

(No Model.)

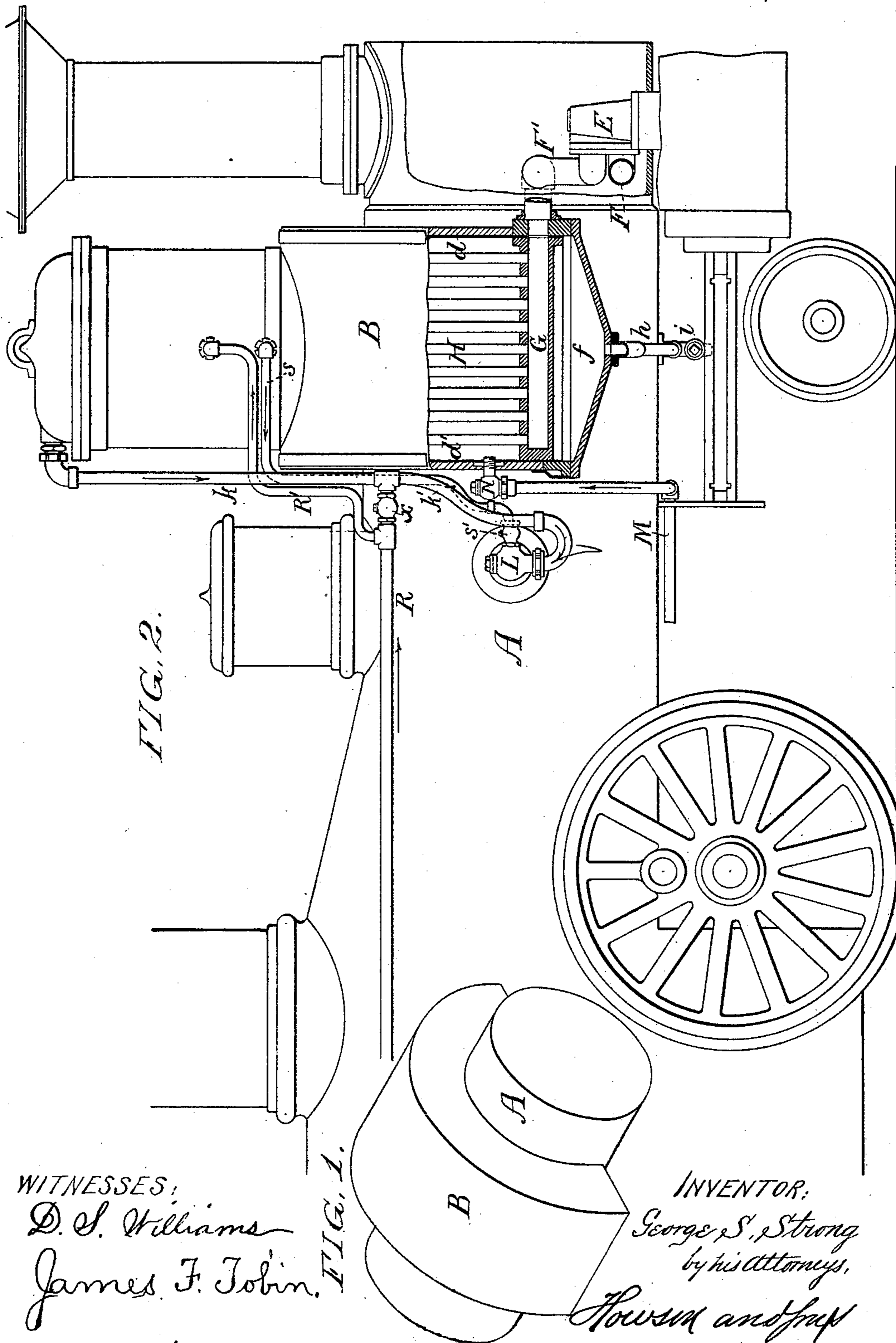
3 Sheets—Sheet 1.

G. S. STRONG.

FEED WATER HEATER FOR LOCOMOTIVES.

No. 250,599.

Patented Dec. 6, 1881.



WITNESSES:  
D. S. Williams  
James F. Tobin.

FIG. 1.

INVENTOR:

George S. Strong  
by his attorneys,

Howson and Hay

(No Model.)

3 Sheets—Sheet 2.

G. S. STRONG.

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FIG. 3.

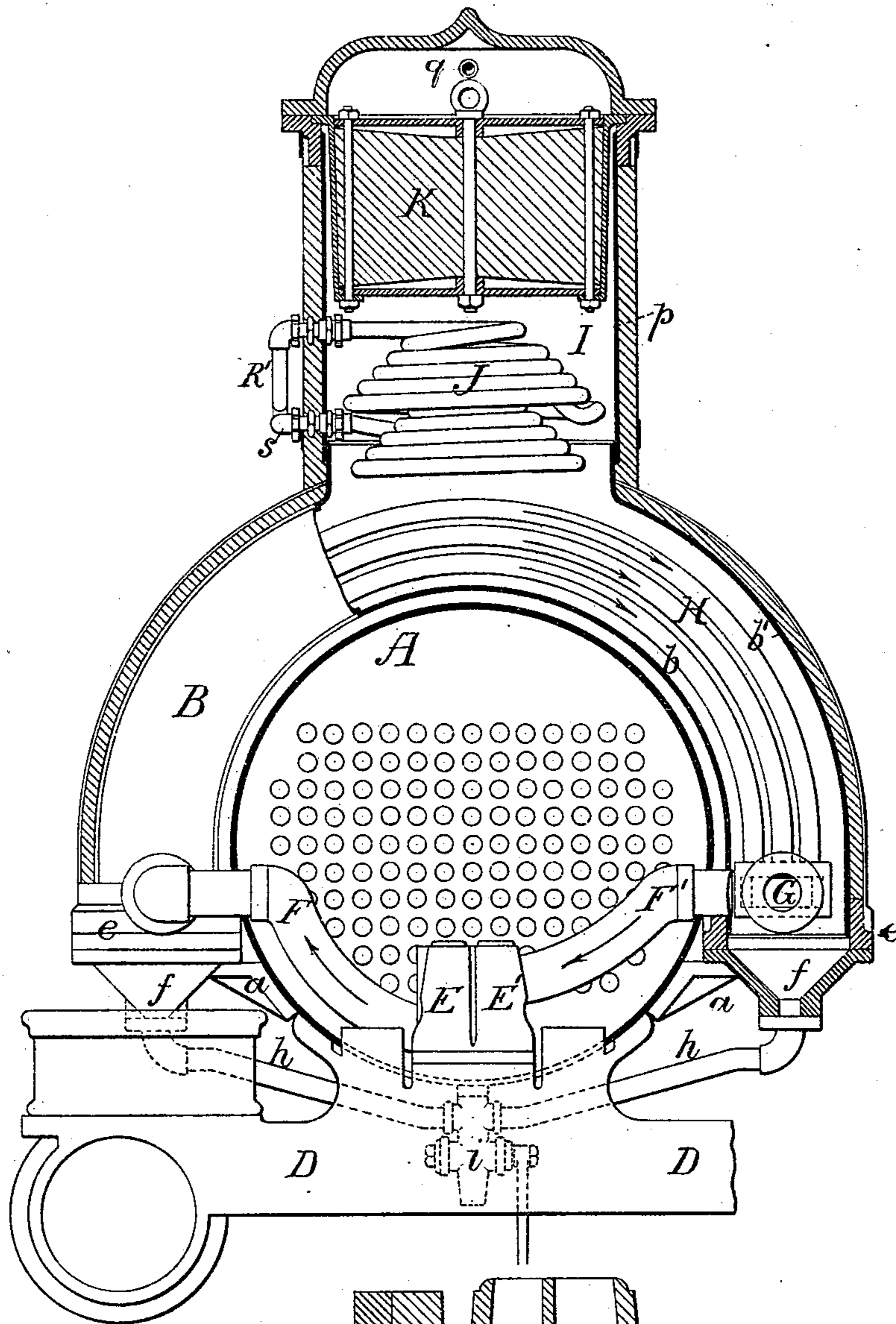
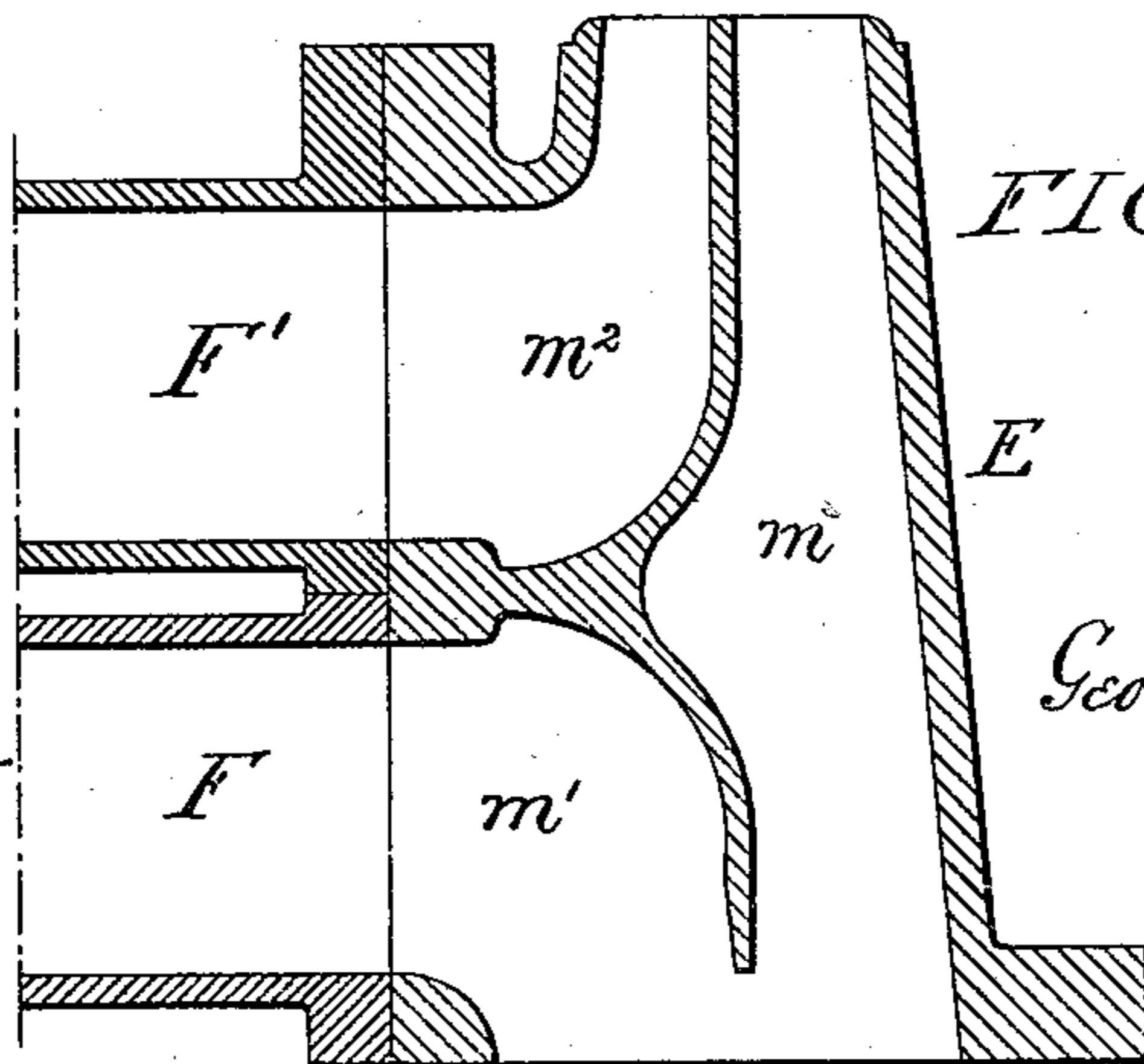


FIG. 4.



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FIG. 6.

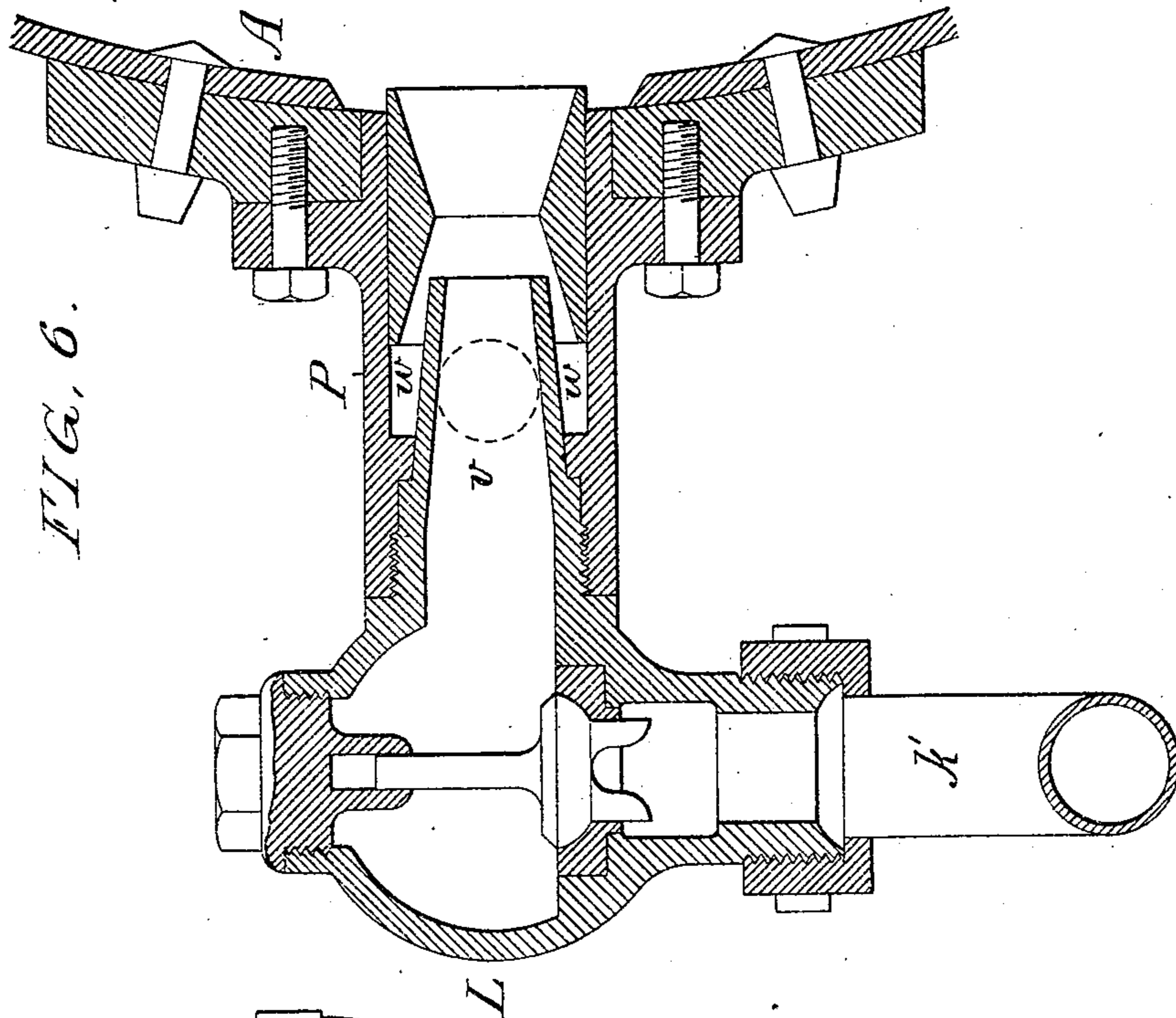
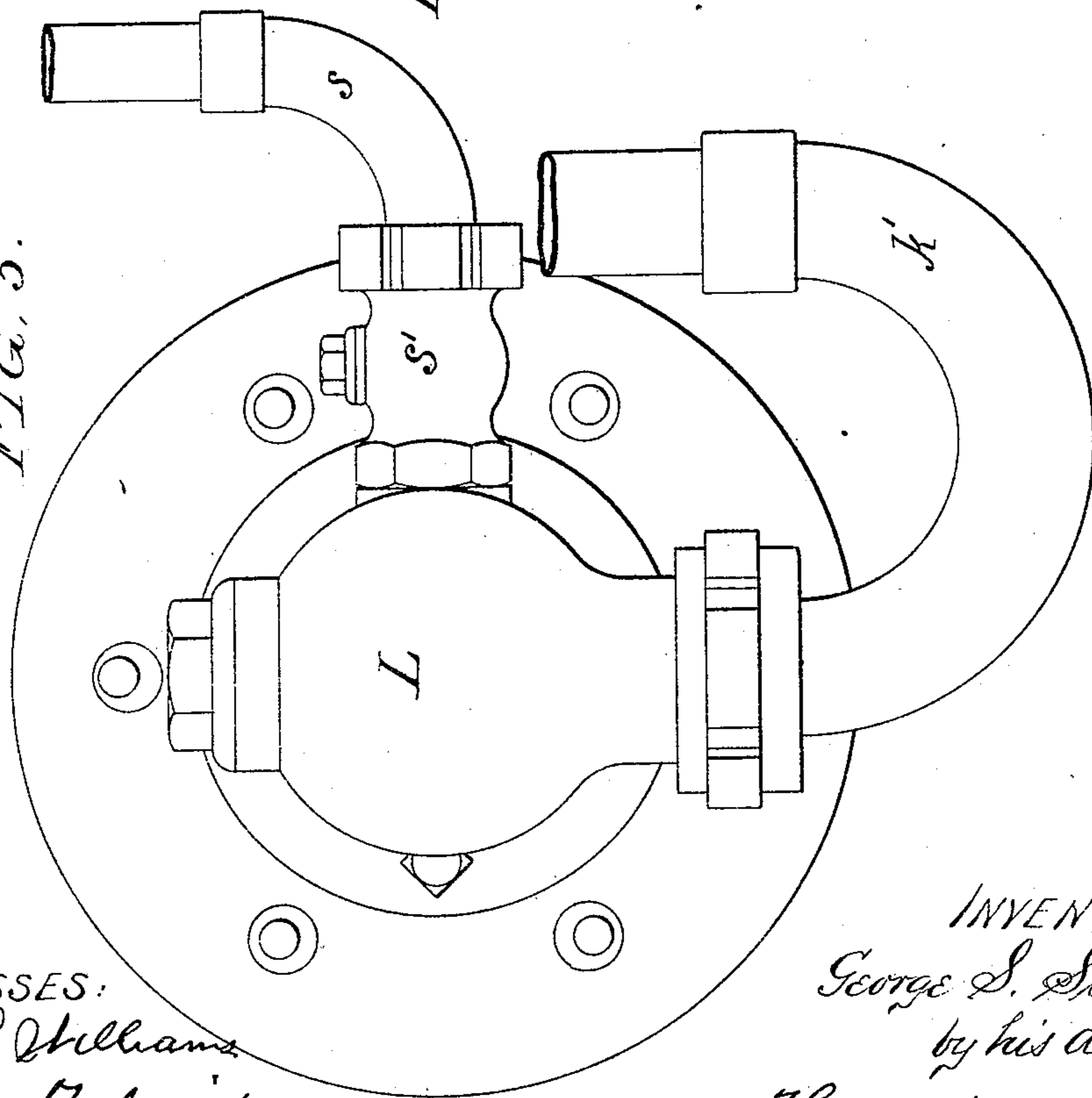


FIG. 5.



WITNESSES:

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*Henry Fulemider*

INVENTOR:

*George S. Strong*  
*by his attorneys*

*Houson and Sons*

# UNITED STATES PATENT OFFICE.

GEORGE S. STRONG, OF PHILADELPHIA, PENNSYLVANIA.

## FEED-WATER HEATER FOR LOCOMOTIVES.

SPECIFICATION forming part of Letters Patent No. 250,599, dated December 6, 1881.

Application filed May 31, 1881. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE S. STRONG, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Feed-Water Heaters for Locomotives, of which the following is a specification.

My invention consists of a feed-water heater especially adapted to locomotive-boilers, and relates to the construction of the heater, to detached parts of the same, and to the mode of applying to the present heater the improvements described in my Patent No. 227,072, April 27, 1880.

In the accompanying drawings, Figure 1, Sheet 1, is a perspective diagram; Fig. 2, a side view of part of a locomotive, showing my improved feed-water heater partly in section; Fig. 3, Sheet 2, an end view of Fig. 2, showing the smoke-box end of the boiler and the heater in section; and Figs. 4, 5, and 6, views of detached devices which I use in carrying out my invention.

A represents part of the body or barrel of a locomotive-boiler, and B the heater, which is saddle-shaped, as shown, so as to correspond with the shape of the boiler, this saddle-shaped heater being, by preference, free from contact with the shell of the boiler and supported by suitable brackets, *a a*, secured thereto, as shown in Fig. 2.

The advantages of the saddle-shaped heater are, first, its ready application to the boiler, preferably at a point behind the chimney; second, its large capacity without adding materially to the bulk of the engine; and, third, its location at a point where it cannot interfere with the working parts of the engine.

While different arrangements of pipes or passages for the circulation of the feed-water and exhaust-steam through the heater may be adopted, I prefer the plan and appliances which I will now proceed to describe.

In Fig. 3, *b* represents the inner side, and *b'* the outer side, of the body of the heater, both being made, in the present instance, mainly in the arcs of circles concentric with the barrel of the boiler.

*d* is the front end, and *d'* the rear end, of the heater, which, in the present case, is made of sheet-iron, the lower ends of the two legs being secured to flanged bases *e e*, of cast-iron,

and to each of the latter is attached a cast-iron receiver, *f*, having its four sides converging to an outlet which communicates with a waste-pipe, *h*, the waste-pipes of the two receivers communicating with the discharge-cock *i*.

In Fig. 3, *D D* represent the two exhaust-pipes from the valve-chests of the two cylinders, and *E E'* the two exhaust-nozzles, the latter of which is of ordinary construction, so that the exhaust-steam has a direct passage through it. The other nozzle, *E*, however, is constructed in the manner shown in the sectional view, Fig. 4, on reference to which it will be seen that three chambers are formed in the nozzle—the chamber *m*, through which a portion of the exhaust-steam from one of the cylinders takes a direct course into the smoke-box of the locomotive, the chamber *m'*, through which another portion of the exhaust-steam from the same cylinder passes into the pipe *F*, and the third passage, *m<sup>2</sup>*, through which the same exhaust-steam, after taking the course explained hereinafter, passes from the pipe *F'* into the smoke-box. The pipe *F* communicates with a box, *G*, in the lower portion of one leg of the saddle-shaped heater, Fig. 2, and the pipe *F'* with a similar box in the opposite leg, Fig. 3, and the two boxes communicate with each other through a series of bent tubes, *H*, so that the exhaust-steam which finds its way through the chamber *m'* of the nozzle into the pipe *F* must first enter the box with which that pipe communicates, thence pass through the bent tubes into the other box, and finally through the pipe *F'* and through the chamber *m<sup>2</sup>* of the nozzle *E* into the smoke-box. The feed-water is first pumped into the heater, where a high degree of heat is imparted to it by contact with the tubes before it finds its way into the boiler.

In carrying out the above-described invention I prefer to combine with it, in the manner which I will proceed to describe, the improvements for which Letters Patent No. 227,072 were granted April 27, 1880.

On the top of the saddle-like heater *B* is a casing, *p*, inclosing a chamber, *I*, which communicates with the said heater, and this chamber contains a coil, *J*, heated by live steam, and above the coil is a filtering medium, *K*, so that the feed-water must first be superheated by the coil and then pass through the filter before it

escapes through the outlet *g*, as and for the purpose described in the aforesaid patent. Feed-water is forced by the ordinary pumps or by an injector through the pipe *M* and check-valve *N* into the heater at the point indicated in Fig. 2, and passes from the heater at the top of the same through the outlet *g*, Fig. 3, and thence through the pipes *k k'* to the under side of the chest *L*, which will be best observed in Figs. 5 and 6, a nozzle, *v*, projecting from the said chest into a chamber, *w*, which communicates with the steam-boiler, the said chamber *w* being contained in a tube, *P*, which is secured to the boiler, and to which the chest is attached. Live steam passes through a pipe, *R*, and branch pipe *R'* to one end of the steam-heating coil *J*, the waste steam from the latter passing through the tube *s* and check-valve *s'* into the chamber *w*. The live-steam pipe *R* communicates with the pipes *k k'* through a check-valve, *x*, which opens from the said pipe. When the engine is running the superheated water, under pressure due to the pump or injector, will pass down the pipes *k k'*, keeping the check-valve *x* closed, and through the chest *L* and nozzle *v* into the boiler. In the meantime the waste-steam from the steam-heating coil *J* passes through the pipe *s* and check-valve *s'* into the chamber *w*, and is forced with the feed-water into the boiler. When the connection between the feed-pipe *M* and the feed pump or injector is closed and the waste-cock *i* opened, the check-valve *x* will open and live steam will pass from the pipe *R* through the pipe *k* into the heater at the top of the same, and will cause such a downward current in the heater as will tend to cleanse the filter and interior of the heater, all sediment which may have accumulated in the receivers *f* being discharged through the waste-cock.

It will be understood that the heater is properly lagged or clothed with non conducting material, and that it is properly stayed internally to resist the pressure to which it is subjected.

I claim as my invention—

1. The combination of the body or barrel of a locomotive with the saddle-shaped feed-water heater, having internal pipes or tubes extending through the same and serving for the conveyance of steam, as set forth.

2. The within-described feed-water heater, the same consisting of the saddle-shaped casing, its boxes *G G'*, and curved tubes with inlets and outlets for exhaust-steam and feed-water, all substantially as set forth.

3. The combination of the heater, its tubes *H*, and boxes *G G'*, with the nozzle *E*, having a chamber, *m'*, communicating with one box, and a chamber, *m''*, communicating with the other box, substantially as set forth.

4. The within-described nozzle *E*, having a chamber, *m*, for the direct passage of a portion of the exhaust-steam to the smoke-box, a chamber, *m'*, for the passage of another portion of the exhaust-steam to the heater, and a third passage, *m''*, for receiving the spent exhaust-steam from the heater and directing it to the smoke-box, all substantially as specified.

5. The combination of the heater and the two receivers *f f*, one for each leg of the heater, with the waste-pipes *h h* and discharge-cock *i*, as set forth.

6. The combination of the saddle-shaped heater with the chamber *I*, steam-heating coil *J*, and filter *K*, as specified.

7. The combination of the feed-pipes *k k'*, the valve-chest *L*, the nozzle *v*, and chamber *w* with the steam-heating coil *J* and the waste-pipe *s*, communicating with the said chamber *w*, all substantially as specified.

8. The combination of the heater, the feed-pipe *M*, the discharge-pipes *k k'*, the live-steam pipe *R*, and the check-valve *x*, as set forth.

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

GEO. S. STRONG.

Witnesses:

JAMES F. TOBIN,  
HARRY SMITH.