(No Model.)

4 Sheets—Sheet 1.

# J. F. McELROY.

## STEAM HEATING APPARATUS.

No. 454,285. Patented June 16, 1891.

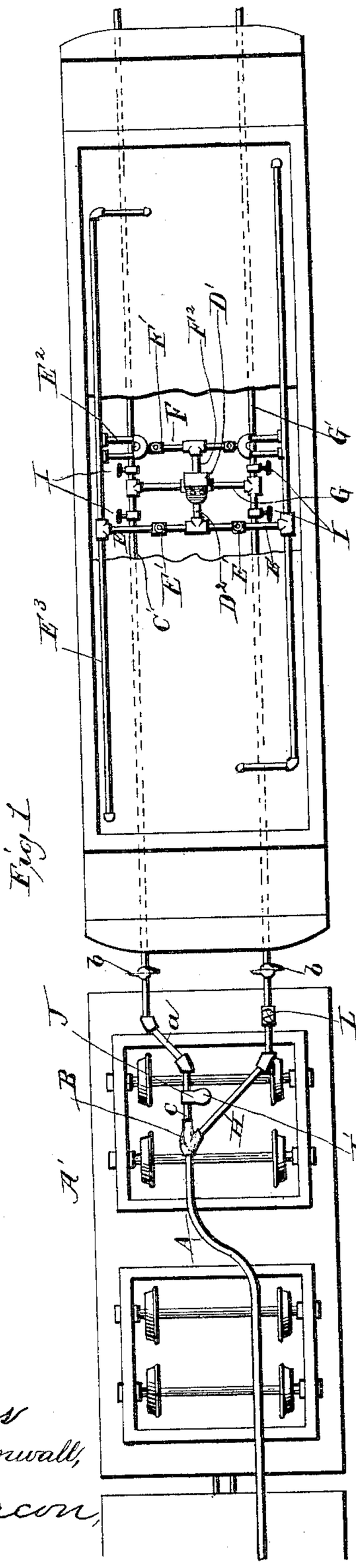


Fig. 1.

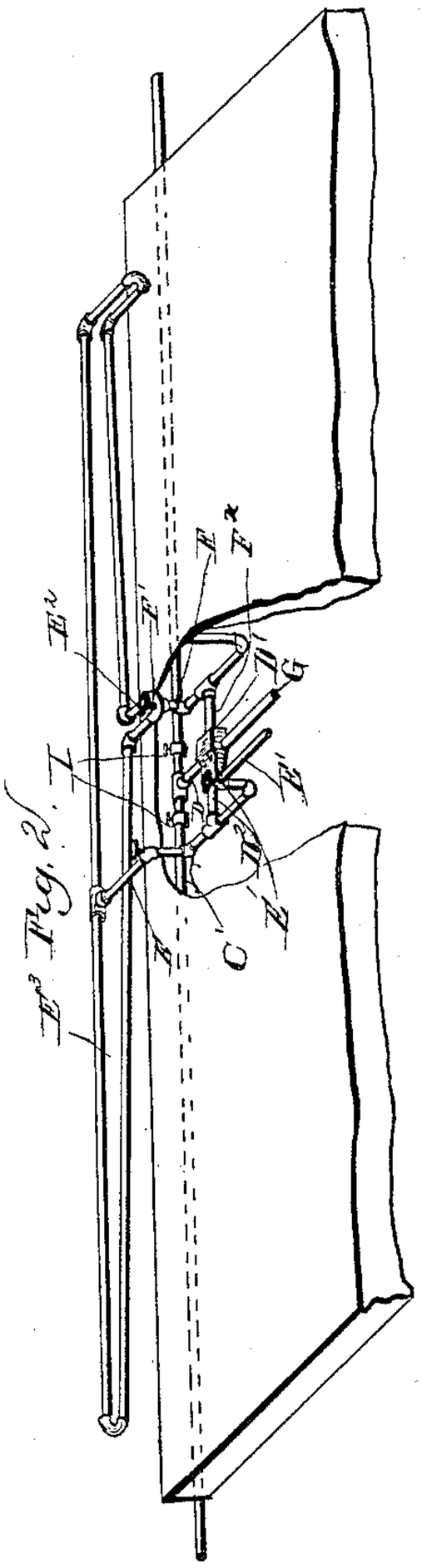


Fig. 2.

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# J. F. McELROY.

## STEAM HEATING APPARATUS.

No. 454,285. Patented June 16, 1891.

Fig. 3.

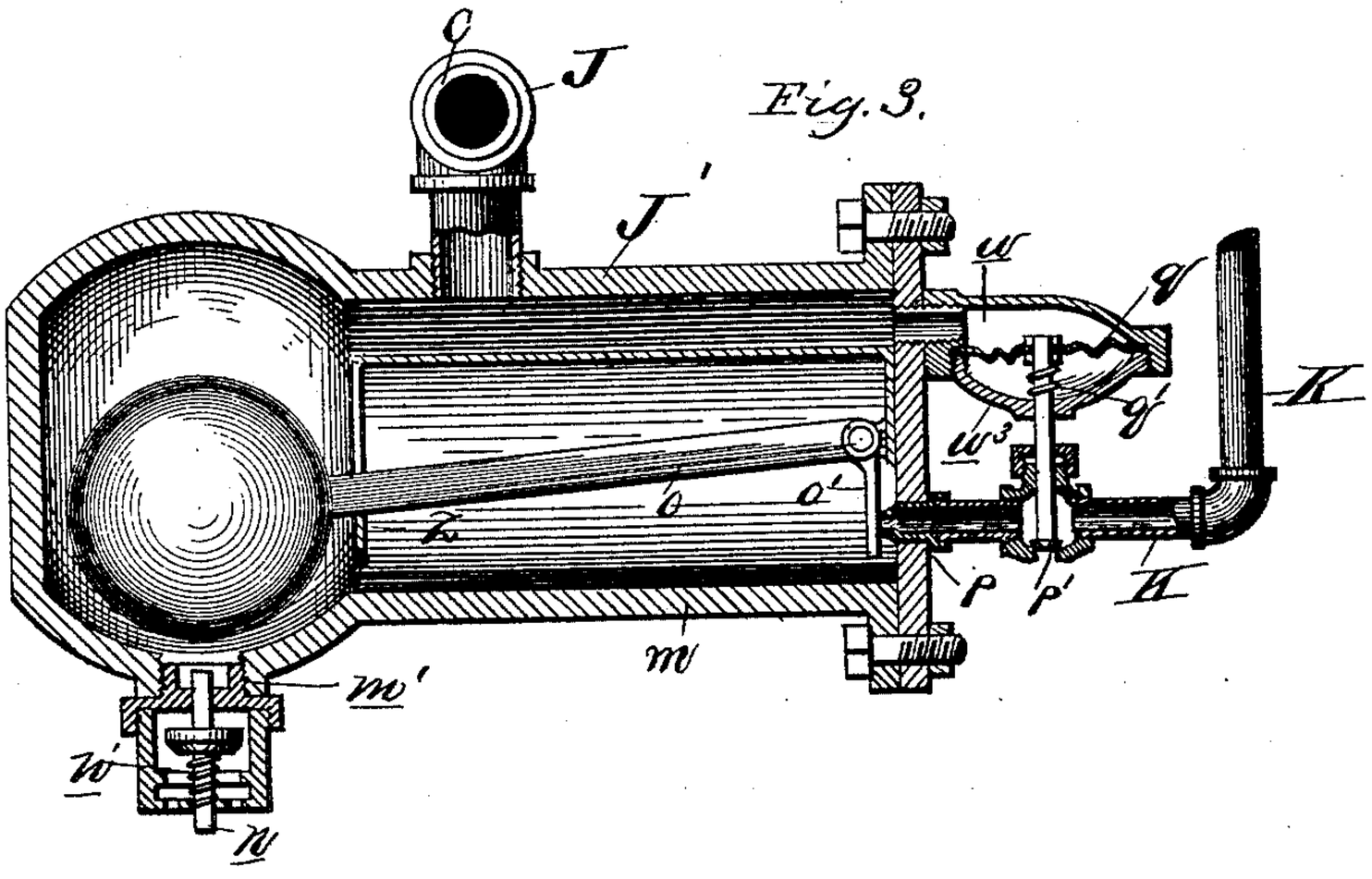
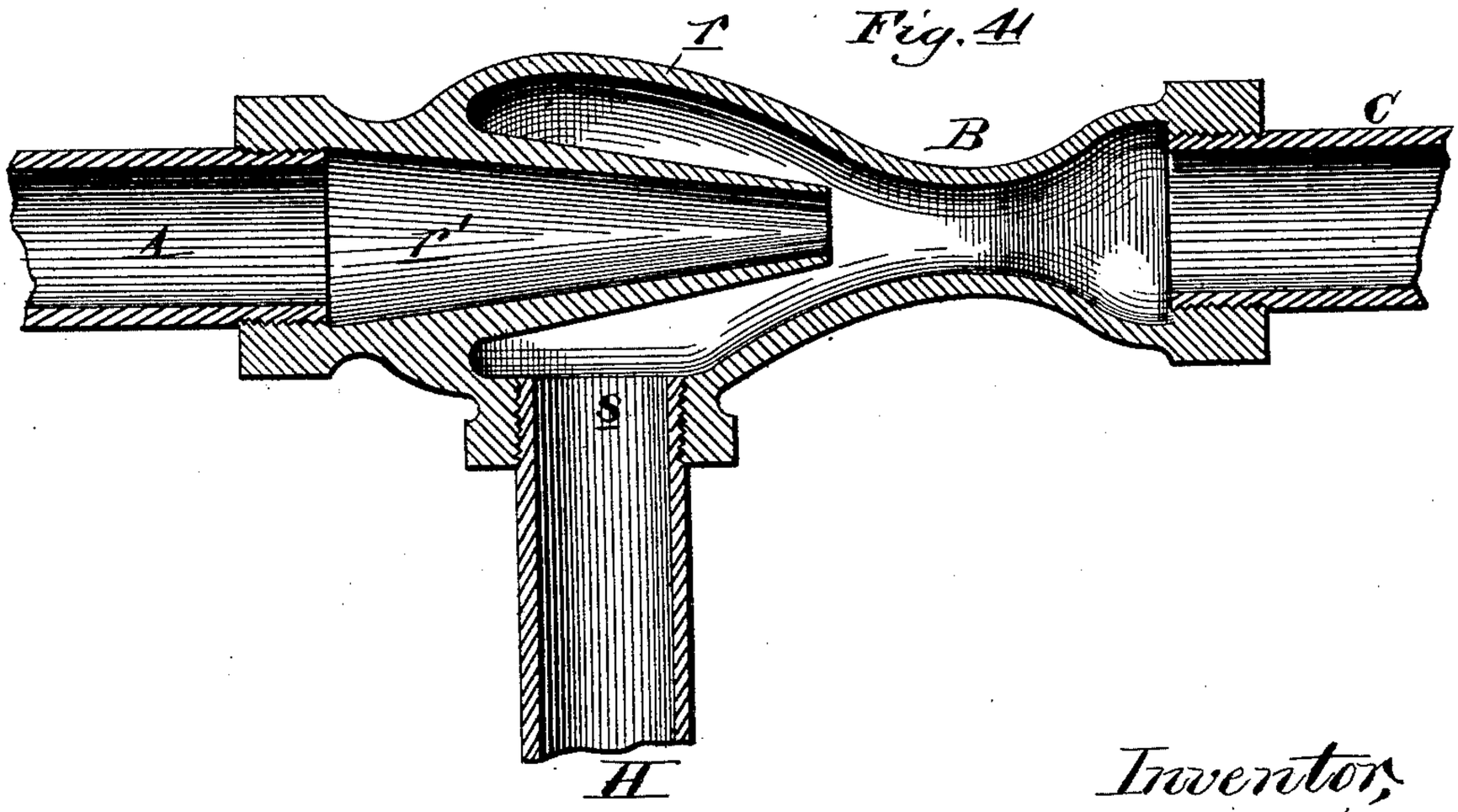



Fig. 4

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(No Model.) 4 Sheets—Sheet 3.

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## STEAM HEATING APPARATUS.

No. 454,285. Patented June 16, 1891.

Fig. 5.

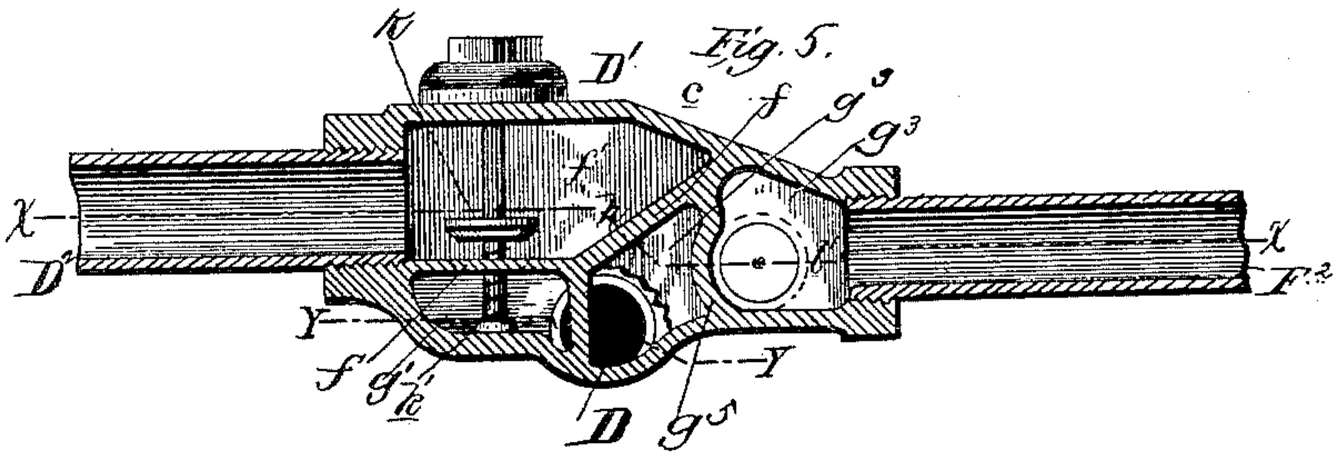



Fig. 6.

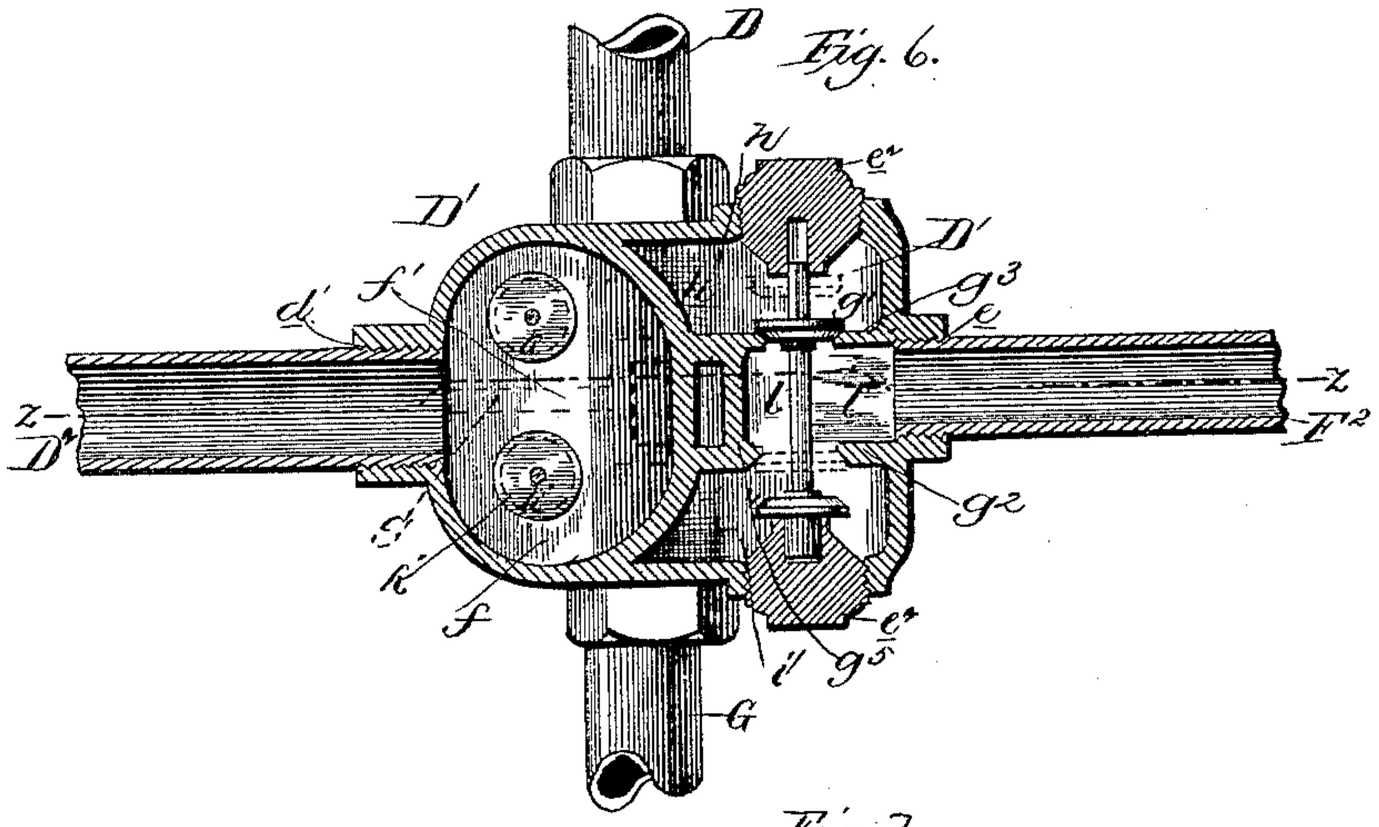
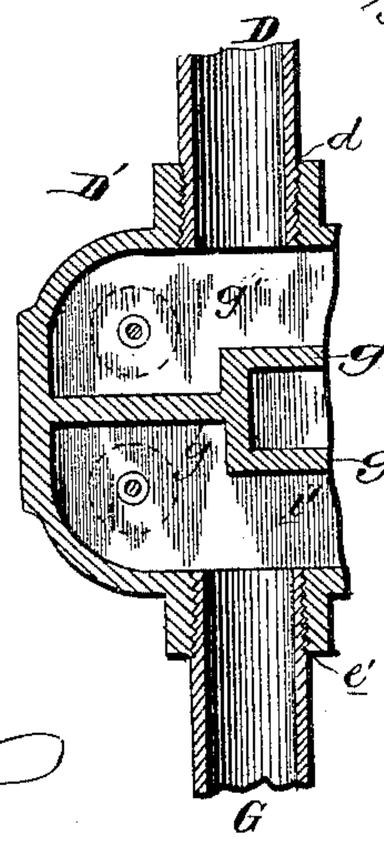



Fig. 7




Witnesses:
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L. S. Bacon

Inventor:
James F. McElroy,
per James Whittemore
his Attorneys.

(No Model.) 4 Sheets—Sheet 4.

# J. F. McELROY.

## STEAM HEATING APPARATUS.

No. 454,285. Patented June 16, 1891.

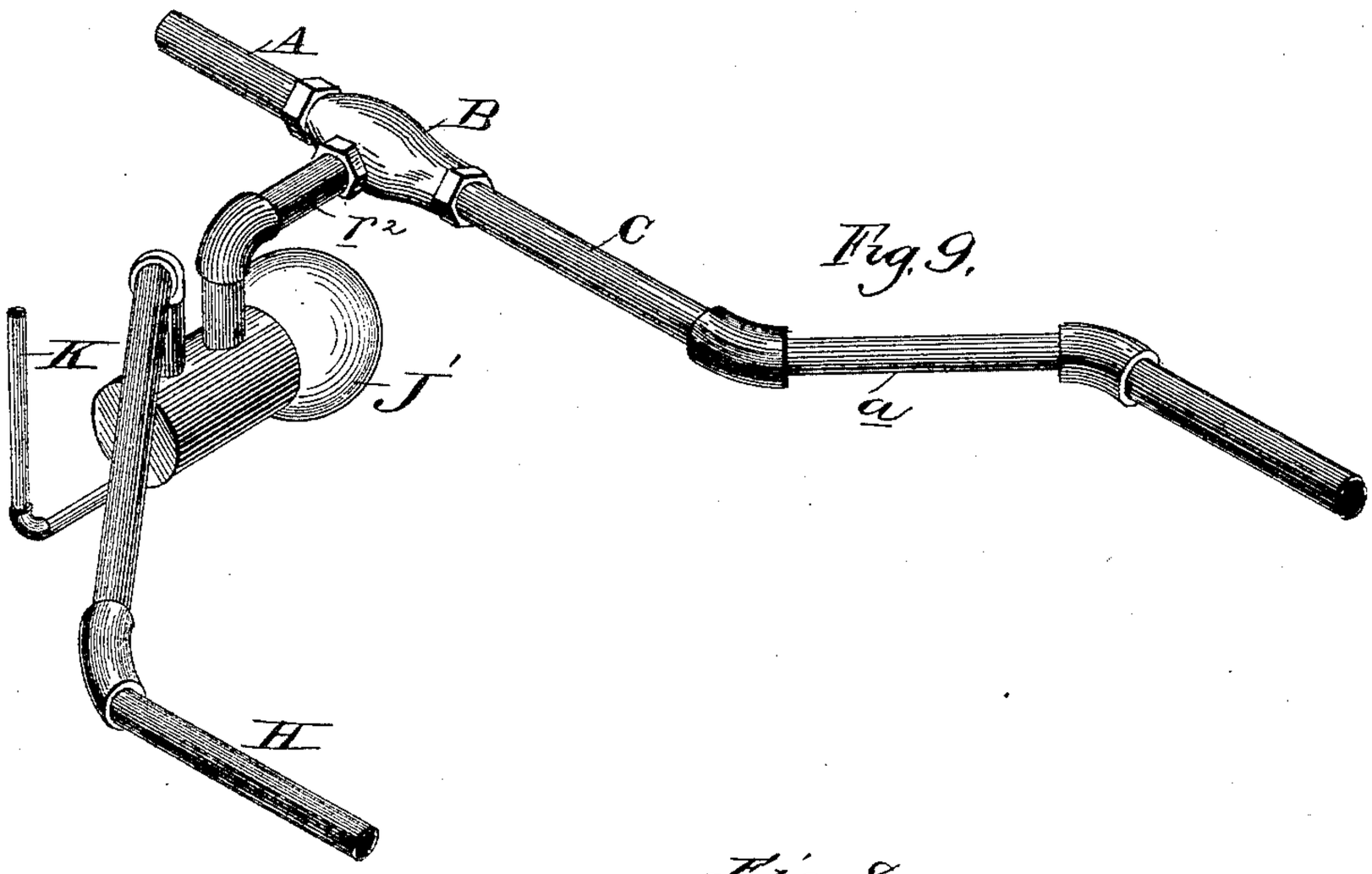


Fig. 9.

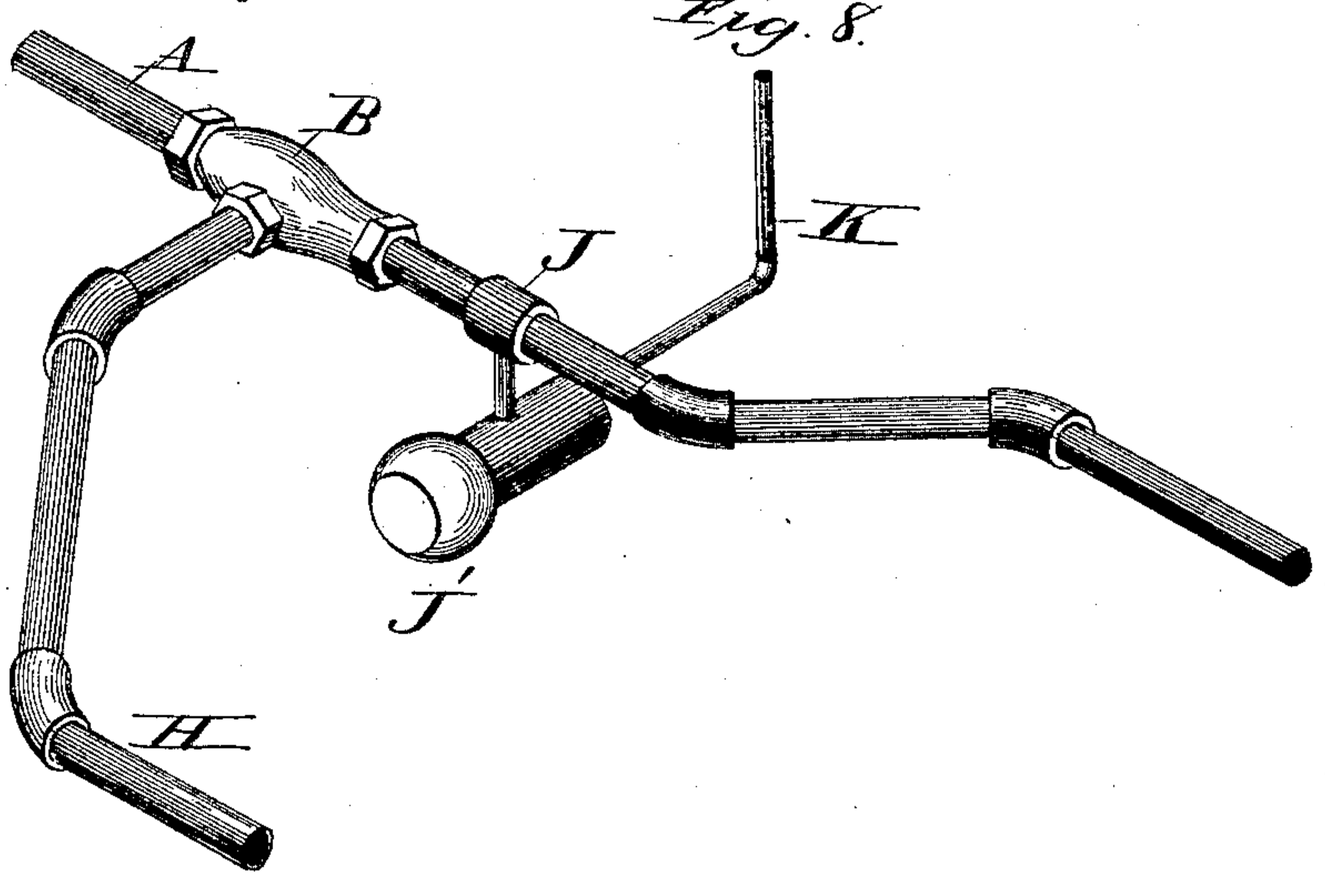


Fig. 8.

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Inventor
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# UNITED STATES PATENT OFFICE.

JAMES F. McELROY, OF ALBANY, NEW YORK, ASSIGNOR TO THE CONSOLIDATED CAR HEATING COMPANY, OF WHEELING, WEST VIRGINIA.

## STEAM-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 454,285, dated June 16, 1891.

Application filed September 9, 1889. Serial No. 323,485. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES F. McELROY, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Steam-Heating Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a new and useful improvement in steam-heating apparatus.

In the drawings my improved apparatus is shown applied to heating railway-cars, for which it is easily adapted, although it may be employed in heating buildings with equally good results.

The invention relates particularly to the arrangement and construction of an apparatus of the type known as "return system," in which the water of condensation is returned from the cars to the tender.

The invention consists in the combination and construction of various parts, all more fully hereinafter described.

In the drawings which accompany this specification, Figure 1 is a top plan view of my apparatus applied to a locomotive-tender and one car. Fig. 2 is a perspective view of the piping on one side of the car and connections to the distributing and return pipes. Fig. 3 is a vertical section through the steam-trap. Fig. 4 is a vertical central section through the injector. Fig. 5 is a vertical longitudinal section through the four-way valve on the line Z Z of Fig. 6. Fig. 6 is a longitudinal section thereof on line X X in Fig. 5. Fig. 7 is a section thereof on line Y Y in Fig. 5. Fig. 8 is a perspective view of the piping and the injector and steam-trap on the tender, and Fig. 9 is a perspective view of a modification thereof.

A′ is the tender, and A is the steam-supply pipe from the locomotive, in which is placed the steam nozzle or injector B, which at its forward end connects into steam-supply pipe C, which communicates with a pipe *a*, extending to the side of the tender A′. The pipe *a* is provided with a suitable hose-coupling at *b*, whereby it may be connected to the supply-pipe C′, extending the length of the car, both ends thereof being provided with suitable pipe-couplings.

D is a branch steam-pipe connecting into the four-way valve D′, which is of the following construction:

*c* is the casing, having the openings *d d′ e e′* and divided by the partitions *g*, *f*, $g^2$, and $g^3$ into four chambers *f′*, *g′*, *i′*, and *l′*. The chamber *f′* being located in the upper part of the partition and formed by the partition *f*, which forms its bottom and rear walls, the rear portion of the partition *f* being inclined upwardly. The chambers *g′* and *i′* are located in the opposite sides of the casing and extend the entire length thereof below the chamber *f′*. They are separated by the vertical partition *g* and the partitions $g^2$ and $g^3$. The partitions $g^2$ and $g^3$ form the chamber *l′*, these partitions being united by a cross-web or partition $g^5$, which forms the forward wall of the chamber *l*. The opening *d* communicates with the chamber *g′*, which connects with the chamber *f′* through an aperture in the partition *f*, controlled by the valve *k*, held normally open by the spring *k′*, sleeved over the stem of the valve. The chamber *i′* also connects the chamber *f′* through an aperture in the partition *f* controlled by a similar valve *k″*.

*l* is a double valve adapted to be seated in suitable valve-seats formed in the outer faces of the partitions $g^2$ and $g^3$ upon either side of the chamber *l′*, which latter communicates with the aperture *e* and with the chambers *g′* and *i′* through the valve-openings. This valve is held in place by the stem slidingly engaging in a plug or plugs $e^2$ $e^2$.

The pipe D connects into the aperture *d* of the four-way valve. The pipe $D^2$ connects into the aperture *d′* and connects with the radiator in the car through the connection-pipes E extending to both sides of the car. The radiator $E^3$ may be of any desired construction, that shown in the drawings arranged on both sides of the cars, consisting of an upper source of pipe dipping toward the ends, (the steam-pipe E connecting at the highest point in the middle,) and the lower course of piping dipping toward the middle. A loop $E^2$ is preferably arranged in the lower

course at the lowest point of the system. This connecting-pipe F, controlled by the valves F′ and leading from both sides of the car, connects through pipe F² with the aperture *e* in the four-way valve. G is a pipe connecting the aperture *e′* with the return-pipe G′. The pipe G′ extends the length of the car, and is provided with suitable couplings to connect the pipe-sections on adjoining cars and to connect said pipe to pipe H on the locomotive. Pipe H connects into or near the nozzle or injector B at a point in the rear of the end of the nozzle, as shown in Fig. 4.

Both of the train-pipes are provided with suitable stop-valves I, arranged one on each side of the branch pipes D and G.

J is a T, arranged in the pipe C, and connecting with its lower opening into the steam-trap J′. The steam-trap consists of a suitable casing *m*, having a suitable aperture to receive the connection at the top, and an exit-opening *m′* at its lowest point, in which is secured the valve *n* held normally open by means of the spring *n′*.

*o* is a float-valve, pivoted to the inside of the casing, and having an offset *o′* arranged to open and close the exit-opening as the float rises and lowers.

K is the exit-pipe connecting into the tender or other suitable receptacle for the water of condensation. This pipe is provided at its lowest point with a suitable drip-valve *p′*, which is operated by means of a diaphragm *q* in the chamber *w* near the top of the trap, the valve *p′* being held normally open by means of a spring *q′* and adapted to be closed as soon as steam is admitted into the trap by the pressure of the steam acting upon the diaphragm.

The injector is preferably of the construction shown in Fig. 4, in which *r* is a casing having inlet and outlet openings in line with each other, and provided interiorly with nozzle *r′*, below which is the aperture *s* for the return-connection H. This aperture *s* is arranged to the rear of the end of the nozzle, so that in the operation of the device a certain amount of suction will be created in the pipe H.

The parts being thus arranged are intended to operate as follows: The steam being admitted from the locomotive through the pipe A passes through the injector B, and from thence fills the steam-trap J′, its pressure closing the valve *n* and the valve *p*. The steam will find passage through the pipes C *a* and the pipe C′. The rear valve I on the train being closed, steam will pass through the pipe D on each car, entering the aperture *d* in the four-way valve, passing into the chamber *g′* and then upward through the valve *k′* entering the chamber *f′*. The pressure therein will close the valve *k″*, so that the steam will pass outward through the pipe D², entering the connecting-pipe E, from whence the steam will be distributed through the radiators in the car upon both sides. The return-water of condensation and steam will pass through the pipe F and the pipe F², thence into the four-way valve entering through the aperture *e*. The valve *l*, owing to the pressure of the steam entering the chamber *g′*, will be moved into the position shown in Fig. 6, allowing the passage of the steam and water of condensation into the chamber *i′*, and from thence into the pipe G, connecting with the train-pipe G′. By this pipe the steam, &c., will be carried back into the pipe H on the locomotive, connecting into the apertures *s* of the injector, where it will again be carried into the main steam-supply pipe by means of the suction caused by the passage through the injector-nozzle of the steam. Such steam as has not been condensed in its passage through the radiators and train-pipes will be carried with the dry steam from the locomotive again through the pipes in the cars, as just described, while the water of condensation entering the main steam-supply pipe will pass through the T J, which is in direct line with the steam-nozzle, and from thence by gravity into the steam-trap. As the water accumulates in the steam-trap, it will raise the float-valve *o*, thereby opening the exit into the pipe K. The pressure of the steam upon the water in the trap will force the water in the pipe K into the tender or other water-receptacle until the water in the trap has been lowered to a point when the float-valve will close. The above-described operation relates to my preferred form, as shown in Fig. 8, where the return-pipe enters the injector. When the return-pipe enters the trap directly, as shown in Fig. 9, the steam first causes a suction of air through the trap until the return-steam closes the drip-valve and the pressure forces the water into the tank, as in the former case. When the steam is cut off, the pressure in the system being relieved, the valve *n* will be opened by means of the spring *n′*, thereby drawing out any water which may be in the trap, and the diaphragm *q* will be moved to its upper position by means of the spring *q′*, thereby raising the valve *p′*, which will drain out any water which may be remaining in the pipes K, thus preventing any freezing up of the parts when not in operation.

If it should happen that the car be turned end for end, whereby the pipe G′ would connect with the steam-supply pipe C, as the steam-supply pipe, and the pipe C′ would connect with the pipe H as the return-pipe, the course of the steam through the four-way valve would be as follows: Steam being supplied through the pipe G′, and the branch pipe G entering the aperture *e′*, the pressure would slide the valve *l* to the position shown in dotted lines in Fig. 6. The steam would then pass up through the valve *k*², the pressure in the chamber *f′* would close the valve *k*, and the steam would find exit through the pipe E to the radiators. The return-water of condensation and steam would pass through

the pipe F and the pipe $F^2$ into the four-way valve at the aperture *e*, pass into the chamber *g'*, thence through the pipe D into the pipe C', thence back through the pipe H to the injector in the manner before described. It will thus be seen that either line of train-pipe may be used as the return or as the supply pipe, the four-way valve acting automatically to distribute and return the steam in either case.

An air-exhaust cock is placed at L to permit the air in the pipes to be blown out. This may be of any desired or well-known construction.

By the use of my apparatus thus constructed I am enabled to use the steam which is returned to the locomotive by sending it back again over its course to be used in heating the cars until it has been condensed, when it is discharged automatically into the tender, and the heat of the water of condensation is utilized in raising the temperature of the feed-water for the locomotive.

No expensive or complicated pump or other machinery is required to create a suction in my apparatus, as the circulation is created by the force of the injector forcing the steam through the pipes.

The suction in the return-pipe, by its location in the rear of the nozzle, is sufficiently strong to draw the water of condensation and steam from the pipe H into the main steam-supply pipe, so that it may be distributed and the water and steam automatically separated.

The location of the trap for carrying off the water of condensation and the connection between the trap and the tender I do not consider of great importance, as the trap may be of any desired construction and may be in a number of different locations.

Fig. 9 shows the trap located in the return-pipe H and connecting-pipe $r^2$ between the top of the trap and aperture *s* in the injector.

While I show my improved apparatus in connection with direct steam-heating radiators it is equally as well applied to hot-water steam heating apparatus as shown in my Patent No. 391,326.

What I claim as my invention is—

1. In a steam-heating apparatus, the combination with a steam-supply pipe, of a return-pipe leading back into and directly communicating with the forward portion of the supply-pipe, a steam-trap located in the rear of the junction of the pipes, and an injector in the supply-pipe, substantially as described.

2. In a car-heating apparatus, the combination, with a tender, of a steam-supply pipe and a return-pipe, a steam-trap communicating with the supply-pipe, a pipe leading from the trap into the tender, and an injector for forcing the steam through the pipes and the water of condensation from the trap into the tender, substantially as described.

3. In a car-heating apparatus, the combination, with the main steam-supply pipe, of a return-pipe leading back into and directly communicating with the forward portion of the supply-pipe, and an injector at the junction of the pipes for forcing the steam from the return-pipe back into and through the supply-pipe, substantially as described.

4. In a four-way valve, the combination, with the casing, of a series of horizontal longitudinal and vertical lateral partitions crossing the interior thereof, forming chambers therein, a valve between the rear chambers and spring-actuated valves between the upper and lower chambers, and pipes leading into the respective chambers, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses, this 9th day of August, 1889.

JAMES F. McELROY.

Witnesses:
EDWIN A. SMITH,
THOS. C. MURRAY.