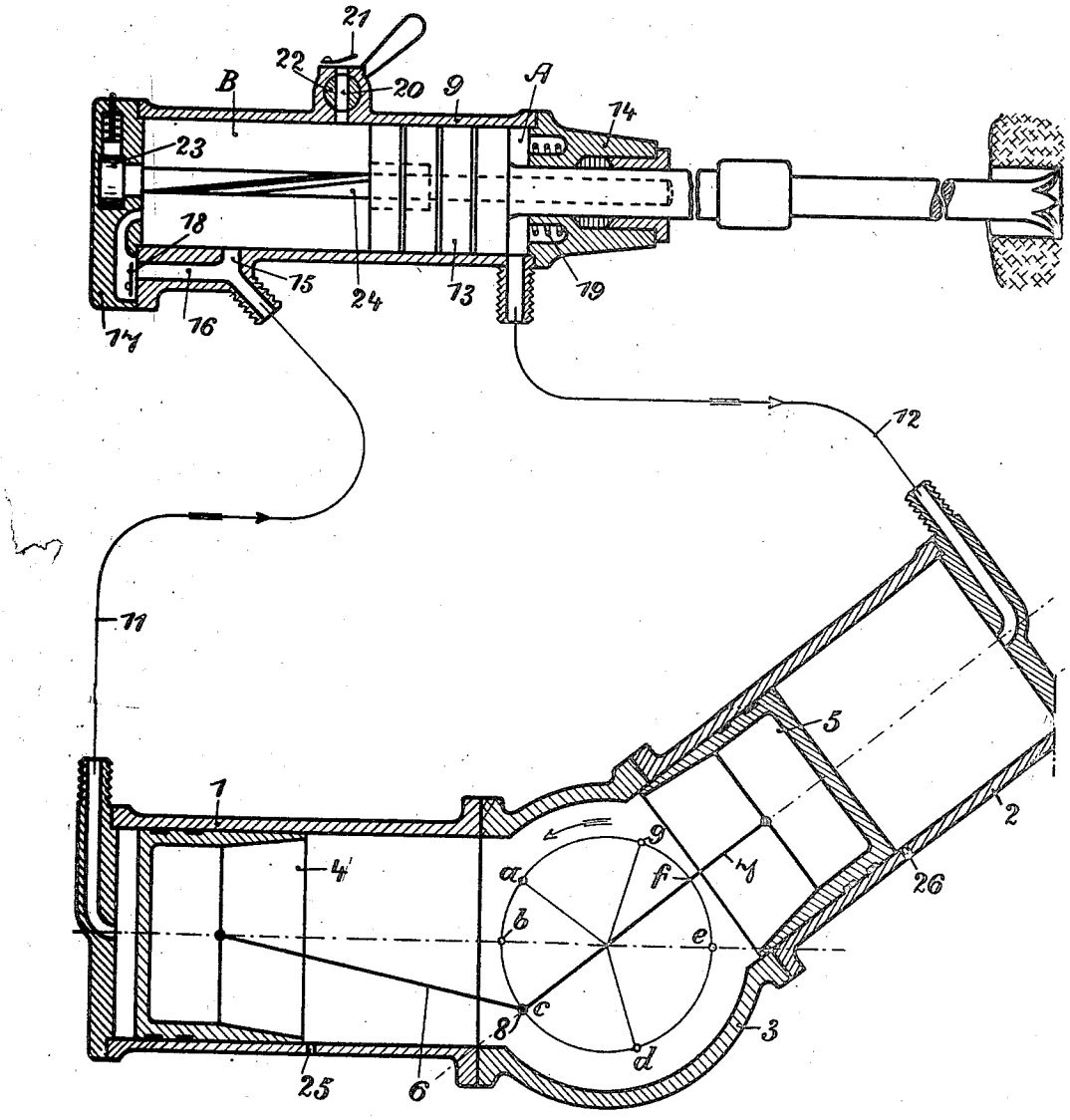
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A. BERNER

PICKING AND ROCK DRILLING MACHINE

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AUGUST BERNER, OF NUREMBERG, GERMANY.

PICKING AND ROCK-DRILLING MACHINE.

Application filed August 6, 1914. Serial No. 855,421.

To all whom it may concern:

Be it known that I, AUGUST BERNER, a citizen of the German Empire, and a resident of Nuremberg, Bavaria, Germany, have invented certain new and useful Improvements in Picking and Rock-Drilling Machines, of which the following is a specification.

The hitherto known picking and rock-drilling machines operate with reciprocating currents whose air quantities are constant. In these machines the escape of air is avoided as much as possible, and a certain maximum efficiency is produced, which could not be surpassed, the difference of the pressures of the two air currents being limited unless certain complicated means are provided to avoid this drawback.

The object of my invention is to provide a construction which permits greater differences of the pressures and a better utilization of the compressor work.

I accomplish my object by providing within the tool cylinder an escape valve which is released from the face side of the piston after the forward stroke thereof and from the ring-side of the piston after the return stroke of the latter. The compressed air will escape after every stroke of the tool piston so that atmospheric pressure will prevail and the suction stroke of the compressor will produce an underpressure. By virtue of the provision of the escape valve also the relative condition between the condenser or compressor and the tool cylinder become independent of each other. There is no limit or maximum to the pressure or tension attainable by a corresponding relative size of the compressor.

My invention will be more fully understood by reference to the accompanying drawing in which similar reference characters denote corresponding parts and which diagrammatically represents a sectional view of a rock-drill with a tool cylinder having an escape valve and compressor cranks placed in alternate positions to each other.

The compressor consists of two cylinders 1 and 2, placed at an angle to each other and each one provided with a port 25, 26 respectively, which ports communicate with each other through the crank casing 3. The compressor pistons 4 and 5 are moved by means of the crank rods 6 and 7 respectively from the crank 8. The tool cylinder 9 communicates by means of the conduit 11 with the cylinder 1 and by means of the conduit 12 with the cylinder 2. The conduit 12 leads into the compartment A at the forward end of the tool piston 13 adjacent the head 14. In this head 14 a spring 19 is provided which is adapted to take up the thrust of the piston 13 when the latter accidentally is driven too far forward, so that the piston 13 will not strike the head 14 but the spring 19. The inlet at the rear end of the tool cylinder into which leads the conduit 11 is branched off into ports 15, 16, of which the branch or port 15 opens into the cylinder at some distance away from the cap 17, which distance is smaller than the height or length of the piston. The port 16 which contains a back stroke valve 18 and runs parallel to the axis of the cylinder 9 opens into a passage made in the cap 17 which passage communicates with the rear end of the cylinder. Arranged about midway between the ends of the cylinder 9 an escape port 20 having a cock valve 22 is provided.

The tool piston 13 in addition to its longitudinal movement also receives a rotary motion, whereby the striking point of the bit is constantly changed. The rotary motion is effected in the usual manner by a rod 24 provided with a spiral thread and actuated from a ratchet wheel 23. During the working operation the ratchet wheel 23 is permitted to freely revolve without turning the tool piston, but during the return movement of the tool from the drill hole the ratchet wheel and the rod are arrested in consequence of which the piston together with the tool is caused to turn.

The machine described works as follows:

The working stroke effected during the time during which the crank 8 travels on the arch *a—b—c*. Owing to the angular position of the cylinders 1, 2 the piston 5 moves in advance of piston 4 in such manner that the piston 5 arrives at its dead point only when the tool piston 13 has moved forward. During the entire forward movement of the tool piston there is an under-pressure in the compartment A, the said pressure rising to atmosphereic pressure at the moment when the stroke is completed. The change from under-pressure to atmospheric pressure is dependent on the movement of the tool piston which also acts as a compressor. There is no air cushion then in front of the tool piston.

As soon as the stroke piston has passed

the conduit 20 the compressed air escapes from the compartment B, and the compression piston 4 produces at once, on completing the stroke an under-pressure thus being relieved from doing any work and establishing atmospheric pressure. The piston 5 commences its compression stroke immediately on the forward movement of the tool piston. Regardless of the under-pressure within the compartment B and the super-pressure in the compartment A the tool piston remains for the moment in its fore-end position because the conditions then prevailing have first to be overcome.

When the crank 8 has arrived at the point *d* the tool piston begins its return movement. When the crank is in the position *g* the return movement of the tool piston has been completed. While the crank traverses the curve *d—e* the piston 4 sucks while on the distance *d—e—f* the piston 5 compresses. On the way *e—f—g* the piston 4 compresses while the piston 5 sucks on the way *f—g*. Thus the underpressure in the compartment B and the super-pressure in the compartment A are reduced towards the end of the return movement of the tool piston, so that its active power becomes gradually neutralized. At any rate any compressed air that might still be present in the compartment A escapes through the valve 21 as soon as the piston has passed the conduit 20. After completing its return movement the tool piston remains for a short time at its dead point while the crank passes along the curve *g—a*.

The change from the return movement to the forward stroke goes on gradually without any violent jerks and any additional pump work.

Still, for the sake of safety, an additional device is provided which entirely obviates a counter stroke against the cap 17. By the branching off of the conduit 11 and the peculiar disposal of the mouths of the branches 15, 16 there is produced an air cushion behind the tool piston whenever it should go beyond the conduit 15. As long as the conduit is closed the compressed air enters through the branch 16 and the valve 18. Corresponding branches may also be provided in the conduit 12, whenever expedient. The fresh air required is sucked in by the compressor through openings 25, 26 which, if necessary may be closed by outwardly opening clack-valves.

By providing the conduit 20 and the clack valve 21 it is rendered possible to adjust the machine for strong and lighter impacts. In the work described the impacts are heavy. If the machine is to make lighter impacts or blows the conduit 20 should be entirely or partly closed by means of the clack valve 22. Consequently an escape of compressed air after the forward stroke and after the return movement is out of the question. The piston meets every time the air cushion which restrains its movement and the machine strikes slightly.

I claim:—

1. A rock drill operated by reciprocating air currents comprising a tool cylinder with conduits for the said reciprocating air currents, a tool piston within the cylinder, and a safety air valve in the tool cylinder located so that it permits the escape of compressed air after each forward and return stroke of the tool piston.

2. A rock drill operated by reciprocating air currents comprising a tool cylinder with conduits for the said reciprocating air currents, a tool piston within the cylinder, and a safety valve in the tool cylinder located so that it permits the escape of compressed air after each forward and return stroke of the tool piston, and another valve in the said cylinder between the escape valve and an escape conduit, said last named valve being adapted to open when the escape conduit is closed.

3. A rock drill machine operated by reciprocating air currents comprising a tool cylinder with an air conduit at its front end and an air conduit at its rear portion having a rear branch with valve and conduit communicating with the rear portion of the cylinder, and a safety air valve in the cylinder located so that it permits the escape of compressed air after each working and return stroke of the tool piston.

4. A rock drill operated by reciprocating air currents comprising a tool cylinder with head and rear cap and having air conduits for the said reciprocating air currents, a tool piston within the cylinder, a safety air valve in the cylinder located so that it permits an escape of compressed air remaining in the pass of the tool piston after each working and return stroke, and a spring in the head of the cylinder to prevent rebounding of the tool piston.

In testimony whereof I affix my signature in presence of two witnesses.

AUGUST BERNER.

Witnesses:
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HANS WALTER.