No. 706,276. Patented Aug. 5, 1902.

J. STUMPF.

COMPRESSOR.

(Application filed May 9, 1901.)

(No Model.)

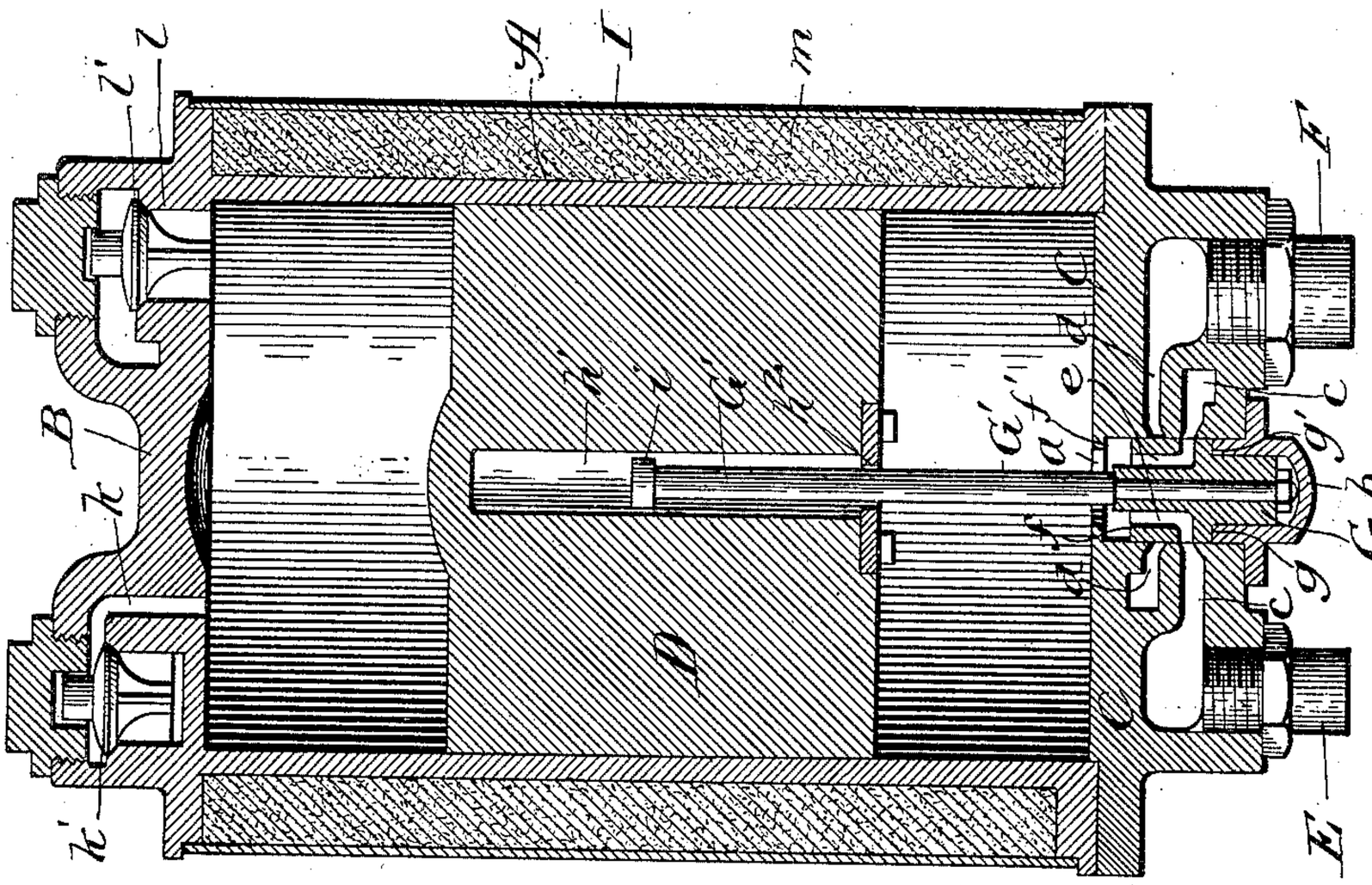

Fig. 2.

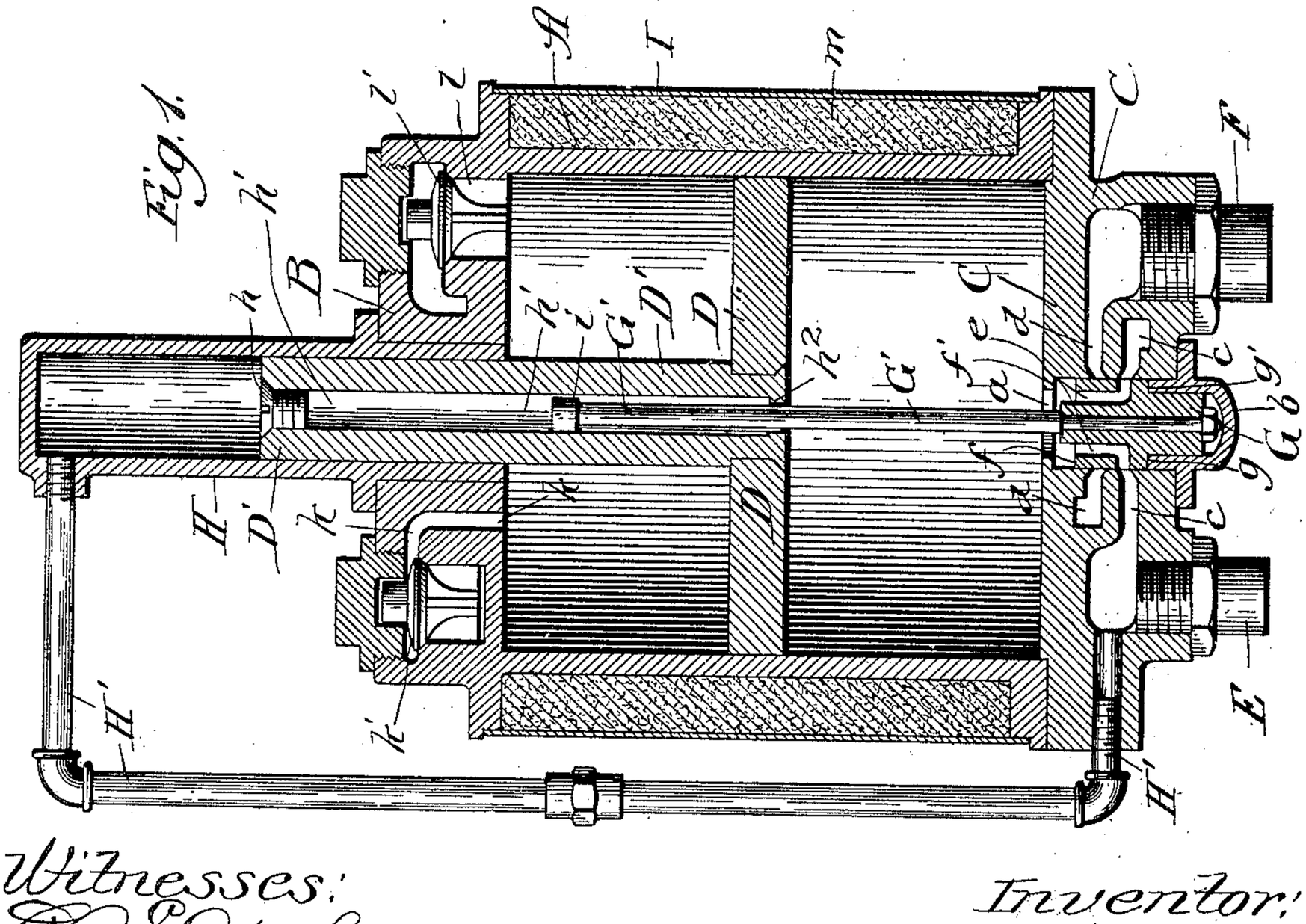

Fig. 1.

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UNITED STATES PATENT OFFICE.

JOHN STUMPF, OF BERLIN, GERMANY.

COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 706,276, dated August 5, 1902.

Application filed May 9, 1901. Serial No. 59,514. (No model.)

To all whom it may concern:

Be it known that I, JOHN STUMPF, a subject of the Emperor of Germany, residing at Berlin, Germany, have invented a new and useful Improvement in Compressors, of which the following is a specification.

My object is to provide an improved steam-actuated air or gas compressor adapted more especially for use where economy in space and simplicity in construction are necessary or desirable.

Referring to the drawings, Figure 1 is a sectional elevation of a compressor constructed in accordance with my improvement in the preferred form, and Fig. 2 a similar view of a modification.

A is a cylinder provided with the heads B C, and D is a piston working in the cylinder. Extending through the center or the cylinder-head C is an opening *a*, closed at its outer or lower end by a hollow plug *b*. The opening *a* and plug together form a valve-chamber surrounded toward its lower side with a steam-inlet port *c*, communicating with the steam-induction pipe E, and also surrounded above the port *c* by a steam-outlet port *d*, communicating with a steam-eduction pipe F. In the steam-chamber *a* is a slide-valve G, having the annular steam-passage *e* extending from its upper face down to a point about midway between its ends and then outward through the side of the valve, as shown. The passage *e* may be a series of small cored openings for convenience of construction. At the upper side of the valve is an annular shoulder *f*, adapted in the rise of the valve to abut against an annular stop or shoulder *f'* in the piston-head, and the valve is formed at its outer side with an annular shoulder *g* to strike a stop *g'*, formed by the end of the plug *b*, to limit the downward movement of the valve.

The piston D in the preferred construction in Fig. 1 is formed with an upwardly-extending hollow stem D', closed at its upper end by a screw or plug *h*. On the valve G is a solid vertical stem G', extending at its upper end in the chamber *h'* of the stem D'. On the stem G' is a shouldered head *i*, adapted to be engaged by the plug *h* in the downstroke of the piston, as hereinafter described, and adapted to be engaged by an annular shoulder h^2 at the lower end of the chamber *h'* in the upstroke of the piston. Rising from the center of the piston-head B is a tubular chamber H, in which the stem D' fits and slides. At its upper end the chamber H communicates through a pipe H' with the steam-induction chamber *c*, or it may communicate with the steam-pipe E. In the head B is an air or gas inlet port *k*, provided with an inwardly-opening check-valve *k'*. Also in the head B is an air or gas outlet port *l*, provided with an outwardly-opening check-valve *l'*. In practice the port *l* would communicate through a pipe (not shown) with a reservoir or the like, and particularly if the compressor is to be employed for compressing gas the port *k* would communicate through through a pipe (not shown) with the gas-supplier.

In operation when the slide-valve G is in the position shown steam entering from the pipe E passes through the chamber or port *c* and passage *e* to the interior of the cylinder A beneath the piston D to force the same in the upward direction. As the piston nears the cylinder-head B the shoulder h^2 engages the head *i* and raises the slide-valve until the port or ports *e* register with the outlet-port *d*. The valve in this movement closes the port *c*. The upper end of the piston-stem D' is exposed at all times to the pressure of steam in the chamber H, and the piston is raised, as described, against the resistance of the steam-pressure upon the comparatively small area of the end of said stem. Thus when the steam is shut off by the slide-valve and the outlet-port open the pressure of the steam in the chamber H forces the piston down until the head *i* of the stem G' is engaged by the plug *h* and forced down to slide the valve G to close the port *d* and open the port *c*. In the downward movement of the piston air or gas is sucked in through the port *k*, and in the upward movement of the piston the air or gas is compressed and forced out through the port *l*.

The cylinder A operates both as the steam-cylinder and aeriform-fluid-compression cylinder, and but one piston is employed both for receiving the steam-pressure and for performing the compression.

Around the cylinder-wall is an outer concentric cylinder-wall I, forming a dead-air or

insulating space *m* around the cylinder-chamber. This air-jacket or insulating-space has the effect of preventing radiation to any material extent of heat from the cylinder-wall. When the air or gas is compressed against a high back pressure, the heat generated by the compression may be greater than that of the steam, particularly when the latter is supplied at a comparatively low pressure. The piston D, particularly under these circumstances, and the wall of the chamber A form heat-conductors which operate to transfer the excessive heat generated in the aeriform fluid by compression to the steam entering the cylinder. The effect of this transfer of heat is to prevent to a more or less material extent the condensation of the steam, with consequent saving of steam. It has been found in practice that this transfer of heat, especially when compression is comparatively high and steam-pressure comparatively low, effects a very material saving in the operation of the compressor, which of course is much to be desired.

In the construction shown in Fig. 2 a weighted piston D is substituted for the construction involving the stem D′ and chamber H with its steam-supplying means. (Shown in Fig. 1.) The piston D is thickened or otherwise constructed to give it comparatively great weight, which will be sufficient in operation to cause the piston to descend quickly when the steam-induction port is closed and the steam-eduction port open. The increased thickness of the piston increases its storing means for heat transferred from the compression to the steam side thereof. The stem G′ of the slide-valve moves at its upper end in a central bore or chamber *h′* of the piston, corresponding with the chamber *h′* in Fig. 1, and the valve is actuated to open and close the steam-ports in practically the same way as in the preferred construction. Both the area exposed to steam in the chamber H, Fig. 1, and the weighted piston in Fig. 2 contribute an ever-present piston-returning counter force to the action of the live steam when it raises the piston.

While I prefer to construct my improvements in the manner shown and described, it will be obvious to any one skilled in the art that they may be variously modified in the matter of details of construction without departing from the spirit of my invention as defined by the claim.

What I claim as new, and desire to secure by Letters Patent, is—

In a steam-actuated aeriform-fluid compressor, the combination of a single cylinder forming both the steam-chamber and the compression-chamber, a piston working in the cylinder exposed on one side to the steam and performing on its other side the work of compression, a steam inlet and outlet slide-valve, means for positively moving the valve consisting of a stem connected at one end to the valve and provided at its other end with a shoulder, said stem being movable in a chamber in the piston, a shoulder at the lower end of the chamber adapted in the upward movement of the piston to engage the shoulder on the stem to close the valve, a shoulder at the upper end of the chamber adapted in the downward movement of the piston to engage the end of the stem to open the valve, and piston-returning means opposing the force of the piston-moving means.

JOHN STUMPF.

In presence of—
THEODOR HÖLSCHER,
TOH. HÖLSCHER.