

(No Model.)

H. D. DUNBAR.  
BRAKE FOR LOCOMOTIVES.

No. 413,500.

Patented Oct. 22, 1889.

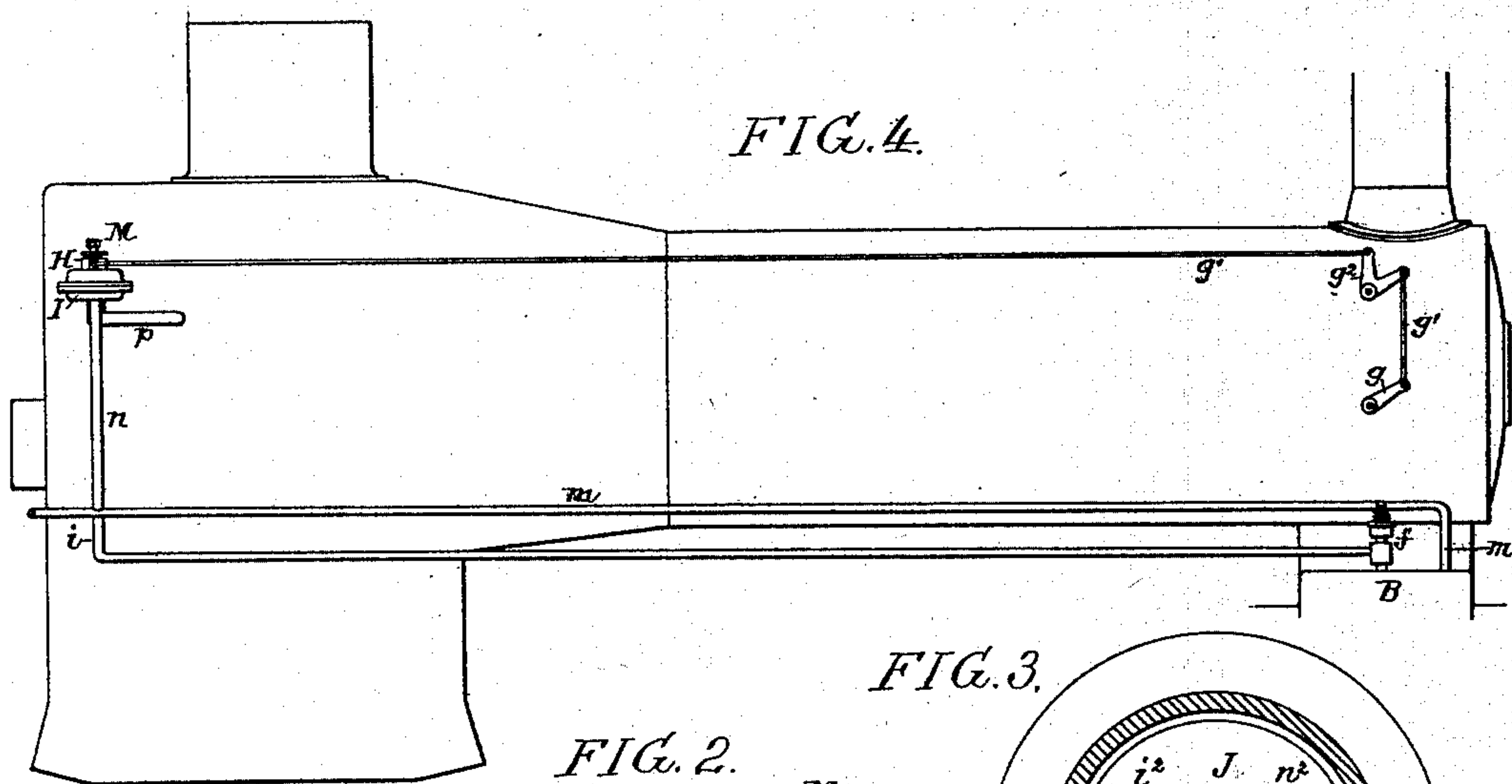
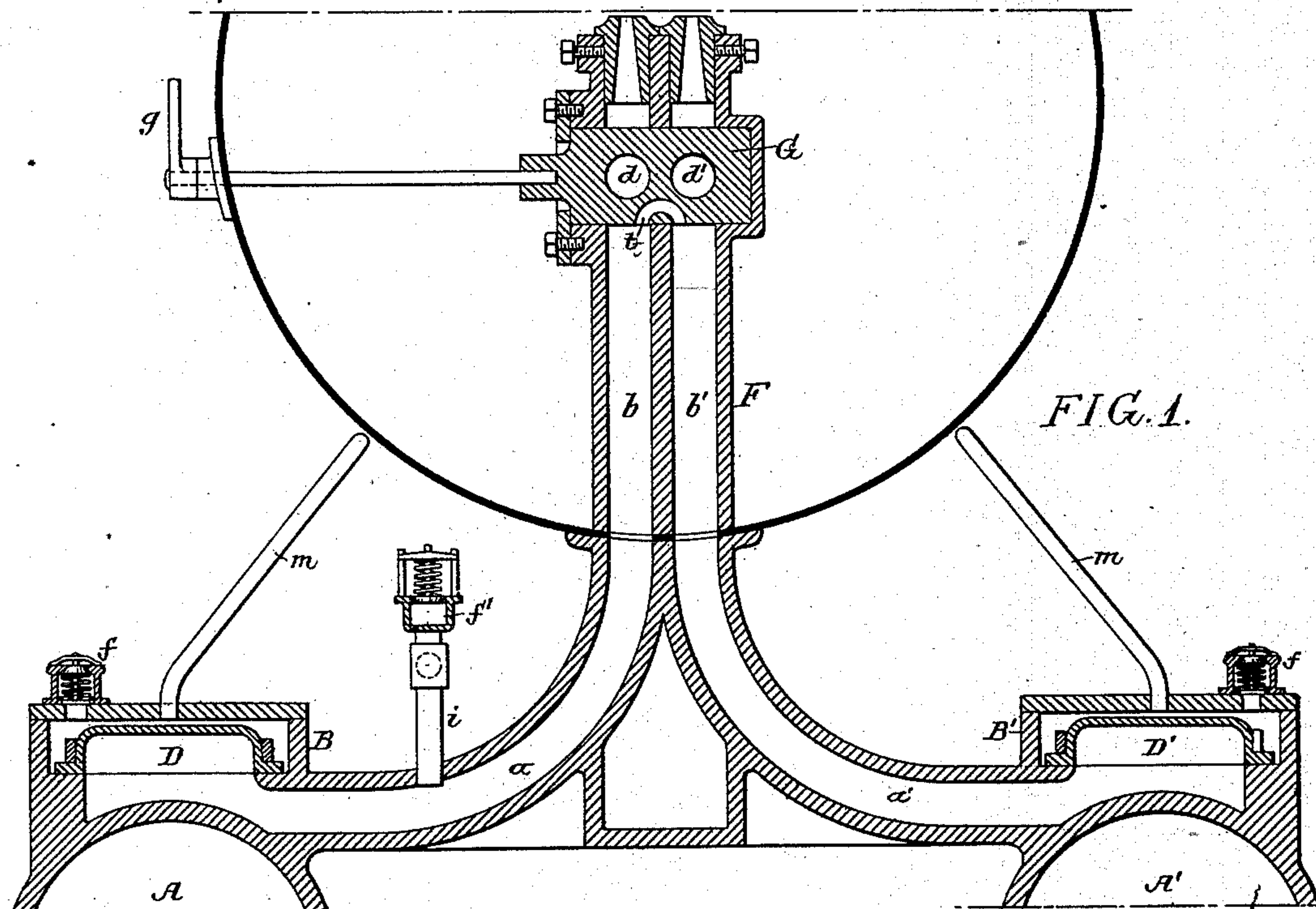
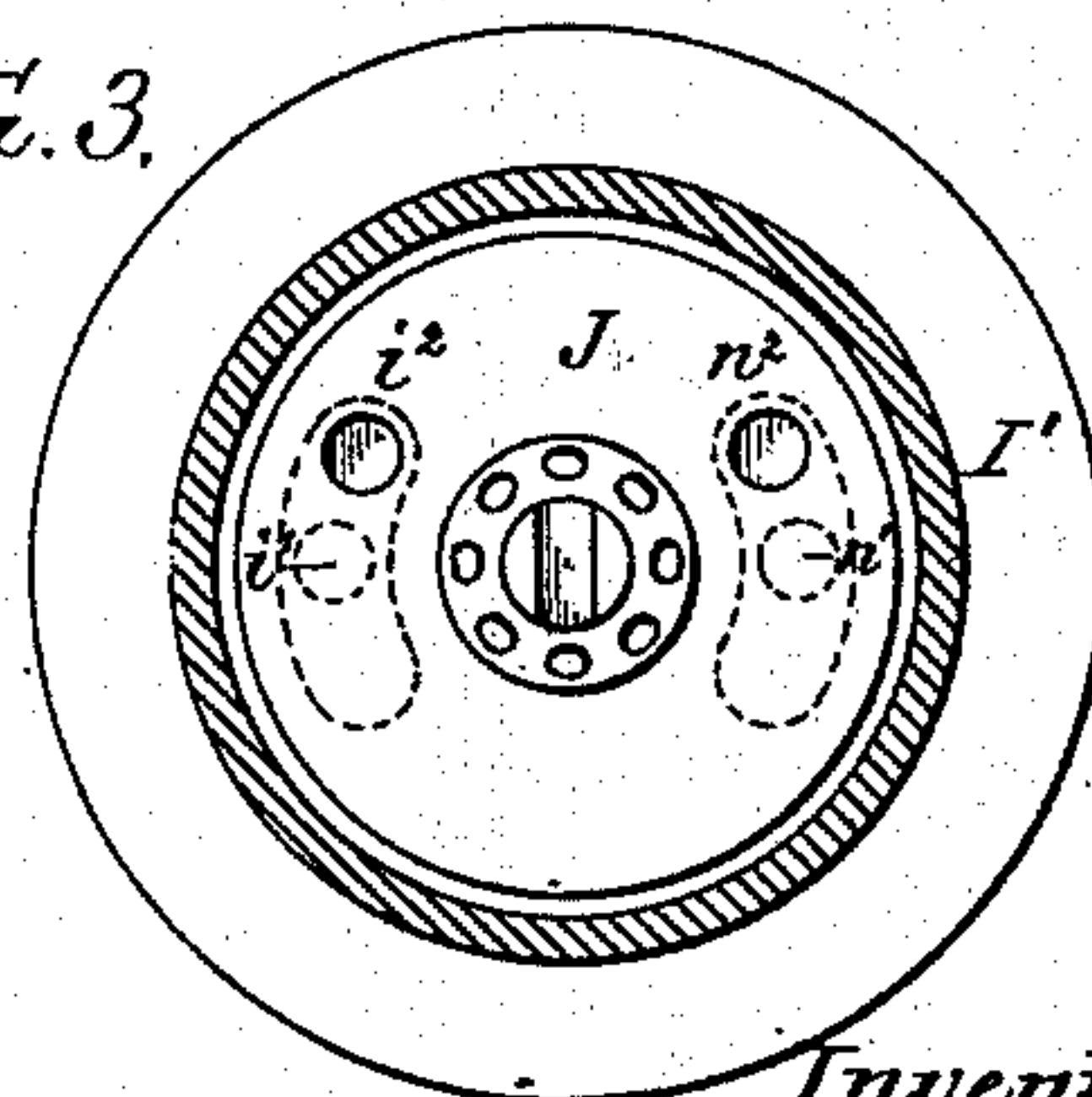
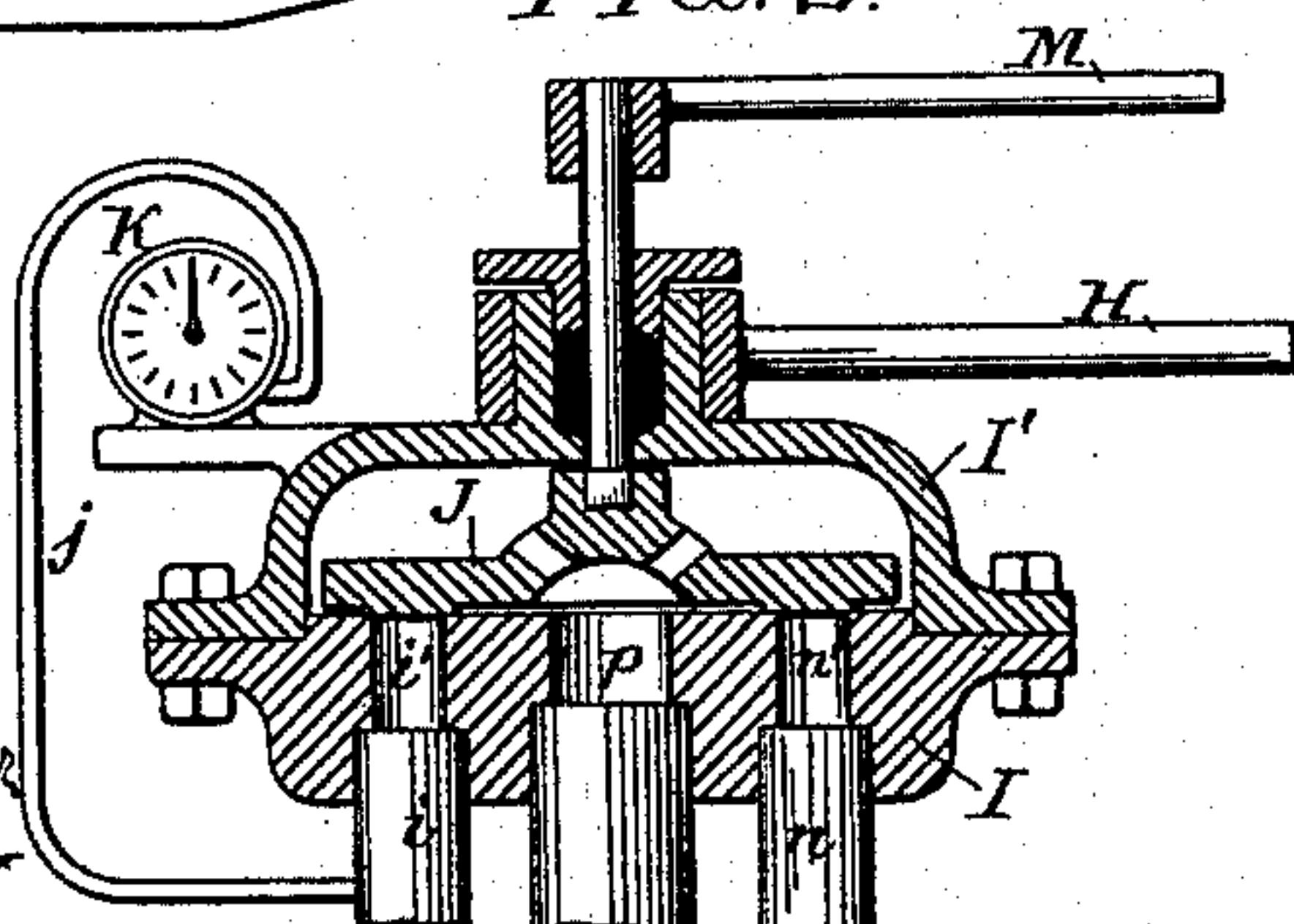


FIG. 3.



Witnesses:  
Hamilton D. Turner  
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Inventor  
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# UNITED STATES PATENT OFFICE.

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## BRAKE FOR LOCOMOTIVES.

SPECIFICATION forming part of Letters Patent No. 413,500, dated October 22, 1889.

Application filed June 6, 1889. Serial No. 313,271. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY D. DUNBAR, a citizen of the United States, and a resident of North Hartland, Windsor county, Vermont, have invented certain Improvements in Brakes for Locomotives, of which the following is a specification.

My invention consists of certain improvements in that class of locomotive-brakes which rely for braking effect upon the cutting off of the exhaust from the cylinders, and thus creating back-pressure upon the pistons, one object of my invention being to so construct such a braking apparatus that the full boiler-pressure may be instantly exerted with retarding or reversing effect upon the pistons of the cylinders when it is desired to quickly stop the movement of the engine, a further object being to prevent excessive heating or burning of the cylinder, piston, piston-rod, valve, or valve-seat in making a long run with the exhaust cut off and the engine acting as a pump, a further object being to provide for readily regulating the back-pressure upon the pistons, and a still further object being to provide a simple and readily-operated compound valve for controlling the flow of steam to the cylinder-chests and exhaust-passages of the engine. These objects I attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a transverse section through the smoke-box and cylinders of a locomotive, illustrating such modifications in the usual construction of these parts as are involved in the carrying out of my invention. Fig. 2 is a vertical sectional view of the compound valve forming part of my invention. Fig. 3 is a sectional plan view of the same on the line 1 2; and Fig. 4 is a side view, on a reduced scale, of part of the locomotive with the attachments forming the subject of my invention.

In Fig. 1, A A' represent the opposite cylinders of the engine; B B', the valve-chests of the same; D D', the usual valves controlling the admission of steam to and its exhaust from the cylinders, and a a' the exhaust-passages of the cylinder structures, these passages terminating, in the present instance,

in a duplex nozzle F, having passages b b', as usual. In the upper portion of this nozzle, however, is formed a seat for a transverse plug-valve G, having ports d d', located in line with the exhaust-passages b b' of the nozzle, and so constructed that when in the position shown in Fig. 1 it will cut off the escape of steam from the nozzle, the valve, however, when a quarter-turn has been imparted thereto, opening the exhaust-passages b b' and permitting the free escape of steam from said exhaust-passages. On closing the throttle-valve of the engine and cutting off the exhaust by the valve G each cylinder is transformed into a pump, a check-valve f on each valve-chest serving to admit air to the valve-chest, and this air, by the action of the valve and piston, being pumped into the exhaust-passage of the cylinder, where it is compressed and exerts back-pressure upon the piston, so as to exercise a gradually-increasing retarding effect upon the movement of the same, and thus bring the engine to a stop, the exhaust-passages preferably communicating with a suitable escape-valve f', loaded to a predetermined pressure, so that the back-pressure upon the pistons may always be restricted to the desired extent. The spindle or operating-stem of the valve G has at the outer end an operating-arm g, connected by rods g' and bell-crank lever g<sup>2</sup>, or other suitable means, to a lever H, Fig. 2, located in the cab within convenient reach of the engineer, so that the latter can readily close or open the exhaust-passages through the nozzle F, as desired.

Apparatus of this sort has heretofore been proposed; but an objection to which it is subject is the comparative slowness of its action, for the engine must make several strokes before the air is compressed in the exhaust-passages to a sufficient degree to exercise material retarding effect upon the movements of the pistons; hence the device cannot be relied upon for making an emergency stop—that is to say, a quick checking of the engine in case of emergency. In order to overcome this objection, I provide for placing the exhaust-passages of the engine in communication with the boiler by means of a pipe i and the valve described hereinafter, so that in case of



emergency live steam at full boiler-pressure may be admitted to the exhaust-passages of the engine, so as to exert full back-pressure upon the pistons or effect a reversal of the engine without changing the position of the reversing-gear, the main throttle-valve remaining closed.

As shown in the drawings, the pipe *i* communicates with the exhaust-passage *a*, the valve *G* having a by-pass *t*, which, when the valve is closed, provides a communication between the two passages *b b'* of the nozzle, and thus serves to make them practically one, so that uniform pressure exists in both, and a single pipe-connection *i* is all that is required. The pipe-connection may of course be duplicated if the exhaust-passages have no communication with each other.

A T-joint on the pipe *i* serves as a means of supporting the escape-valve *f'*, and a branch pipe *j* connects said pipe *i* with a pressure-gage *K*, mounted on the casing of the compound valve, described hereinafter, (see Fig. 2,) so that the amount of back-pressure in the exhaust-passages can always be determined at a glance.

Another objection to the ordinary arrangement of choked exhaust-brakes is that in making a long run with the exhaust-passages closed and the engine pumping air into said passages the cylinder, piston, piston-rod, valve, and valve-seat become dry, owing to the fact that the air has not the lubricating power of the steam; hence these parts are likely to be burned or otherwise injured by the heat and friction. To overcome this defect I provide for the admission of a small quantity of steam into each steam-chest when the engine is being operated as a pump, in the manner set forth, this steam having the desired effect of lubricating the various parts and overcoming the objection above referred to. The steam is preferably admitted through the pipes *m*, used for conveying lubricant to the valve-chests, steam being admitted to these pipes through suitable branches of a pipe *n*, which terminates in the valve-box *I*, (shown in Figs. 2 and 3,) and which I will now proceed to describe. This valve-box has a central port *p* and two side ports *i'* and *n'*, communicating, respectively, with the pipe *i*, for supplying steam to the exhaust-passages of the engine, and with the pipe *n*, for supplying steam to the valve-chests thereof. In the valve-box is a valve *J*, which has a central chamber inclosing the port *p*, the casing of this chamber being perforated, so that the steam can escape therefrom into the valve-box. The valve also has two ports *i<sup>2</sup>* and *n<sup>2</sup>*, so arranged with reference to the ports *i'* and *n'* of the valve-box that when the valve is in the position shown in Fig. 3 both ports are closed; but by movement of the valve in one direction the port *i'* will be opened, and by movement of the valve in the opposite direction the port *n'* will be opened. The valve has a stem *s*, passing through a stuffing-box on the cover *I'* of the valve-box,

and having a suitable operating-handle *M*, the casing of the stuffing-box also serving, by preference, as a pivot-stud for the lever *H*, whereby the valve *G* in the exhaust-nozzle is operated. When the valve *G* is open and the valve *J* is closed, the lever *M* is directly above the lever *H*, as shown in Fig. 4, and the latter lever is by preference so connected to the valve *G* that the lever will have to be moved in the same direction for closing the valve as the lever *M* has to be moved in order to open the port *i'*. In making an ordinary stop, therefore, the engineer simply operates the lever *H* so as to close the valve in the exhaust-nozzle; but in making an emergency stop both levers *I* and *M* are pressed forward simultaneously, so as to not only close the exhaust-passages, but also to provide for the admission of live steam thereto, the location of the levers (one above the other) permitting them both to be pushed forward at the same time by the movement of one hand.

In case the engine is running for a long distance the exhaust-passages are partly closed, the plug-valve *G* providing a ready means of effecting this object, and the proper position of the valve being readily determined by the engineer, owing to the fact that the gage *K* at all times indicates the amount of back-pressure being exerted upon the pistons, and thus facilitates the regulation of the pressure. Under these conditions the valve *J* is moved so as to open the port *n'*, thus admitting steam to the valve-chests of the two cylinders and providing for the proper lubrication of the parts, so as to prevent the burning or injury of said parts due to the heat and friction. The admission of steam through the supplementary pipes to the valve-chests of the two cylinders or to the exhaust-passages of the same may also be availed of in effecting movement of the locomotive for a short distance instead of operating the main throttle-valve, the device being of considerable advantage in this respect in the case of switching-engines in making up trains, &c.

It will be evident that instead of providing the valve-box *I* with a single port communicating with the supplementary steam-supply pipes of both valve-chests these pipes may be independent of each other, and the valve-box may have a port for each, the construction shown being preferred, however, as the simplest.

The valve has on the under side, at each port, a segmental projecting face, the extent of which is limited to the extent of travel of the valve, this bearing-face being only so much wider than the port as to provide for the proper lap; hence the bearing-surface of the valve on its seat is reduced to a minimum, and the consequent pressure of steam upon the valve is not such as to interfere with the ready operation of the same.

The air compressed in the exhaust-passages of the engine may, if desired, be used as an auxiliary supply for the brake-operat-



ing devices of the train by providing a communication between the exhaust-passages and the usual air-brake reservoir on the locomotive, this passage being most conveniently effected by a branch from the pipe *i*, this branch having a suitable stop-cock, so that communication can be cut off when desired.

It should be understood that the valve D of each engine is so guided in the valve-chest that the valve cannot be lifted from its seat by the back-pressure of air or steam underneath the valve.

The operating-arm *g* on the stem of the valve G, which closes the exhaust-passage, is, by preference, so set that when said valve is being closed the arm will occupy the position in which power can be most effectively applied thereto, as shown in Fig. 4, the greatest power being needed when the valve is approaching the limit of its closing movement, as the pressure exerted upon it at such time tends to resist this movement.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The combination of the cylinders, valve-chests, and exhaust-passages of the engine, a valve for closing said exhaust-passages, and a pipe providing a communication between the exhaust-passages and the boiler, whereby steam may be admitted to the exhaust-passages for the purpose of making an emergency stop, substantially as specified.

2. The combination of the cylinders, valve-chests, and exhaust-passages of the engine, a valve for closing said exhaust-passages, and pipes independent of the main steam-supply for permitting the introduction of steam into the valve-chests, substantially as specified.

3. The combination of the cylinders, valve-chests, and exhaust-passages of the engine, and the valve for closing said exhaust-passages, said valve having a by-pass, whereby when it is closed to cut off the escape of steam from the passages it provides a communication from one passage to the other, substantially as specified.

4. The combination of the cylinders, valve-chests, and exhaust-passages of the engine, the valve for closing said exhaust-passages, supplementary steam-pipes—one communicating with the exhaust-passages and the other communicating with the valve-chests—and a compound valve for controlling the flow of steam into said supplementary steam-pipes, substantially as specified.

5. The combination of the valve-box, its steam-inlet pipe, and the outlet-pipes with a single valve having a steam-inlet port communicating with valve-box and opposite ports for governing the flow of steam through the outlet-pipes, substantially as specified.

6. The combination of the cylinders, steam-chests, and exhaust-passages, and a valve for closing the latter, the supplementary steam-pipes and their valve-box, the valve in the latter, a lever for operating the valve in the exhaust-passage, and an operating-arm on the valve of the valve-box, said lever and arm occupying such position as to be operated simultaneously, substantially as specified.

7. The combination of the cylinders, valve-chests, and exhaust-passages of the engine with a pipe *i*, communicating with said exhaust-passages and with the boiler, a valve for cutting off the communication with the boiler, a pressure-gage, and a branch pipe whereby said gage is put in communication with the pipe *i* and the exhaust-passages, substantially as specified.

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

HENRY D. DUNBAR.

Witnesses:

WILLIAM D. CONNER,  
HARRY SMITH.