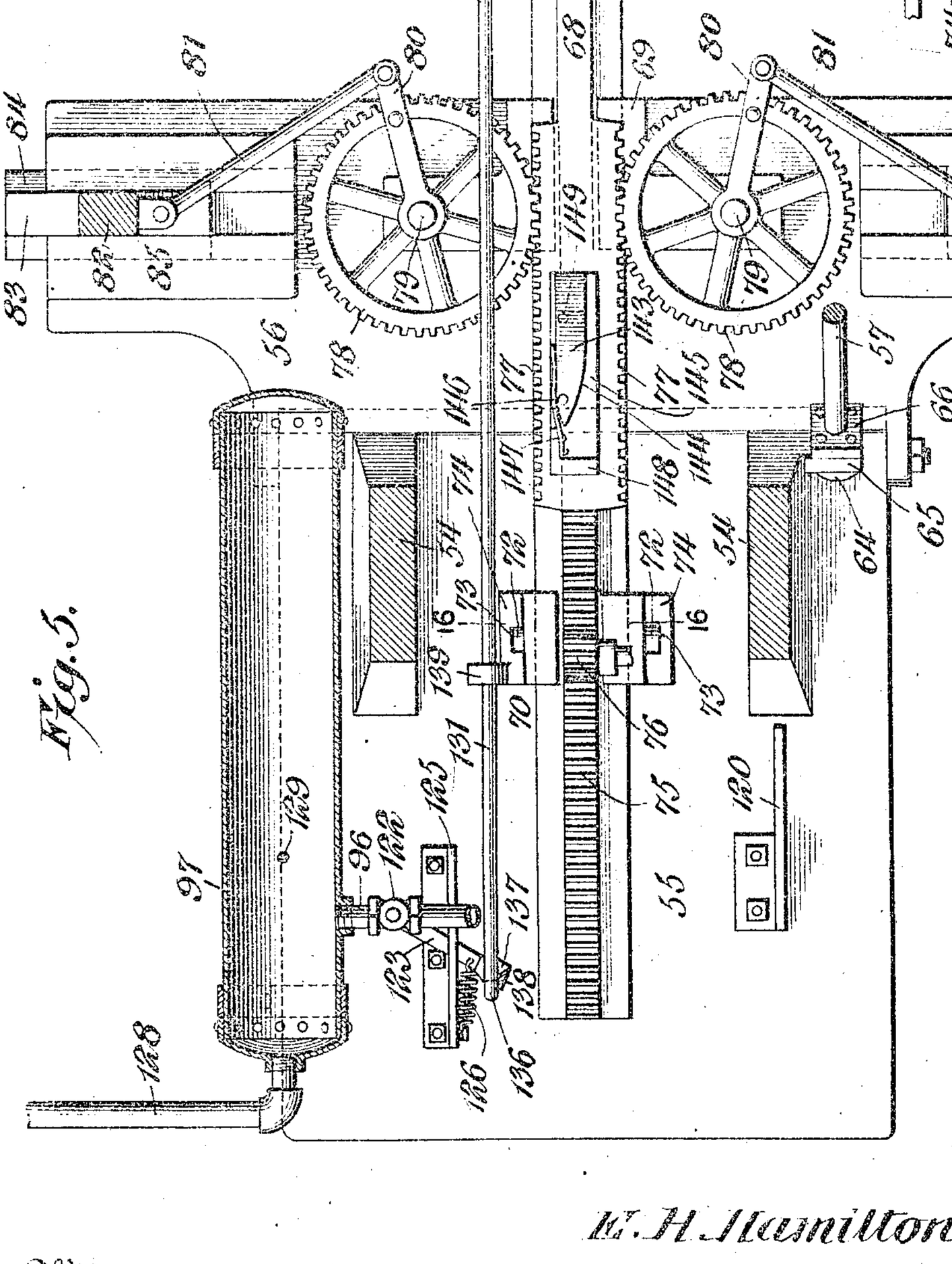


Fig. 5.



Witnesses

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7 SHEETS—SHEET 6.

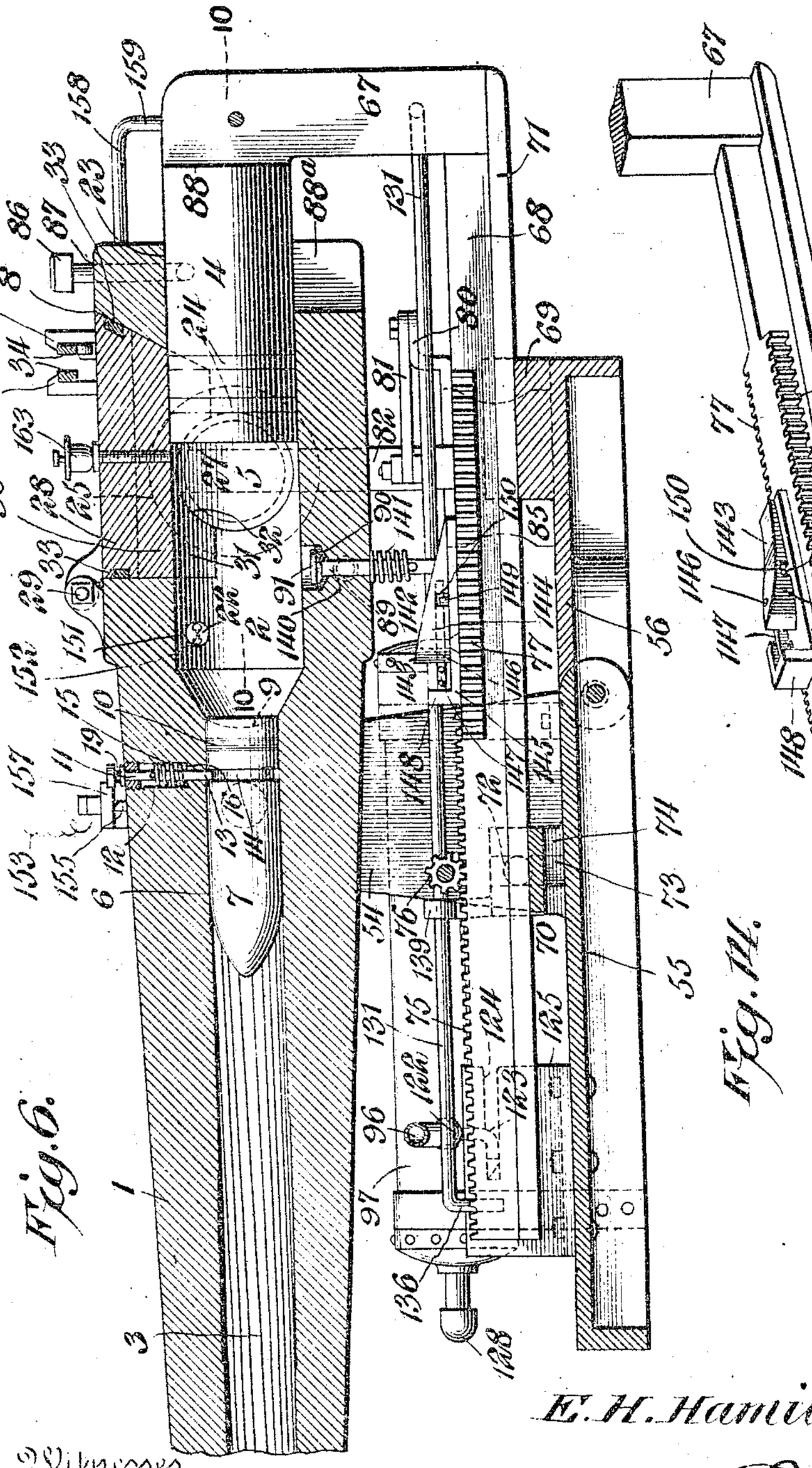

Fig. 6.

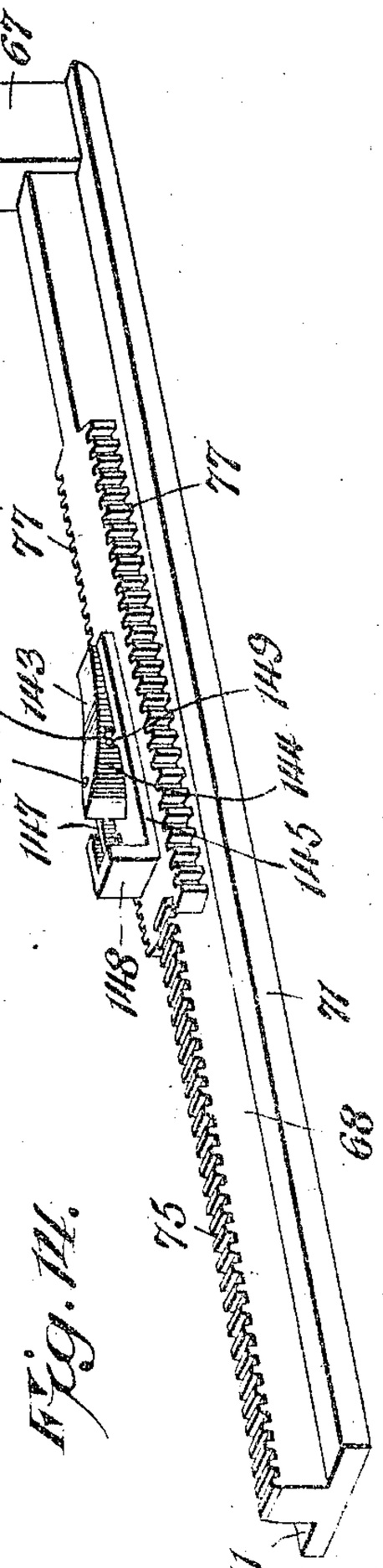

Fig. 7.

Witnesses

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7 SHEETS—SHEET 7.

Fig. 10.

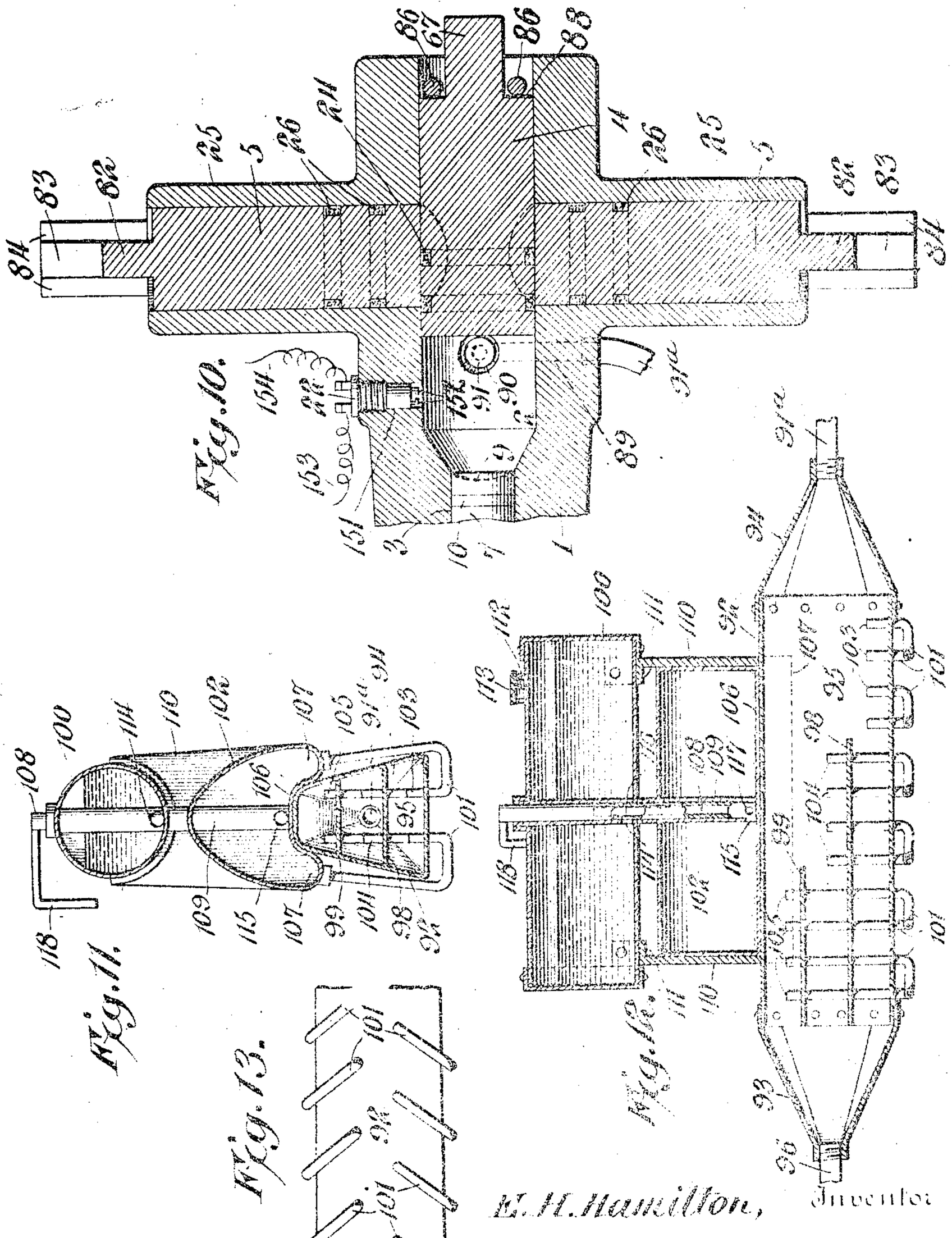

Fig. 11.

Fig. 12.

Fig. 13.

Witnesses

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UNITED STATES PATENT OFFICE.

ERNEST HUBBARD HAMILTON, OF KILGORE, TEXAS.

GAS-EXPLODED ORDNANCE.

993,983. Specification of Letters Patent. Patented May 30, 1911.

Application filed March 24, 1910. Serial No. 551,330.

To all whom it may concern:

Be it known that I, ERNEST H. HAMILTON, a citizen of the United States, residing at Kilgore, in the county of Gregg and State of Texas, have invented a new and useful Gas-Exploded Ordnance, of which the following is a specification.

The invention relates to gas exploded ordnance.

The object of the present invention is to provide a simple and efficient gas gun, which will be powerful, smokeless and positive in its operation, and adapted to reduce the expense and lessen the danger of firing guns.

A further object of the invention is to provide a gun of this character, which after a projectile or shell has been placed in the barrel of the gun, will be automatic in operation, and equipped with mechanism for supplying a charge of explosive aeriform fluid to the breech of the gun, and for compressing such explosive and igniting the charge after the same has been compressed.

With these and other objects in view, the invention consists in the construction and novel combination of parts hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended; it being understood that various changes in the form, proportion, size and minor details of construction, within the scope of the claims, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:—Figure 1 is a plan view of the gas gun, constructed in accordance with this invention. Fig. 2 is a side elevation of the same. Fig. 3 is a similar view, showing the other side of the gun. Fig. 4 is a rear elevation of the gas gun. Fig. 5 is a horizontal sectional view, taken substantially on the line 5—5 of Fig. 2. Fig. 6 is a central longitudinal sectional view. Fig. 7 is a detail side view, partly in section, illustrating the mechanism for opening and closing the hinged door or closure of the compression chamber. Fig. 8 is a detail transverse sectional view on the line 8—8 of Fig. 2. Fig. 9 is a similar view on the line 9—9 of Fig. 2. Fig. 10 is a detail horizontal sectional view on the line 10—10 of Fig. 6. Fig. 11 is a transverse sectional view of the carbureter. Fig. 12 is a longitudinal sectional view of the same. Fig. 13 is a reverse plan view of a portion of the carbureter, illustrating the arrangement of the opposite spray pipes or tubes. Fig. 14 is a detail perspective view of the reciprocatory rack bar. Fig. 15 is a perspective view of the hinged door or closure of the compression chamber. Fig. 16 is a detail sectional view on the line 16—16 of Fig. 5, illustrating the construction of the front guide of the longitudinal plunger actuating rack bar. Fig. 17 is an enlarged detail perspective view of the arm of the air valve.

Like numerals of reference designate corresponding parts in all the figures of the drawings.

In the embodiment of the invention illustrated in the accompanying drawings, 1 designates the barrel of the gun, which is designed to be constructed of different calibers. The barrel of the gun is provided at the breech with a cylindrical compression chamber 2, tapered at the front end to the bore 3 of the barrel, and adapted to receive a charge of explosive gas, which is compressed by a main longitudinal piston 4 and laterally reciprocatable auxiliary pistons 5. The auxiliary pistons, which are designed for use on large or heavy guns, may be dispensed with on the smaller class of guns. The bore 3 of the barrel of the gun is provided with a smooth projectile receiving portion 6, and it is rifled therefrom to the muzzle. A shell or projectile 7 is placed in the barrel of the gun, being introduced through an opening 8 at the top of the compression chamber, and any suitable mechanism of the ordinary construction may be employed for handling the projectile 7 to place the same in the barrel of the gun. The shell or projectile 7 is preferably provided at its rear end with a concavity 9 in order to enable it to receive the full effect of the force of the explosive, and it is preferably equipped at its rear portion with one or more bands 10 of soft metal, adapted to form an air tight packing or fit to prevent escape of the aeriform fluid while the same is being compressed by the pistons. The metallic band is of slightly greater diameter than the body of the projectile, which has to be forced into the smooth portion 6 of the bore.

The projectile is held in the bore of the

barrel during the compression stroke of the pistons 4 and 5 by means of a catch, which in the present form of the invention, consists of a pin 11, mounted in an opening 12 of the barrel and having an inner engaging terminal 13, adapted to extend into the bore of the barrel and engage the annular groove 14 of the projectile. The groove 14, which extends entirely around the projectile to enable it to be engaged at any point, is located in advance of the soft metal bands 10, and it forms a shoulder, which engages with the catch for holding the shell or projectile in position. The pin 11 is actuated in its outward movement by a coiled spring 15, bearing at its inner end against a shoulder 16 of the barrel of the gun and having its outer end engaging the pin. The locking pin 11 is held in engagement with the groove of the projectile by a lever 17, pivoted at an intermediate point to the barrel of the gun by a pin 18, or other suitable means, and having one arm arranged to engage the locking pin. The locking pin is preferably provided at its outer end with an annular groove 19 to receive the engaging arm of the lever, and the latter, which may be of bell crank form, has its other end arranged in the path of a tripping arm 20, which is timed to release the locking pin simultaneously with the operation of the means for exploding the compressed charge of gas. The engaging arm of the lever 17 preferably operates within a suitable keeper 21, but it may be mounted in any other desired manner, and instead of employing the means shown for releasing the projectile, any other suitable mechanism may be used for withdrawing the locking device from engagement with the projectile.

The main piston 4, which is cylindrical, extends through a cylindrical opening 23 in the rear wall of the compression chamber, and it is equipped with suitable packing rings 24 to provide an air tight fit and prevent escape of the gas. The auxiliary compression pistons 5 are preferably operated in laterally extending cylinders 25, located at opposite sides of the compression chamber and communicating at their inner ends with the same. The laterally extending pistons, which are provided with suitable packing rings 26, have concave inner ends 27, adapted to form a continuation of the wall of the compression chamber and complete the same at the inner ends of the cylinders 25, when the auxiliary pistons are at the limit of their inward movement. This inward movement of the auxiliary pistons is completed before the front end of the main longitudinally reciprocatable piston has entirely moved past the auxiliary pistons, so that the latter cannot operate to pocket any of the gas. The main piston, which completes the compression of the charge, is moved forwardly or inwardly to a point beyond the opening 8 before the gun is discharged, and a hinged door or closure, 28, which normally covers the said opening 8, is not subjected to any of the pressure resulting from the discharge of the compressed gas. The door or closure 28, which is connected at its front edge with the barrel by suitable hinges 29, is let into recesses in the side walls of the compression chamber, and it has an inner reduced depending portion 30, which fits around the top of the main piston and completes the cylindrical wall of the compression chamber at the opening 8. The depending portion 30 is grooved longitudinally at 31 and it has segmental recesses 32 at opposite sides of the groove 31 to register with the laterally extending cylinders of the auxiliary pistons. The hinged door or closure is provided at its edges with a suitable packing strip 33, adapted to prevent the escape of the gas during the compression stroke of the pistons. The rear wall of the opening 8 and the rear edge of the hinged door or closure are beveled or inclined, as clearly shown in Fig. 6 of the drawings, so that the packing is compressed when the hinged door or closure is forced to its seat. The hinged door or closure is locked in its closed position by opposite transversely disposed levers 34, provided at their outer ends with heads or enlargements 35, which are pierced by pivots 36. The pivots 36 are mounted in suitable bearing brackets 37, and the heads 35 have outer engaging portions or fingers 38, which extend through upper eyes or openings 39 of links 40. The links 40, which are located at opposite sides of the compression chamber, are provided at their lower ends with eyes 41, which are linked into exteriorly arranged eyes 42 of the side walls of the compression chamber. The links may be connected with the outer faces of the side walls of the compression chamber in any suitable manner, and the inner arms of the transverse locking levers 34 are engaged with keepers 43, projecting from the upper face of the hinged door or closure and provided with upper or outer engaging portions, as clearly shown in Fig. 6 of the drawings.

When the hinged door or closure is unlocked it may be conveniently opened and closed by gearing comprising a vertically movable rack bar 44, operating in a vertical guide 45 and actuated by a pinion 46 of a horizontal shaft 47. The vertical guide, which is provided at opposite sides with spaced parallel flanges, extends downwardly from a bracket or attaching portion 48, which is suitably secured to the outer face of one of the side walls of the compression chamber. The bracket is provided with spaced bearings 49 for the operating shaft

47, and the latter is equipped at its rear end with a hand wheel 50. The upper end of the vertical movable rack bar 44 is connected by a link 51 with the hinged door or closure, and when the gearing is operated to raise the rack bar, the door or closure will be opened. A reverse movement of the rack bar operates to close the door 28. The link 51, which is inclined when the door 28 is closed, is pivoted at its upper end to the door at the contiguous side edge thereof, and its lower end is pivoted to the rack bar 44.

The barrel of the gun is provided at opposite sides with trunnions 52, journaled in suitable bearings 53 of pedestals or supports 54, rising from a fixed front section 55 of a platform having a hinged rear section 56. The platform is designed to constitute a portion of a suitable mount or carriage, which may be of any preferred construction and which in practice will be adjusted in the ordinary manner for aiming the gun. The hinged rear section of the platform permits a fine adjustment of the gun should the preliminary sighting be found to be slightly defective, and in order to obviate an entire resighting or adjustment, the gun may be tilted vertically by means of an inclined shaft 57, extending downwardly and forwardly at one of the side walls of the compression chamber and having a threaded portion 58, extending through and engaging a threaded opening 59 of a nut 60. The nut 60 is in the form of a lug and is provided with curved attaching arms 61, secured to be adjacent laterally extending cylinder, as clearly illustrated in Fig. 2 of the drawings. The upper end of the inclined shaft 57 is equipped with a hand wheel 62, and its lower end is provided with a head 63, secured in a socket 64 of a flange 65 by a plate 66, or other suitable means. The flange 65 extends laterally from one of the pedestals or supports 54 and is preferably formed integral therewith. The connection between the lower end of the inclined shaft or screw 57 and the front fixed section of the base or platform forms a swivel connection, which permits a rotary movement of the shaft or screw 57 and a limited oscillatory movement of the same to conform to the tilting or pivotal movement of the barrel of the gun.

The main longitudinally reciprocatable piston 4 is connected at its outer or rear end with an upwardly extending arm or upright 67, carried by a longitudinally reciprocatory rack bar 68, located beneath the gun barrel and operating in a rear guide 69 and in a front guide 70. The rack bar 68 is provided at opposite sides with longitudinal bottom flanges 71, and the rear and front guides 69 and 70 are provided at opposite sides with grooves to receive the flanges 71, whereby the rack bar is interlocked with the guides. The rear guide is fixed to the hinged rear section of the base or platform, and the front guide 70 is provided with horizontally projecting pivots 72, operating in vertical ways 73 of vertical guides 74. This construction permits a limited vertical movement of the front guide with relation to the base.

The rack bar 68 is provided at its upper edge or face with teeth 75, extending from the front end of the rack bar to a point intermediate of the ends thereof, and meshing with a motor actuated pinion 76, adapted to communicate motion to the rack bar for reciprocating the pistons. The pinion 76 is mounted on the shaft of a motor 76ª, which may be electrical or any other desired construction, and the said motor 76ª is hung from the barrel of the gun in order not to interfere with the limited up and down movement of the adjustment of the gun through the shaft or screw 57. The rack bar is provided at opposite sides at an intermediate point with teeth 77, which mesh with horizontally disposed gear wheels 78 for simultaneously rotating the same to actuate the auxiliary pistons, which are moved in opposite directions. The gear wheels 78, which are located at opposite sides of the rack bar, are mounted on vertical stub shafts 79 and are provided with radial arms 80, projecting beyond the peripheries of the gear wheels and connected by a pitman 81 with vertical arms or uprights 82 of transversely disposed slides 83. The slides 83, which are provided with bottom flanges 84, reciprocate in grooved guides 85, which are mounted upon the rear section of the base or platform, and which in practice may be sufficiently loose to permit a limited upward and downward movement of the transverse slides so as not to interfere with the slight adjustment of the gun by means of the screw 57.

The vertical arms or uprights are connected with the outer ends of the laterally movable auxiliary pistons, which are simultaneously moved inwardly and outwardly. When the rack bar is moved rearwardly, the pistons are moved outwardly, and the gas is admitted at this time to the compression chamber under pressure, both the pressure and the suction created through the outward movement of the piston operating to charge the compression chamber with gas. When the rack bar 68 moves forwardly, the pistons are moved inwardly, the inward movement of the lateral or auxiliary pistons continuing until their inner ends are brought in flush relation with the inner faces of the side walls of the compression chamber. The side teeth 77 of the rack bar then disengage themselves from and move forwardly beyond the horizontal

gear wheels 78, so that the main longitudinal piston may be advanced beyond the laterally extending cylinders and the front hinged edge of the door or closure 28 to relieve such parts of the pressure produced by the discharge of the gas. The rearward movement of the rack bar reëngages the side teeth 77 with the horizontal gears 78, and a simultaneous outward movement of the pistons is effected.

The gun is equipped at the breech with gravity acting locking devices, preferably consisting of vertical pins 86, mounted in suitable openings 87 and spaced apart to clear the vertical arm or upright 67, and adapted to drop into engagement with the rear end 88 of the main piston, when the latter reaches the limit of its inward or forward movement. The main or auxiliary piston, which constitutes a breech block, is thereby securely locked against outward or backward movement. The gravity locking pins 86, which relieve the gearing of strain, pierce the top wall of the compression chamber, and the bottom wall is provided with a recess 88^b to receive the upright or arm 67 to permit the piston to move inwardly a sufficient distance to carry its rear end beyond the gravity acting locking pins. Any other suitable means, however, may be employed for locking the main piston against outward or rearward movement when the charge is exploded. The locking pins 86 may be raised by any other suitable means to release the main piston.

The bottom wall of the compression chamber is provided with a transverse passage 89, extending from one side of the compression chamber to a point below the center of the front portion of the same, and communicating with the compression chamber through an upright branch having a valve seat 90, closed during the compression stroke of the pistons 4 and 5 by a check valve 91, which is opened automatically by the means hereinafter described to permit the gas to enter the compression chamber.

Naphtha, gasolene or other hydrocarbon may be employed for producing an explosive aeriform fluid, but the gun may be charged with an explosive gas of any other suitable character. In the form of the invention illustrated in the accompanying drawings, a carbureter is connected by a pipe 91^a with the passage 89. The carbureter comprises in its construction a horizontally disposed shell or casing 92, provided with tapered end portions 93 and 94 and forming an interior mixing chamber 95. The tapered end portion 93 is connected by a suitable pipe 96 with an air tank 97 for supplying a current of air under pressure to the mixing chamber of the carbureter. This current is divided within the carbureter by means of horizontal partitions 98 and 99, located at different elevations and terminated successively short of each other, as clearly illustrated in Fig. 12 of the drawings. In Fig. 12 of the drawings I have illustrated two horizontal partitions in addition to the bottom of the mixing chamber. The horizontal partition 98 terminates short of one end of the bottom, and the other horizontal partition 99 terminates short of one end of the partition 98. The gasolene from a superimposed tank 100 is sprayed into the mixing chamber by means of a plurality of pipes 101, having a fine bore or passage. The spray pipes or tubes 101, which are bent into approximately U-shape, have their outer sides or limbs connected with a spreader 102, and the inner sides or limbs of the tubes pierce the bottom of the mixing chamber. The tubes having their discharge ends 103 lying beyond the partitions 98 and 99 terminate a short distance above the bottom of the mixing chamber and spray the gasolene thereon. Those pipes or tubes having their discharge ends 104 lying beyond the partition 99 and between the same and the discharge ends 103 pierce the horizontal partition 98 and spray gasolene thereon. The discharge nozzles 105 of the other tubes are those arranged between the discharge nozzles 104, and the front tapered portion 93 of the shell or casing and they pierce the partition 99. The compressed air from the tank 97 commingles with the gasolene as it is sprayed from the tubes or pipes 101, and the particular arrangement of the latter in connection with the horizontal partitions of the mixing chamber secures a uniform and thorough mixing of the air and gasolene.

The spreader 102 consists of a horizontally disposed transversely tapered casing, mounted upon the shell or casing of the mixing chamber and having the central portion 106 of its bottom arched, forming side grooves or gutters 107 and adapted to cause the gasolene delivered to the spreader to run to each side of the same. The outer sides or limbs of the tubes 101, pierce the bottom of the spreader at the side grooves or gutters 107, and the gasolene is accurately delivered to the spreader by means of a measuring valve, composed of inner and outer vertical tubes 108 and 109, extending from the bottom of the spreader through the top thereof and through the superimposed gasolene tank or reservoir 100. The gasolene tank or reservoir 100 is mounted on suitable supports 110, arranged at the ends of the spreader and attached to the same and to the shell or casing of the mixing chamber. The supports 110 are provided at the top with transversely curved flanged seats 111 on which the tank or reservoir 100 is suitably secured.

The tank or reservoir is preferably cylindrical, as shown, and is provided with a suitable filling orifice 112, normally closed by a screw plug or cap 113. The outer tube 109, which is fixed, is provided with upper and lower openings 114 and 115. The inner tube 108, which constitutes the movable member of the valve, is provided with upper and lower openings 116 and 117, adapted to register alternately with the openings 114 and 115. The inner tube 108 is provided at its upper end with a horizontally projecting L-shaped arm 118, and is normally held open to the tank or reservoir and closed to the spreader by a spring 119, connected at one end to the operating arm 118 and at the other end to the body portion of a guide 120, having a horizontal slot 121 in which the arm 118 operates. When the movable member of the valve is partially rotated by the means hereinafter described, the upper opening 116 of the inner tube is carried away from the upper opening of the outer tube, and the valve is thereby closed to the tank or reservoir. This movement also carries the lower opening 117 to and places it in register with the lower opening 115 of the outer tube, and thereby opens the measuring valve to the spreader, and a predetermined quantity of gasolene is delivered to the carbureter. The gasolene delivered by the valve to the spreader flows downward to each side of the raised or arched bottom and is delivered by the side grooves or gutters to the spray tubes.

The pipe 96 connecting the air tank with the carbureter is equipped with a valve 122, having a horizontally swinging arm 123, operating in a slot 124 of a guide 125 and connected with a spring 126, which normally maintains the valve in its closed position. The spring is connected at one end to the arm 123 and at its other end to the body portion of the guide 125. The guides 120 and 125 are suitably secured to the front section 55 of the base or platform, but the arms of the gasolene and air controlling valves may be guided in any other suitable manner. The air tank 97 is equipped with a suitable pressure gage 127, and is connected by a pipe 128 with an air pump or compressor (not shown). It is also provided at the bottom with a drain cock 129 by means of which any pressure may be reduced, if desired.

The gasolene and air valves are simultaneously operated in their opening movement by horizontal longitudinally disposed rods 130 and 131, located at opposite sides of the gun and connected with the arm or upright 67 of the rack bar 68. The rear ends of the operating rods 130 and 131 are bent at right angles and extend to the arm or upright 67. The gasolene valve operating rod, which is mounted in front and rear guides 132 and 133, is located at the upper portion of the gun, and the connecting arm 134 inclines downwardly and inwardly, as clearly shown in Fig. 4 of the drawings. The L-shaped arm 118 consists of an upper horizontal portion and a depending vertical portion, which is engaged at its lower end by the rod 130. The front engaging end 135 of the operating rod 130 is enlarged to form a head, which is beveled at the front and provided at the back with a shoulder. The beveled engaging head or portion of the rod 130 is adapted to pass the arm 118, the parts being sufficiently loose to permit the front end of the operating rod to spring into engagement with the arm 118 after it has passed the same, whereby when the operating rod moves rearwardly, it will carry the arm 118 with it and open the measuring valve and permit the gasolene contained within the same to flow into the carbureter. The operating rod 130 in its rearward movement passes and releases the arm 118, which is automatically closed by the spring 119.

The air valve operating rod 131 is provided at its front engaging end with an enlargement or head 136, and the arm 123 is provided at its engaging end with an inclined upper face 137 and a beveled or inclined corner face 138. The inclined upper face 137 extends downwardly and rearwardly, and is arranged in the path of the engaging end of the operating rod 131, and the head or engaging portion 136 slides up the inclined face 137 and drops in front of the operating arm, whereby the latter is engaged and is moved rearwardly by the rod 131 in the backward reciprocation thereof. The beveled or inclined corner face 138 permits the disengagement of the operating rod from the arm of the air valve at the proper time. The rod 131 operates in a suitable guide 139 which supports the front portion of the said rod 131 and maintains the same in proper position for engaging the arm of the air valve.

The valve 91, which is vertically movable, is provided with a depending valve stem 140, extending through the bottom of the compression chamber and receiving a coiled spring 141, interposed between the lower face of the bottom of the compression chamber and a pin 142, or other suitable means carried by the valve stem. The spring is adapted to close the valve 91 automatically, and the lower end of the stem is arranged in the path of an operating block or member 143, carried by the rack bar and extending longitudinally of the same and having an inclined upper face, adapted to engage and lift the valve stem to open the valve 91. The valve operating block or member is tapered vertically and horizontally, the vertical taper forming the inclined upper face, which extends downwardly and rearwardly,

and the transverse taper providing an angularly disposed side face 144. When the rack bar moves rearwardly, the valve operating block or member 143 moves beneath the valve stem 140 and opens the valve 141, and when it passes the valve stem the valve is closed by the spring 141, which carries the lower end of the valve stem downward below the plane of the upper end of the inclined face of the block or member 143, and when the rack bar moves forward on the compression stroke of the pistons, the lower end of the valve stem engages the angularly disposed side face of the actuating block or member 143, and moves the same laterally, whereby the block or member 143 in the forward movement of the rack bar is permitted to pass the valve without opening the same. The block or member is pivoted near its front end upon a support 145 by a pin 146, and it is maintained in proper position for engaging the stem 140 of the valve 91 by a spring 147. The support consists of a horizontal plate, provided at the front portion with a flange 148, to which one end of the spring 147 is secured. The free end of the spring bears against the adjacent side of the block or member 143 in rear of the pivot 146 and urges the block or member laterally, such lateral movement being limited by a stop 149, projecting upward from the support 145 and operating in a recess 150 of the block or member 143. The gasolene and air valves and the inlet valve of the compression chamber of the gun are simultaneously opened during the rearward movement of the rack bar, and the inlet valve is maintained in such open position until the pistons reach the limit of their outward movement, when it is automatically closed to confine the carbureted air within the compression chamber.

The gun is fired by the closing of the circuit in which the spark plug 22 is placed. The spark plug, which is mounted in a transverse opening 151 in one of the walls of the compression chamber, is equipped with spaced terminals 152, and when the circuit is closed a current of sufficient strength is passed through the spark plug to jump the space between the terminals 152 and thereby produce a spark for igniting the compressed gas within the gun for firing the latter. Instead of using a spark plug, the charge may be exploded electrically by means of a cap or cartridge, or any other suitable means.

The wires 153 and 154, which are connected with a dynamo or other suitable source of supply of electrical energy, extend to upper and lower spaced contact points or terminals 155 and 156, mounted in a suitable support 157 and arranged in the path of a firing or contact rod 158, extending longitudinally of the gun and connected at its rear end by a transverse portion 159 with the upright arm 67 of the rack bar 68. The contact or firing rod 158 is supported in a guide 160, mounted on the adjacent transverse cylinder 25, and adapted to maintain the rod in alinement with the spaced terminals 155 and 156. The spaced terminals 155 and 156 are preferably in the form of binding screws or posts, and the front end 161 of the rod 158 is flattened and is adapted to extend between and contact with the terminals 155 and 156 for closing the circuit. With this equipment the firing of the gun is automatic after a shell or projectile has been placed in the barrel, the operation being controlled by the motor for actuating the rack bar. Instead of firing the gun automatically, a suitable switch or push button (not shown) may be employed for closing the spark plug circuit from any convenient point. The tripping arm 20 is adjustably mounted on the gasolene valve operating rod 130, and is arranged to effect a complete release of the locking pin at the instant the contact is made between the spaced terminals or contact points 155 and 156. After firing a projectile the main piston is released and is moved outwardly or rearwardly, the operating rods 130 and 131 being held away from the arms of the valves 108 and 122 by hand or any other suitable means, so that the said valves will not open during such rearward movement. The door at the compression chamber of the gun is then opened and a projectile is introduced into the barrel of the gun, after which the main piston is moved forwardly to the limit of its inward movement. The door of the compression chamber is then closed and the gun is ready for automatic operation in the manner heretofore explained.

A gas meter 162 of any preferred construction is designed to be connected with the pipe 91^a for registering the amount of gas passing into the compression chamber of the valve. The gun is equipped with suitable oil cups 163 and 164, mounted on the hinged door or closure and on the laterally extending cylinders and adapted to lubricate the main and auxiliary pistons.

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

1. In a gas gun, the combination with a barrel, of means for holding a projectile in the bore of the barrel, means for supplying the barrel with a charge of explosive aeriform fluid, mechanism movable within the bore of the barrel for compressing the charge between it and the projectile, and means for exploding the charge.

2. In a gas gun, the combination with a barrel, of means for holding a projectile in the bore of the barrel, means for supplying the barrel with a charge of explosive aeriform fluid, a piston operating within the

bore of the barrel and arranged to compress the charge between it and the said projectile, and means for exploding the charge.

3. In a gas gun, the combination with a barrel, of means for holding a projectile in the bore of the barrel, means for supplying the barrel with a charge of explosive aeriform fluid, a plurality of pistons arranged to compress the charge, one of the pistons being reciprocatable within the bore of the barrel in rear of the projectile.

4. In a gas gun, the combination with a barrel, of means for holding a projectile within the bore of the barrel, means for supplying the barrel with a charge of aeriform fluid, and a plurality of pistons arranged to compress the charge and simultaneously operating in angular relation, one of the pistons being reciprocatable in the bore of the barrel in rear of the projectile.

5. In a gas gun, the combination with a barrel, of means for holding a projectile within the bore of the barrel, means for supplying the barrel with a charge of explosive aeriform fluid, and a plurality of pistons arranged to simultaneously compress the charge and having differential strokes, one of said pistons operating in the bore of the barrel in rear of the projectile.

6. In a gas gun, the combination with a barrel, of means for holding a projectile within the barrel, means for supplying the barrel with a charge of explosive aeriform fluid and a plurality of pistons mounted on and carried by the barrel and arranged to simultaneously compress the charge and disposed in angular relation and having differential strokes, one of the pistons operating in the bore of the barrel in rear of the projectile and movable toward the same.

7. In a gas gun, the combination with a barrel, means for supplying the same with a charge of explosive aeriform fluid, of a plurality of pistons disposed in angular relation and having differential strokes for compressing the charge, one of the pistons being movable past the other.

8. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive aeriform fluid, of a pair of pistons arranged to compress the charge and disposed in angular relation and having differential strokes, one of the pistons being movable past the other, and the latter being disposed in flush relation with the former during such movement.

9. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive gas, of a reciprocatory piston movable inwardly to compress the charge, a device for locking the piston against outward movement, and means for exploding the charge.

10. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive gas, of a piston reciprocatable longitudinally of the barrel and movable inwardly to compress the charge and forming a breech block, an automatic device arranged to lock the piston at the limit of its inward movement, and means for exploding the charge.

11. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive gas, of a piston movable inwardly with respect to the barrel to compress the charge, and a gravity acting locking device located above the piston and arranged to engage the same at the limit of its inward movement to lock the piston against outward movement when the charge is exploded, and means for exploding the charge.

12. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive gas, of a piston movable inwardly to compress the charge, a pair of spaced locking pins located above and arranged to drop in rear of the piston to lock the same against outward movement, and means connected with the piston and operating in the space between the locking pins for moving the piston inwardly and outwardly.

13. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive gas, of mechanism for compressing the charge, a projectile having an annular groove, and a locking device carried by the barrel and arranged to engage with the groove for holding the projectile in place while the charge is being compressed.

14. In a gas gun, the combination of a barrel having means for detachably holding a projectile within its bore in spaced relation with the inner end of the barrel, means for supplying a charge of aeriform explosive fluid to the space between the projectile and the inner end of the barrel, and means movable in rear of the projectile in the said space between the same and the inner end of the barrel to compress the charge.

15. In a gas gun, the combination with a barrel, of means for holding a projectile within the bore of the barrel in spaced relation with the inner end thereof and including a soft metal band arranged to be compressed within the bore to form an air tight connection, means for supplying a charge of explosive gas to the barrel, and mechanism movable in the bore of the barrel within the said space for compressing the charge.

16. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive gas, of a projectile provided with an annular groove and having a soft metal band arranged in rear of the groove and adapted to be compressed within the barrel to form an air tight con-

nection, mechanism for compressing the charge, and a locking device carried by the barrel and engaging the groove for holding the projectile against outward movement while the charge is being compressed.

17. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive gas, of a projectile, mechanism for compressing the charge within a barrel, a locking device for holding the projectile against outward movement while the charge is being compressed, and means for simultaneously exploding the charge and releasing the shell.

18. In a gas gun, the combination with a barrel, and means for supplying the same with a charge of explosive gas, of mechanism for compressing the charge, a locking pin carried by the barrel and movable inwardly and outwardly and engaging the shell to hold the same against outward movement while the charge is being compressed, means for exploding the charge and for simultaneously moving the pin outwardly to release the projectile.

19. In a gas gun, the combination of a barrel provided with a compression chamber and having an opening communicating therewith, a closure for the said opening, means for supplying a charge of explosive gas to the compression chamber, and a piston operating in the said chamber to compress the charge.

20. In a gas gun, the combination of a barrel provided with a compression chamber and having an opening communicating therewith, a closure for the said opening, means for supplying a charge of explosive gas to the compression chamber, and a piston operating in the said chamber to compress the charge and movable inwardly to a point beyond the opening and the said closure to relieve the same of pressure incident to the discharge of the gun.

21. In a gas gun, the combination of a barrel provided with a compression chamber and having an opening communicating therewith, a closure for the said opening, means for supplying a charge of explosive gas to the compression chamber, a piston operating in the said chamber to compress the charge and movable inwardly to a point beyond the opening and the said closure to relieve the same of pressure incident to the discharge of the gun, and means for locking the piston against outward movement.

22. In a gas gun, the combination of a barrel provided at the breech with a compression chamber and having an opening communicating therewith to permit a shell or projectile to be placed in the barrel, a door for closing the said opening, a reciprocatory piston operating in the compression chamber and through the rear end of the barrel and movable inwardly to compress the charge, and means connected with the outer end of the piston for operating the same.

23. In a gas gun, the combination of a barrel having a compression chamber, means for supplying the barrel with a charge of explosive gas, and a reciprocatory piston operating through the rear end of the barrel and movable inwardly to compress the charge and outwardly to create a suction to assist in drawing the charge into the compression chamber.

24. In a gas gun, the combination of a barrel having a compression chamber and provided with an opening for the introduction of a shell or projectile, mechanism for compressing a charge of gas within the chamber, a hinged closure for the said opening, a locking lever mounted on the closure, a link connected exteriorly with the barrel and engaged by the outer end of the lever, and a keeper mounted on the closure for engaging the inner portion of the lever.

25. In a gas gun, the combination of a barrel having a compression chamber and provided with an opening, mechanism for compressing a charge of gas within the barrel, a closure for the said opening, opposite transverse locking levers pivotally mounted on the closure and having outer engaging portions, links engaging with the outer ends of the levers and connected with the barrel, and keepers mounted on the closure and arranged to be engaged by the inner portions of the locking levers.

26. In a gas gun, the combination of a barrel having a compression chamber and provided with an opening, mechanism for compressing a charge of gas within the chamber, a hinged closure for the said opening, and means for operating the closure including a rack bar, gearing for reciprocating the rack bar, and means for connecting the rack bar with the closure.

27. In a gas gun, the combination of a barrel having a compression chamber and provided with an opening, mechanism for compressing a charge of gas within the chamber, a hinged closure for the said opening, and means for operating the closure including a rack bar, gearing for reciprocating the rack bar, and a link pivotally connected with the rack bar and with the closure.

28. In a gas gun, the combination of a barrel having an opening, a hinged closure for the same, a vertically movable rack bar, an inclined link pivotally connected with the rack bar and with the closure, and a horizontal shaft having operating means, and a pinion carried by the shaft and meshing with the rack bar.

29. In a gas gun, the combination of a barrel provided at the top with an opening,

a vertical guide arranged at one side of the barrel and provided with bearings, a vertical reciprocatable rack bar operating in the said guide, a horizontal shaft journaled in the said bearings and having a pinion meshing with the rack bar, and means for connecting the rack bar with the hinged closure.

30. In a gas gun, the combination of a barrel having a compression chamber and provided with an auxiliary cylinder communicating with the compression chamber, a main piston operable in the compression chamber to compress a charge of explosive gas, an auxiliary piston coöperating with the main piston, and gearing for actuating the said pistons.

31. In a gas gun, the combination of a barrel having a compression chamber and provided with an auxiliary cylinder communicating with the compression chamber, a main piston operating in the compression chamber, an auxiliary piston operating in the cylinder, and gearing for simultaneously moving the pistons inwardly and outwardly.

32. In a gas gun, the combination of a barrel having a compression chamber and provided with an auxiliary cylinder communicating therewith, a main piston operating in the compression chamber, an auxiliary piston operating in the cylinder, and gearing for moving the pistons inwardly and outwardly, said gearing including means for stopping the inward movement of the auxiliary piston and for advancing the main piston beyond the auxiliary piston.

33. In a gas gun, the combination of a barrel having a compression chamber provided with a cylinder communicating therewith, a main piston operating in the compression chamber, an auxiliary piston operating in the auxiliary cylinder and arranged in flush relation with the inner wall of the compression chamber and completing the said inner wall when at the limit of its inward movement, said main piston being movable inwardly to a point beyond the auxiliary piston and constituting a breech block and adapted to relieve the auxiliary piston of pressure when a charge is exploded.

34. In a gas gun, the combination of a barrel having a compression chamber, a piston movable inwardly and outwardly in the said chamber to compress a charge of explosive gas, a rack bar connected with the piston for reciprocating the same, and a motor operated gear for actuating the rack bar.

35. In a gas gun, the combination of a barrel having a compression chamber, a longitudinal piston movable inwardly and outwardly in the said chamber to compress a charge of explosive aeriform fluid, a rack bar located beneath the barrel and connected with the rear end of the piston, and means for actuating the rack bar.

36. In a gas gun, the combination of a barrel having a compression chamber and provided with a laterally extending cylinder communicating with the compression chamber, a main longitudinal piston operating in the compression chamber, a laterally movable auxiliary piston operating in the cylinder, a longitudinal rack bar located beneath the barrel and connected with the main piston, and gearing meshing with the rack bar for actuating the auxiliary piston.

37. In a gas gun, the combination of a barrel having a compression chamber and provided with a laterally extending cylinder communicating with the compression chamber, a main longitudinal piston operating in the compression chamber, a laterally movable auxiliary piston operating in the cylinder, a longitudinal rack bar located beneath the barrel and connected with the main piston, a gear meshing with the rack bar, and means for communicating motion from the gear to the auxiliary piston.

38. In a gas gun, the combination of a barrel having a compression chamber and provided with a laterally extending cylinder communicating with the compression chamber, a main longitudinal piston operating in the compression chamber, a laterally movable auxiliary piston operating in the cylinder, a longitudinal rack bar located beneath the barrel and connected with the main piston, a slide carrying the auxiliary piston, a gear meshing with the rack bar and a pitman pivoted to the slide and eccentrically connected with the gear.

39. In a gas gun, the combination of a barrel having a compression chamber and provided with a laterally extending cylinder communicating with the compression chamber, a main longitudinal piston operating in the compression chamber, a laterally movable auxiliary piston operating in the cylinder, a longitudinal rack bar located beneath the barrel and connected with the main piston, a slide having an arm connected with the auxiliary piston, a gear meshing with the rack bar, and means for communicating motion from the gear to the slide.

40. In a gas gun, the combination of a barrel having a compression chamber and provided with a laterally extending cylinder communicating with the compression chamber, a main longitudinal piston operating in the compression chamber, a laterally movable auxiliary piston operating in the cylinder, a longitudinal rack bar located beneath the barrel and connected with the main piston, a transverse guide, a slide reciprocating in the guide and connected with the auxiliary piston, a gear meshing with

the rack bar, and a pitman connecting the gear with the slide.

41. In a gas gun, the combination of a barrel having a compression chamber, laterally extending cylinders communicating with the compression chamber, a main longitudinal piston operating in the compression chamber, a pair of laterally movable pistons operating in the said cylinders, a rack bar located beneath the barrel and connected with the main piston, a motor actuated gear meshing with the rack bar for reciprocating the same, and gearing for communicating motion from the rack bar to the auxiliary pistons.

42. In a gas gun, the combination of a barrel provided with a cylindrical compression chamber, an auxiliary cylinder extending laterally from the compression chamber and communicating therewith, a main longitudinal piston reciprocating in the compression chamber, an auxiliary piston operating in the cylinder and provided with a concave inner end arranged in flush relation with the inner wall of the compression chamber and completing the same when at the limit of its inward movement, and mechanism for actuating the pistons.

43. In a gas gun, the combination of a barrel provided with a compression chamber and having an auxiliary cylinder communicating therewith, a main piston operating in the compression chamber, an auxiliary piston operating in the cylinder, and mechanism for actuating the pistons including means for advancing the main piston beyond the auxiliary piston and for moving the auxiliary piston in flush relation with the wall of the compression chamber before the main piston has passed it to prevent gas from being pocketed in the auxiliary cylinder.

44. In a gas gun, the combination of a barrel having a compression chamber and provided with an auxiliary cylinder communicating with the compression chamber, a main piston operating in the compression chamber, an auxiliary piston operating in the cylinder, a rack bar connected with the main piston, means for actuating the rack bar, and gearing meshing with the rack bar for communicating motion to the auxiliary piston, the teeth of the rack bar being arranged to move the auxiliary piston inward in flush relation with the wall of the compression chamber and being carried beyond the gearing to prevent further movement of the auxiliary piston when the latter reaches such position.

45. In a gas gun, the combination with a barrel having a compression chamber and provided with laterally projecting auxiliary cylinders communicating with the compression chamber, of a main longitudinal piston operating in the compression chamber, auxiliary pistons operating in the said cylinders, a longitudinal rack bar connected with the main piston and provided at opposite sides with series of teeth, means for actuating the rack bar, and gearing meshing with the side teeth for communicating motion to the auxiliary pistons, the series of side teeth being of a length to move the auxiliary pistons inward in flush relation with the opposite walls of the compression chamber and arranged to be carried beyond the gearing to prevent further inward movement of the auxiliary pistons.

46. In a gas gun, the combination of a barrel having a compression chamber, means for supplying a charge of explosive gas to the said chamber, a piston movable inwardly and outwardly and adapted to compress the charge, mechanism for actuating the piston, an inlet valve controlling the admission of gas to the compression chamber and adapted to prevent the escape of gas, and means for automatically opening the inlet valve on the outward movement of the piston and for closing the valve on the inward or compression stroke of the piston.

47. In a gas gun, the combination of a barrel having a compression chamber, an inlet valve for controlling the admission of gas to and for preventing the escape of the same from the compression chamber, a piston operating in the compression chamber, reciprocatory means for actuating the piston, and a valve operating device carried by the said means.

48. In a gas gun, the combination of a barrel having a compression chamber, an inlet valve for controlling the admission of gas to and for preventing the escape of the same from the compression chamber, a piston operating in the compression chamber, reciprocatory means for actuating the piston, and a tapered or wedge-shaped member carried by the reciprocatory means and arranged to open the valve during the outward movement of the piston.

49. In a gas gun, the combination of a barrel having a compression chamber, an inlet valve for controlling the admission of gas to and for preventing the escape of the same from the compression chamber, a piston operating in the compression chamber, reciprocatory means for actuating the piston, and a tapered or wedge-shaped member carried by the reciprocatory means and arranged to open the valve during the outward movement of the piston and movable away from the valve on the inward or compression stroke of the piston.

50. In a gas gun, the combination of a barrel having a compression chamber, an inlet valve for controlling the admission of gas to and for preventing the escape of the same from the compression chamber, a pis-

ton operating in the compression chamber, reciprocatory means for actuating the piston, and a movably mounted tapered or wedge-shaped member carried by the reciprocatory means and arranged to open the valve on the outward movement of the piston and presenting an angularly disposed face to the valve and adapted to be moved out of line with the same during the inward movement of the piston.

51. In a gas gun, the combination of a barrel having a compression chamber, an inlet valve for controlling the admission of gas to and for preventing the escape of the same from the compression chamber, a piston operating in the compression chamber, reciprocatory means for actuating the piston, and a movably mounted tapered or wedge-shaped member carried by the reciprocatory means and arranged to open the valve on the outward movement of the piston and presenting an angularly disposed face to the valve and adapted to be moved out of line with the same during the inward movement of the piston, a spring engaging the movable member for normally maintaining the same in position for engaging the valve, and a stop for limiting the movement of the member when the same is actuated by the spring.

52. In a gas gun, the combination of a barrel having a compression chamber, a piston for compressing a charge of gas in the said chamber, a reciprocatory rack bar connected with the piston, means for actuating the rack bar for operating the piston, an inlet valve for controlling the admission of gas to the compression chamber, and a device carried by the rack bar and arranged to open the valve.

53. In a gas gun, the combination of a barrel having a compression chamber, a piston for compressing a charge of gas in the said chamber, a reciprocatory rack bar connected with the piston, means for actuating the rack bar for operating the piston, an inlet valve for controlling the admission of gas to the compression chamber, a spring for holding the valve normally closed, and a device carried by the rack bar and arranged to open the valve.

54. In a gas gun, the combination of a barrel having a compression chamber, a piston for compressing a charge of gas in the said chamber, a reciprocatory rack bar connected with the piston, means for actuating the rack bar for operating the piston, an inlet valve for controlling the admission of gas to the compression chamber, a spring for holding the valve normally closed, and a wedge-shaped device carried by the rack bar and presenting an inclined face to the valve for opening the same.

55. In a gas gun, the combination of a barrel having a compression chamber, a piston operating in the chamber to compress a charge of explosive gas, an automatically closable spring actuated inlet valve for controlling the admission of gas to the compression chamber and for preventing the escape of the same therefrom, said valve having a stem depending from the barrel, a reciprocatory rack bar located beneath the barrel and connected with the piston, and a device carried by the rack bar and arranged to open the valve on the outward movement of the piston and being yieldingly mounted and arranged to pass the valve without opening the same on the inward or compression stroke of the piston.

56. In a gas gun, the combination of a barrel provided with a compression chamber, a carbureter communicating with the compression chamber, a piston movable inwardly and outwardly in the compression chamber, means for automatically delivering a quantity of hydrocarbon to the carbureter and for forcing the current of air through the latter during the outward movement of the piston, and a valve for confining the carbureted air within the compression chamber during the inward movement of the piston.

57. In a gas gun, the combination of a barrel having a compression chamber, a piston movable inwardly and outwardly in the said chamber, a carbureter communicating with the compression chamber, a hydrocarbon reservoir communicating with the carbureter, a compressed air supply connected with the carbureter, and valves connected with the hydrocarbon reservoir and with the compressed air supply for controlling the passage of the hydrocarbon and air to the carbureter.

58. In a gas gun, the combination of a barrel having a compression chamber, a piston movable inwardly and outwardly in the said chamber, a carbureter communicating with the compression chamber, a hydrocarbon reservoir communicating with the carbureter, a compressed air supply connected with the carbureter, valves connected with the hydrocarbon reservoir and with the compressed air supply for controlling the passage of the hydrocarbon and air to the carbureter, means for opening the said valves during the outward movement of the piston, and means for closing them when the piston moves inward to compress a charge.

59. In a gas gun, the combination of a barrel having a compression chamber, a piston movable inwardly and outwardly in the said chamber, a carbureter communicating with the compression chamber, a hydrocarbon reservoir communicating with the carbureter, a compressed air supply connected with the carbureter, valves connected with the hydrocarbon reservoir and with the compressed air supply for controlling the pas-

sage of the hydrocarbon and air to the carbureter, and means connected with the piston for automatically opening the valves during the outward movement of the said piston.

60. In a gas gun, the combination of a barrel having a compression chamber, a piston movable inwardly and outwardly in the said chamber, a carbureter communicating with the compression chamber, a hydrocarbon reservoir communicating with the carbureter, a compressed air supply connected with the carbureter, valves connected with the hydrocarbon reservoir and with the compressed air supply for controlling the passage of the hydrocarbon and air to the carbureter, means connected with the piston for automatically opening the valves during the outward movement of the said piston, and means for automatically operating the valves to maintain the same in a closed position during the inward movement of the piston.

61. In a gas gun, the combination of a barrel having a compression chamber, a piston movable inwardly and outwardly in the said chamber, a carbureter communicating with the compression chamber, a hydrocarbon reservoir communicating with the carbureter, a compressed air supply connected with the carbureter, valves connected with the hydrocarbon reservoir and with the compressed air supply for controlling the passage of the hydrocarbon and air to the carbureter, and operating rods reciprocating with the piston and arranged to open the valves during the outward movement of the piston.

62. In a gas gun, the combination of a barrel having a compression chamber, a piston movable inwardly and outwardly in the said chamber, a carbureter communicating with the compression chamber, a hydrocarbon reservoir communicating with the carbureter, a compressed air supply connected with the carbureter, valves connected with the hydrocarbon reservoir and with the compressed air supply for controlling the passage of the hydrocarbon and air to the carbureter, operating rods reciprocating with the piston and arranged to open the valves during the outward movement of the piston, and springs for automatically closing the valves.

63. In a gas gun, the combination of a barrel having a compression chamber, a piston moving inward and outward in the compression chamber, a carbureter connected with the compression chamber, a hydrocarbon reservoir connected with the carbureter, a compressed air supply also connected with the carbureter, valves for controlling the passage of the hydrocarbon and the air to the carbureter, said valves having operating arms, and reciprocatory rods connected with the piston and provided with means for operating the valves.

64. In a gas gun, the combination of a barrel having a compression chamber, a piston moving inward and outward in the compression chamber, a carbureter connected with the compression chamber, a hydrocarbon reservoir connected with the carbureter, a compressed air supply also connected with the carbureter, valves for controlling the passage of the hydrocarbon and the air to the carbureter, said valves having operating arms, reciprocatory rods connected with the piston and provided with means for engaging the arms of the valves to open the latter on the outward stroke of the piston, and springs for automatically closing the valves.

65. In a gas gun, the combination of a barrel having a compression chamber, a piston movable inwardly and outwardly in the compression chamber, a carbureter communicating with the compression chamber for supplying a charge of explosive gas, a hydrocarbon reservoir connected with the carbureter, a compressed air supply also connected with the carbureter, valves for controlling the passage of the hydrocarbon and the compressed air to the carbureter, said valves having horizontally movable arms, guiding means for the arms, springs for automatically closing the valves, and operating rods connected with the piston and provided with means for engaging the arms to open the valves on the outward stroke of the piston.

66. In a gas gun, the combination of a barrel having a compression chamber, a piston moving into and out of the compression chamber, a carbureter communicating with the compression chamber for supplying a charge of explosive gas, a hydrocarbon reservoir connected with the carbureter, a supply of compressed air also connected with the carbureter, valves for controlling the passage of hydrocarbon and the compressed air to the carbureter, a check valve for confining the gas within the compression chamber, means for opening the valves during the outward movement of the piston.

67. In a gas gun, the combination of a barrel having a compression chamber, a piston moving into and out of the compression chamber, a carbureter communicating with the compression chamber for supplying a charge of explosive gas, a hydrocarbon reservoir connected with the carbureter, a supply of compressed air also connected with the carbureter, valves for controlling the passage of hydrocarbon and the compressed air to the carbureter, a check valve for confining the gas within the compression chamber, and means moving with the piston for opening the valves during the outward movement of the said piston.

68. In a gas gun, the combination of a

barrel having a compression chamber, a piston movable inwardly and outwardly in the compression chamber, a carbureter communicating with the compression chamber for supplying a charge of explosive gas to the same, a hydrocarbon reservoir connected with the carbureter, a compressed air supply also connected with the carbureter, valves for controlling the flow of the hydrocarbon and compressed air to the carbureter, a check valve for confining the gas within the compression chamber, operating rods reciprocating with the piston and provided with means for opening the valves of the hydrocarbon reservoir and the air supply when the piston moves outward, and reciprocatory means also connected with the said piston for opening the check valve to permit the carbureted air to enter the compression chamber during the outward movement of the piston.

69. In a gas gun, the combination of a barrel having a portion of its bore forming a compression chamber, means for holding a projectile in the bore of the barrel at the front end of the compression chamber, means for supplying a charge of explosive gas to the compression chamber, mechanism movable within the bore of the barrel and located at the rear of said projectile for compressing the charge, and an electric circuit including circuit closing means, and means for igniting the charge within the compression chamber.

70. In a gas gun, the combination of a barrel having a portion of its bore forming a compression chamber, means for holding a projectile in the barrel at the front end of the compression chamber, means for supplying a charge of explosive gas to the said chamber, mechanism movable within the bore of the barrel for compressing the charge within the said chamber, and an electric circuit including a spark plug for igniting the charge, and means operated by the compression mechanism for closing the circuit.

71. In a gas gun, the combination with a barrel having a compression chamber, and means for supplying a charge of explosive gas to the same, of a piston operating in the chamber to compress the charge, an electric circuit including means for exploding the charge within the compression chamber, and spaced terminals or contacts, and a circuit closing device movable with the piston and arranged to engage the terminals or contact points for closing the circuit.

72. In a gas gun, the combination with a barrel having a compression chamber, and means for supplying a charge of explosive gas to the said chamber, of a piston for compressing the charge in the said chamber, a reciprocatory circuit closing device movable with the piston, and an electric circuit including means for igniting the charge within the compression chamber, and spaced contacts arranged in the path of the circuit closing device.

73. In a gas gun, the combination of a barrel having a compression chamber, a piston reciprocating in the compression chamber, means for supplying a charge of explosive gas to the compression chamber, a valve for controlling the passage of gas to the compression chamber, means moving with the piston for opening the valve during the outward stroke of the said piston, an electric circuit including means for igniting the charge, and spaced contacts, and a device also moving with the piston and arranged to close the circuit during the inward movement of the said piston to explode the charge on the compression stroke.

74. In a gas gun, the combination of a barrel having a compression chamber, a piston reciprocating in the compression chamber, a carbureter communicating with the compression chamber, a hydrocarbon reservoir connected with the carbureter, a compressed air supply also connected with the carbureter, valves for controlling the passage of hydrocarbon and compressed air to the carbureter, means moving with the piston for opening the valves during the outward stroke of the said piston, an electric circuit including means for igniting the explosive gas within the compression chamber, and spaced contacts, and an electric circuit closing device moving with the piston and arranged to engage the contacts for closing the circuit during the inward or compression stroke of the piston.

75. In a gas gun, the combination of a barrel having a compression chamber, a piston reciprocating in the said chamber, a carbureter communicating with the compression chamber, a hydrocarbon reservoir connected with the carbureter, a compressed air supply also connected with the carbureter, valves for controlling the passage of hydrocarbon and the air to the carbureter, a valve for controlling the passage of the carbureted air to the compression chamber, means moving with the piston for opening the said valves during the outward movement of the said piston, an electric circuit including means for igniting the explosive gas within the compression chamber, and a circuit closing device moving with the piston and arranged to close the circuit during the inward or compression stroke of the said piston.

76. In a gas gun, the combination of a base or platform composed of a fixed front section, and a hinged rear section, a barrel pivotally mounted on the front section and having a compression chamber, a piston reciprocating in the compression chamber, mechanism for reciprocating the piston guided on the said sections of the base or platform and having removable connections

with one of the same, and an inclined adjusting screw connected with the barrel and with the platform.

77. In a gas gun, the combination of a barrel having means for detachably holding a projectile within it in spaced relation with its inner end, means for supplying a charge of explosive aeriform fluid to the barrel between the projectile and the inner end of the barrel, and a piston reciprocatable in the bore of the barrel and movable forwardly in the said space to compress the charge.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

ERNEST HUBBARD HAMILTON.

Witnesses:
J. N. GOODWIN,
G. O. ERWIN.