

No. 706,653.

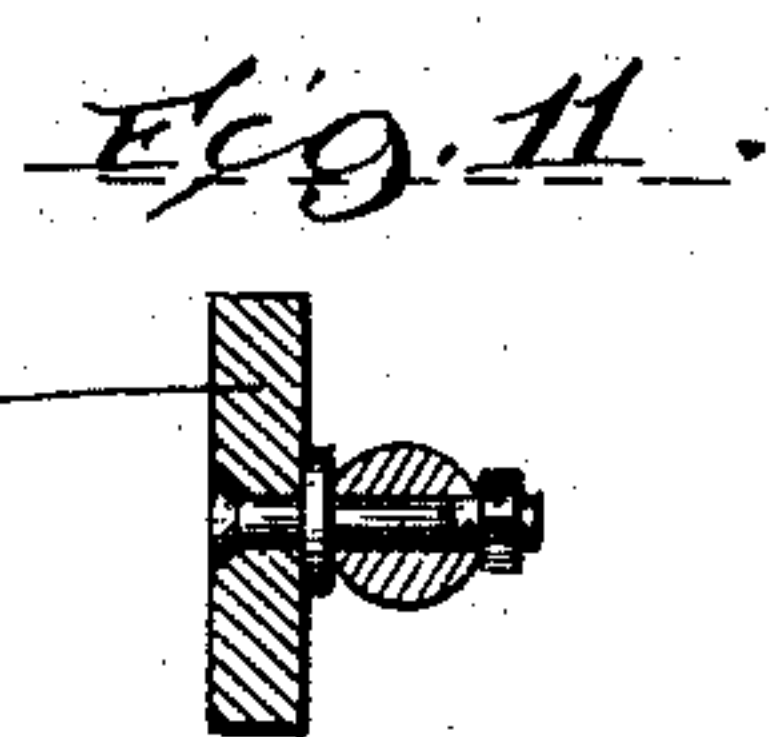
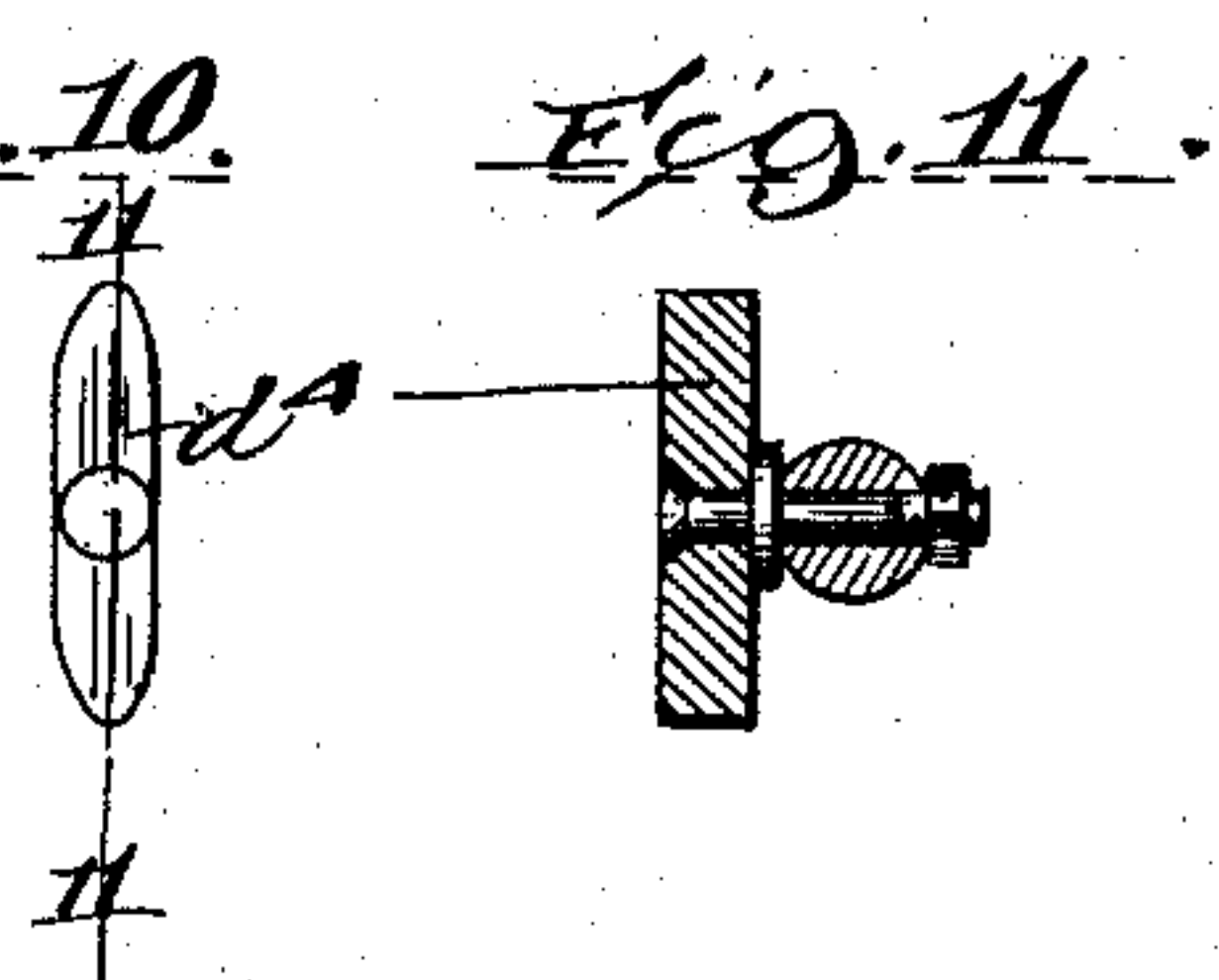
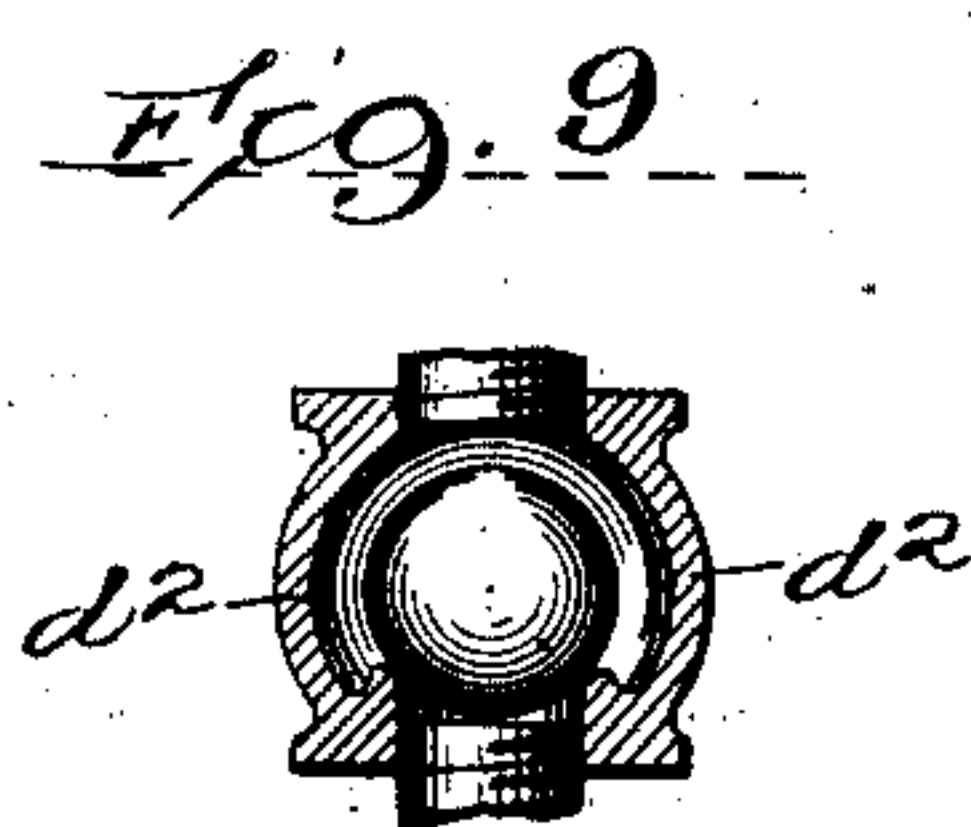
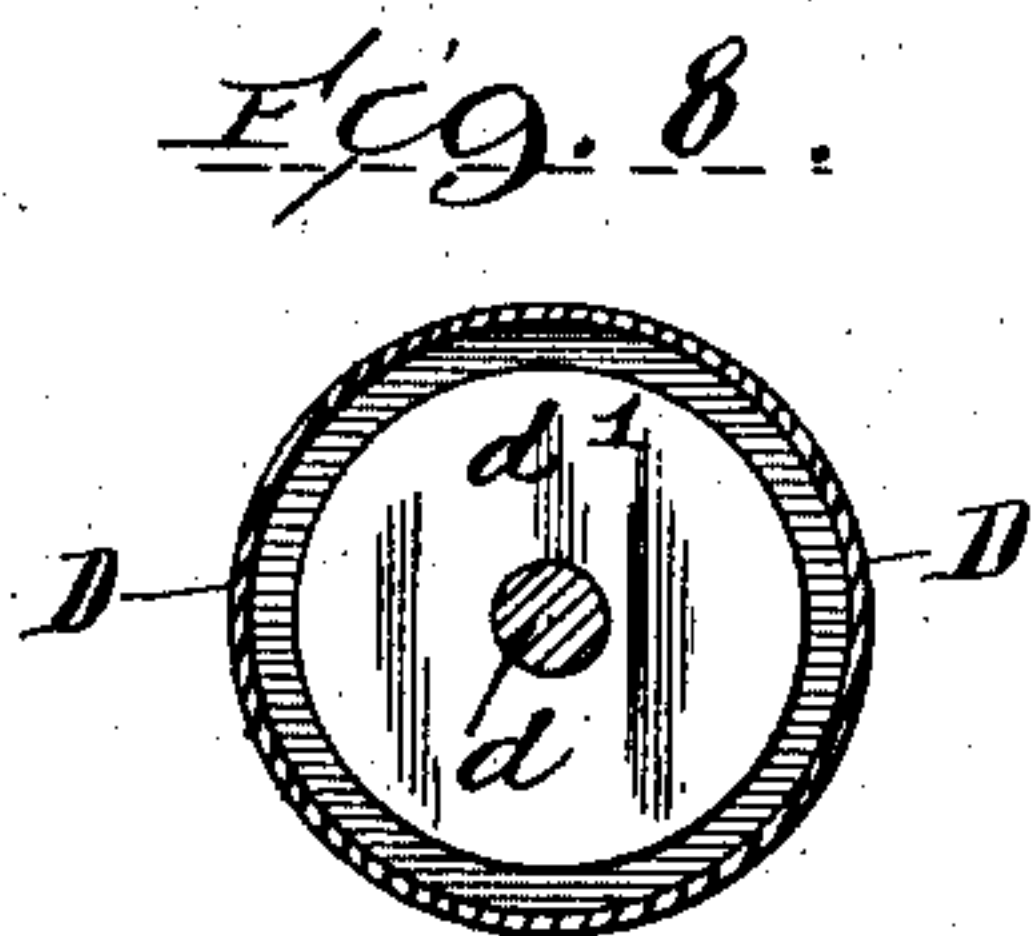
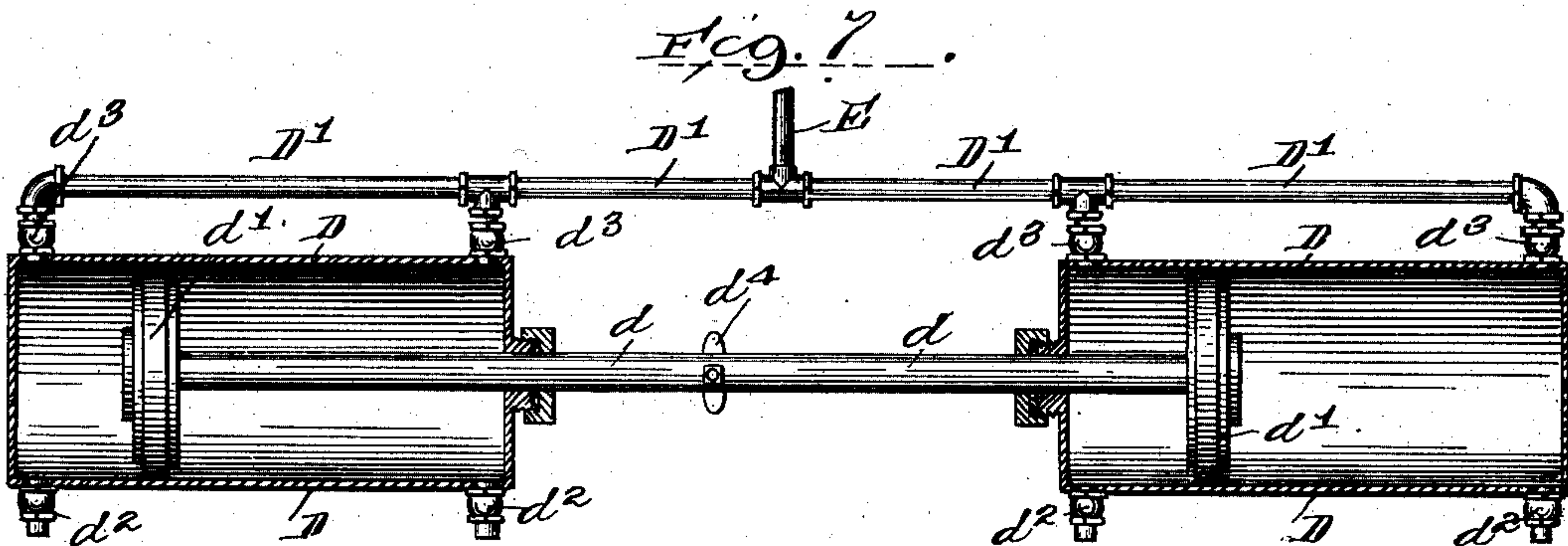
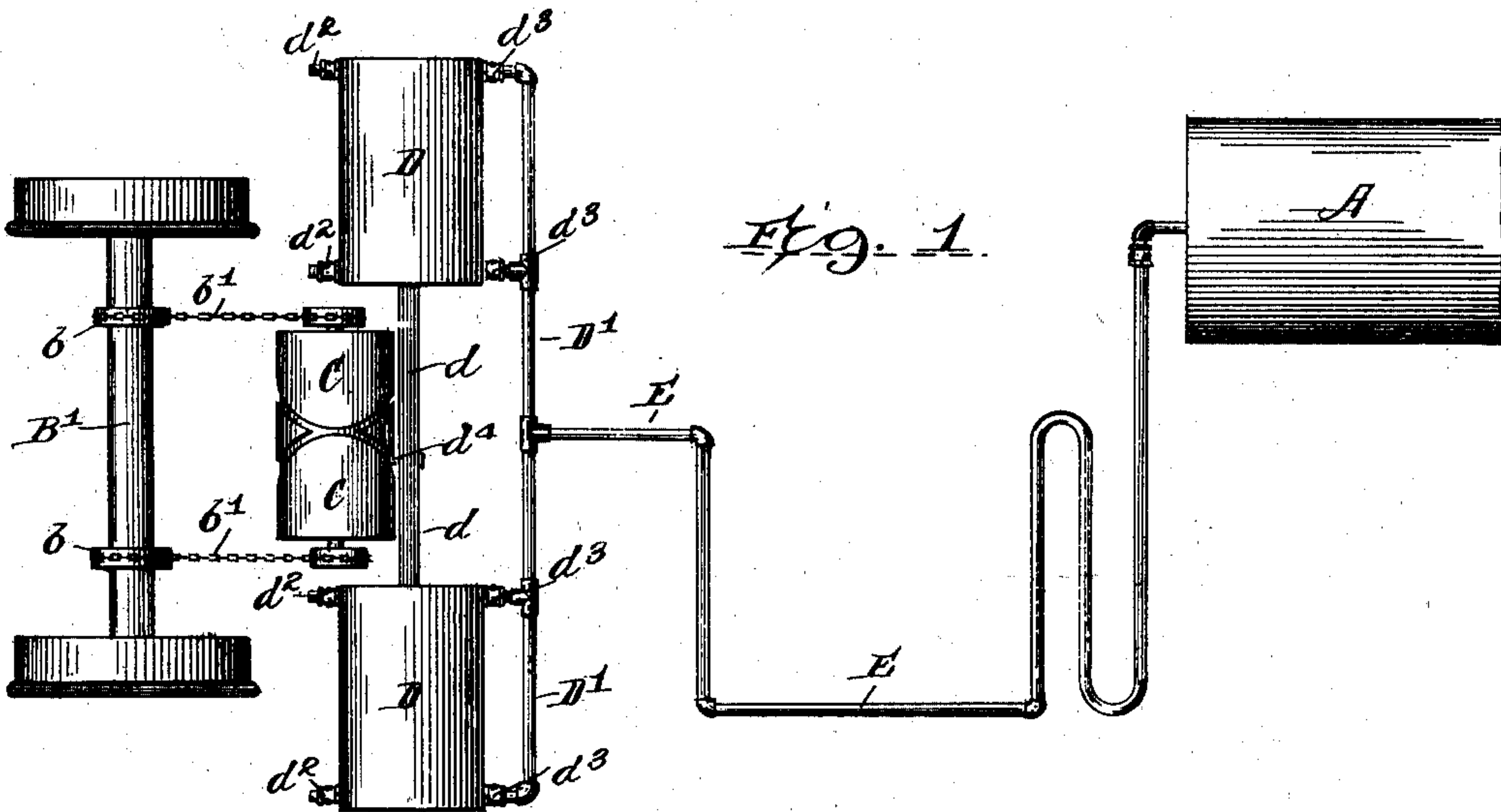
Patented Aug. 12, 1902.

E. HAYWARD.  
MEANS FOR UTILIZING COMPRESSED AIR.

(Application filed Feb. 15, 1901.)

(No Model.)

2 Sheets—Sheet 1.



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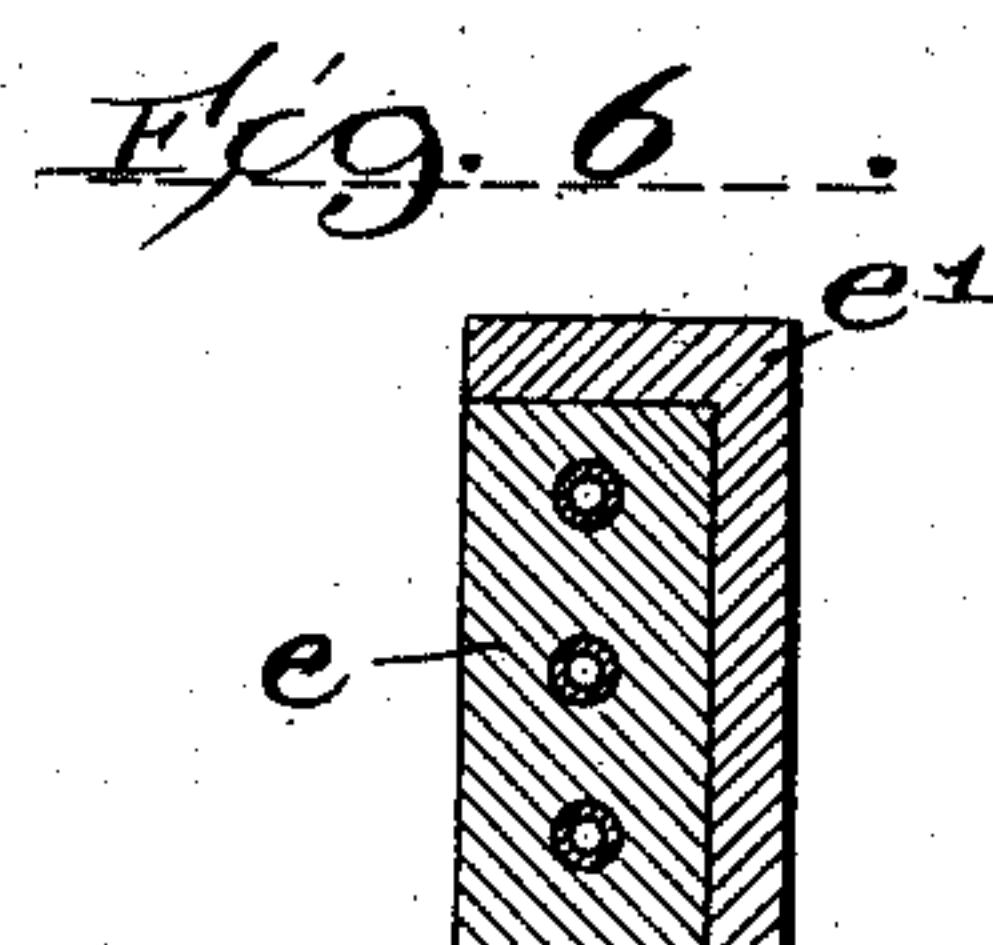
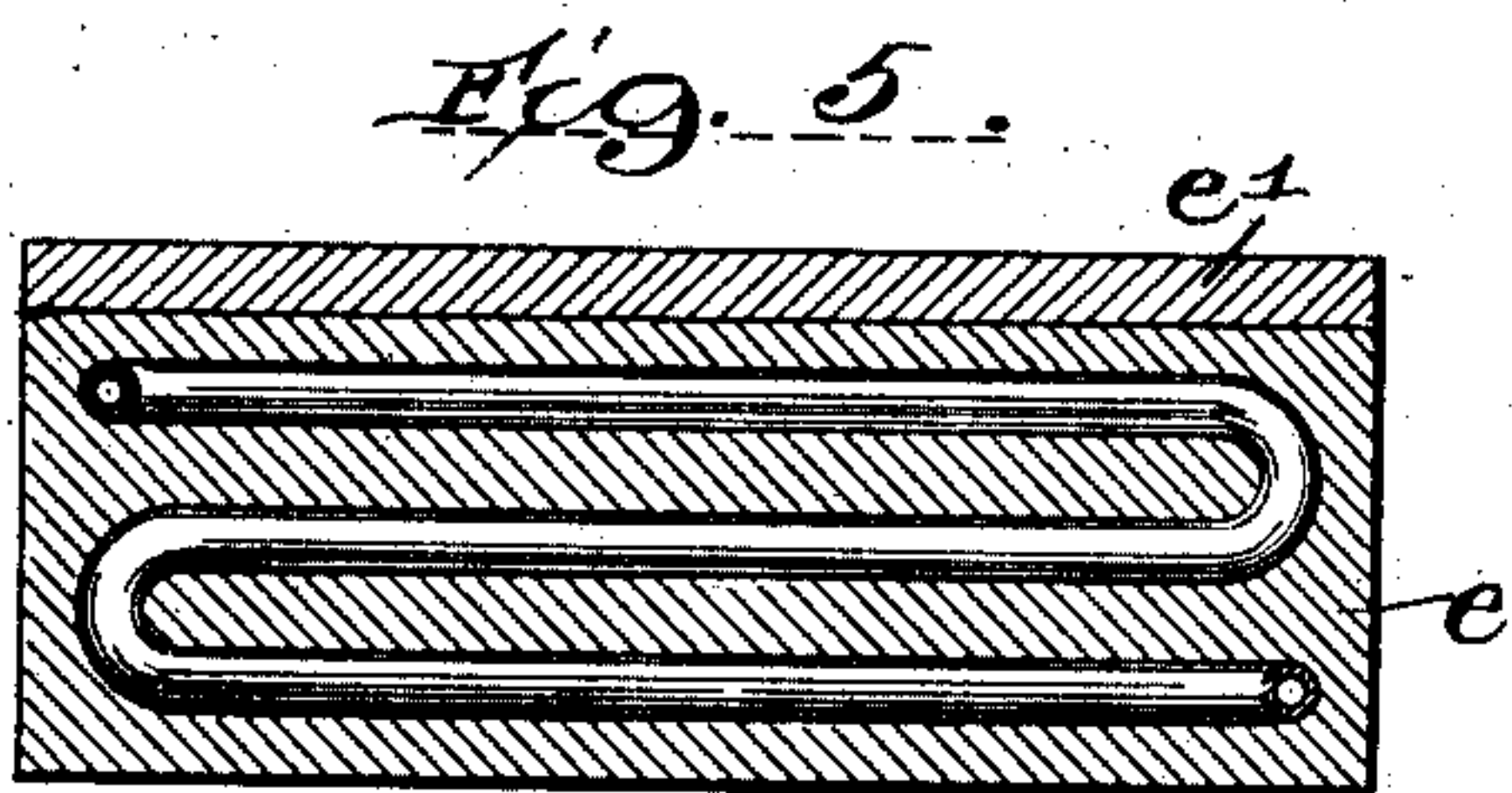
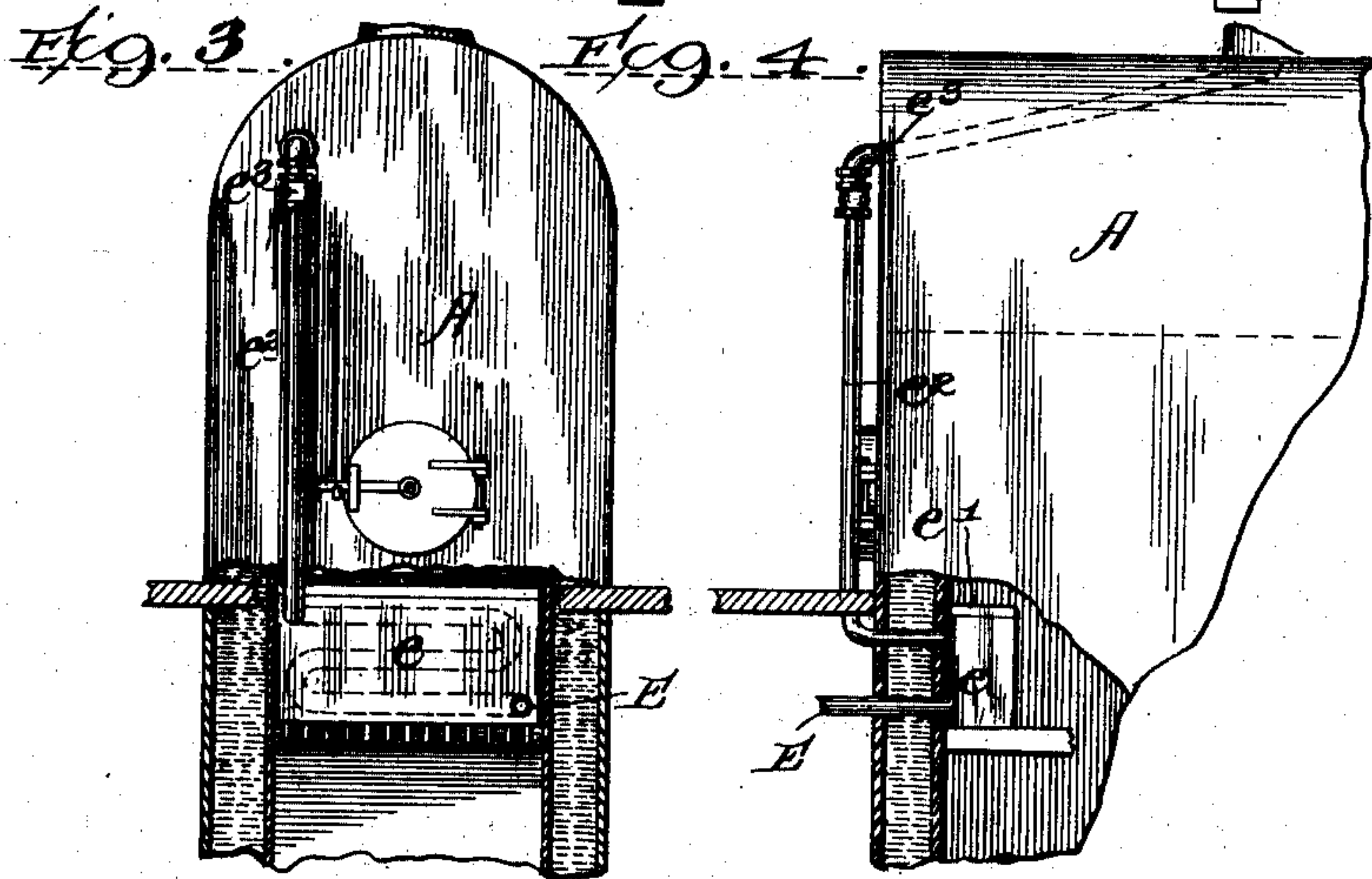
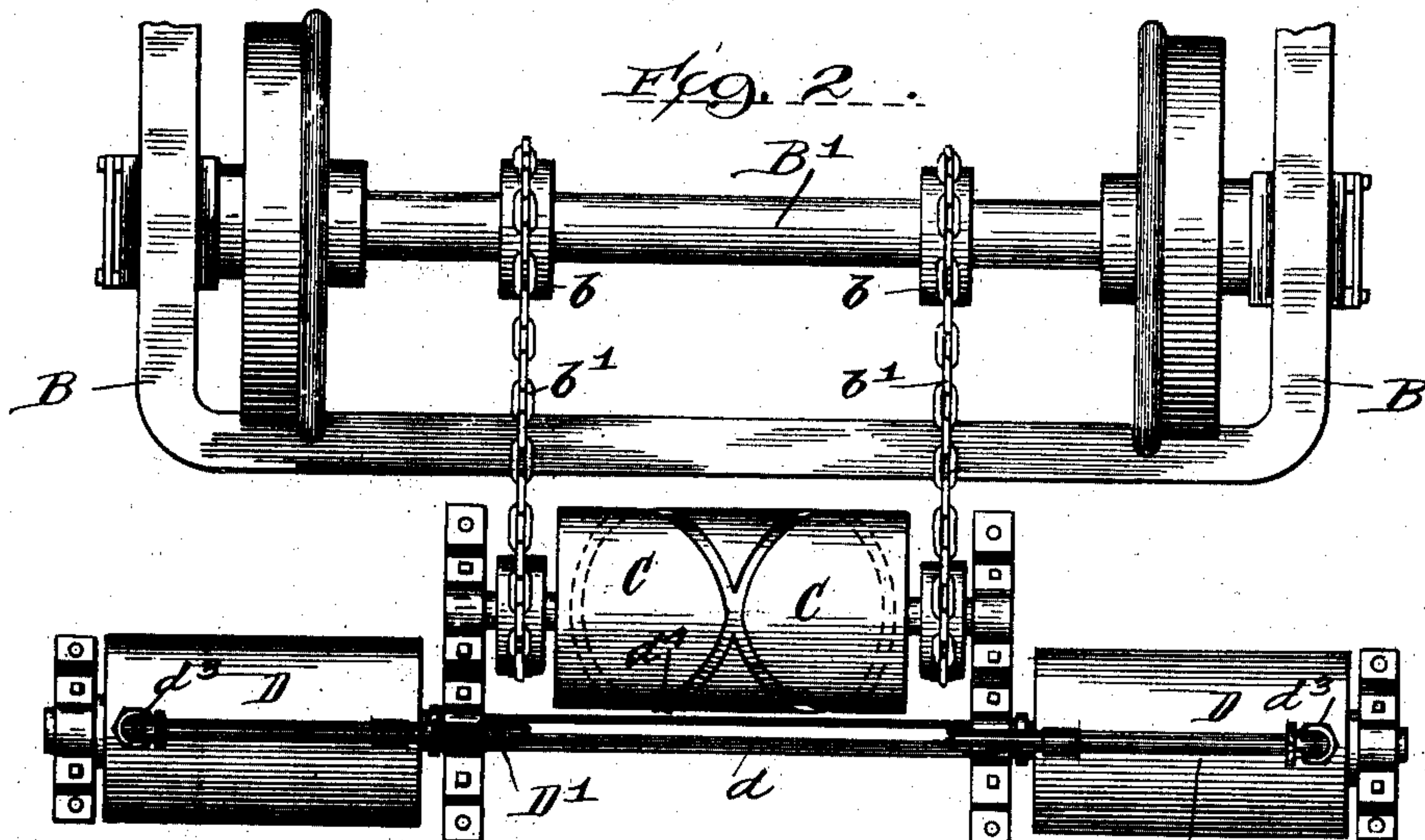
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2 Sheets—Sheet 2.



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# UNITED STATES PATENT OFFICE.

EUGENE HAYWARD, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO JOHN T. LUEDER AND JOHN B. MORRIS, OF CHICAGO, ILLINOIS.

## MEANS FOR UTILIZING COMPRESSED AIR.

SPECIFICATION forming part of Letters Patent No. 706,653, dated August 12, 1902.

Application filed February 15, 1901. Serial No. 47,490. (No model.)

*To all whom it may concern:*

Be it known that I, EUGENE HAYWARD, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Means for Utilizing Compressed Air; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to means for utilizing compressed air, and more particularly for utilizing compressed air in steam-boilers or the like.

The object of the invention is to provide means for subjecting compressed air to a high temperature and admitting the same into a steam-boiler, either continuously or at intervals, when a special load is placed upon an engine and high pressure is desirable.

The invention consists of the matters hereinafter described, and more fully pointed out and defined in the appended claims.

In the drawings, Figure 1 is a plan view, partly diagrammatic, of a device embodying my invention. Fig. 2 is an enlarged plan view of the compressing apparatus. Figs. 3 and 4 are sectional views of the steam-boiler, illustrating means for heating the air and admitting the same to the boiler. Fig. 5 is a longitudinal section of the coil. Fig. 6 is a cross-section of the same. Fig. 7 is a longitudinal section of the compressor. Fig. 8 is a section taken through one of the compressing-cylinders. Fig. 9 is a vertical section of one of the small valves employed in my invention. Fig. 10 is a plan view of the shoe. Fig. 11 is a longitudinal section of the same.

In the drawings, in which my invention is shown applied to the boiler of a locomotive, A indicates the boiler, of the usual or any desired construction.

B indicates a portion of one of the tender-trucks, showing one of the track-wheel axles B' journaled therein in a familiar manner and having secured thereon the sprocket wheels or pulleys *b b*, over which are trained the chains *b' b'*, which are also trained around similar wheels or pulleys on a shaft journaled

on the under side of the tender, which has rigidly secured thereon the cylindric cam C.

D D indicate the compressing-cylinders, also supported on the under side of the tender and comprising two cylinders longitudinally in alinement and into which extends the piston-rod *d*, the ends of which within said cylinders are each provided with a piston-head *d'*, as shown in Fig. 7. Inlet-ports *d<sup>2</sup> d<sup>2</sup>* and outlet-ports *d<sup>3</sup> d<sup>3</sup>* are provided at each end of each of said cylinders, each of which is provided with an automatic valve which permits the air to flow in but one direction—that is to say, inwardly through the inlet-ports and outwardly through the outlet-ports. Any automatic valve may be used, as preferred. As shown, however, a ball-valve, such as illustrated in Fig. 9, is employed.

Means are provided for reciprocating the piston-rod, comprising a shoe *d<sup>4</sup>*, pivoted on said piston-rod transversely of the same, as indicated in Fig. 7, and which fits in the peripheral groove of the said cylindric cam C. Said cam-groove is continuous and extends longitudinally of the cylinder and twice around the same, as indicated in Fig. 2. The rotation of said cylinder acts to give the piston-rod a relatively long stroke, thereby forcing air alternately from opposite ends of each cylinder into the delivery-pipes D' D', which connect with the service-pipe E. The service-pipe leads inwardly from the cylinder to the fire-box of the boiler and, as shown in Figs. 3 and 4, is admitted thereto beneath the fire-door and into a fitting *e*, of cast-iron or the like, provided with an internal coil, as shown in Figs. 3, 5, and 6. For the purpose of protecting said casting or fitting *e* from injury by the intense heat of the furnace a removable casing *e'*, of fire-brick or other suitable material, is provided, which, together with said casting or fitting *e*, rests upon the grate-bars and incloses said casting on its upper and inner sides. From the delivery end of said coil extends a pipe *e<sup>2</sup>*, which leads upwardly to the dome of the boiler. As shown, said pipe leads upwardly on the outside of the boiler; but obviously the same may be contained wholly within the boiler and fire-box and lead inwardly to the steam-dome. Said pipe *e<sup>2</sup>* may be provided with a



valve, whereby air will be excluded from the boiler or admitted thereto, as desired by the operator, or a check-valve may be provided similar to those heretofore described or of any desired kind, which acts to admit the air under pressure into the boiler when the pressure of the steam falls below a given point. Such a valve is indicated by  $e^3$  in the pipe  $e^2$ .

The operation of my device is as follows: A locomotive-engine having my device applied thereto in running either backward or forward rotates the cylinder C and compresses the air within the cylinders, as before described. The air thus compressed flows through the pipe E to the fitting or casting  $e$  and is there heated to a very high temperature by the furnace, thereby greatly expanding the same and increasing the pressure thereof. Thus heated the same is admitted to the dome, thereby, together with the expansive effect of the steam in the boiler, aiding to drive the engine. Obviously any desired safety-valve may be employed on said cylinders, and, if preferred, devices may be connected therewith whereby the same may be operated only when desired by the engine-driver.

Obviously many features of construction may be modified without departing from the principle of my invention.

I claim as my invention—

1. The combination with a boiler of an air-compressor, means for operating the same, a metal-cased pipe located transversely in the fire-box and leading into the dome of the boiler and adapted to deliver thereinto heated and compressed atmospheric air.

2. The combination with a steam-boiler of an air-compressor, means for actuating the air-compressor, the pipe leading therefrom to

the dome of the boiler and a bend or bends of said pipe incased or jacketed in metal and extending into and transversely of the fire-box near the rear end thereof and exposed to the maximum direct heat.

3. The combination with a steam-boiler, of a double-acting air-compressor, means for actuating said compressor, a pipe connected therewith and adapted to deliver compressed air to the dome of said boiler and means for heating the compressed air before delivery in the dome, comprising a coil in said pipe located in and transversely of the furnace of said boiler and a valve in the connection acting to regulate the flow of said compressed air to the boiler.

4. In a device of the class described, the combination with a locomotive-boiler, of a compressor secured beneath the tender or the like, means operated from a truck-axle for actuating said compressor, a pipe leading therefrom through transversely of the fire-box of the boiler to the dome thereof, said pipe being cased in metal and exposed to maximum heat, whereby the air is first compressed then heated and then delivered within the boiler.

5. The combination with a steam-boiler of a coil located transversely in the fire-box or furnace thereof adjacent to and below the fire-door said coil comprising a tube bent to the desired shape and cased in cast metal and a protecting-covering on said coil.

In witness whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

EUGENE HAYWARD.

Witnesses:

JOHN B. MORRIS,  
JOHN T. LUEDER.