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MULTIPLE EXPANSION ENGINE.

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1,067,484.

Patented July 15, 1913.

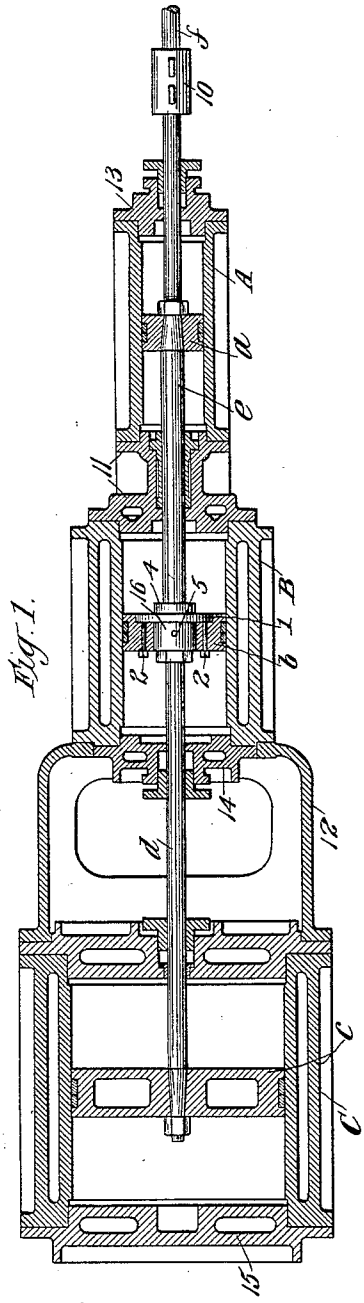


Fig. 1.

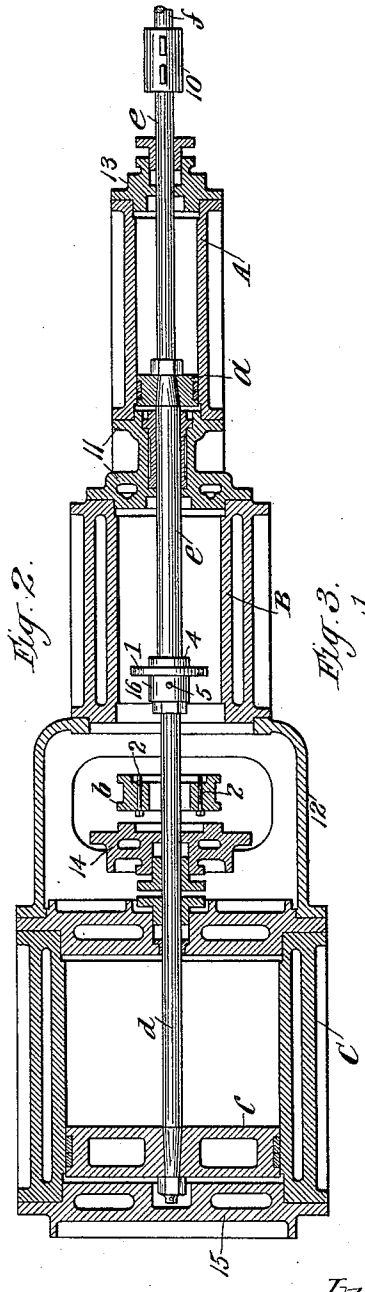


Fig. 2.

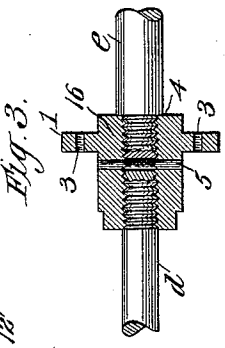


Fig. 3.

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UNITED STATES PATENT OFFICE.

FRANZ F. NICKEL AND JEFFERSON M. SHARP, JR., OF HAZLETON, PENNSYLVANIA, ASSIGNORS TO INTERNATIONAL STEAM PUMP COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

MULTIPLE-EXPANSION ENGINE.

1,067,484. Specification of Letters Patent. Patented July 15, 1913.

Application filed April 29, 1910. Serial No. 558,419.

To all whom it may concern:

Be it known that we, FRANZ F. NICKEL and JEFFERSON M. SHARP, JR., citizens of the United States, residing at Hazleton, county of Luzerne, and State of Pennsylvania, have invented certain new and useful Improvements in Multiple-Expansion Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of the present invention is to provide an improved construction of triple expansion engines of that class having their cylinders arranged in line, and especially to render the piston rods of the respective cylinders readily accessible and removable without requiring an excessive amount of space between the outside cylinder and the wall of the engine room and without disturbing the alinement of the cylinders.

In the accompanying drawings there is shown for purpose of illustration a triple expansion engine embodying the invention in a preferred form, and this construction will now be described in detail and the features forming the invention then specifically pointed out in the claims.

In the drawings:—Figure 1 is a longitudinal central section of the engine cylinders. Fig. 2 is a view similar to Fig. 1, showing the intermediate pressure piston withdrawn from its cylinder. Fig. 3 is a detail of the preferred form of connection between the rod sections.

Referring to said drawings, A, B, C are respectively the high pressure, intermediate and low pressure cylinders, and *a*, *b*, *c* their respective pistons, the cylinders being arranged in the order of expansion, with the high pressure cylinder A inboard or next the pump or crank shaft to which the power is applied. The pistons are connected by a central piston rod, no side rods being used, this piston rod being preferably formed in two sections, section *d* connecting the intermediate and low pressure pistons and section *e* connecting the intermediate and high pressure pistons and connected by cross head or coupling 10 to the rod *f* through which the power of the three cylinders is applied. This rod *f* may be the plunger rod of the pump, or in some types of pumps the plungers may be connected directly to the cross head or coupling 10. The high and intermediate pressure cylinders A, B are connected by a twin head 11 provided with suitable packing for the piston rod *e*, and the intermediate cylinder B and low pressure cylinder C are connected by a suitable frame piece 12 which separates the cylinders B, C and provides sufficient space within the frame piece for removing the intermediate cylinder head and piston for examination and renewal of the piston rings. The inner head 13 of the high pressure cylinder and the outer heads 14 and 15 of the intermediate and low pressure cylinders are removable for access to the pistons and removal of the piston rod.

The rods *d*, *e* forming the sections of the single central piston rod are connected by a coupling 16 over which the intermediate piston *b* fits snugly and which is squared at the outer end for a wrench. The inner end of the coupling 16 is provided with a flange 1 to which the intermediate piston is detachably secured, preferably by tap bolts 2 entering the bolt holes 3 in the flange as shown. The rods *d*, *e* screw into the opposite ends of the coupling 16, and in the preferred construction shown the rod *e* screws into the coupling up tight against a shoulder 4 and the rod *d* screws up tight against the end of the rod *e*, and the ends of the rods are then locked by a pin 5 through the coupling and through a hole formed half in the end of each rod. While this method of locking the rods to the coupling is preferred, it will be understood that other suitable locking means may be used for this purpose.

The high pressure piston *a* is readily accessible by the removal of the inner head 13 of the high pressure cylinder, and can be removed by uncoupling the cross head or coupling 10 and removing the piston nut. The intermediate piston *b* is readily accessible, as shown in Fig. 2, by removing the outer head 14 of the intermediate pressure cylinder into the hollow frame piece 12, then removing the tap bolts 2 from the flange 1, and moving the piston outward from the coupling 16 into the space within the frame piece 12. The low pressure piston *c* is accessible and removable in the usual manner through the outer end of cylinder C by removing head 15. The rods may be removed through the high pressure cylinder, if de-

sired, by removing the coupling piece 16 and the piston nut outside the low pressure piston. It will be seen that all the pistons are thus readily accessible, although no side piston rods are used, and this result and the convenient removal of the piston rod is secured without providing space outside the cylinder C for withdrawing the rod beyond the cylinder to move the intermediate piston outside its cylinder, or for the removal of the rod at the outer end of the low pressure cylinder. If it be desired to provide for withdrawing the piston rod through the low pressure cylinder C, this may be done without providing the excessive space outside the low pressure cylinder required when external side rods or single piece center rods are used.

What we claim is:—

1. In a triple expansion engine, the combination of high, intermediate and low pressure cylinders arranged in line in the order of expansion, the inner head of the inner cylinder and the outer heads of the other two cylinders being removable, pistons in the cylinders, and a single central piston rod connecting the three pistons and on which the intermediate piston is detachably mounted by means permitting the piston to be detached from the piston rod and moved outward without disconnecting the sections of the rod or moving the rod longitudinally, said piston rod being formed in sections, one section connecting the intermediate and high pressure pistons and the other connecting the intermediate and low pressure pistons, the intermediate cylinder and cylinder at the outer end of the engine being separated to provide space for access to the intermediate piston when detached from the piston rod and moved outward thereon.

2. In a triple expansion engine, the combination of high, intermediate and low pressure cylinders arranged in line in the order of expansion, pistons in the cylinders, a single central piston rod connecting the three pistons and formed in sections, one section connecting the intermediate and high pressure pistons and another section connecting the intermediate and low pressure pistons, and a coupling for said rod sections to which the intermediate piston is detachably connected by means permitting the piston to be detached from the piston rod and moved outward without disconnecting the sections of the rod or moving the rod longitudinally, the intermediate cylinder and one of the other cylinders being separated to provide space for access to the intermediate piston when detached from the piston rod and moved outward thereon.

In testimony whereof, we have hereunto set our hands, in the presence of two subscribing witnesses.

FRANZ F. NICKEL.
JEFF. M. SHARP, JR.

Witnesses:
J. H. BIGELOW,
JAMES A. GORMAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."