C. C. ALLEN.

MOTOR TOOL.

APPLICATION FILED OCT. 8, 1906.

911,562.

Patented Feb. 9, 1909.

2 SHEETS—SHEET 1.

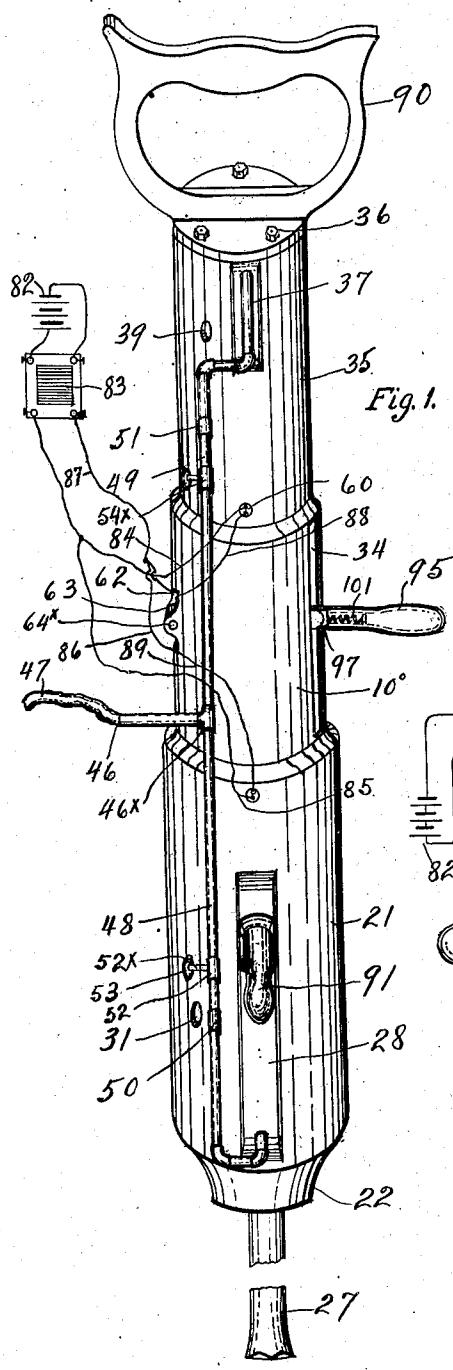


Fig. 1.

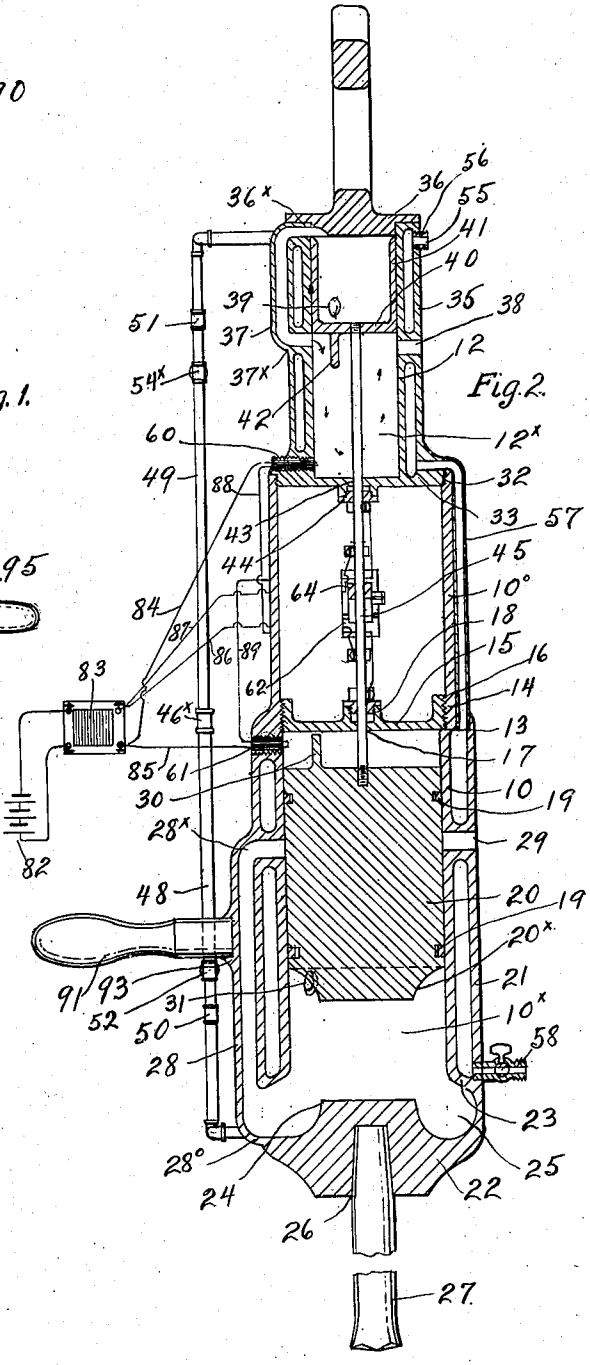


Fig. 2.

Witnesses.

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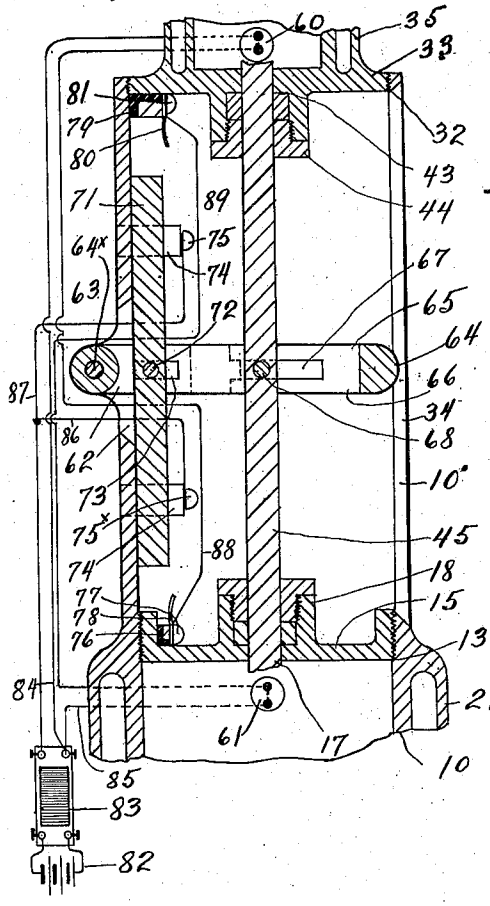


Fig 3.

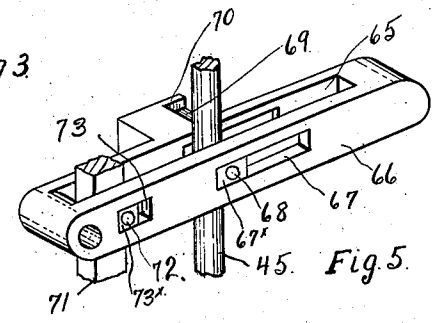


Fig 5.

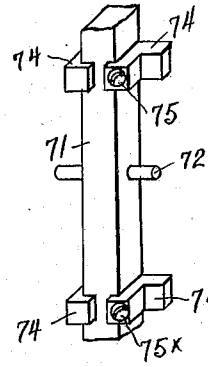


Fig 4.

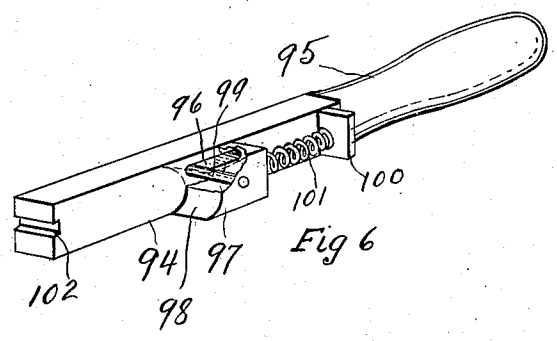


Fig 6

Witnesses

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MOTOR-TOOL.

No. 911,562. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed October 8, 1906. Serial No. 338,027.

To all whom it may concern:

Be it known that I, CHARLES C. ALLEN, a citizen of the United States of America, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Motor-Tools; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

The object of the invention is to obtain the cycle movements within the implement or tool and the power of the piston imparted to the tool reciprocally from co-acting heat expansions upon separate pistons.

The invention consists in the novel construction and combination of parts, such as will be first fully described and then specifically pointed out in the claims.

In the drawings—Figure 1 is a view in elevation of the invention in readiness for operation showing the battery and induction coil. Fig. 2 is a vertical sectional view taken at right angles to that seen on Fig. 1. Fig. 3 is a vertical sectional detail view of the portion of the casing of the tool intermediate the combustion cylinders showing the igniting devices operated by the piston rod. Fig. 4 is a detail perspective view of the reciprocating slide of the electric contact. Fig. 5 is a detail in perspective view of the slotted lever actuating the sliding contact, showing a broken portion of the piston rod. Fig. 6 is a view in perspective of the detachable starting handle.

Similar numerals of reference indicate corresponding parts in all the figures of the drawings.

Referring to the drawings 10 indicates the cylindrical casing composing the lower portion or main body of the tool and 12 the cylindrical case forming the upper portion of the tool which as shown is smaller in circumference than the case 10. The cylindrical case 10 is made of considerable length or more than twice in proportion to the length of the case 12. At a point within the case 10 nearly equidistant from the outer ends of the respective cylindrical portions 10 and 12 of the tool is a shoulder 13, from which shoulder downwardly the inner circumference of the case 10 is slightly reduced in circumference. Above said shoulder is a male screw thread 14 extending a short distance in the direction of the upper end of cylinder 10. Within the casing 10 is a cylinder head 15, having the female thread 16, which engages with the screw thread 14, said head fitting closely against the shoulder 13. In the said head 15 is a central opening 17 and upon the outer surface of the said head extending around said opening is a packing or stuffing box 18.

The space in the lower portion of the cylindrical casing 10 below the line of the cylinder head comprises the piston chamber $10^{\times}$ in which is fitted a solid elongated hammer piston 20, the lower end of which is reduced in circumference as at $20^{\times}$. Extending around said piston, adjacent to its ends, are packing rings 19. The lower end of the cylinder 10 forming in the anvil the lower end of chamber $10^{\times}$ is cast integral with the lower end of a water jacket 21, extending concentrically to the portion of the outer surface of the cylindrical casing 10 from a point in line transversely with the cylinder head 15, downwardly a short distance below a line extending transversely through the lower end of said cylindrical casing 10. From the end of the casing 10 are outwardly bent portions 23 extending to the inner surface of the water jacket 21 and forming a closed lower end thereto. Upon the inner surface of the lower end 22 of the chamber $10^{\times}$ is an upward extension 24, smaller in circumference than the casing 10 forming an anvil or holder for the tool or drill, which receives the blows of the piston 20 by percussion. Concentric with this upward extension 24 and below the lower end 23 of the water jacket is formed in the anvil an annular recess or pocket 25. In the end portion 22 of chamber $10^{\times}$, and extending upwardly from the outer surface inwardly to the upward extension or anvil 24 is an opening 26, in which is fitted snugly the upper end of a stem of a drill 27. Upon the outer surface of the water jacket 21, and formed integral therewith is a longitudinally extended pipe or conduit 28 for the compressed charging gases which extends outside of the water jacket and thereby lessens the danger of pre-ignition of the gases. The lower end 28° of this pipe or conductor is bent at right angles and extends within or leads from the concentric recess 25 in the lower portion of the chamber 10 and the upper end $28^{\times}$ of said pipe is bent at right angles and extends through the water jacket into said chamber

10× at a point about one-third the distance downwardly from the line of the inner surface of the cylinder head 15 to the lower end of the chamber 10×. Transversely to and slightly higher in position than the inner end 28× of the pipe or conductor 28 and extending through the casing 10 and the water jacket 21 is an exhaust port 29. The length of the piston 20 is such that when the lower end 20× contacts with the anvil 24 in the bottom of the chamber 10× the upper end of said piston is below the line of the lower surfaces of the inlet pipe or conductor 28 for the compressed gases, and the exhaust port 29. In order to divert or prevent escape of the compressed gases from the port 29 and assist them in exhausting burned gases upon the upper or inner end of the piston is a projection or vane 30, extending a short distance in the direction of the cylinder head 15 and located a short distance inwardly from the outer surface of the piston and adjacent to the surface moving alternately past the inlet opening 28× of the pipe 28 for the compressed gases.

Through the water jacket 21 and the cylindrical casing 10, at a point upon said casing about one-third the distance upwardly from the lower end of said casing in the direction of the cylinder head 15 is extended a short air supply port 31, this port being in supply communication with the chamber 10× when the piston 20 is at the upper end of the said chamber, and closed in the downward movement of the piston.

The combustion cylinder or case 12 at the upper end of the tool case is about one third smaller in circumference and about one half the length of the combination cylinder 10. This casing 12 is provided with an enlarged or outwardly extended cylinder head 33, which is screw threaded and is fitted to the internal screw threads 32, upon the upper end portion 10° of the cylindrical casing 10. which portion 10° forms the connecting means between the separate combustion cylinders and in which portion is a longitudinally extended opening 34. Extending around the combustion cylinder 12 is a water jacket 35. Upon the upper end of the cylinder 12 is a cylinder head 36 in which is a depression 36×. Upon the outer surface of the water jacket is a pipe or conductor 37 of the compressed gases which is similar to the pipe or conductor 28, and is located upon the water jacket in a corresponding position to the said conductor 28. One end 37× of said conductor 37 extends through the water jacket and the casing 12 to the inner surface of the combustion cylinder 12 at a point about equidistant from the respective cylinder heads 33 and 36, and the upper end of said conductor extends through the water jacket and casing 12, within the depression 36× on the inner surface of the cylinder head 36, which depression communicates with the combustion chamber 12×. In the opposite side of the cylinder 12 to that having the inlet pipe 37× and slightly downwardly in position toward the cylinder head 33 is the exhaust port 38, which extends from the inner surface and through the said casing 12 and water jacket 34. 39 is the inlet port for the air which is above the line of the inlet pipe 37× and is closed by the portion 41 of the piston 40.

40 indicates the elongated piston within the chamber 12× and which is preferably hollow. The open end of the cylindrical portion 41 of the piston when the piston is in line with the upper surfaces of the respective inlet and exhaust openings 37× and 38 is close in position to the inner surface of the cylinder head 36. Upon the piston 40 is an extension of vane 42 which is located in a position opposite the inlet opening 37 for the compressed gases in like manner and for the same purpose as the extension or vane 30 on the piston 20. In the cylinder head 33 is an opening 43, around which opening upon the outer surface of the said head is a stuffing box 44. 45 indicates the piston or connecting rod, one end of which rod is connected with the piston 40, and the other end of said rod extends through the respective openings 17 and 43 in the cylinder heads 15 and 33 and the stuffing boxes 18 and 44 and is connected with the hammer piston 20.

46 indicates the supply pipe on the tool for the carbureted gas, with which is connected the main flexible supply pipe 47. Upon the inner end of pipe 46 is a three way pipe joint 46×. With said joint is connected one end of a branch pipe 48, the other end of which pipe extends downwardly to a position opposite the lower end of the conductor or pipe 28 in the water jacket 21, and extends within said conductor and the bent portion 28° of said conductor, and communicates with the recess 25. With the pipe joint 46× is also connected one end of a separate pipe 49, the other end of which pipe extends upwardly and is bent at right angles and extended within the upper end of the conductor 37 in line with the upper bent portion of said conductor. In the pipe 48 is a check valve 50 and in the pipe 49 is a check valve 51. In the said pipe 48 is a gas regulating valve casing 52, in which extends the valve stem 52× and upon which stem is a hand wheel 53. On pipe 49 is a gas regulating valve casing and stem 54× which is the same as the valve casing 52. 55 is an opening for the admission of cold water to the water jacket 35 in which is an externally screw threaded nipple 56, this opening being near the upper end of said water jacket. With the lower end portion of the water jacket is connected the upper end of a connecting pipe 57, which is bent at right angles and extended down-

wardly and within the upper end of the water jacket 21. With the lower end of the water jacket 21 is connected a discharge or pet cock 58.

The gas igniting devices consist of an insulated perforate plug 60 which is externally screw threaded and inserted within a threaded opening in the lower portion of the casing 12 of the upper combustion cylinder at a point adjacent to the upper surface of the cylinder head 32. A similar hollow plug 61 is inserted horizontally through the upper end of the casing 10 to the inner surface of said casing. In the portion 10° of the cylindrical casing 10 connecting the separate combustion cylinders and in a transverse direction to the longitudinal opening 34 is a wide slot 62, located at a point equidistant from the respective cylinder heads 17 and 33. Upon the outer surface of the said portion 10° of said casing upon opposite sides of the slot 62 are lugs 63, to which lugs are pivoted at $64^{\times}$ the lower end of an oscillating lever or bar 64 in which bar is a longitudinal opening or slot 65, extending from near the pivotal point of said bar nearly to its outer end, the portion 66 of said bar on the sides of the opening 65 extends on each side of the piston rod 45, the outer end of the bar terminating within the slot 34. In portions 66 of the lever or bar forming the sides to said opening 65 are longitudinal slots 67 in which are sliding blocks $67^{\times}$, and upon the sides of the piston rod 45 are pivots 68, which extend pivoted within the said blocks $67^{\times}$. The outer end portion of the lever or bar 64 is curved in the arc of a circle. Upon the outer surface and one of the sides 66 to the opening 65 at a point about equidistant from the ends of said bar is a lateral extension or lug 69 upon the outer end portion of which lug is an upward projection 70.

Upon the inner surface of the portion 10° of the casing and between the sides 66 of the oscillating bar 64 is a sliding contact or plate 71 which is about two thirds the length of the said portion 10° of the casing. Upon the sides of the sliding contact plate 71 at a point equidistant from its ends are pivots 72 and in the sides 66 to the opening 65 in bar 64 are longitudinal slots 73, within which slots are sliding blocks $73^{\times}$ in which blocks are pivots 72 and in the oscillating movement of the lever or bar 64 a sliding movement is communicated to the contact plate 71. Upon the respective sides of the plate 71 and secured to the inner surface of the casing 10° are guide plates 74, which extend upwardly and are bent at right angles and extended inwardly toward each other and upon the upper surface of the contact plate 71 so as to permit the sliding movement of the plate and also retain frictional contact therewith. Upon these guide plates are binding screws 75, $75^{\times}$. With the flanged portion of the cylinder head 75 is connected an insulated block 76, upon which is secured by the binding screw 77 a spring plate 78, the outer end of which plate extends in the direction of the upper surface of the sliding plate 71, and is curved upwardly at its outer end. Upon the inner surface of the casing 10° adjacent to the cylinder head 33 is an insulated block 79 upon which is a curved plate 80 secured by the binding screw 81 and which plate contacts with the other end of the sliding contact plate 71.

82 indicates an ordinary electric battery and 83 an induction coil. With the induction coil 83 is connected the inner end of the separate conducting wires 84 and 85, the outer ends of which conductor 84 extends within the perforate plug 60 and within the chamber $12^{\times}$ of the cylinder 12 and the outer end of the conductor 85 is extended within the perforate plug 61 within the chamber $10^{\times}$ of casing or cylinder 10.

86 and 87 are the return conducting wires and connected at one end with the coil, the outer ends of which wires extend through the opening 62 in the casing 10°. The outer end of one of said wires 87 is connected with the binding screw 75, upon one of the guide plates 74 in the direction of the cylinder head 33 and the outer end of other wire 86 is connected with the binding screw $75^{\times}$ upon the guide plate 74 in the direction of cylinder head 15. With the binding posts or screws 77 and 81 on the respective insulated block 76 and 79 are connected the inner ends of the circuit conducting wires 88 and 89, these insulated wires being extended outwardly through the slot 62 in the casing 10°, the outer end of the wire 88 being extended upwardly and within the perforate plug 60 and the other wire 89 extended downwardly within the perforate plug 61 into the lower combustion chamber $10^{\times}$, the ends of the wires within the plugs being bent at an angle toward each other.

With the outer surface of the cylinder head 36 is connected rigidly a handle 90 extending in an upward direction and with the outer surface of the pipe 28 is connected a handle 91 extending in a horizontal direction from the said pipe, the said handle being secured to lugs 93.

The starting handle for communicating an initial compression movement to the piston rod and pistons consists of a straight bar 94, upon one end of which bar is a handle 95. In the bar 94 at a point equidistant from its ends is a longitudinal slot 96. Upon the side of bar 94 is a sliding block 97 in the lower surface of which is a groove 98, extending transversely to the bar and adapted to receive the outer end of the oscillating bar 64. Upon the inner surface of the block is a pivot 99 which extends through the slot 96 in the bar 94. Upon the upper end of bar 94

near the handle 95 is an outwardly extended plate 100.

101 indicates a spiral spring secured at one end to the lower surface of the plate 100, the lower end of which spring bears upon the upper surface of the block 97.

In the lower end portion of the bar 94 is a transverse notch 102.

In the operation of the invention carbureted gas is admitted through the supply pipe 46 from any suitable source and enters the pipes 48 and 49. The gas regulating valves 53 and $54^{\times}$ being opened the gas passes into the chambers $10^{\times}$ and $12^{\times}$ of the cylinders 10 and 12 and so proportioned in quantity as to not fill these chambers completely from the resulting action of the piston but in a diminished quantity so that when the piston 20 is near the end of the up stroke and the air port 21 is beginning to be opened a partial vacuum has been formed in the said chamber $10^{\times}$ which will be filled by air from the air inlet 31 and the equilibrium established. The same result occurs in the cylinder 12 in the downstroke of the piston 40. The handle 95 is then placed in position with the groove 98 in the block 97 upon the outer end of the oscillating bar 64 and pressure being imparted to the handle 95 the spring 101 is compressed and the notched portion 102 of the bar 94 engages with the plate 69 on said bar. During the application of pressure to retain the handle in position upon the bar or lever 64 power is applied to oscillate the bar and communicate an initial reciprocal movement to the pistons 20 and 40, and in this downward movement of the piston the lower piston 20 which acts as and imparts the blows to the anvil 24, closes the air inlet opening 31 and compresses the air and gas into the recess 25, which recess admits of more air and gas being admixed, and forces said mixed gases through pipe 28 into the upper portion of the chamber 20 through the upper or inlet opening, the piston 20 in the meantime passing below the said opening and the gases being directed toward the cylinder head 15 by the baffle 30. In the said downward movement of the piston 40 the piston closes the inlet opening of the gases from pipe 37 and exhaust port 38, and compresses the gases and air between the piston and the cylinder head 33. In this movement of the piston 20 the lower end of the contact plate 71 comes into contact with the spring plate 78 closing the circuit through the conducting wire 88 to the sparking plug 60 and completing the circuit through the wire 84, the spark igniting the compressed gases and under the expansion of the gases from the combustion the piston 40 moves upwardly compressing more gas between the piston 20 and the cylinder head 15, at the same time the piston 40 compresses the new charge between it and the cylinder head 36 the burned gases passing out of the exhaust opening 38. In the completion of the upward movement of the piston 20 the upper end of the contact plate 71 comes into contact with the spring plate 80 closing the circuit through wire 89 to sparking plug 61 completing circuit through wire 85, and igniting the compressed gases in the cylinder 10, and in the expansion of the gases from combustion the hammer piston 20 comes forcibly into contact with the anvil 24, delivering a blow which is transmitted to the drill 27. In this movement toward the anvil the piston 20 closes the air inlet opening 31 through which the air is drawn by suction occasioned by its upward movement.

Within the cylinder 12 the mixed gases are prevented from moving toward the exhaust openings by the vanes 30 and 42 on the respective pistons 20 and 40. As soon as the compression and ignition of the gases in the separate combustion cylinders impart a reciprocal movement to the pistons downward pressure upon the handle 95 is relieved and the action of the spring 101 tends to force the handle outwardly and the handle is instantly disengaged from the oscillating bar 64.

In the alternate expansions of gases upon the pistons from the combustions of the gases the recoil of the implement is alternate and the impact from the blow of the piston hammer 20 which is made of steel upon the anvil is communicated to the tool.

In the employment of the implement for drilling, riveting, puncturing substances, mill stamping or other purposes a higher efficiency or conservation of force may be obtained within a small compass and results obtained that are commensurable with the power used. The employment of carbureted gas which may be readily stored affords ready transmission through a flexible tube as at 47 regulated in quality by the valve 53, so that the tool may be carried for mining operations or other purposes in the hand to the place where the work is to be performed. The water for cooling, which may in like manner be supplied to the opening 45, is discharged when heated from the pet cock 58, the water serving to cool both cylinders before discharged.

I am aware that hammer pistons are old in motor tools, and that an impact plate or anvil with which the hammer piston comes into contact is shown in the patent to Choteau, No. 519147, May 1, 1894. In the impact of the hammer piston upon the anvil the auxiliary chamber 25, prevents cushioning of the hammer upon the air, and enables the hammer piston to come into contact with the anvil, said chamber providing for the admixture of gases, as before described.

Having fully described my invention,

what I now claim as new and desire to secure by Letters Patent is—

1. The combination in a motor tool of a rear compression combustion cylinder for the combustion of gases, having suitable gas inlets at the rear compression end and intermediate the ends of said cylinder, means connecting the rear compression end of the cylinder with the intermediate gas inlet, and an exhaust port also intermediate the ends of said cylinder, a hammer piston within said cylinder acting to control the supply and exhaust respectively, to and from said intermediate gas inlet and exhaust openings, means for effecting the compression stroke of the hammer piston in the explosion end of the cylinder, means for igniting the gases within said cylinder, and an upward extension of the inner portion of the rear compression end of said cylinder forming an anvil upon which the hammer piston comes forcibly into contact, said cylinder having a recessed enlargement concentric with said upward extension or anvil forming an auxiliary mixing chamber for the gases.

2. A motor tool comprising separate rear compression combustion cylinders, means connecting the said cylinders with each other, means connecting the outer or compression ends of said cylinders with each other, said means serving to conduct combustible gases to both cylinders, said cylinders having inlet openings for the compressed gases, and exhaust openings intermediate the ends of said cylinders, means connecting said inlet openings with the compression ends of said cylinders, means for regulating the supply of gases, gas igniting devices connected with the respective cylinders, elongated pistons in said cylinders adapted to control the supply of gas to and exhaust from said cylinders, one of said pistons being adapted to impart a blow, an inward extension of the rear compression end of one of said cylinders, forming an anvil upon which the hammer piston comes into contact, the latter cylinder having a recessed enlargement concentric with said upward extension or anvil forming an auxiliary mixing chamber for the gases.

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