W. J. LEIGHTY.

BOILER FOR ARTICULATED LOCOMOTIVES.

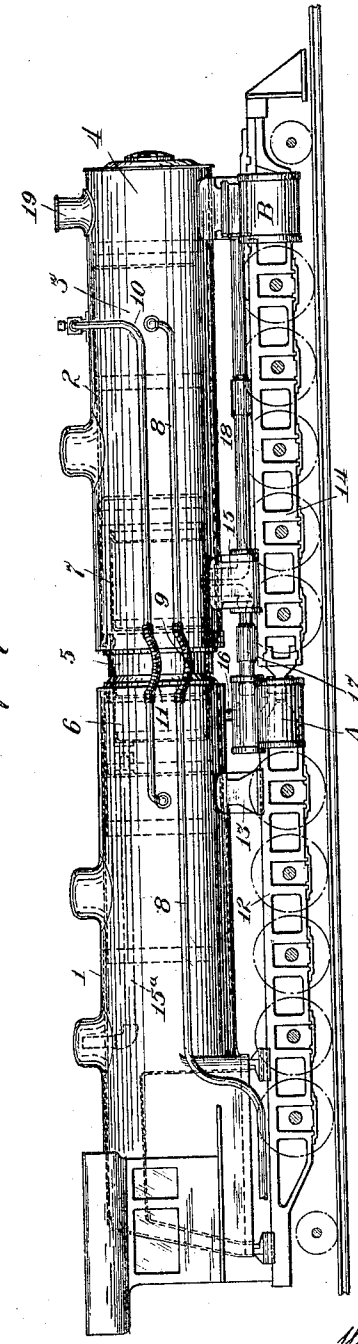
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4 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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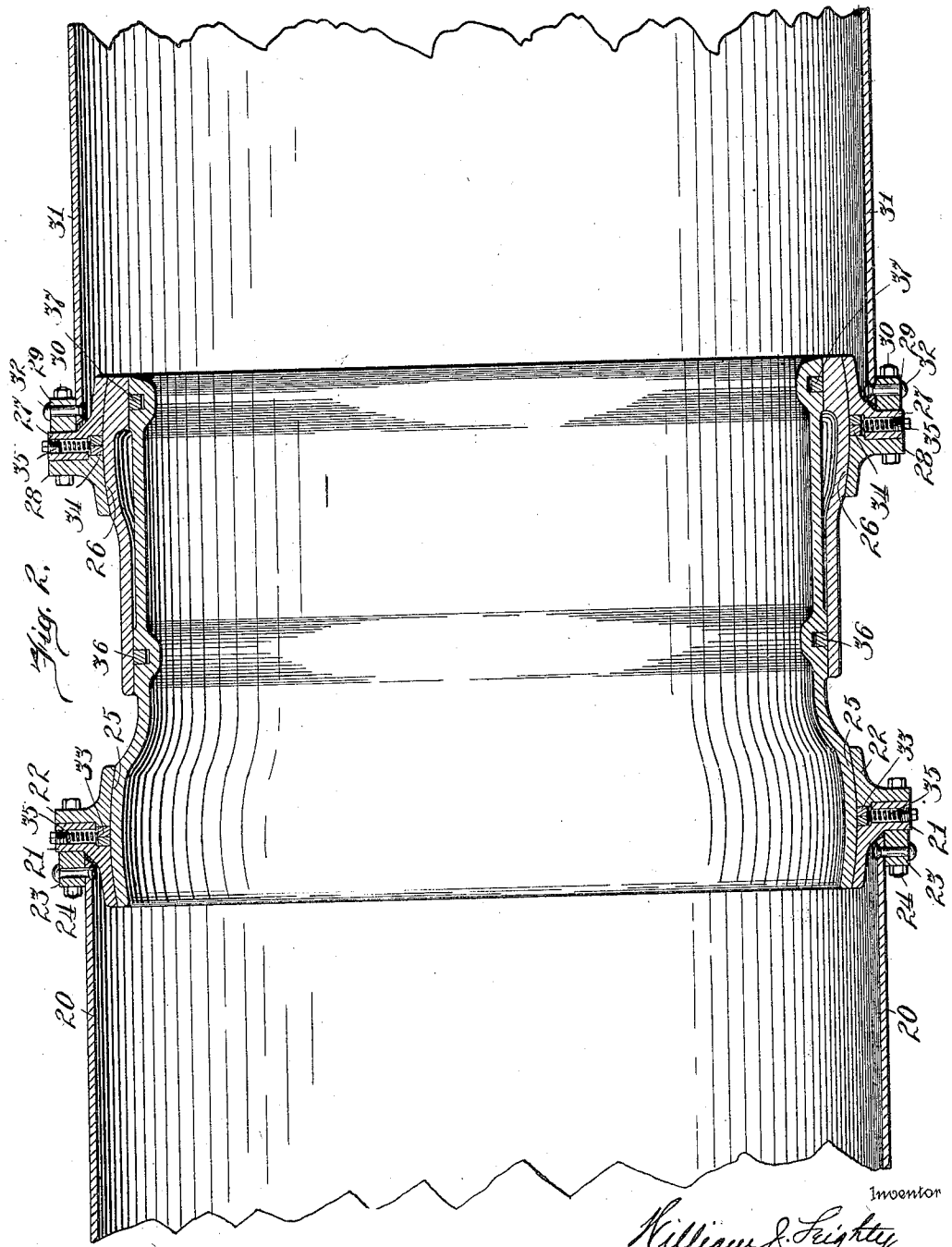


Fig. 2.

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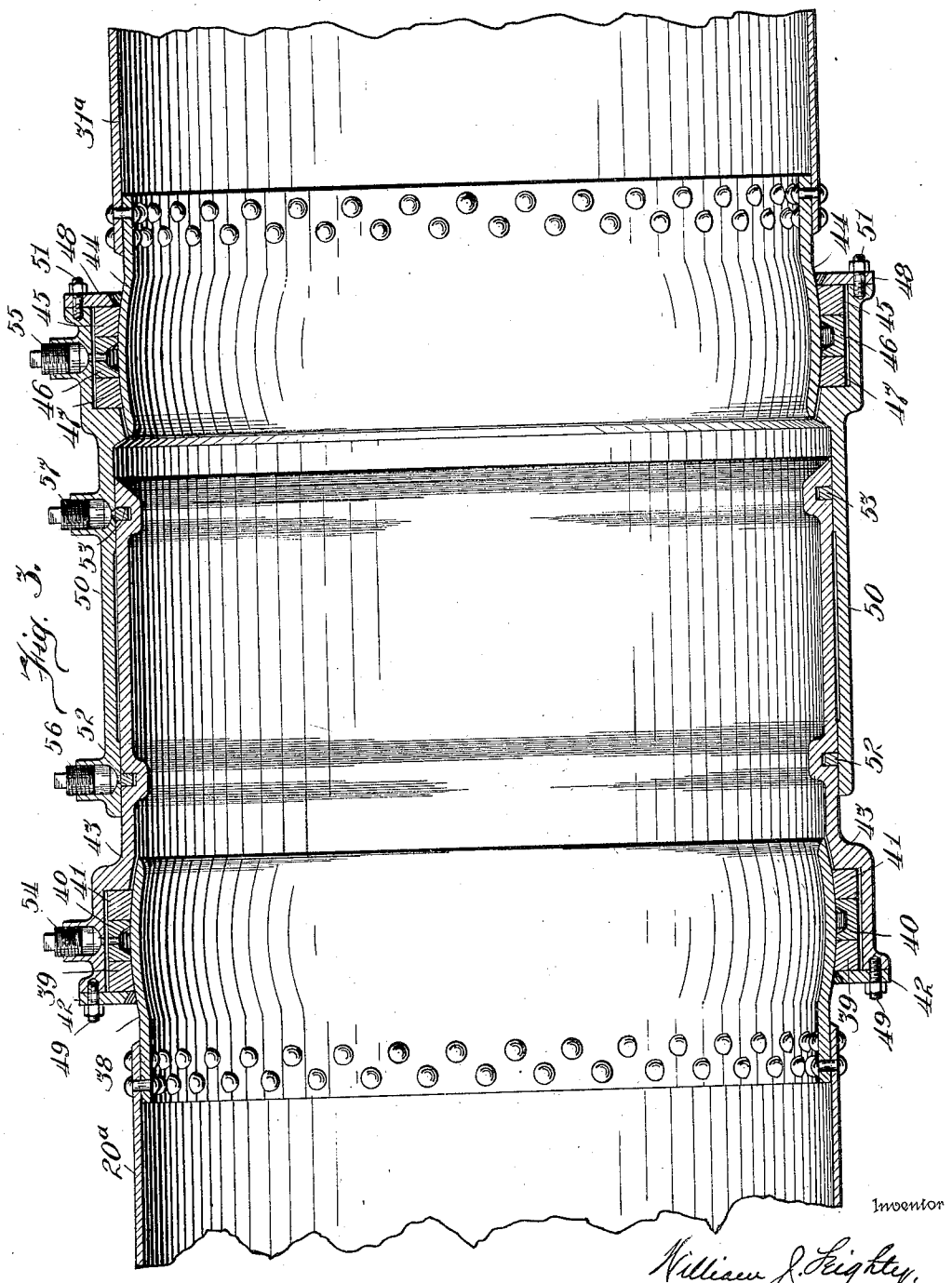


Fig. 3.

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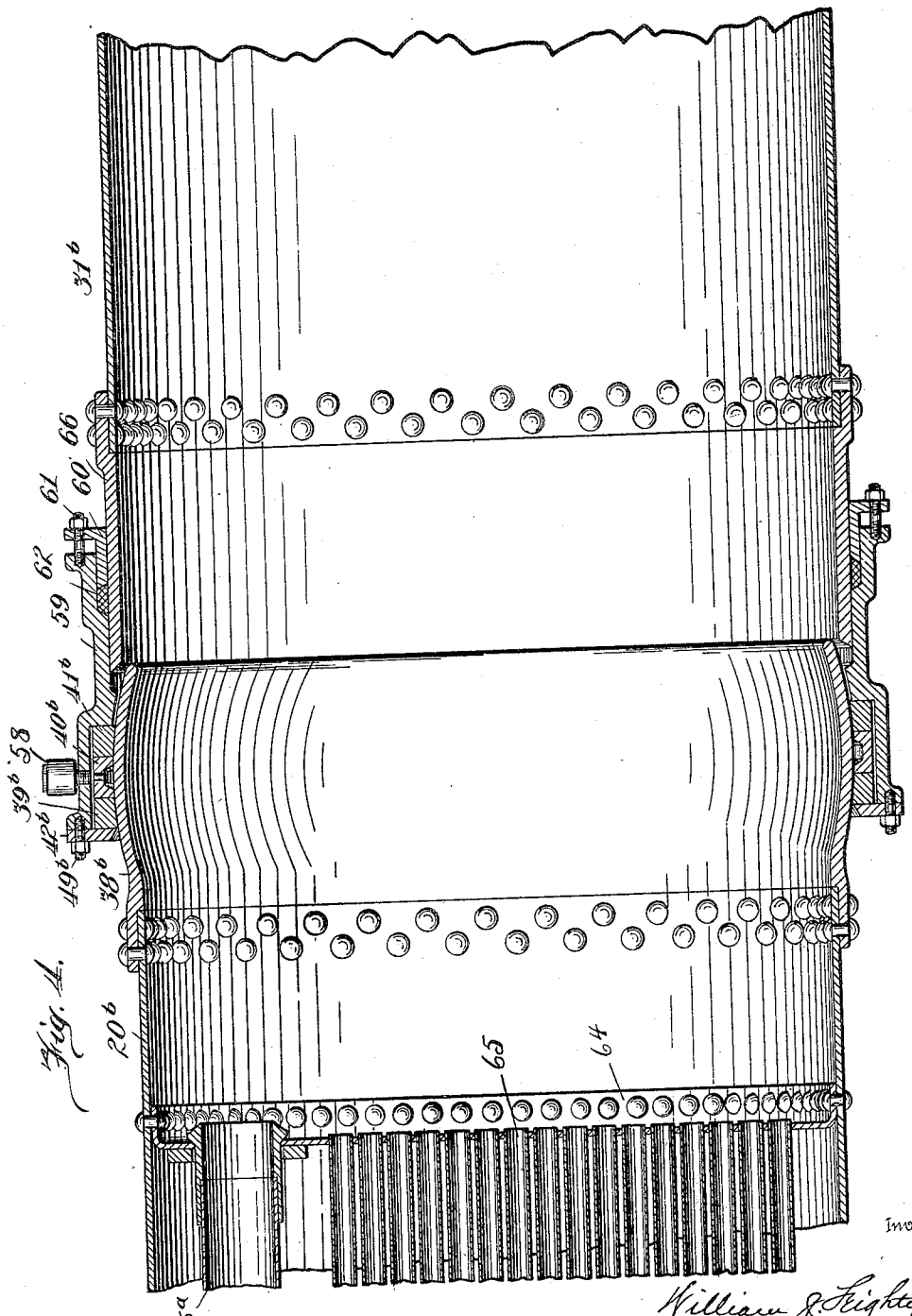


Fig. 4.

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UNITED STATES PATENT OFFICE.

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BOILER FOR ARTICULATED LOCOMOTIVES.

1,074,877. Specification of Letters Patent. **Patented Oct. 7, 1913.**

Application filed July 28, 1910. Serial No. 574,300.

To all whom it may concern:

Be it known that I, WILLIAM J. LEIGHTY, a citizen of the United States, and resident of Topeka, in the county of Shawnee and State of Kansas, have invented a certain new and useful Improvement in Boilers for Articulated Locomotives, of which the following is a description, reference being had to the accompanying drawings, which form a part of my specification.

My invention relates to a flexible joint for boilers on articulated locomotives; the object being to provide a flexible joint whereby the two parts of the boiler of an articulated type of locomotive are connected together, *i. e.*, a locomotive consisting of two independent sets of mechanism attached to two frames which are hinged or coupled together, thus allowing a long wheel base, but providing enough flexibility for the locomotives to pass around curves.

The object of my invention is to provide means whereby the two parts of the boiler may be rigidly attached to the two independent frames of the locomotive, permitting the two parts of the boiler to follow the relative movement of the frames to which they are attached.

A further object of my invention is to provide space for superheating means for the two locomotives and a simple steam pipe arrangement with the least possible number of flexible joints in the steam pipes.

Another object of my invention is to provide as large a flexible joint as possible in order to keep the temperature of the walls as low as possible and thus allow more favorable conditions of the lubrication of the joints.

A still further object of my invention is to provide a joint which is readily separable, allowing the two sections of the locomotive to be easily parted in order to make repairs on the flues and the like.

The advantages of my invention will be more clearly understood from the following detailed description of the accompanying drawings, wherein:—

Figure 1 is a side elevation of a locomotive equipped with my improved flexible joint. Fig. 2 is a longitudinal sectional view of the flexible joint of the boiler shown on an enlarged scale. Fig. 3 is a longitudinal sectional view illustrating a modified form of the flexible joint of the boiler. Fig. 4 is a longitudinal sectional view of another modified form of the flexible joint of the boiler.

In Fig. 1 I have illustrated the flexible joint applied to a locomotive consisting of two ten coupled units, in which 1 represents the rear or fire-box end of the boiler, which consists of the boiler proper, *i. e.*, the part that is used for generating the steam; while the front part 2 of the boiler constitutes a feed-water heater 3, and a smoke box 4. These two parts 1 and 2 are connected by the flexible joint 5, see Fig. 1, which forms the intermediate part of the boiler shell and surrounds that portion of the boiler shell which I will designate as the superheating combustion chamber which is occupied by the superheaters 6 and 7 which supply the engines for the rear and forward sets of driving mechanism, respectively. The boiler feed-water is supplied to the feed-water heater 3 by the injector pipes 8, see Fig. 1, leading from the injectors. The injector pipes 8 are provided with flexible means 9 which allow the pipes to articulate with the parts of the boiler and frame. The feed-water is conducted from the feed-water heater 3 to the boiler 1 by the pipes 10, which pipes are also provided with the flexible means 11 for the same purpose as that mentioned in connection with the flexible means 9 of pipes 8. The front end of the rear part 1 of the boiler is rigidly secured to the frame 12 by the saddle 13; while the rear end of the forward part 2 of the boiler is rigidly secured to the frame 14 by the saddle 15. The steam distribution indicated in Fig. 1 applies to an articulated locomotive in which the rear part is the high pressure engine, while the forward part is the low pressure engine. The steam is delivered to the high pressure superheater 6, see Fig. 1, through the dry pipe 15^a, shown in dotted lines, and is conducted from the superheater by the steam pipe 16 to the high pressure cylinders A. The steam is conducted from the high pressure cylinders A to the saddle 15 through the flexible steam pipe 17, which, in my improved construction, is the only flexible steam pipe required in the entire locomotive.

The steam is conducted to and from the low pressure superheater 7, located in the forward part of the boiler, through the saddle 15 and from the low pressure superheater forward to the low pressure cylinders B by means of the steam pipe 18. The gases of combustion pass from the fire-box in the rear portion through the boiler into the superheating combustion chamber, which surrounds superheaters 6 and 7, passing through the flexible boiler joint 5, passing on forward through the feed-water heater 3 and smoke box 4 and out through the smoke stack 19 into the atmosphere.

The construction of the flexible joint can more clearly be understood by referring to Fig. 2. The joint consists of what may be termed two ball and socket or spherical joints provided with an expansion joint between them. The rear part of the boiler shell 20 is secured to the members 21 and 22 by means of the annular ring 23 which is riveted to the boiler shell 20 by the bolts 24; the members 21 and 22 constituting the socket of the rear ball. The member 25 which may be said to be the ball of the rear joint, forms the inner cylinder of the expansion or flexible joint; while the member 26, which constitutes the ball of the forward joint, forms the outer shell of the expansion or flexible joint. The members 27 and 28 are secured to the ring 29 by the bolts 30, and form the socket on the forward joint; and the ring 29 is secured to the forward boiler shell 31 by the rivets 32. It is apparent from this construction that the thrust required to operate the expansion joint is carried by the socket members 21, 22, and 27, 28 of the spherical joint. In order to insure these joints being air tight, I provide the packing rings 33 in the rear spherical joint, and 34 in the forward spherical joint; and the tension of these packing rings is regulated by the springs 35, which are preferably inserted in holes drilled in the members 21 and 27. The cylindrical or spherical member 25 is preferably provided with annular grooves on its outer surface into which are placed the packing rings 36 and 37 which insure the expansion joint being air tight, as these rings are placed at a point where the member 26 takes up flush against the member 25, see Fig. 2. It is apparent from this construction that the joint is sufficiently flexible to permit of any necessary horizontal, vertical or longitudinal movement.

In Fig. 3 I show a modification of my invention, wherein the thrust of the expansion joint is carried by the expansion rings on the spherical joint, the rear boiler shell 20^a being riveted to the rear ball or member 38 of the spherical joint. The expansion rings 39, 40, and 41, are placed about the member 38, engaging the surface thereof and are held in place by the annular ring 42 which is secured to the inner cylindrical member or wall 43 of the expansion joint by means of studs 49. The ball or member 44 of what may be termed the forward spherical joint is riveted to the shell 31^a of the forward part of the boiler. Expansion rings or members 45, 46, and 47 are arranged to engage the spherical surface of member 44 and are secured in place by an annular ring 48 which in turn is secured to what may be termed the outer cylindrical wall or member 50 by the studs 51. These expansion rings 39, 40, 41, and 45, 46, 47 of the spherical joints make them air tight; and in order to insure the expansion joint being air tight, I prefer to provide the packing or expansion rings 52 and 53 which are seated in the circumferential grooves with which member 43 is provided; the rings 52 and 53 being placed where they will take against the smooth surface of member 50 which impinges on the member 43. The various expansion or packing rings are lubricated through lubricating cups 54, 55, 56 and 57; while the expansion rings 40 and 46 of the spherical joints are preferably provided with annular grooves in the inner faces for the purpose of carrying a lubricant for the spherical joints. It can be readily seen that the flexible joint just described will give the necessary horizontal, vertical and longitudinal movement to which the joint may be subjected.

In Fig. 4 I illustrate another modification of my invention, this construction it might be said is a modification of Fig. 3 having but one spherical joint and expansion joint. In this construction the rear boiler shell 20^b is riveted to what may be termed the ball member 38^b of the spherical shell of the joint. The expansion rings or members 39^b, 40^b and 41^b are provided which engage with the spherical surface of the member 38^b and are secured in place by the annular ring 42^b which is secured in any suitable manner to the end of the outer longitudinal shell of member 59 of the expansion joint, as for example, by studs 49^b. A packing gland 60, in the nature of a band or ring, compresses the high heat-resisting lubricated packing 62 by means of the studs 61 which take through the vertical extending portion of the gland 60 and into the end of the cylindrical shell of member 59. I have shown the shell 31^b of the forward part of the boiler provided with the extension or member 66 riveted thereto, about which the packing gland 60 takes; the member 66 normally taking about the inner edge of the member 38^b, as clearly shown in Fig. 4. The ring 40^b is preferably provided with an annular groove on its inner face, which groove is provided for the purpose of carrying the lubricant obtained from the lubricating cup 58. The front flue sheet 64 of the boiler is

shown riveted into the boiler shell 20[b]. The forward end of the dry pipe 15[a] is shown in its relation to the front flue sheet of the boiler; the front end of the boiler tubes are also shown at 65, secured to the flue sheet 64.

In smaller articulated locomotives or in those where the vertical movement required of the flexible joint is very slight, the modification shown in Fig. 4 and just described, will be found adequate to suit the conditions to which the joint may be subjected.

By having the flexible joint as near the diameter of the boiler as possible, the gases of combustion will have ample room to pass through and thus impart as little heat to the walls of the joint, as possible, and in this manner keep the temperature of the walls of the joint comparatively low, and thus aid the lubrication of the joint.

The object of my invention is to make a practicable and economical construction that will simplify the construction of the rigid boilers such as are now in use on articulated locomotives and are supported on the front or movable frame by sliding supports. Such a construction necessitates the use of complicated steam pipes provided with numerous flexible steam joints. With my improved construction the number of flexible steam joints are reduced to a minimum; and with the front part of the boiler rigidly secured to the frame and made to articulate with it, permits the center of gravity of the boiler to remain at all times in the same relation to the frames and driving mechanism of the locomotive.

I have shown and described what I believe to be the simplest form of my invention, but the same may be altered in a number of details without departing from the spirit of my invention, and I do not wish to be understood, therefore, as limiting myself to the exact construction shown and described, but

What I claim as my invention and wish to secure by Letters Patent is:—

1. A boiler made in two sections, one section being articulated to the other by a movable joint connection.

2. A boiler made in two sections, one section being articulated to the other by a two part movable joint flue.

3. A boiler made in two sections, a coupling member secured to each of said sections, said coupling members being articulated by a movable joint.

4. A boiler made in two sections, means intermediate of said sections, the interior diameter of said means being substantially the same as the interior diameter of said boiler sections whereby the boiler sections may have independent movement.

5. A locomotive boiler made in two sections disposed one in advance of the other, and an articulated flue whose interior diameter is substantially the same as the interior diameter of said sections and attached at its opposite ends thereto to constitute the coupling member.

6. A boiler made in two sections and provided with a smoke box in the adjoining ends of said sections, said sections being secured together by an articulated flue of substantially the same diameter as said boiler sections, said flue permitting of the relative movement of said boiler sections.

7. A boiler made in two sections, means intermediate of said sections formed to provide a ball and socket joint between said sections of substantially the same diameter as said boiler sections.

8. A boiler made in two sections, each section provided with a smoke box in the adjacent ends, and a pair of members intermediate of said sections, formed to provide ball and socket and expansible joints whereby the sections may have universal and longitudinal movement.

9. A locomotive boiler made in two sections, one disposed in advance of the other and spaced apart, and an intermediate movable joint section whereby the two boiler sections are coupled together, said intermediate section constituting a flue for the boiler.

10. A boiler made in two sections, and means secured to the adjacent ends of said sections, formed to provide ball and socket and expansible joints capable of universal and longitudinal movement.

11. A boiler made in two sections spaced apart, and a pair of members arranged intermediate of the sections to form a flue for the boiler of substantially the same diameter as said sections, said members being formed to provide spherical and expansible joints capable of universal and longitudinal movement.

12. A boiler made in two sections, the one section disposed in advance of the other section, and means removably secured to the adjacent ends of said sections whereby ball and socket and expansible joints are provided capable of horizontal, vertical and longitudinal movement.

13. A boiler made in two sections, the one section in advance of the other section, and means secured to the ends of said sections arranged to form two ball and socket joints, said means permitting longitudinal movement.

14. A boiler made in two sections, one section in advance of the other, and means coacting with the adjacent ends of said boiler sections to provide an interlocking joint therefor.

15. A boiler made in two sections, one section in advance of the other, and means coacting with the adjacent ends of said boiler sections to provide an interlocking

joint therefor, whereby an articulated flue is provided of substantially the same diameter as the boiler sections.

16. A boiler made in two sections, one section in advance of the other, and means coacting with the adjacent ends of said boiler sections arranged to provide interlocking ball and socket and expansible joints capable of universal and longitudinal movement.

17. A boiler made in two sections, one section in advance of the other, and means coacting with the adjacent ends of said boiler sections arranged to provide interlocking ball and socket joints whereby an articulating flue is provided of substantially the same diameter as the boiler sections.

18. A boiler made in two sections, one section in advance of the other, and means coacting with the adjacent ends of said boiler sections to provide an interlocking and expansible joint capable of universal movement whereby an articulating flue is provided of substantially the same diameter as the boiler sections.

19. A boiler made in two sections, a combustion chamber between the two sections, the casing of the combustion chamber being cylindrical and of substantially the same diameter as said boiler sections, said casing comprising non-flexible sections so connected as to constitute a substantially universal joint.

20. A boiler made in two sections, a combustion chamber between the two sections, the casing of the combustion chamber being cylindrical in form and constituting a flexible joint.

21. A boiler made in two sections, means whereby the two sections are flexibly joined together, a portion of said means constituting a ball and socket joint, while the other portion constitutes a sliding or expansible joint.

22. A boiler made in two sections, means whereby the two sections are flexibly joined together, said means being formed of non-flexible sections which are of substantially the same diameter as the boiler sections, and means whereby said joints are maintained air-tight.

23. A boiler made in two sections, the one in advance of the other, means whereby the two sections are flexibly joined together, a portion of said means constituting a sliding or expansible joint, and means whereby said joints are maintained air-tight.

24. A boiler made in two sections, the one in advance of the other, and means intermediate of said sections, the coacting ends of the boiler sections and of said means being formed to constitute ball and socket joints, said means providing a combustion chamber intermediate of the two boiler sections.

25. A boiler made in two sections, the one in advance of the other, and means intermediate of said sections, the coacting ends of the boiler sections and said means being formed to provide ball and socket joints whereby the two sections are flexibly joined together, said means permitting of independent longitudinal movement of the two sections.

26. A boiler made in two sections, the one in advance of the other, means intermediate of the two sections to form a combustion chamber, the coacting ends of said means and the two boiler sections being formed to provide ball and socket joints, and means whereby said joints are lubricated.

27. A boiler made in two sections, the one in advance of the other, and means intermediate of the two sections forming a combustion chamber, the coacting ends of said means and the two sections being formed to provide ball and socket or spherical joints, while the intermediate part of said means constitutes a sliding or expansible joint.

28. A boiler made in two sections, one arranged in advance of the other, and an intervening movable section comprising non-flexible members whereby the two boiler sections are coupled together, said intervening section constituting a combustion chamber of substantially the same diameter as the boiler sections.

29. A boiler made in two sections, one arranged in advance of the other on the same longitudinal line, and an intervening flexible section, whereby the two boiler sections are coupled together, said intervening section being composed of telescopic members.

30. A boiler made in two sections, one arranged in advance of the other on the same longitudinal line, with an intervening flexible section whereby the two boiler sections are coupled together, said intervening section being composed of telescopic members, and means whereby said members are locked into place.

31. A boiler made in two sections, the one arranged in advance of the other on the same longitudinal line, and means coacting with the adjacent ends of the two boiler sections whereby a flexible combustion chamber is formed, said means being arranged to permit of independent longitudinal movement by the boiler sections, but locking the same together.

32. A boiler for an articulating locomotive comprising two sections, and means whereby the two sections are flexibly joined together, the relation between said means and the boiler sections being such as to provide an articulating combustion chamber of substantially the same diameter as the boiler

sections, the whole being so arranged as to require two swivel ball joints in the steam distributing pipes.

33. A boiler made in two sections, the one in advance of the other, and coupling means cylindrical in form and of substantially the same diameter as the boiler sections, said means forming an interlocking joint capable of universal movement.

34. A boiler made in two sections, coupling means cylindrical in form and of substantially the same diameter as the boiler sections, said means forming an interlocking joint capable of universal movement, and means whereby said joint is maintained air-tight.

35. A boiler made in two sections, the one in advance of the other, and a composite member coacting with the ends of the boiler sections whereby said sections are flexibly joined together, said member comprising nonflexible parts which are removably secured to the adjacent ends of said boiler sections.

36. A boiler made in two sections, the one in advance of the other, and a composite member coacting with the ends of the boiler sections to form a ball and socket or spherical joint, the parts of said member being removably secured to the adjacent ends of said boiler sections.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."