G. R. HENDERSON.

LOCOMOTIVE.

APPLICATION FILED JUNE 12, 1911.

1,013,771.

Patented Jan. 2, 1912.

7 SHEETS—SHEET 1.

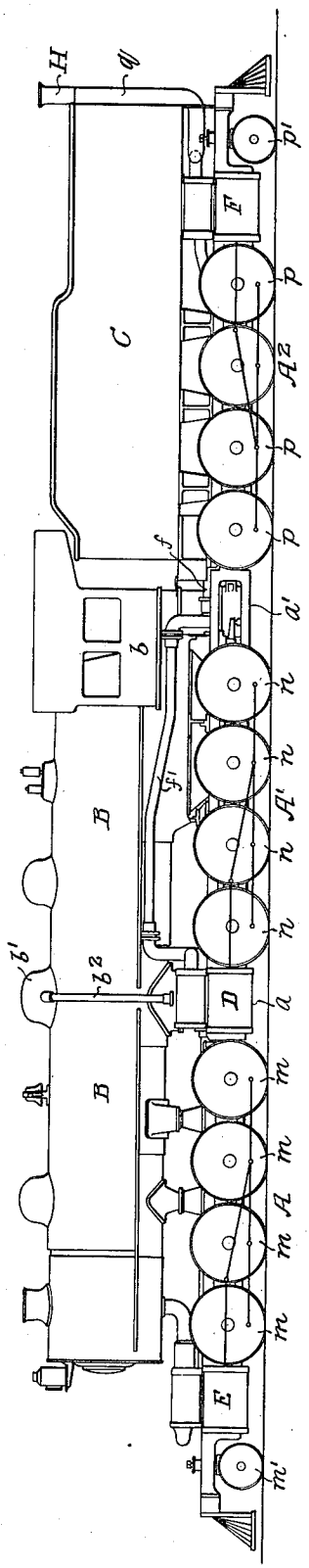

Fig. 1.

Witnesses.-
Wills A. Burrowes
Walter F. Dullinger

Inventor.
George R. Henderson
by his Attorneys.-
Howson & Howson

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7 SHEETS—SHEET 2.

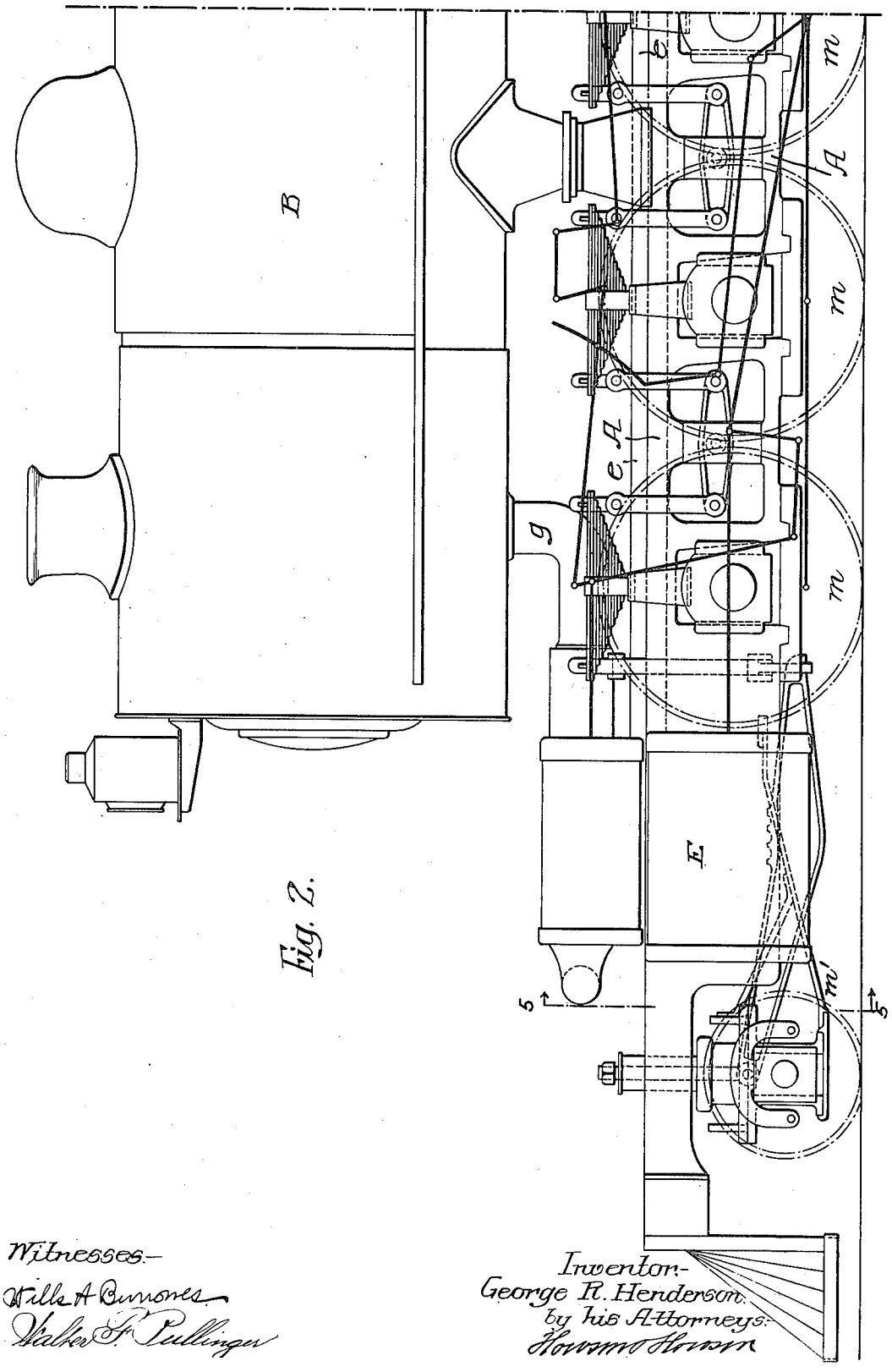

Fig. 2.

Witnesses:-
Willis A. Burnes
Walter F. Pellinger

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by his Attorneys:-
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7 SHEETS—SHEET 3.

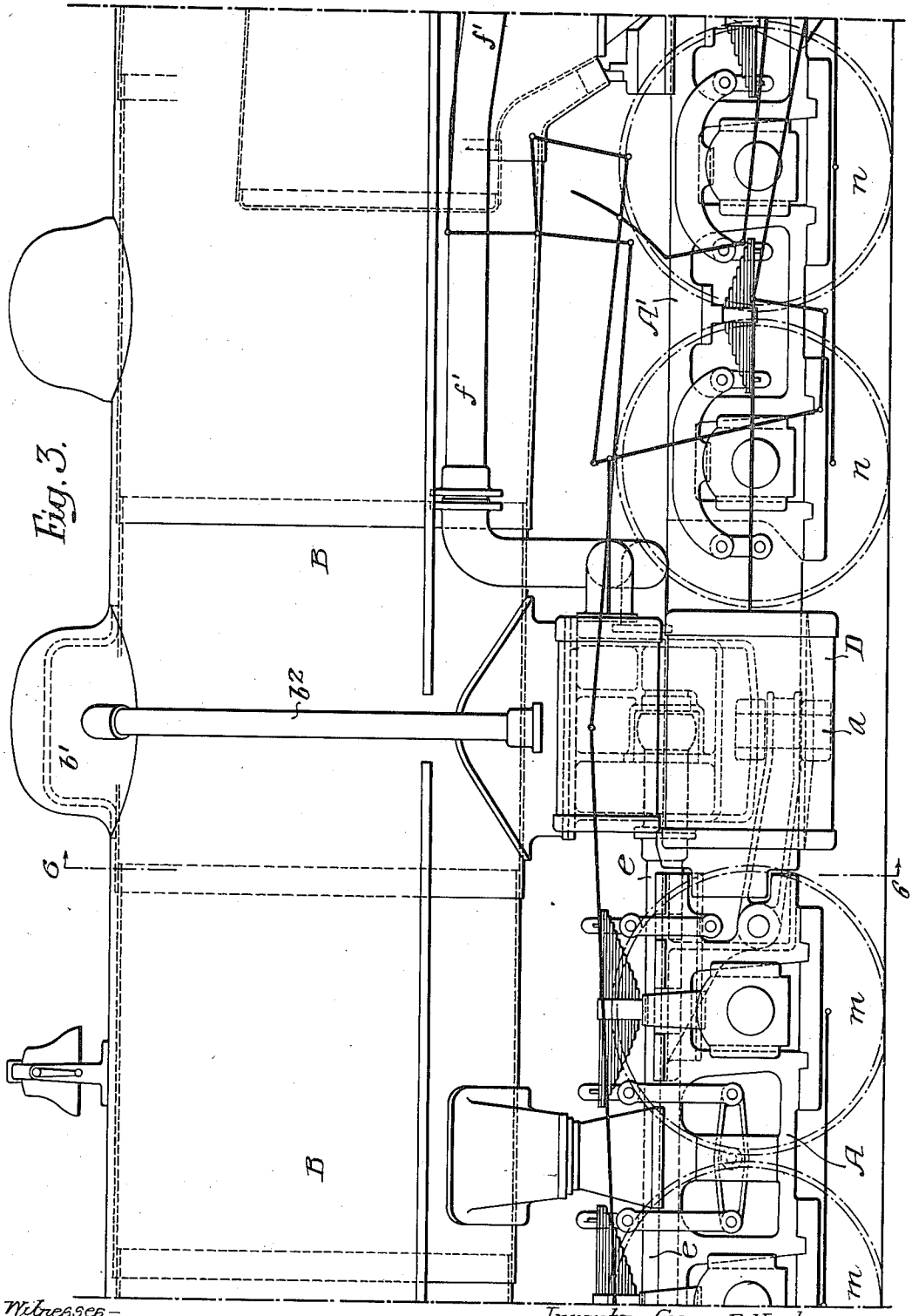

Fig. 3.

Witnesses.-
Wells & Simmons
Waller & Pullman

Inventor-George R. Henderson.
By his Attorneys.-
Howson & Howson

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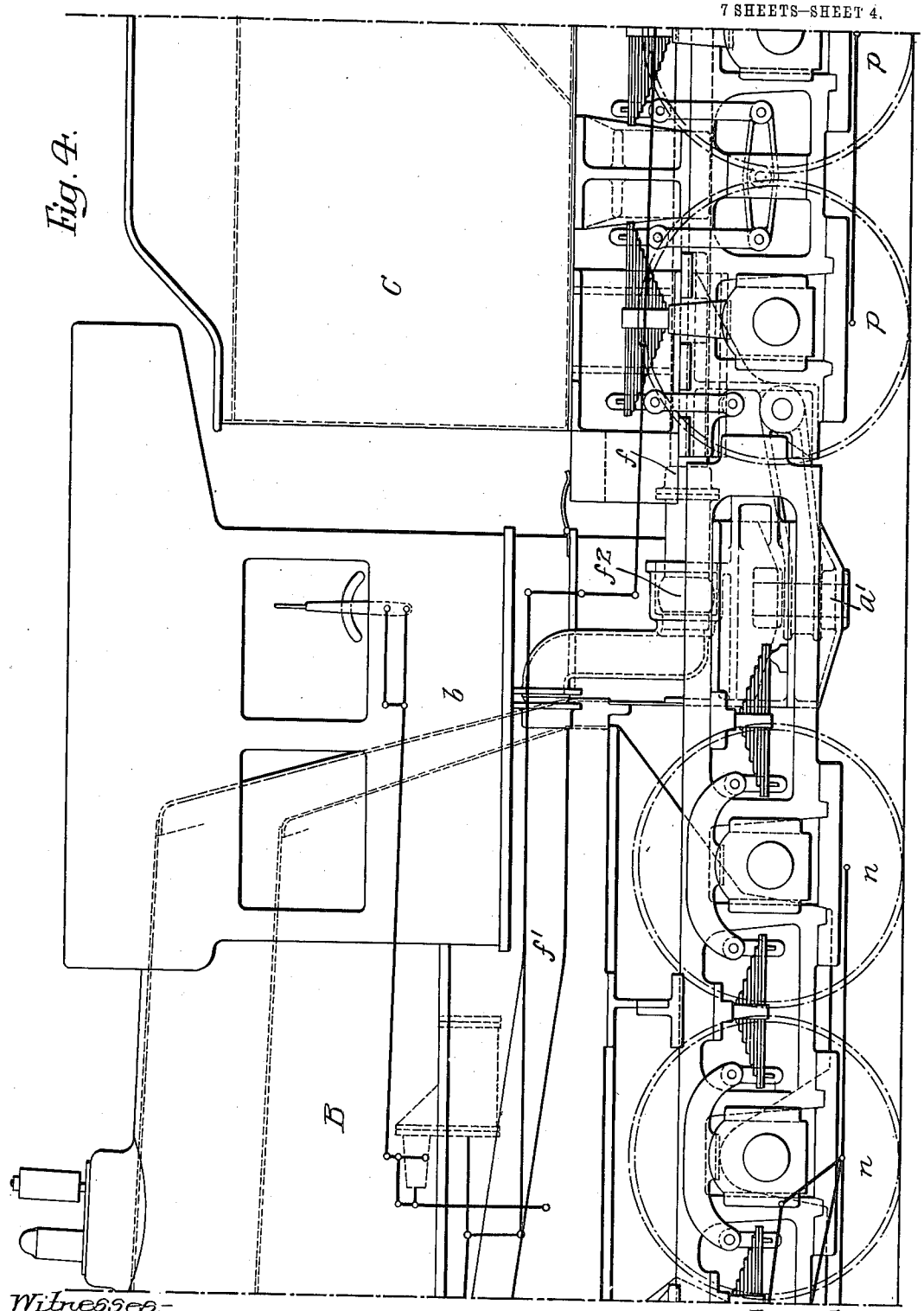
7 SHEETS—SHEET 4.

Fig. 4.



Witnesses.—
Wills A. Burrones
Walter F. Tullinger

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7 SHEETS—SHEET 5.

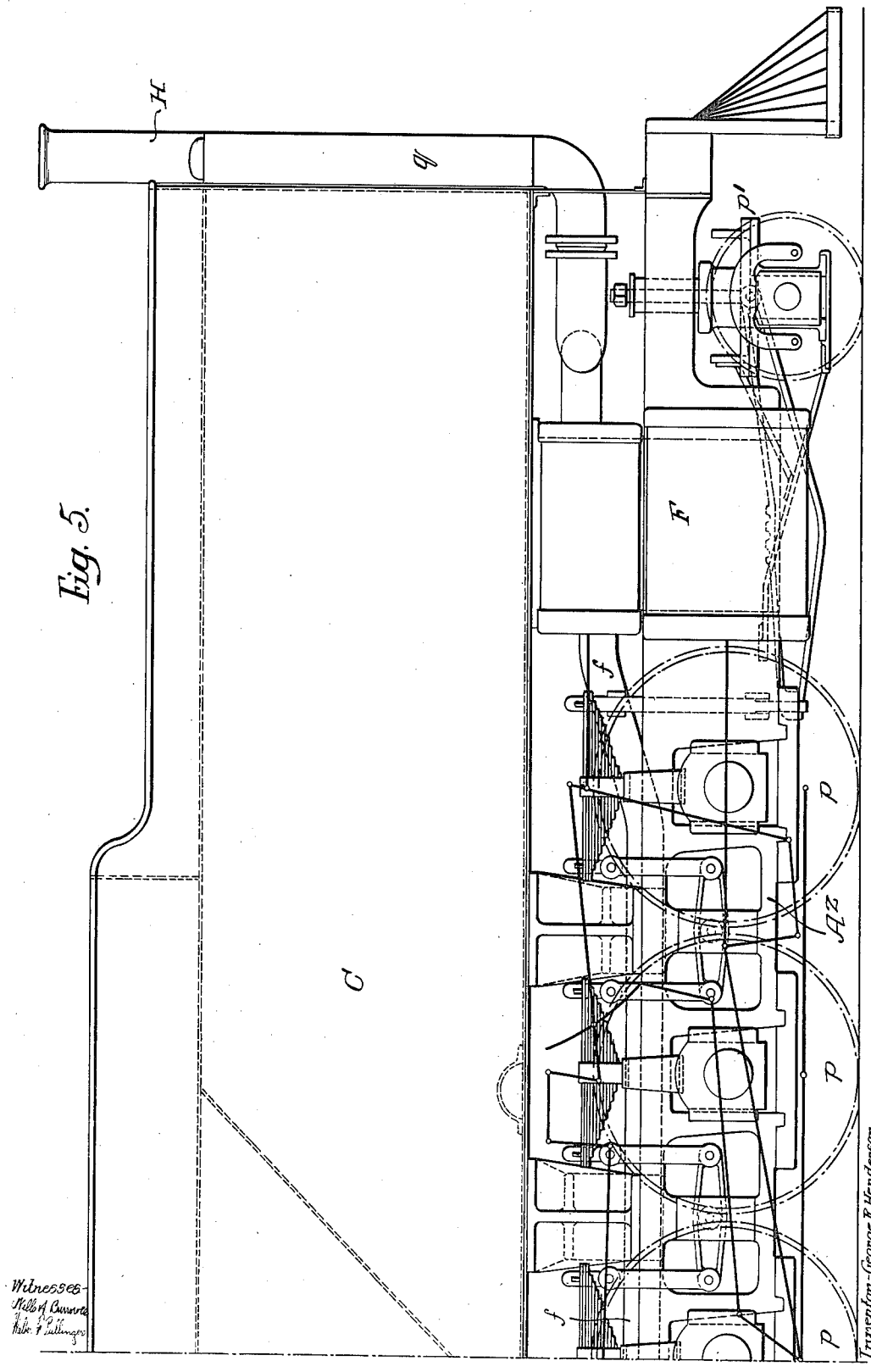

Fig. 5.

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7 SHEETS—SHEET 6.

Fig. 7.

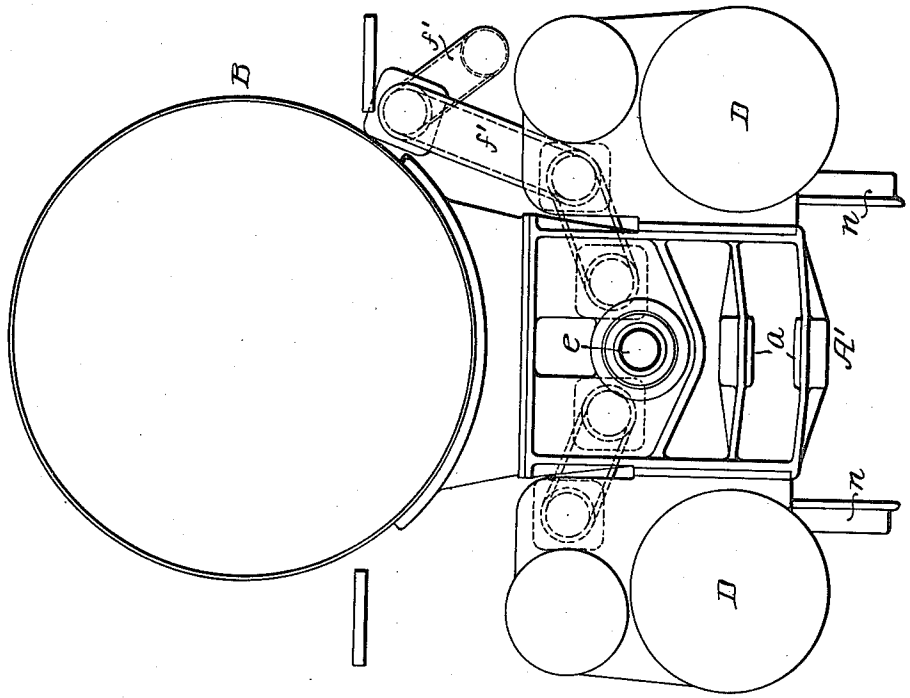
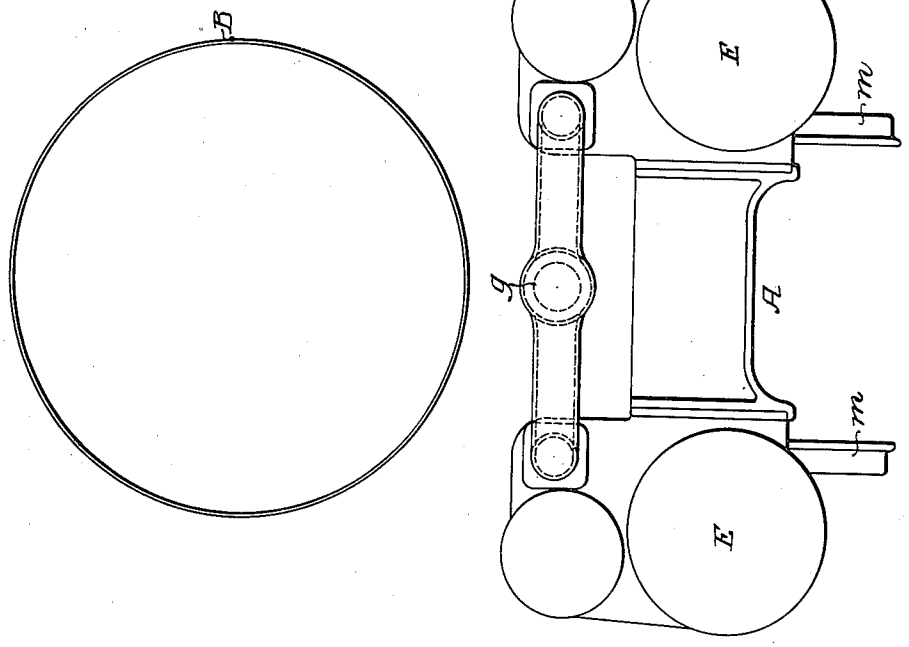


Fig. 6.



Witnesses—
Wills A. Burrows
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Inventor—
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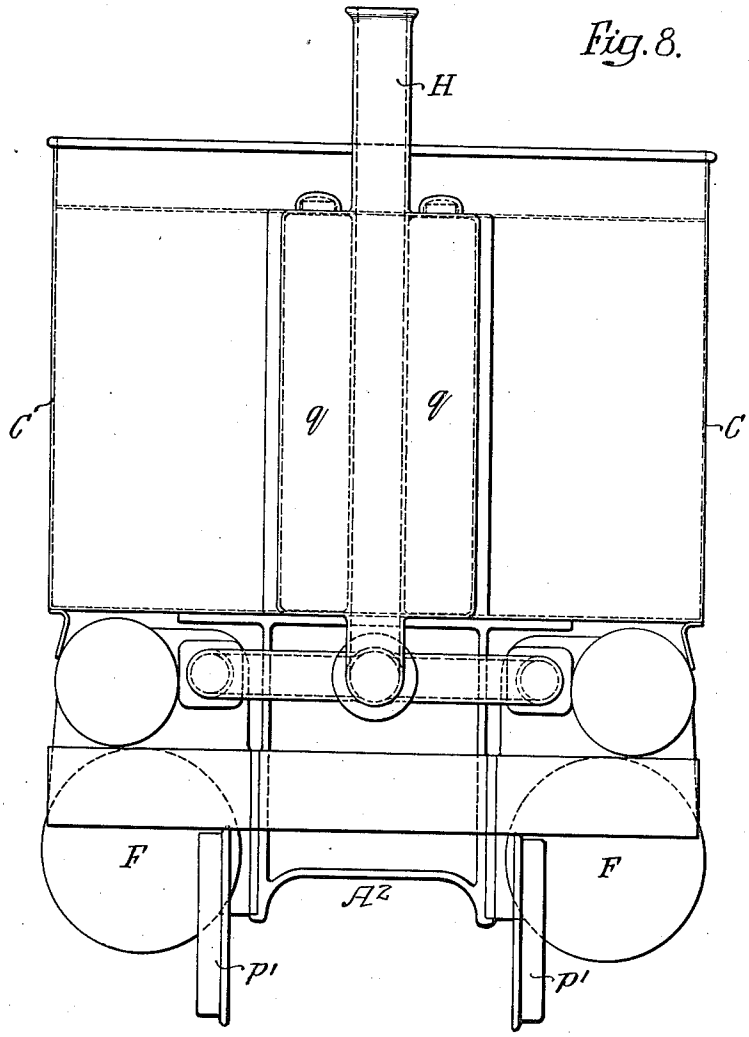
7 SHEETS—SHEET 7.

Fig. 8.



Witnesses.—
Wills A Burrowes
Walter R Pullinger

Inventor.—
George R. Henderson.
by his Attorneys.—
Howson & Howson

UNITED STATES PATENT OFFICE.

GEORGE R. HENDERSON, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE BALDWIN LOCOMOTIVE WORKS, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

LOCOMOTIVE.

1,013,771. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed June 12, 1911. Serial No. 632,727.

To all whom it may concern:

Be it known that I, GEORGE R. HENDERSON, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Locomotives, of which the following is a specification.

This invention relates to certain improvements in compound locomotives, especially of the type in which the locomotive boiler extends over two frames, which are coupled together by an articulated joint. In this type of locomotive the usual practice has been to use an ordinary tender and these locomotives are now of such size that the tender must be of an appropriate size and, consequently, must be heavier than those heretofore used.

One object of the invention is to utilize a large portion, or all, of the weight of the tender for purposes of adhesion and traction, as well as the weight of the locomotive proper. This object I attain by mounting the tender on a driven element corresponding in many parts to the two elements on which the locomotive boiler is mounted so that, in the present instance, there are three independent driving units to form a triple, compound locomotive.

A further object of the invention is to design the locomotive so that all the cylinders will preferably be of the same diameter and to direct the exhaust from the high pressure cylinder to the two low pressure cylinders, one at the forward end of the locomotive and the other at the tender.

In the accompanying drawings:—Figure 1, is a side view, in outline, illustrating my invention; Figs. 2 to 5, inclusive, illustrate fractions of the locomotive, in the order of numbering, drawn to an enlarged scale; Fig. 6, is a transverse, sectional view on the line 5—5, Fig. 2; Fig. 7, is a transverse, sectional view on the line 6—6, Fig. 3, and Fig. 8, is a rear elevation.

Referring to the drawings, A is the forward frame of the locomotive and A′ is the intermediate frame. These two frames are connected by an articulated or hinged joint at *a*, which is the common method of connecting the two frames of an ordinary articulated locomotive.

A^2 is the rear frame of the locomotive, connected to the intermediate frame A′ by an articulated joint *a′*, which may be similar to the joint *a*. Mounted rigidly, in the present instance, upon the intermediate frame A′ is the boiler B. This boiler extends over the forward frame A and has a sliding support thereon; so that, when the locomotive is turning curves, the frame A may have a lateral movement independently of the boiler B and the intermediate frame A′. At the rear end of the boiler is the usual cab *b* for the engine driver and this cab terminates substantially on a line with the articulated joint coupling the intermediate frame A′ with the rear frame A^2. The rear frame A^2 of the locomotive is, in fact, the tender of the locomotive, having the tank C and the space for the fuel.

The boiler, while shown as a continuous boiler rigidly supported on the intermediate frame and freely overhanging the forward frame, may be made in two sections; each section rigidly mounted on its frame and connected together by a flexible joint. The boiler may be used entirely for the generation of steam, or it may be used partly for the generation of steam and partly for superheating, or heating the feed water with which the boiler is supplied.

D are the high pressure cylinders, one located on each side of the intermediate frame A′ of the locomotive and E and F are the low pressure cylinders, one on each side of the frames A and A^2. The cylinders D have valve chests of the ordinary type and steam is supplied to the cylinders directly from the steam dome *b′* of the locomotive boiler through the pipes b^2, one at each side of the boiler. The exhaust ports of the cylinders D communicate with the steam space of the two low pressure cylinders E and F on each side of the locomotive and *e* is a pipe leading to the steam space of the cylinder E. *f* is a pipe leading to the steam space of the cylinder F. The pipe *e* is preferably coupled on a line with the pivot *a* by a ball and socket connection with the exhaust passage from the cylinder D, while the pipe *f*, which is on the tender frame A^2, is connected to a fixed pipe *f′* in the intermediate frame A′ by a flexible connection f^2 on a line with the pivot *a′*. By this construction, live steam is supplied to the cylinders D on the intermediate frame and the exhaust steam from these cylinders is divided; part passing to the low pressure cylinder E on the forward

frame of the locomotive, and part passing to the cylinder F on the rear or tender frame of the locomotive. The exhaust from the low pressure cylinder E passes through a pipe *g* into the smoke box and escapes through the usual nozzle direct to the stack, while the exhaust from the cylinder F passes through a pipe H projecting upwardly at the rear of the tender and this pipe terminates at a point preferably above the top of the tender, and, in fact, above the top of the cars of the train.

In the present instance, the intermediate frame A′ is mounted on eight driving wheels *n*, four on each side, and these driving wheels are all coupled to the piston of the engine in the ordinary manner. The front frame is mounted on eight driving wheels *m*—four on a side—and a two wheel radial truck of the ordinary type. The rear tender frame is also mounted on eight wheels *p* and connected in the ordinary manner to the piston in the cylinder F and at the rear of the frame is a two-wheel radial truck *p′*, similar to the truck *m′* in the present instance. The ordinary type of equalizing beams is used throughout. The valve motion for the three sets of cylinders is operated by means of a power mechanism controlled from the cab so that all the valve motions can be operated uniformly and together.

The locomotive, as illustrated, shows an equal number of driving wheels under each of the four sections with a two-wheeled truck at each end of the cylinders of the same size, which gives a ratio of compounding 2 and it is evident that these cylinders may be made of different diameters and that any combination of driving wheels and truck wheels may be used in order to obtain any particular weight and arrangement of engine desired.

The engine can be run either forward or backward with equal effectiveness, as the rear frame is coupled to the intermediate frame in the same manner as the forward frame. The boiler can be made, as above remarked, in a single shell and has flexible or articulated steam pipes so that when steam at a greatly reduced pressure is used the difficulty of maintaining the same is proportionately reduced.

In order to provide means for applying sand to the tracks, when the locomotive is running backward, I provide, in the present instance, a sand box *q* at the rear of the tender, and this sand box preferably surrounds the exhaust pipe, or is located in contact with one side of the exhaust pipe, as clearly shown in Fig. 8, so as to heat the sand to the proper temperature.

It will be understood that in some instances the high pressure steam may be used in all of the cylinders, if considered desirable, by simply reducing them to a size inversely proportional to the mean effective pressure operating the pistons in these cylinders.

When the locomotive is built, as indicated in the drawings, the parts are duplicated for the different frames of the locomotive; the two low pressure cylinders at each side of the locomotive being similar to the high pressure cylinder—thus economizing considerably in the construction and gaining a result which will utilize a large proportion of adhesion and traction, as well as the weight of the locomotive proper.

When I use the term "tender" as applied to the locomotive, I mean an independent frame connected to the locomotive having either the usual water tank and fuel connection, or any equivalent, whereby the frame is sufficiently weighted to give the driving wheels the necessary adhesion, and I may, in some instances, so construct the locomotive that a single frame carries the boiler, driven by high pressure or compound cylinders and a tender frame independently driven and having low pressure cylinders receiving steam from either the high pressure cylinder or the low pressure cylinder of the locomotive frame.

In some instances, where a large engine is desired, more than three frames may be used, each independently driven, without departing from the essential features of the invention.

The exhaust from the cylinders mounted on the tender frame may be allowed to escape to the atmosphere, or may be utilized to heat the train, or to heat the tender water, or for other purposes where a moderate heat is desired. If the tender water is heated a pump will then be used to supply the boiler.

It will be understood that the pipe connections between the several sections are flexible so that they will accommodate themselves to the articulation of the locomotive and, in the present instance, the pipes are connected by ball joints and one of the sections is arranged to slide in the other. Other connections may be used without departing from the essential features of the invention.

I claim:

1. The combination in a compound articulated locomotive, of a series of frames; pivots connecting the said frames; a set of driving wheels for each frame; a pair of cylinders on each frame and through which the wheels are driven; a boiler located above two of the frames; a tender mounted on the other frame; steam pipes leading from the boiler to the cylinders on one frame and pipes leading from said cylinders to the cylinders on the other two frames.

2. The combination in a compound articulated locomotive, of a series of frames pivotally connected; a boiler fixed to the inter-

mediate frame and overhanging the forward frame; a tender carried by the rear frame; cylinders on the front end of the forward frame and on the front end of the intermediate frame also on the rear end of the rear frame; pipes leading from the steam dome of the boiler to the cylinders on the intermediate frame and pipes leading from the exhaust chambers of the cylinders on the intermediate frames to the steam space in the cylinders on the forward and rear frames, and driving wheels on each frame driven from the cylinders on said frames.

3. The combination in a compound articulated locomotive, of a series of frames pivotally connected; independent driving wheels carrying each of said frames; cylinders on each frame; a boiler extending over two of the frames; a tender mounted on the other frame; a radial truck at the forward end of the forward frame and at the rear end of the rear frame; and means for supplying steam from the boiler to the several cylinders.

4. The combination in an articulated locomotive, of a series of frames pivotally connected; driving wheels supporting each frame; cylinders carried by each frame and through which the wheels are driven; a boiler extending over the forward and the intermediate frames; a tender mounted on the rear frame; pipes supplying steam from the boiler to the cylinders on the intermediate frame; pipes extending from the exhaust space of said cylinders to the steam space of the cylinders on the forward and rear frames; an exhaust pipe leading from the cylinder frame to the stack of the locomotive; and a pipe extending at the end of the tender and communicating with the exhaust space of the rear cylinders.

5. The combination in a tender of a locomotive, consisting of a frame; a water receptacle thereon; driving wheels supporting the frame; cylinders mounted on the frame and through which the wheels are driven; said cylinders having a rear exhaust pipe extending upward; with a sand box in close proximity to the exhaust pipe so that the sand is heated to the proper degree.

6. The combination in a compound locomotive, of two frames pivotally connected; one frame carrying the locomotive boiler and the other carrying the tender; driving wheels supporting each of said frames; cylinders on each frame; means by which the driving wheels of each frame are independently driven, the cylinders on the boiler frame being the high pressure cylinders and the cylinders on the tender frame being the low pressure cylinders; and pipe connections between the two sets of cylinders.

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

GEORGE R. HENDERSON.

Witnesses:
WM. E. SHUPE,
WM. A. BARR.