(No Model.)

A. B. DRAUTZ.

COMPOUND ENGINE.

No. 422,051. Patented Feb. 25, 1890.

Fig. 1.

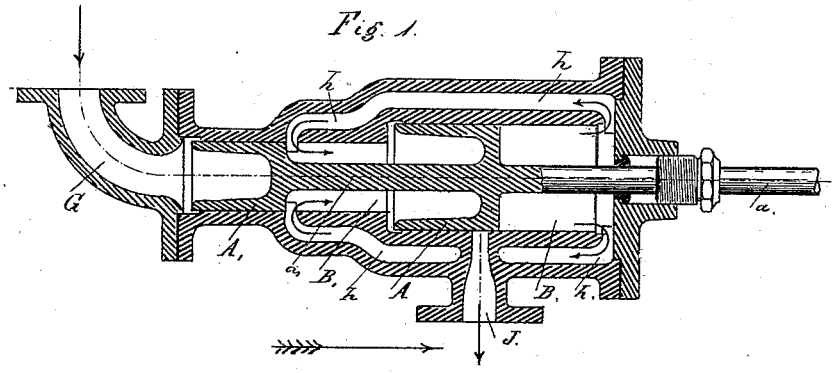


Fig. 2.

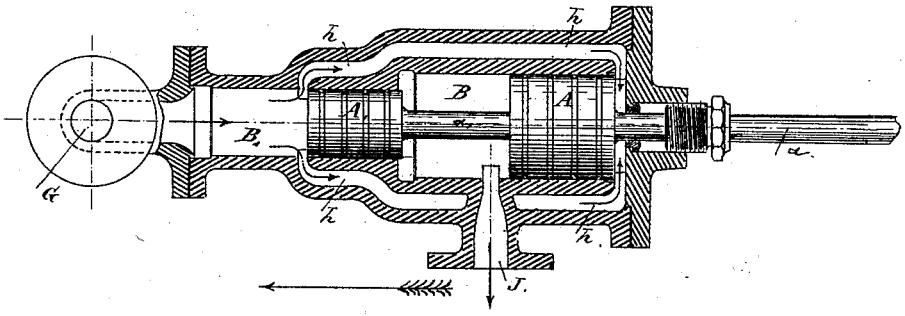
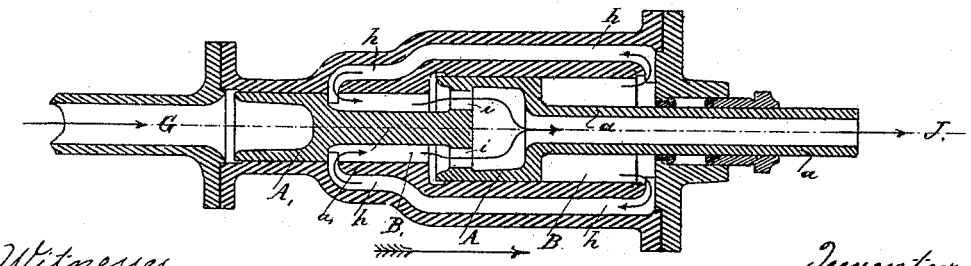


Fig. 3.



Witnesses.
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UNITED STATES PATENT OFFICE.

AUGUST BERNHARDT DRAUTZ, OF STUTTGART, WÜRTEMBERG, GERMANY.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 422,051, dated February 25, 1890.

Application filed March 19, 1889. Serial No. 303,860. (No model.) Patented in England March 1, 1889, No. 3,613.

To all whom it may concern:

Be it known that I, AUGUST BERNHARDT DRAUTZ, a subject of the Emperor of Germany, and a resident of Stuttgart, Würtemberg, Germany, have invented a new and useful Improvement in Compound Engines, (for which I have obtained patent in England dated March 1, 1889, No. 3,613,) of which the following is a specification.

This invention relates to an improved compound engine, and has for its purpose to more completely utilize the motive power than is the case in the compound engines hitherto known. The improved engine has two pistons of different cross-sections and only one distribution-canal.

Referring to the accompanying drawings, Figure 1 is a longitudinal section showing the position of the double piston when the distribution-canal is open; Fig. 2, a longitudinal section showing the position of the piston when the said canal is closed; and Fig. 3 is a longitudinal section of the improved device as applied to percussion boring-machines.

The pistons A and A′ of different cross-section are connected with each other by means of the rod *a′*, the diameter of which is inferior to that of the small piston A′, the piston-rod *a* passing through the rear cylinder-cover. The pistons operate in the cylinders B and B′, communicating with one another through the distribution-canal *h*, one aperture of which terminates about the middle of the small cylinder B′, and at the end of the return-stroke of the double piston, Fig. 2, communicates with the inlet G for the fresh motive power, (steam or air,) while at the end of the forward stroke, Fig. 1, it is situated between the two pistons. The other aperture of the distribution-canal terminates in the large cylinder B at the rear end thereof, and the canal I, for the exhaustion of the utilized motive power, is so situated as to be opened between the pistons at the end of the return-stroke, Fig. 2, and to be closed at the end of the forward stroke by the piston A.

The improved device works as follows: When the pistons occupy the position shown in Fig. 2, the fresh motive power passes from G, through cylinder B′ and canal *h*, to the rear surface of piston A, and, owing to the difference of cross-sections referred to, forces the double piston forward, as indicated by an arrow, notwithstanding the constant counter-pressure on the piston A′ produced by the entering motive power. The volume of the distribution-canal must of course be so chosen as to enable the pressure on the rear surface of the piston A to overcome the aforementioned counter-pressure throughout the whole stroke. As soon as the piston A′ has closed the one aperture of the canal *h*, the motive power inclosed in *h* and B expands until the piston A′ has passed and reopened the said aperture, Fig. 1. On the piston A′ attaining the position shown in Fig. 1 a communication is established between the two halves of the cylinder B through the canal *h*, as the rod *a′* has a cross-section inferior to that of the cylinder B′. The already-expanded motive power therefore is allowed to be distributed on the two surfaces of the piston A, thus producing a compensation of pressure with regard to the latter. Subsequently the constant pressure of the fresh motive power on the outer surface of A′ returns the double piston, as indicated in Fig. 1 by an arrow. Thereby first one aperture of the distribution-canal is closed by A′, and a further expansion takes place within the cylinder-spaces comprised between the pistons, while compression is produced in the canal *h* and in the rear space of the cylinder B. This second period of expansion, taking place on the opposite side of the first, terminates with the opening of the exhaust-canal I by the piston A, while simultaneously the compression ceases with the opening of one aperture of the canal *h* by the piston A′. The double piston having resumed the position shown in Fig. 2, the above operation is repeated.

The modification (shown by Fig. 3) of the improved system is intended to be applied to percussion boring-machines to allow the utilized motive power to be employed for removing the bore-dust. For this purpose the piston-rod *a*, connected with a hollow boring-tool, is likewise made hollow and connected by means of small apertures *i* with the cylinder-spaces comprised between the pistons A and A′. With this modification a second period of expansion between the pistons A and A′ does not take place; but the utilized

motive power flows from the rear half of the cylinder B through canal *h* and apertures *i* provided in the piston A into the hollow piston-rod *a'*, whence it passes to the boring-tool and bore-hole, delivering the latter of the bore-dust. In this modification the exhaust-canal I is replaced by the hollow piston-rod *a*.

What I claim is—

1. A compound motor actuated by gaseous fluid, having two pistons A and A' of different cross-sections, connected by a rod *a'* of a cross-section inferior to that of the small piston, and a transmission-port *h* so connecting the cylinders B and B' as to cause the motive force to act during the forward stroke of the two pistons with full pressure on the small piston A', while during the reverse movement of the pistons expansion takes place on one side of the large piston, and during the next forward stroke a second expansion of the motive fluid already expanded is produced on the other side of the large piston for the purpose of completely utilizing the motive force, substantially as specified.

2. A motor for rock-drilling purposes actuated by gaseous fluid, having two pistons A and A' of different cross-sections connected by a rod *a'* of a cross-section inferior to that of the small piston, the large piston A having apertures *i* and so communicating with its hollow piston-rod *a* and transmission-port *h* as to cause the waste motive fluid to pass through the piston-rod *a* and be utilized for removing bore-dust from a boring-tool connected therewith, substantially as specified.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

AUGUST BERNHARDT DRAUTZ.

Witnesses:
HERMAN PAHL,
ADOLF RAMSPERGER.