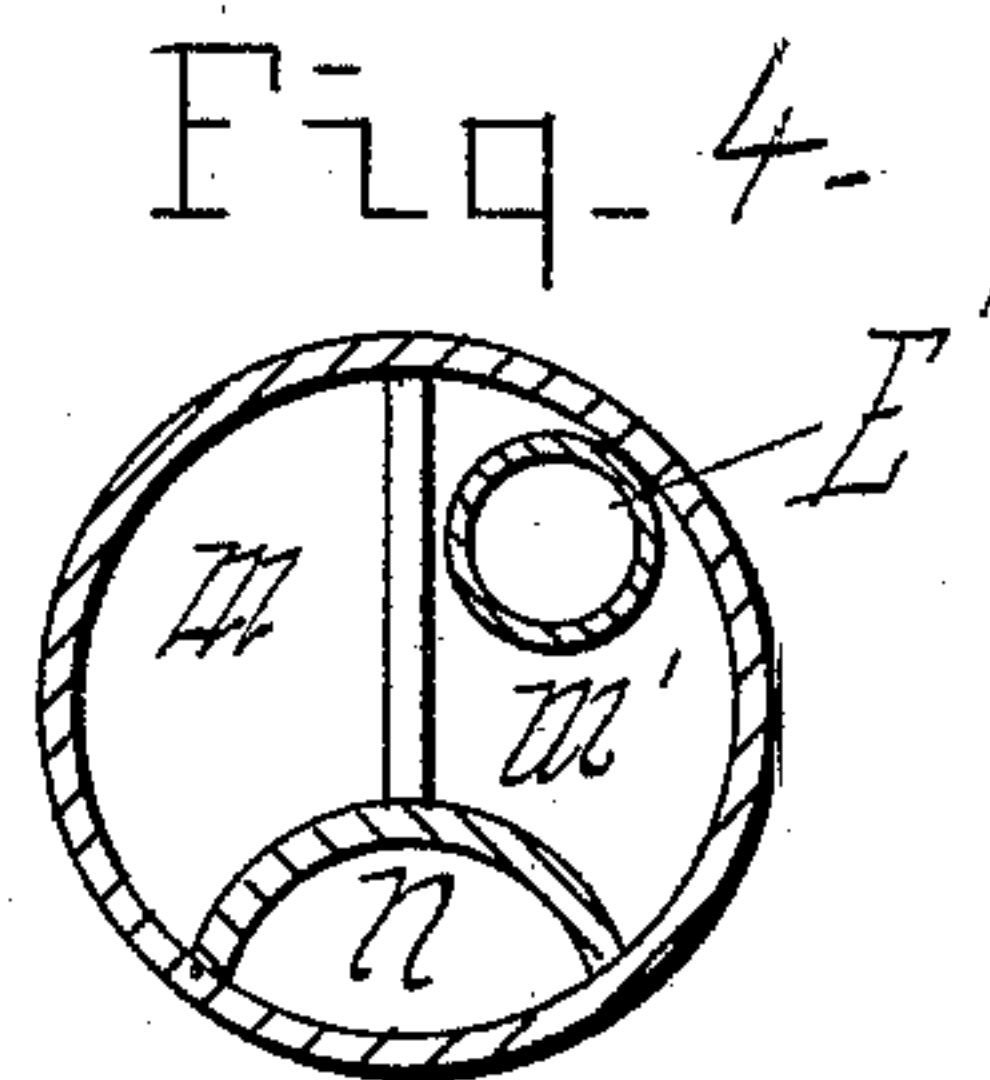
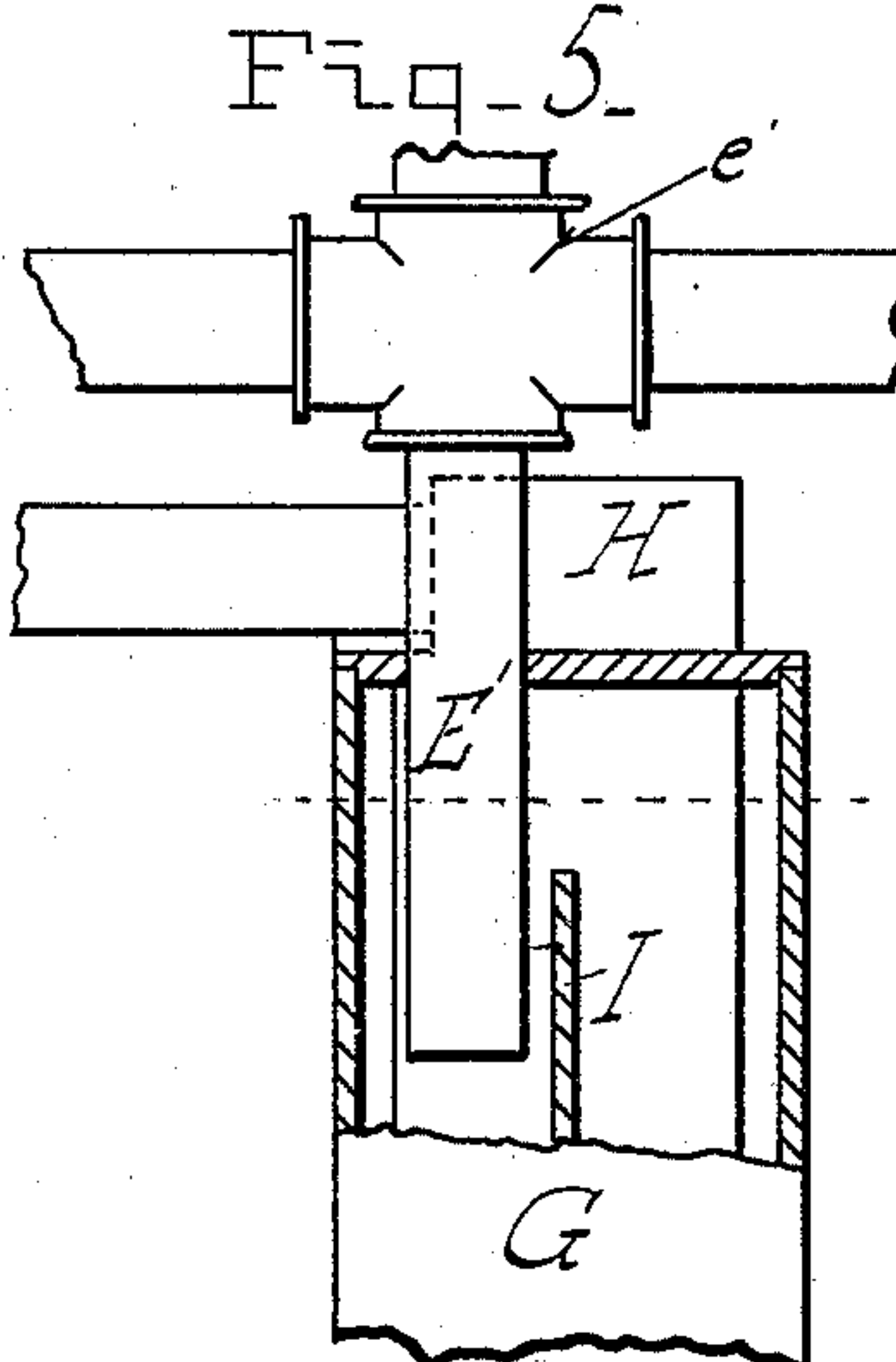
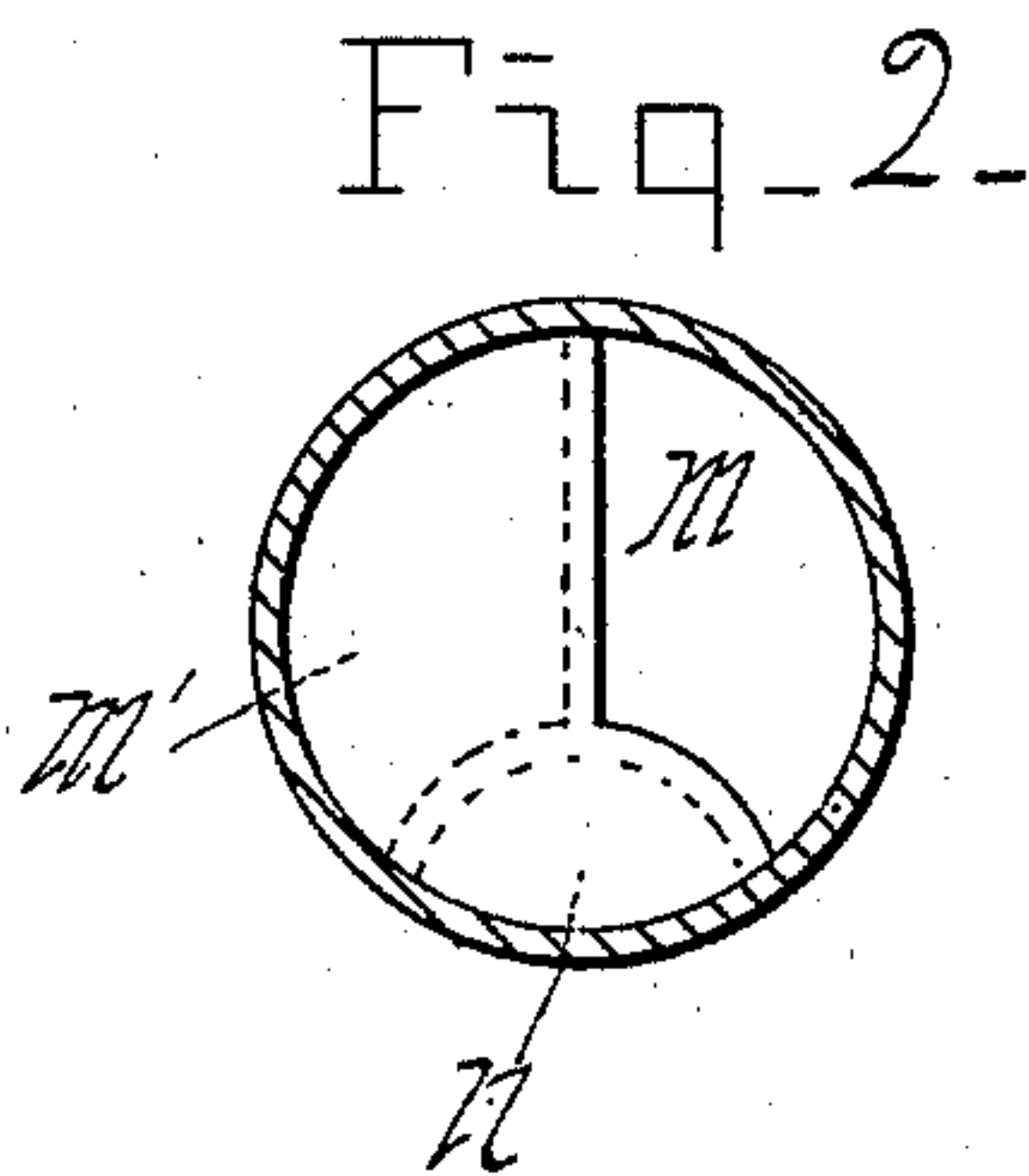
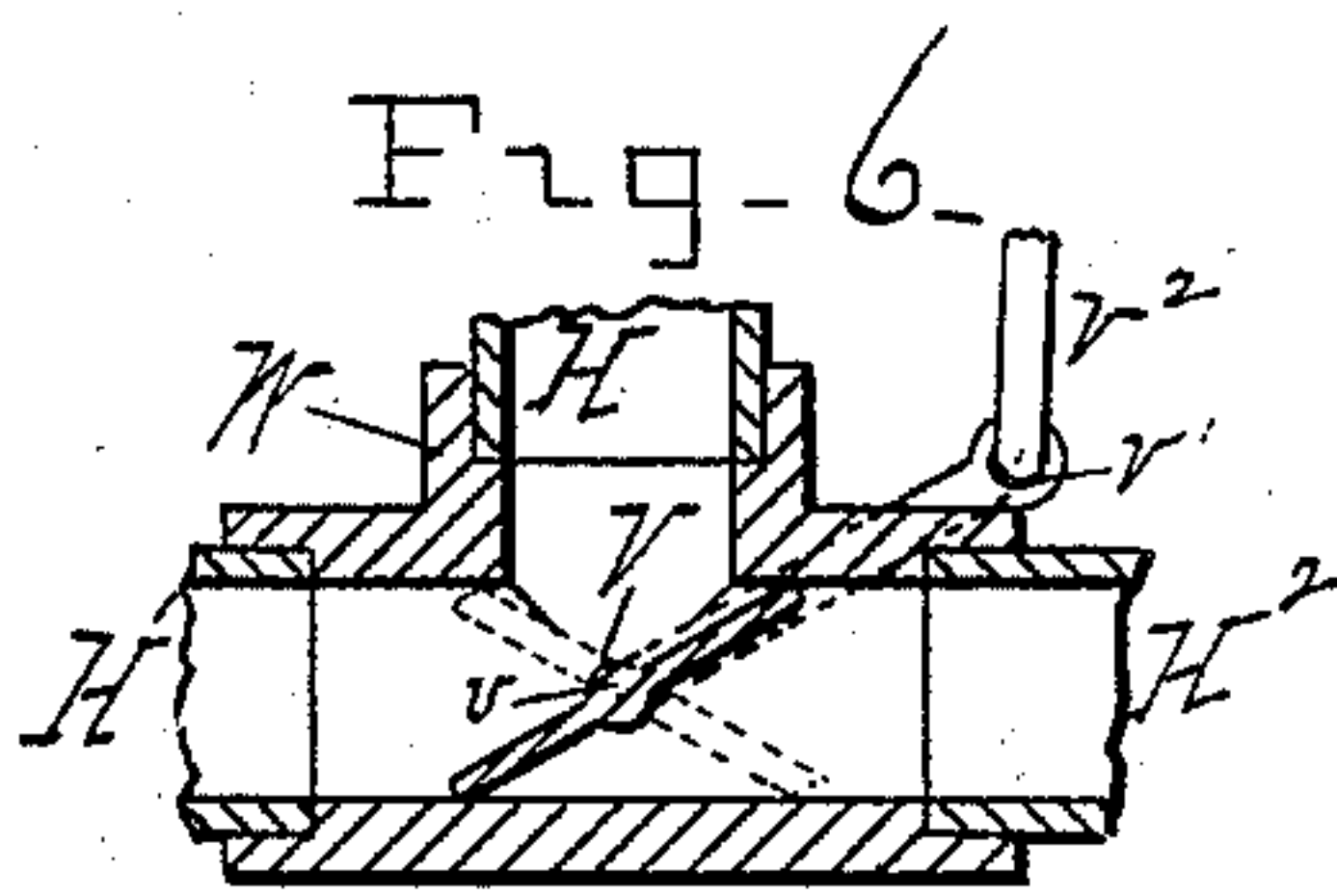
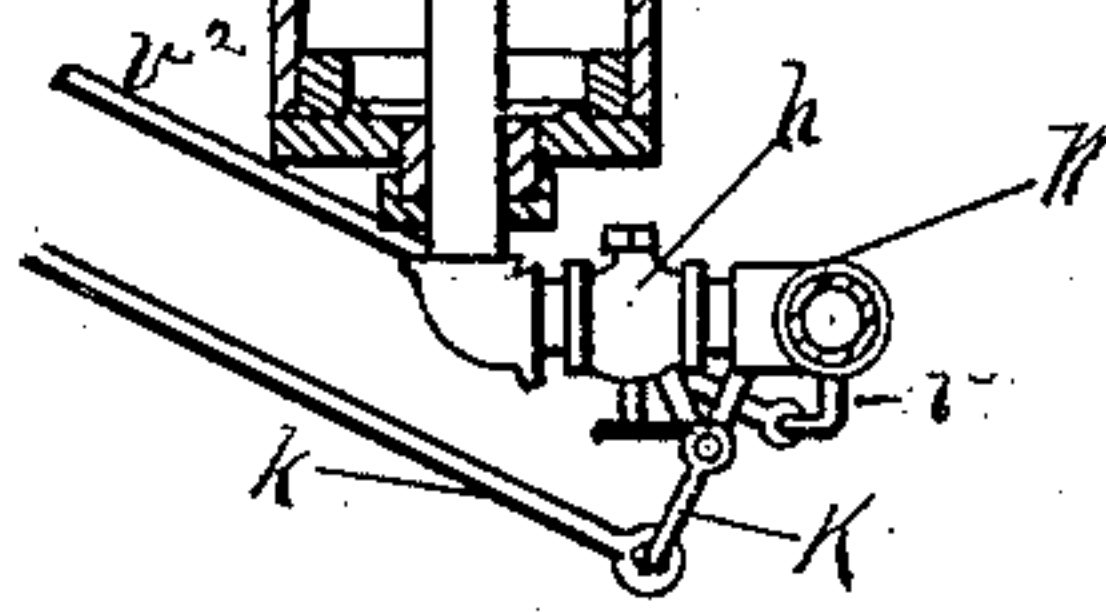
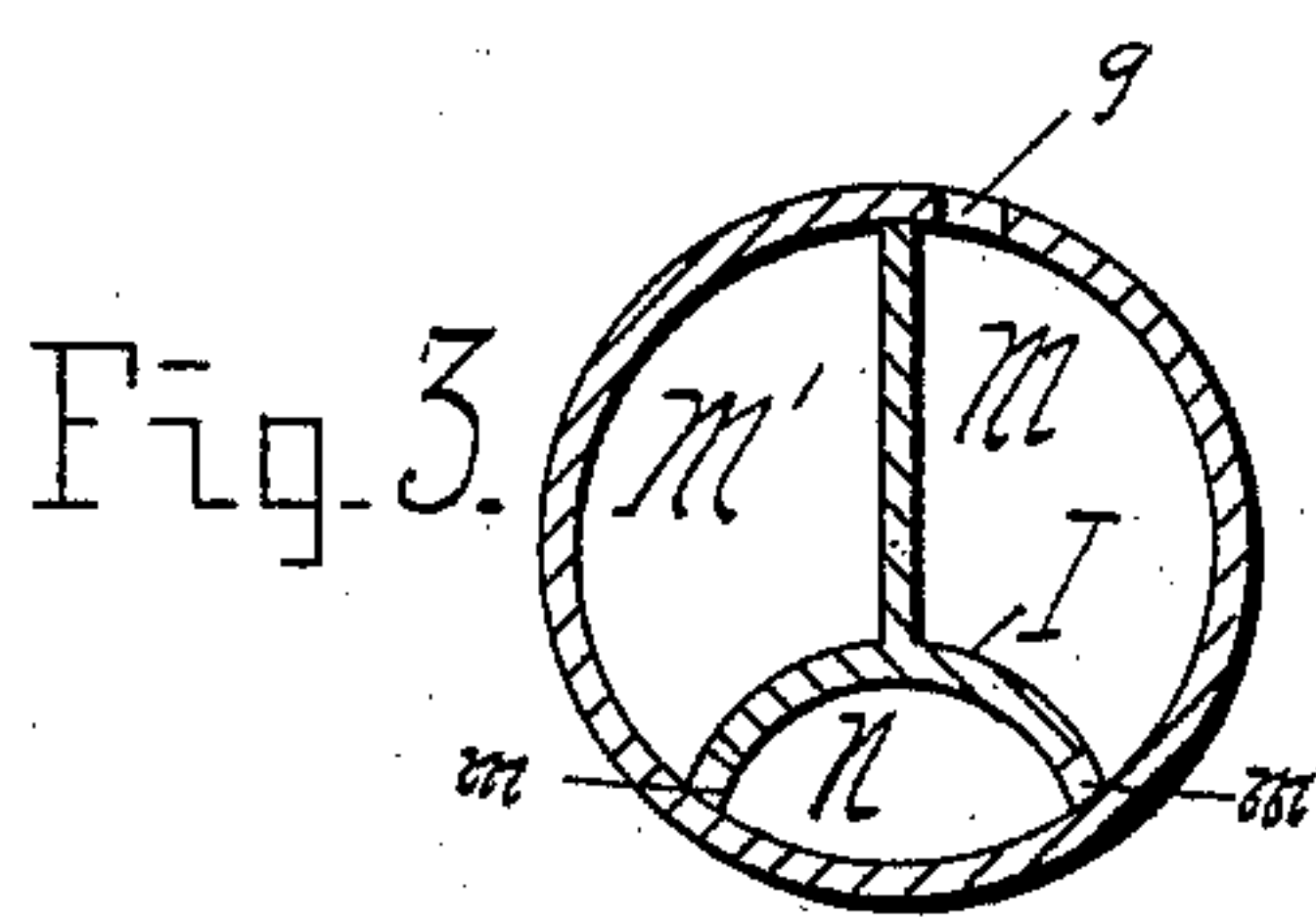
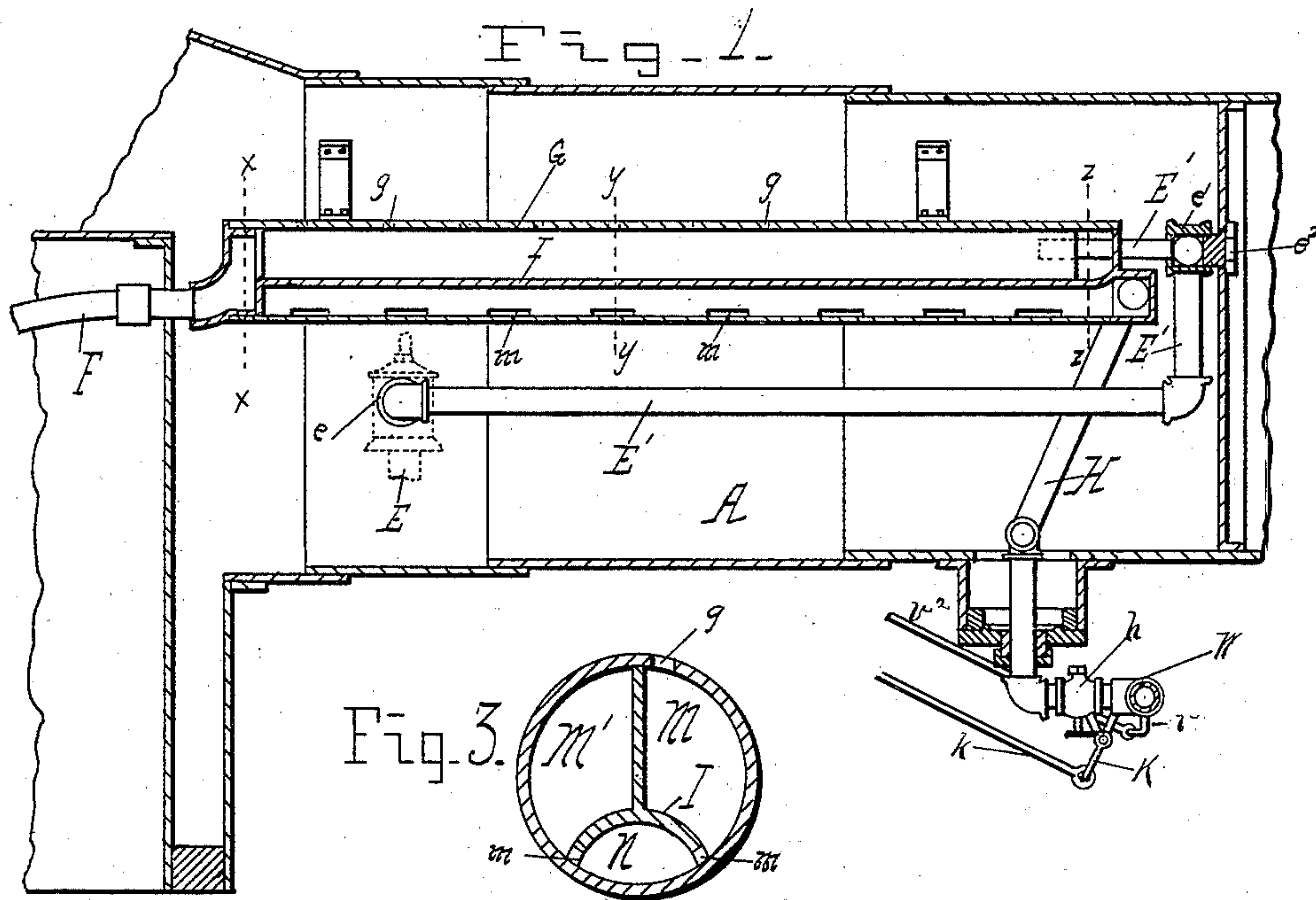


(No Model.)

H. HACKNEY.
STEAM BOILER.

No. 408,303.

Patented Aug. 6, 1889.



Witnesses

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Inventor

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UNITED STATES PATENT OFFICE.

HERBERT HACKNEY, OF TOPEKA, KANSAS.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 408,303, dated August 6, 1889.

Application filed October 18, 1888. Serial No. 288,502. (No model.)

To all whom it may concern:

Be it known that I, HERBERT HACKNEY, a citizen of the United States of America, residing at Topeka, in the county of Shawnee and State of Kansas, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

In the drawings presented herewith, Figure 1 is a longitudinal vertical section of a portion of a locomotive-boiler, showing the arrangement of my improvements therein. Fig. 2 is a cross-section in line *x x* of the mud-drum shown in Fig. 1; Fig. 3, a cross-section of said drum in line *y y*; Fig. 4, a cross-section of said drum in line *z z*; Fig. 5, a detail view, partly in section, showing the arrangement of the pipes at the forward end of the mud-drum; and Fig. 6, a detail view, in section, of a T-coupling and butterfly-valve, which enable the engineer to "blow off" from either side of the locomotive.

Like reference-letters indicate the same parts.

In a former patent, issued to me August 7, 1888, No. 387,511, I have described a locomotive-boiler fitted with a circulation-pipe *F* exposed to the heat of the fire or of the hot gases therefrom, and a mud-drum *G*, isolated from the direct action of the fire and containing a lower compartment *N*, provided with a discharge-pipe *H*. These essential elements I still retain; and my present invention consists in certain improvements upon said former invention whereby better results are obtained, and also in certain mechanical devices which cheapen the construction and care of the apparatus, all of which are hereinafter fully described, and pointed out definitely in the claims appended hereto. Of the many impurities contained in such water as is necessarily used in locomotive-boilers probably the most abundant, as well as the most objectionable, is carbonate of lime. This is precipitated from solution in the boiler and collects upon the bottom of the same and upon the flues, and is there transformed by the heat into what is commonly termed "scale," adhering tightly and being removed only with the greatest difficulty.

One of the main objects of my present in-

vention is to thoroughly cleanse the feed-water of this impurity before it passes into the water-space of the boiler.

It is a well-known fact that carbonate of lime in itself is but slightly soluble in water, and that the large quantity held in solution by what is known as "hard water" is due to the presence therein of an excess of carbonic acid, which unites with the carbonate of lime, forming an acid carbonate or bicarbonate fairly soluble in water. Upon freeing the water from this excess of carbonic acid the lime is at once precipitated in the form of the insoluble carbonate. To drive out this excess of carbonic acid from the feed-water, I make use of two agents: first, the heat of the boiler, and, second, the circulating feed-water, the former tending to decompose the acid, and the latter, having itself been freed from the same, to dissolve a portion of the excess of acid in the feed-water.

The apparatus which I prefer to employ is, referring to the drawings, as follows: In the mud-drum *G*, I fit a three-winged partition *I*, dividing it into three compartments *M M' N*, as shown in Figs. 2, 3, and 4. The circulation-pipe *F* opens into one end of compartment *M*, as shown in Figs. 1 and 2. Compartments *M M'* are connected at the other end, as shown in Figs. 1, 4, and 5. Compartment *M'* opens through the holes *g g*, Figs. 1 and 3, into the water-space of the boiler, and compartment *N* communicates with both of the above compartments by means of the small openings *m m*, and is provided with suitable discharge-pipes, hereinafter described, to carry the sediment which collects therein out of the boiler. From the feed-water pipe *E*, which enters the boiler at *e*, a pipe *E'* extends through the water-space and discharges the feed-water into the forward end of the compartment *M'*, as shown in Figs. 1, 4, and 5.

The operation of this apparatus is as follows: The circulating water is carried up through the pipe *F* by the action of the heat applied thereto. Thence it enters the compartment *M* of the mud-drum and passes slowly along the same, depositing whatever sediment it may contain. At the opposite end of the drum it enters the compartment

M' and here meets the feed-water coming from the pipe E', already somewhat heated in its passage through the same, and, mingling with it, imparts to it a portion of its heat, while at the same time, being itself free from carbonic acid, it dissolves a portion of the excess contained in the feed-water. This sudden rise of temperature and loss of carbonic acid by the feed-water causes a rapid precipitation of carbonate of lime and the deposition of the same along the bottom of the compartment M'. In blowing out the sediment which collects in these pipes it is a great advantage to be able to discharge it on the side opposite to the one from which the wind happens to be blowing, to avoid bespattering the locomotive with the muddy water. To do this I attach to the discharge-pipe H, on the eduction side of the cock *h*, a T-coupling W, (shown in Figs. 1 and 6,) into which I fit lateral pipes H' H², leading out to the sides of the locomotive, and in this coupling I place a butterfly-valve V, pivoted at *v* and operated by means of a handle *v'*, to which is attached a rod *v²*, leading to the cab. When this valve is in the position shown in Fig. 6, the water will be discharged through the left-hand pipe; but by throwing it into the position shown by the dotted lines the water will escape at the opposite side.

The discharge-cock *h* may be of any desired pattern. I have represented it as operated by means of a bell-crank lever K, attached to a rod *k*, leading to the cab of the locomotive.

As many mud-drums G may be used as is desired, and the compartments M M' may be formed by separate pipes connecting at one end, and each provided with a discharge-passage N, without departing from the principle of my invention.

As it is frequently necessary to inspect the interior of the mud-drum, I provide a convenient opening for this purpose by drilling a hole through the front flue-sheet opposite the coupling *e'* in the pipe E', and fitting a screw-plug *e²* into this hole, extending it inward so as to also screw into the coupling *e'*, thus closing both openings, and at the same time supporting the pipe E'. 45 50

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

1. The combination of the circulation-pipe F, the mud-drum G, provided with means for blowing it out with the pipe E', which discharges the feed-water into said mud-drum at a point intermediate between the opening through which the circulating water enters and that through which it leaves said mud-drum, as and for the purpose stated. 55 60

2. The combination of the mud-drum G, containing the three compartments M M' N, with the circulation-pipe F, the feed-water pipe E', and the discharge-pipe H, as and for the purpose stated. 65

3. The combination of the boiler A, the circulation-pipe F, and the mud-drum G with the three-winged partition I, dividing said mud-drum into a discharge-passage N, and two circulation-passages M M', connected at one end and opening, respectively, into the circulation-pipe F and the water-space of the boiler, substantially as set forth. 70

4. The combination of the mud-drum G, the discharge-pipe H, the feed-water pipe E', and the screw-plug *e²*, as and for the purpose stated. 75

HERBERT HACKNEY.

Witnesses:

HARRY BITNER,
W. M. HILL.