A. SANDSTROM.

ELECTRIC PICK MINING MACHINE.

APPLICATION FILED APR. 1, 1904. RENEWED APR. 7, 1908.

903,508. Patented Nov. 10, 1908.

3 SHEETS—SHEET 1.

Fig. 1.

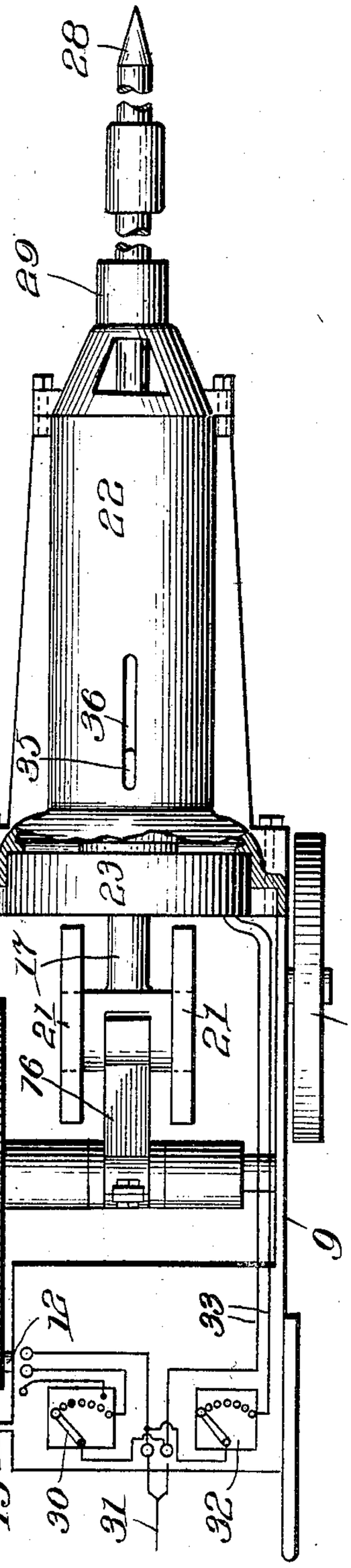
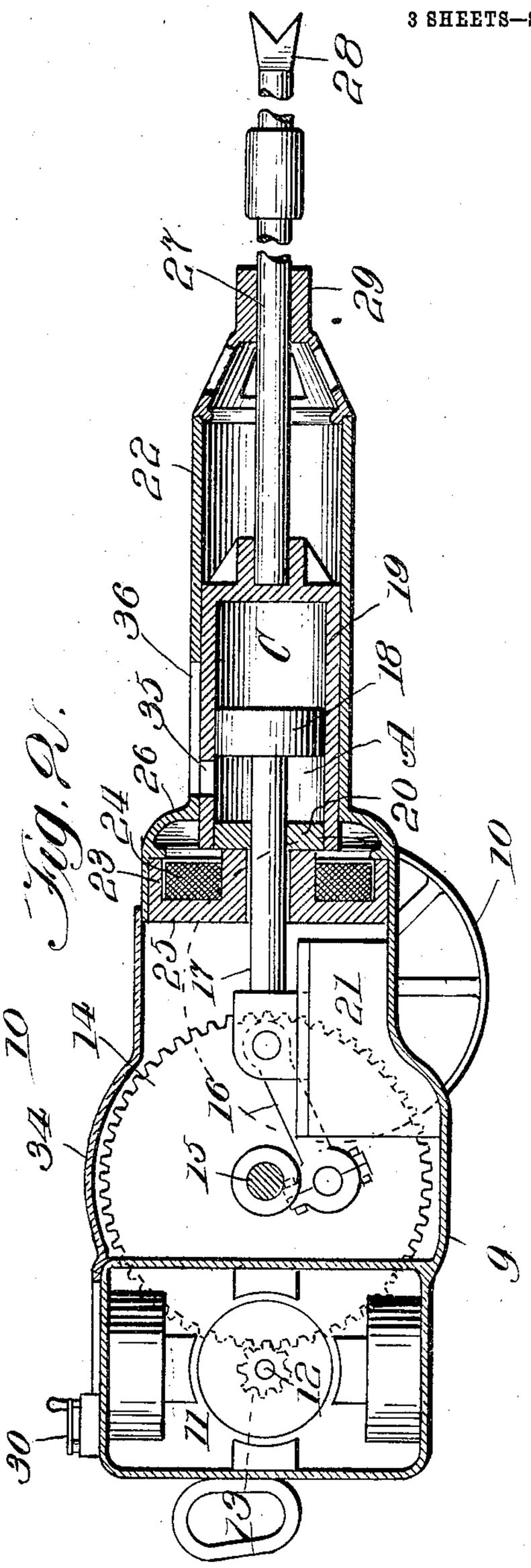


Fig. Q.



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3 SHEETS—SHEET 2.

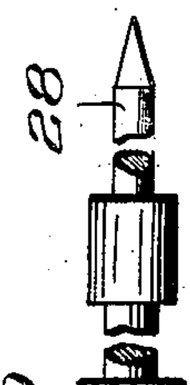


Fig. 3.

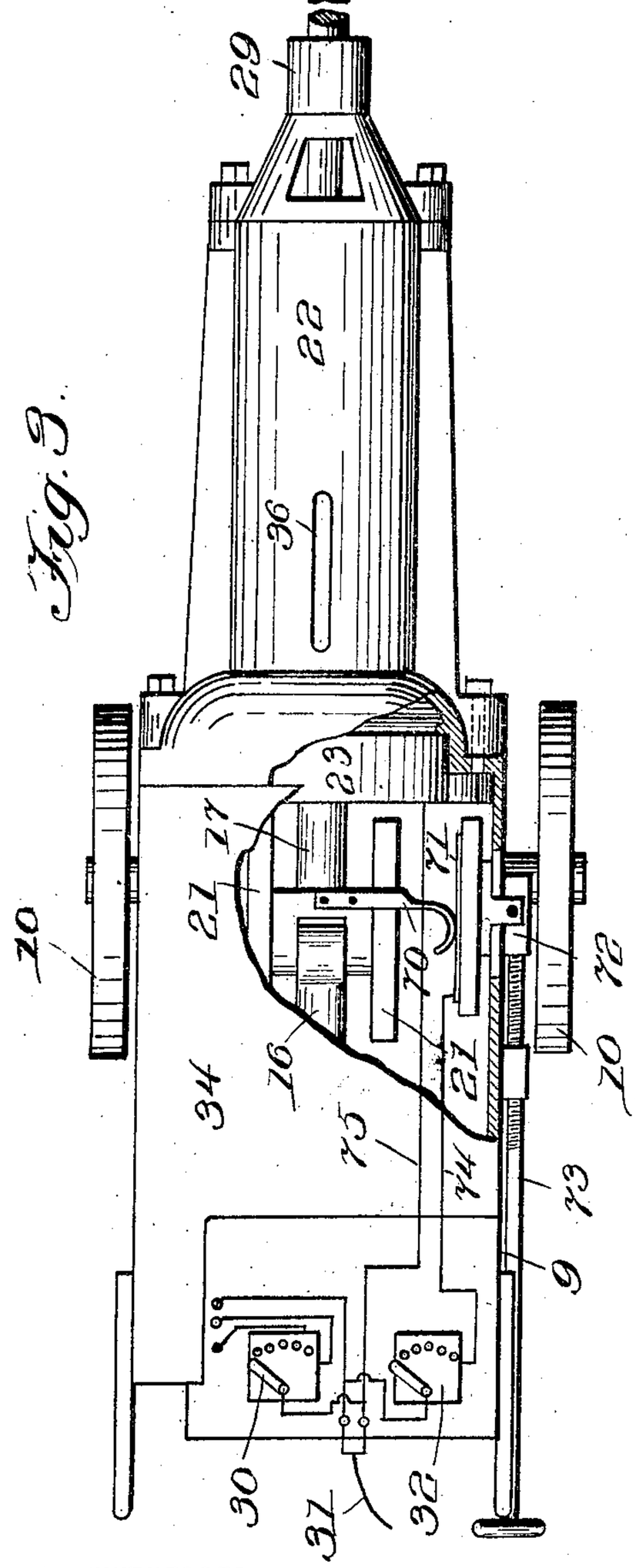
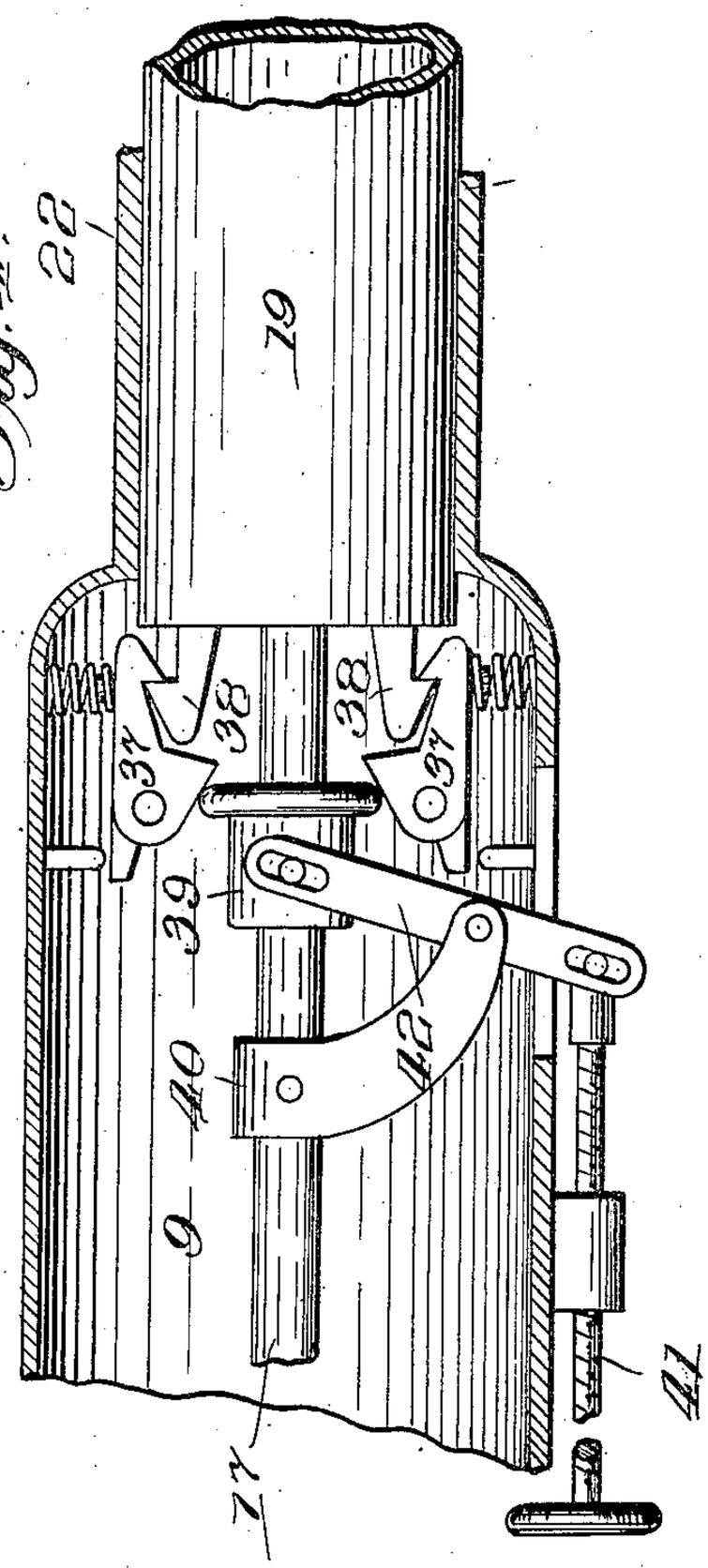


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

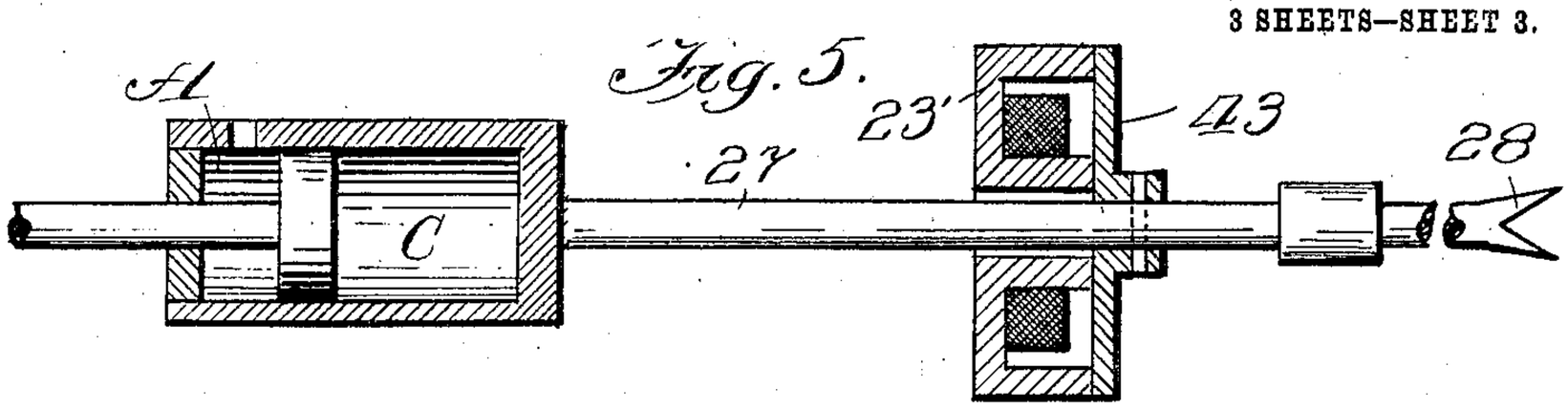


Fig. 6

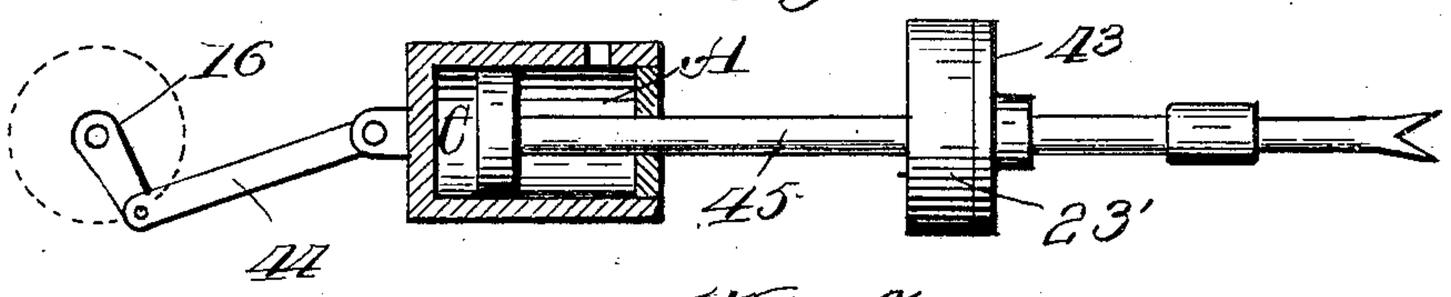


Fig. 7.

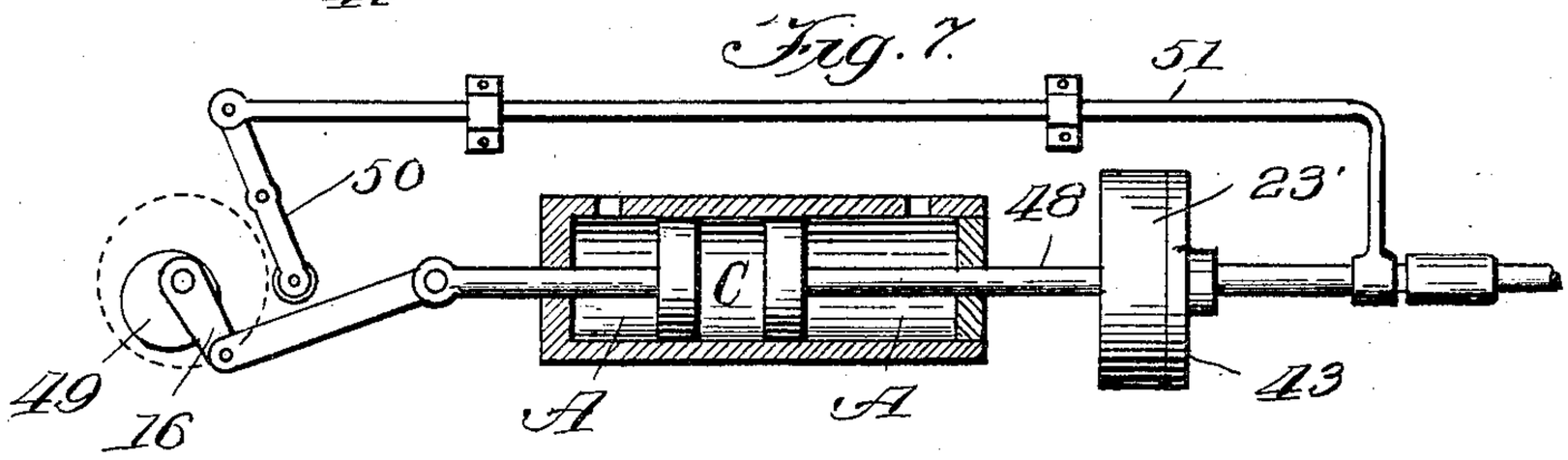


Fig. 8.

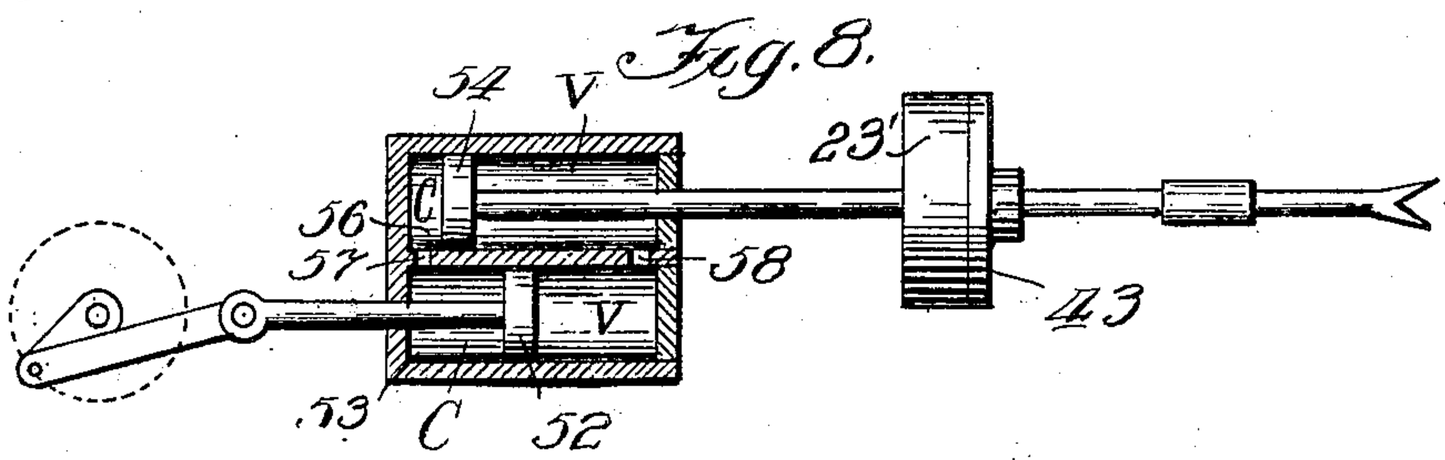
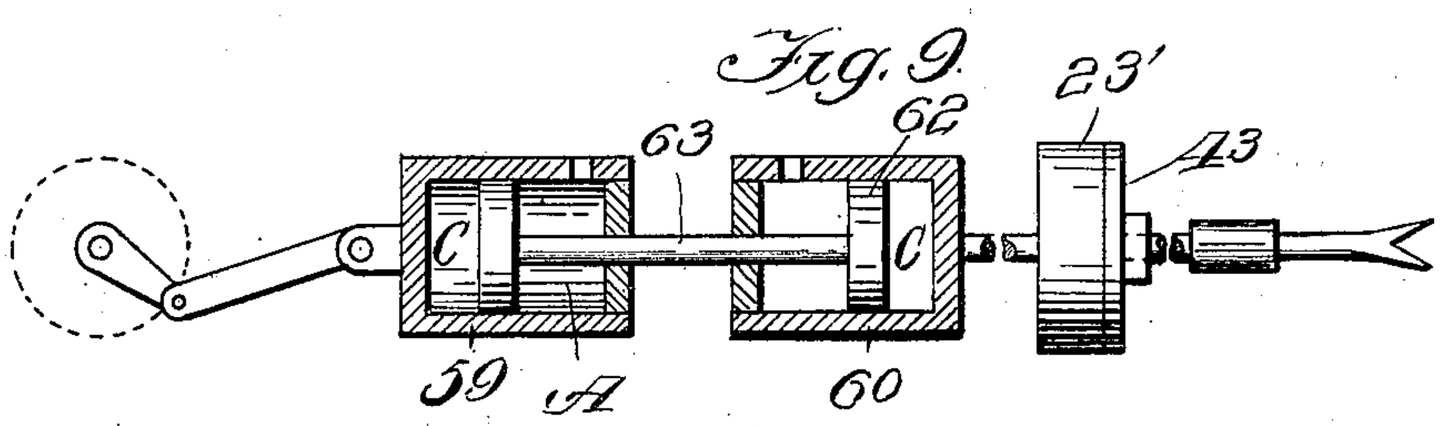


Fig. 9.



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UNITED STATES PATENT OFFICE.

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ELECTRIC PICK MINING-MACHINE.

No. 903,508. Specification of Letters Patent. Patented Nov. 10, 1908.

Application filed April 1, 1904, Serial No. 201,187. Renewed April 7, 1908. Serial No. 425,704.

To all whom it may concern:

Be it known that I, ALFRED SANDSTROM, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Pick Mining-Machines, of which the following is a specification.

This invention relates to coal mining machines of the type generally known as "pick machines" and its object is to provide a machine of this character of simple and substantial construction and adapted to be driven electrically.

The invention has other objects in view which will be fully pointed out hereinafter in the detail description, reference being had to the accompanying drawings which show one manner of embodying the invention in physical form and in which

Fig. 1 is a top plan view of a pick machine embodying the invention and shown partly in section with the lid removed.

Fig. 2 is a longitudinal sectional view.

Fig. 3 shows means for releasing the compression cylinder by breaking the exciting current to the magnet.

Fig. 4 shows mechanical means for holding the compression cylinder.

Figs. 5–9 show diagrammatically, and partly in section, various modifications of the invention.

Like characters of reference indicate corresponding parts in the several figures and referring thereto 9 designates the casing which incloses the operative parts of the invention and which is mounted on wheels 10 and can be made of any suitable size, shape and material for this purpose. An electric motor 11 of suitable construction is secured to the rear end of the casing and its armature 12 carries a spur pinion 13 which drives a spur gear 14 on the crank shaft 15 journaled in suitable bearings in the casing. This crank shaft is connected by a link 16 with a piston rod 17 carrying a piston 18 within the cylinder 19 and guided by guides 21. The cylinder is adapted to move longitudinally in the cylindrical portion 22 of the casing at the rear end of which an electro magnet 23 is located. The coil 24 of this magnet is arranged in a shell 25 which is open at the front and the magnetic circuit will be completed around the coil through the shell, the contiguous portion 26 of the casing and the rear end of the cylinder. A tool rod 27 carrying a tool 28 is secured in any suitable manner to the front end of the cylinder and is guided in the cap 29 of the casing. 30 is the starting switch and 31 is the double cable carrying the current for the motor. I provide a rheostat 32 or resistance in the circuit 33 of the electro magnet to control the current in this circuit and regulate the blow which is communicated to the tool. The operating switch and the rheostat may be conveniently located as shown on the top of the casing at the rear end thereof, above the motor, and a lid 34 may be provided in the casing above the spur gear and crank shaft to permit access thereto.

The electro magnet operates as a holding device to hold the cylinder 19 in its rearward position (Fig. 2) until the energy stored in the cylinder by compression of the air therein on the continued forward movement of the piston is sufficient to overcome the holding power of the magnet, whereupon the cylinder and the tool will be thrust forward by the expansion of this compressed air. The air pressure for operating the tool is thus produced and utilized at each operation of the machine, that is to say, at each blow of the tool. The cylinder is provided with an opening 35 to register with a slot 36 in the cylindrical portion 22 of the casing and this opening is located in advance of the rear head of the cylinder so that a cushion of air will be formed between the piston and this head on the backward stroke of the cylinder to avoid shock to the machine. Another reason for locating the opening 35 in advance of the rear end of the cylinder is to provide connection between the compression end of the cylinder and the atmosphere when the piston is at the limit of its rearward movement so that whatever air is lost by leakage past the piston during the preceding operation of the machine may be replenished before the piston passes the opening 35 on its forward stroke. The piston is reciprocated by the crank shaft and on its backward stroke moves the cylinder back to its rearward position in contact with the magnet. The magnet holds the cylinder until its power is overcome by the pressure of the compressed air in front of the piston in the front end of the cylinder. The holding power of the magnet is controlled by the rheostat and the

force of the blow struck by the pick is correspondingly regulated. As the holding power of the magnet is increased greater pressure would be required in the cylinder to release it from the magnet and consequently this greater pressure will thrust the cylinder forward with greater force and cause the pick to strike a heavy blow; when the holding power of the magnet is decreased a correspondingly less pressure will be required in the cylinder to release it from the magnet and a correspondingly lighter blow will be struck by the pick. If the pick should fail to engage a resisting body the machine will be saved from shock by the air cushion between the piston and the head 20. My improved machine compresses air to store energy and utilizes this energy on the same stroke of the machine and thus I avoid the necessity for storage tanks or pipes because the power required for operating the pick is derived initially from the motor and produced as required for each operation of the pick. An electrically operated machine of this character presents many desirable advantages over machines operated pneumatically and otherwise because of its higher efficiency and inconsiderable loss in transmitting the power. The wires required for transmitting the electricity are far cheaper and can be installed and maintained at considerably less expense than the hose and pipes for pneumatic machines which are commonly employed for this purpose.

In Fig. 3 I have shown means for automatically opening the electric circuit of the electro magnet to release the compression cylinder. A brush 70 is connected to the piston rod 17 and is carried thereby in engagement with a stationary contact 71 which is supported in and insulated from a block 72 adjustably mounted on a hand screw 73. The current travels from rheostat 32 through wire 74 to contact 71 and brush 72 and thence through the piston rod, cylinder and frame of magnet to the magnet coil and out through wire 75. When the piston is at the forward end of its stroke the brush will be carried off of the contact and thus break the current in the magnet which will cause the release of the cylinder. The time of the release can be regulated by the adjusting screw.

In Fig. 4 I have shown a mechanical means to take the place of the electro magnet for holding the pressure cylinder. This means consists of one or more spring pressed dogs 37 adapted to engage the hooks 38 on the cylinder 19 and operated by the tripping collar 39 which is slidable on the piston 17, and is adapted to be engaged by the projection 40. It will be readily understood that when the piston is moved forward, as heretofore described, the projection 40 will engage and cause the tripping collar to disengage the dogs from the hooks and thus release the cylinder. The force of the blow to be struck by the pick can be regulated in this construction by controlling the time at which the cylinder is released from the dogs with relation to the position of the piston in the cylinder, and this is accomplished by means of an adjusting screw 41 which is connected to the lower end of a lever 42, this lever being pivotally connected at its other end to the tripping collar and fulcrumed on the projection 40 which is made in the form of a depending arm fastened to the piston. By adjusting the screw 41 the distance between the stop and the tripping collar can be increased or decreased to shorten or lengthen the stroke of the piston before the cylinder is released.

In Figs. 5 to 9 I have shown several other ways in which the invention can be embodied, the object in each case being to hold the tool until a sufficient air pressure has been produced, then to release the tool and utilize the said air pressure to drive the tool.

In these several figures A designates that part of the cylinder where there is atmospheric pressure, C indicates the space where the compression takes place, and in Fig. 8 V indicates where a partial vacuum may occur. In Figs. 1 and 2 the magnet 23′ is located at the rear end of the cylinder but obviously the magnet could be located in front of the cylinder and on the tool rod as shown in Fig. 5. In this construction the magnet is rigidly held in the casing in any suitable manner and a disk 43 is rigid on the tool rod to correspond to the head 20 or rear end of the cylinders in the construction of Fig. 2. It will be readily understood that the magnet will hold the disk, tool rod, cylinder and pick stationary until its holding power has been overcome by the pressure of the air in front of the piston in the cylinder, whereupon the magnet will release the disk and the air pressure in the cylinder will force the cylinder, the tool rod and the pick forward to strike the blow. In Fig. 6 the positions of the cylinder and piston are reversed and the cylinder is connected by a link 44 to the crank shaft 16 while the piston rod 45 projects through the front end of the cylinder and carries the disk 43 and also the tool, thus taking the place of the tool rod, shown in Fig. 2. The operation of this construction is exactly similar to that heretofore described, except that the cylinder is moved on the piston to compress the air.

In Fig. 7 I provide two pistons 46, 47, the former being connected to the crank shaft 16, as shown in Fig. 2, and the latter being carried by the tool rod 48 which extends into the cylinder through the front end thereof. In this construction the compression takes place between the two pistons and for the purpose of returning the cylinder to its backward position I provide a cam 49 on the crank shaft, which is adapted to operate a lever 50 connected to a shifting rod 51 attached to the

piston rod 48. In Fig. 8 I have shown a piston 52 connected to the crank shaft and operating in a compression chamber 53, and also a piston 54 on a piston rod 55 and operating in a compression chamber 56 located above the chamber 53 and connected therewith by the ports 57 and 58. In this construction the piston 52 is on its forward stroke when moving to the left and consequently the air pressure is stored in front of the piston in the spaces marked C while a partial vacuum will be behind the piston in the spaces marked V. In Fig. 9 I have shown a construction somewhat similar to Fig. 7 except that two cylinders 59 and 60 connected respectively to the crank shaft and the tool rod are movable on the pistons 61, 62 carried by the connecting rod 63. It will be apparent that all of these constructions come within the generic invention heretofore described more particularly in connection with Figs. 1 and 2 and while I am aware that various other changes and modifications in the construction and arrangement of parts may be made without departing from the spirit or sacrificing the scope of the invention I believe that the foregoing is sufficient to indicate the scope of the invention.

While I have shown and described the machine as particularly adapted for a pick mining machine it will be understood that a tool of any desired character can be provided and the machine employed for drilling and other purposes.

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

1. In combination, a reciprocatory tool, a motor, means operated thereby for producing a pneumatic drive and including a cylinder and piston movable relatively to each other, to the movable one of which parts the tool is connected, and releasable engaging means for the movable part adapted to allow the release and forward drive of the tool when the air pressure overbalances the hold of the engaging means.

2. In a machine of the character described, a motor, a reciprocatory tool, means for holding the tool temporarily in fixed position, and means connected to the motor for producing a sufficient air pressure in the machine to release the tool from the holding means.

3. In a machine of the character described, a reciprocatory tool, an electric magnet to hold the tool in retracted position, a motor, and means operated by the motor for producing sufficient air pressure to release the tool from control of the said magnet and thrust it forward.

4. In an electrically operated machine of the character described, a movable air compression cylinder, a tool connected with said cylinder, means for holding said cylinder temporarily in fixed position, and means for producing sufficient pressure in the cylinder to release it from said holding means and enable said pressure to move the cylinder.

5. In an electrically operated machine of the character described, a movable air compression cylinder, a tool connected to said cylinder, an electro magnet to hold the cylinder in retracted position, and reciprocatory means for producing a sufficient air pressure in the cylinder at each stroke of the reciprocatory means to release the cylinder from said magnet and permit the pressure to expand and thrust the cylinder and tool outward.

6. In an electrically operated machine of the character described, a movable air compression cylinder, a tool connected to said cylinder, an electro magnet to hold the cylinder and tool in retracted position, a piston in said cylinder and means for operating the piston to produce a sufficient air pressure in the cylinder to release the cylinder from the magnet and thrust the cylinder and pick outward.

7. In an electrically operated machine of the character described, a tool, means for holding the tool in retracted position and means for producing in the machine a sufficient air pressure to release the tool from its retracted position and for utilizing the expansion of said pressure to thrust the tool outward.

8. In an electrically operated machine of the character described, a tool, an electro magnet, means to regulate the holding power of said magnet, and means for producing sufficient air pressure to overcome the holding power of the magnet and to operate the tool.

9. In an electrically operated machine of the character described, a tool, an electro magnet, a variable resistance in the electric circuit of said magnet, and means for producing a sufficient air pressure in the machine for the purpose set forth.

10. In combination, a reciprocatory tool, a magnet for holding the tool in retracted position, and means for producing air pressure sufficient to release the tool from its retracted position and thrust it forward.

11. In combination, a reciprocatory tool, means for holding the tool releasably in retracted position, and means for producing air pressure sufficient to release the tool from its retracted position and thrust it forward.

12. In a machine of the character described, a tool, a movable air compression cylinder, a piston in said cylinder, a port opening in said cylinder constantly open to the atmosphere, and means for compressing the air in said cylinder for the purpose set forth.

13. In a machine of the character described, a casing, a tool, a movable air compression cylinder operating in said casing, a

piston in said cylinder, a port opening in said cylinder registering with an elongated slot in the casing, and means for compressing air in said cylinder to operate the tool.

14. In an electrically operated machine of the character described, a movable air compression cylinder, a tool connected to the forward end thereof, an electro magnet behind the cylinder to hold said cylinder and tool in retracted position, a piston in the cylinder and means for operating the piston to produce sufficient pressure in the cylinder to release the cylinder from said magnet and by expansion thrust the cylinder and tool outward.

15. In an electrically operated machine of the character described, a movable air compression cylinder, a tool connected to said cylinder, an electro magnet to hold the cylinder and tool in retracted position, a variable resistance in the electric circuit of said magnet, a piston in the cylinder, and means for operating the piston to produce sufficient pressure in the cylinder to release the cylinder from said magnet and by expansion thrust the cylinder and tool outward.

16. In an electrically operated machine of the character described, a movable air compression cylinder, a tool connected to said cylinder, a piston in said cylinder, a crank shaft connected to and operating said piston, an electric motor for operating said shaft, and means for holding the cylinder until a sufficient air pressure has been produced therein to cause the tool to strike the required blow.

17. In an electrically operated machine of the character described, a movable air compression cylinder, a piston in said cylinder, and a port opening in said cylinder between its ends so that atmospheric pressure is maintained in the cylinder behind the piston during its advance stroke and until said piston occupies a position behind said port.

18. In combination, a reciprocatory tool, a magnet for holding the tool in retracted position, an air compression cylinder and piston for producing air pressure sufficient to release the tool from its retracted position and thrust it forward, means for replenishing the air in the working end of the cylinder, and means for operating the cylinder and piston.

19. In combination, a reciprocatory tool, means for holding the tool releasable in retracted position, an air compression cylinder and piston for producing air pressure sufficient to release the tool from its retracted position and thrust it forward, means for replenishing the air in the working end of the cylinder and means for operating the cylinder and piston.

20. In combination, a reciprocatory tool, means for producing resilient pressure for operating the tool, and means of predetermined holding power for restraining the drive of the tool until sufficient resilient power is stored up to overbalance the said means of predetermined holding power, whereby the tool is driven by the stored up power.

21. In combination, a reciprocatory tool, means for producing resilient pressure for operating the tool, and a magnet for restraining the drive of the tool until sufficient resilient power is stored up to overbalance the magnet, whereby the tool is released and driven by the stored up power.

22. In combination, a reciprocatory tool, means for producing air pressure for operating the tool, and a magnet for restraining the drive of the tool until sufficient pressure is secured to overbalance the magnet whereby the tool is released and driven by the compressed air.

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