

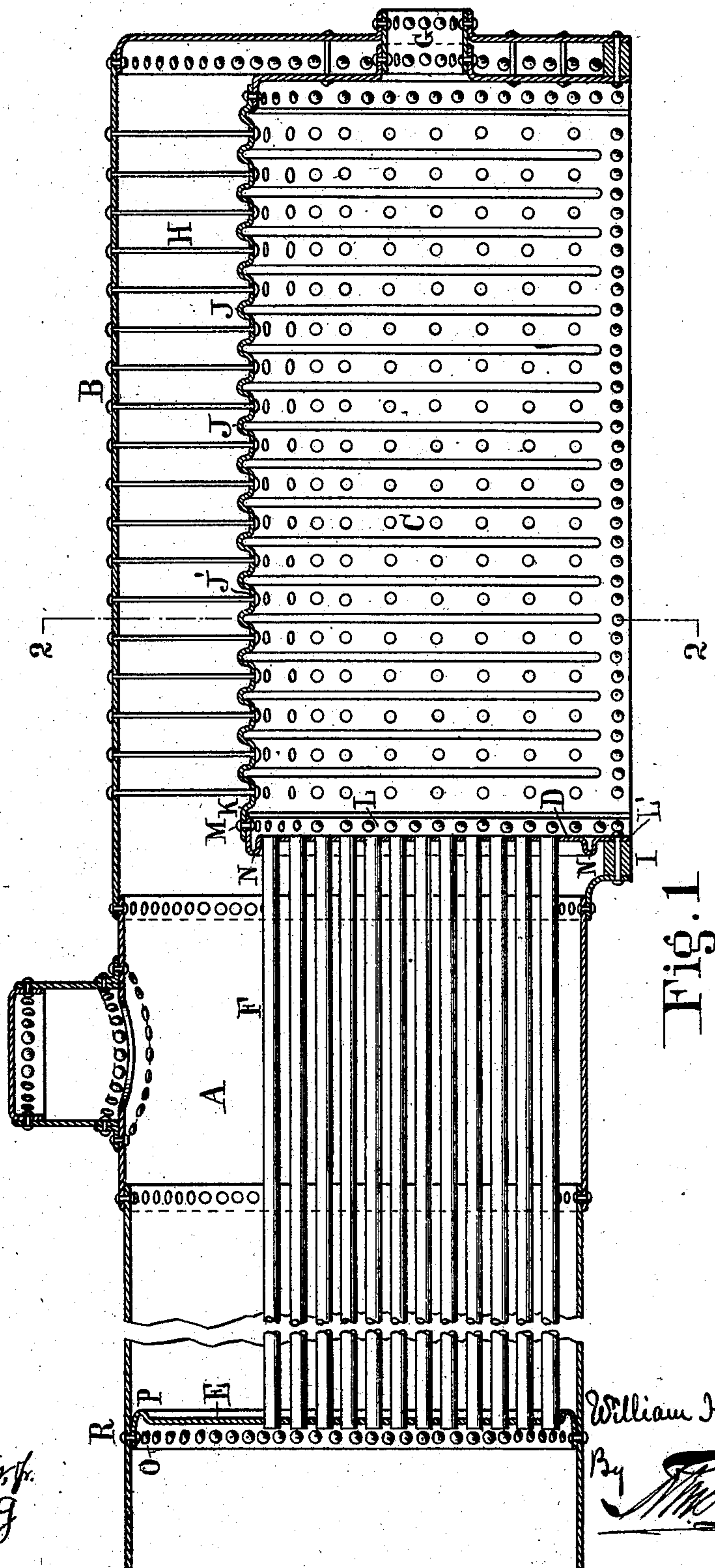
No. 885,123.

PATENTED APR. 21, 1908.

W. H. WOOD.
STEAM BOILER.

APPLICATION FILED MAY 15, 1907.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

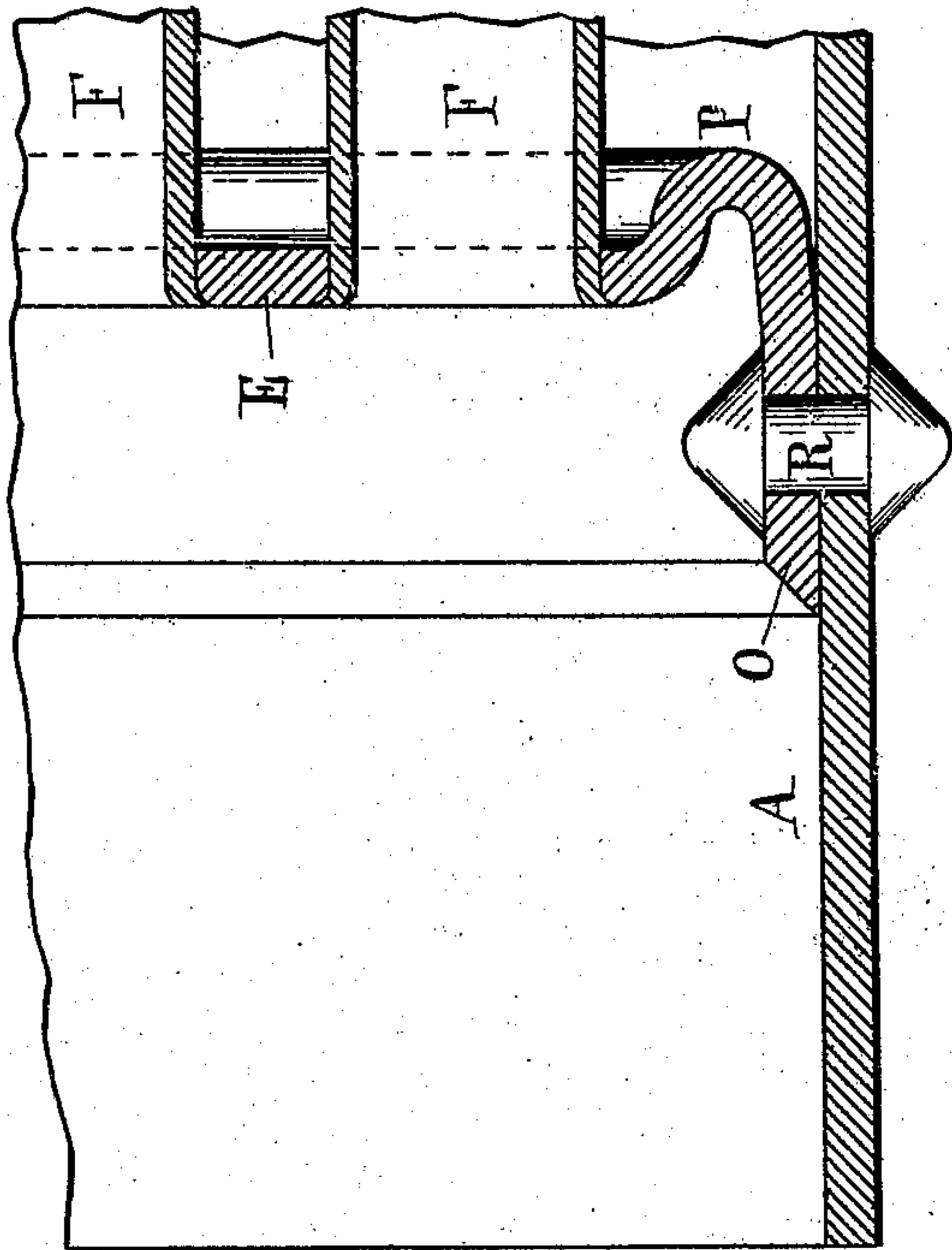


Fig. 3

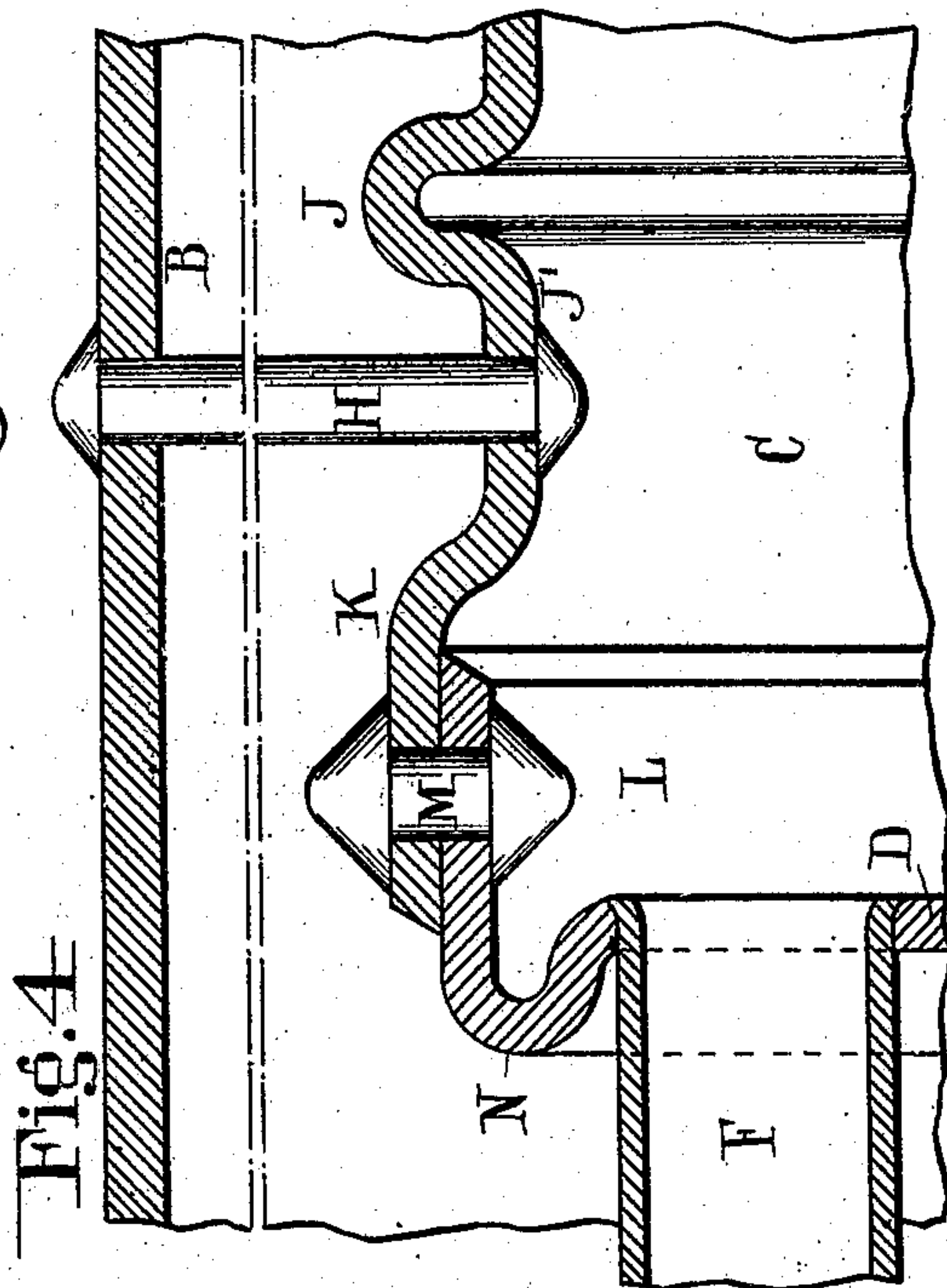


Fig. 4

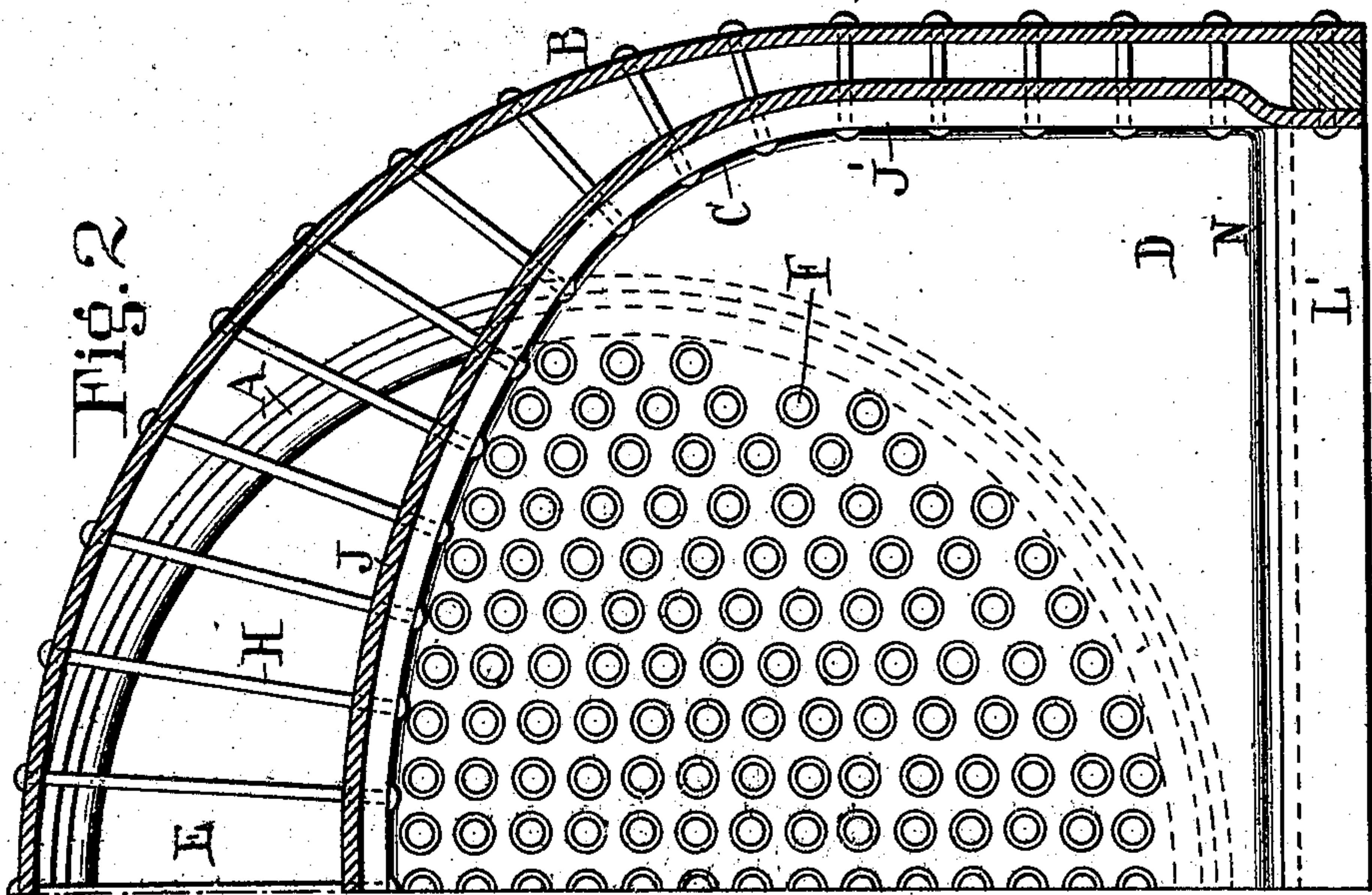


Fig. 2

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UNITED STATES PATENT OFFICE.

WILLIAM H. WOOD, OF MEDIA, PENNSYLVANIA.

STEAM-BOILER.

No. 885,123.

Specification of Letters Patent.

Patented April 21, 1908.

Application filed May 15, 1907. Serial No. 373,707.

To all whom it may concern:

Be it known that I, WILLIAM H. WOOD, of the city of Media, county of Delaware, and State of Pennsylvania, have invented an
5 Improvement in Steam-Boilers, of which the following is a specification.

My invention has reference to steam boilers and consists of certain improvements which are fully set forth in the following
10 specification and shown in the accompanying drawings which form a part thereof:—

Heretofore, great danger and damage have been experienced from that construction of steam boilers in which too great rigidity was
15 provided in the internal construction of the boilers and more especially in the manner of supporting the tubes in the fire-box tube-sheet or back-head for the tubes or both, the result being the rupture of the said tube-sheet and back-head at their flanges, some-
20 times causing explosions and invariably frequent repairs with consequent loss of the use of the locomotive during the making of such repairs.

25 The object of my invention is to provide a construction of boiler, especially adapted for locomotives, which shall overcome the above recited defects and dangers, whereby the durability and life of the boiler is greatly increased and danger to life and property ma-
30 terially reduced.

The nature of my invention contemplates the making of the internal structure of the boiler in such manner as to give flexibility be-
35 tween the parts so that the enormous power exerted by the contraction and expansion of the boiler-tubes relative to the boiler-shell or barrel shall be rendered non-destructive by the yielding character of the fire-box tube-sheet or back-head or both; thus, in the
40 most complete form of my inventions, the tubes and sheets or heads in which they are secured will be free to mutually adjust themselves one to the other and to the rigid shell
45 and fire-box of the boiler, so as to avoid all objectionable rupturing stress and tendencies.

While the coefficients of expansion of the longitudinal elements of the boiler are substantially the same, the conditions of varia-
50 tion of temperatures to which the different elements are subjected are so varied and widely divergent that tremendous effort is created in the form of tensile strains which

tend to tear asunder or rupture the flanges 55 forming the union of the tube-sheet with the sides of the fire-box as well as the corresponding flanges of the back-head at their union with the boiler-shell; and it is the particular object of my invention to circumvent these
60 destructive influences by embodying into the boiler features of construction which render said forces practically harmless.

My object is further to so construct the fire-box itself that it shall have great flexibil- 65 ity without introducing elements of weakness, and thus permitting the walls of the fire-box to yield in adapting themselves to meet the conditions of stress set up rather than to oppose said stress or strains by rigidity. 70

My invention consists in providing the fire-box flue-sheet with a flanged outer portion surrounding the flues in such a manner as to produce a grooved portion within the bound- 75 ary of the flange and in such a way that a very materially increased sectional area of the tube-sheet is thus provided between the tubes and flanged connection to the top and sides of the fire-box, whereby that portion of the tube-sheet rigidly united to the flues may
80 move with the flues in their expansion and contraction without rupturing the said flue-sheet adjacent to its connection with the sides and crown of the fire-box structure.

My invention also consists in forming the 85 sides and crown of the fire-box with an ogee shape where it connects with the flange of the tube-sheet, whereby a larger tube-sheet having my improved form may be employed with a given size of fire-box and tube area. 90

My invention further consists in providing the boiler with a back-head for connecting with the ends of the tubes furthest from the fire-box, in which the said back-head is provided outside of the tube area and inside of 95 the flange with a grooved portion to increase the sectional area and impart flexibility and yielding characteristics to the tube area with respect to the flange where it is riveted to the boiler-shell. 100

My invention also consists in providing the sides and crown of the fire-box of one curved sheet having corrugations or indented portions formed therein at intervals, leaving
105 straight portions between and with which the stay bolts connect; the said corrugations terminating above the lower edges of the sides and above the base of the box.

My invention consists further in details of construction which, together with the features above specified, will be better understood by reference to the drawings, in which:—

Figure 1 is a longitudinal sectional elevation of a boiler of locomotive type, embodying my invention; Fig. 2 is a cross section on line 2—2 of Fig. 1 showing one-half of the boiler in section; Fig. 3 is an enlarged sectional view showing on a large scale the construction of back-head illustrated in Fig. 1; and Fig. 4 is a similar sectional view showing on a larger scale the construction of the joint between the flue-sheet with the sides and crown of the fire-box illustrated in Fig. 1.

A is the outer shell or barrel of the boiler; B is the outer shell of the fire-box portion of the boiler; C is the fire-box; D is the tube-sheet of the fire-box; E is the back-head; and F are the tubes.

The tube-sheet D is made of pressed steel and in area to conform to the cross section of the fire-box; and is flanged as at L on sides and top and by which flanges it is riveted at M to the sides and crown of the fire-box C. The body of the tube-sheet D, exterior to the area occupied by the tubes F, is flanged in such a way as to form a grooved or indented portion N, which gives an increased surface and sectional area in a plane parallel to the surface of the tube-sheet and transversely considered with respect to the length of the boiler and fire-box. In this manner, the actual flange L is considerably removed from the tubes and consequently the tube-sheet at its tube area is flexibly sustained relatively to the flanged portions L which are riveted to the sides and crown of the fire-box. This flexibility permits the expansion and contraction of the tubes and consequent movement of the tube-sheet without rupturing its flange bend. The lower edge of this flue-sheet D is continued with a downward part or flange L' in the plane of the tube-sheet and beyond the grooved part N, and said edge is riveted to the leg of the boiler-shell through a steel base bushing I in the ordinary manner. Where the leg of the boiler extends considerably below the tubes and a considerable area of tube-sheet below the tubes is available, the grooved portion N may be omitted at the bottom as there will be sufficient flexibility without it.

The sides and crown-sheet of the fire-box may be formed with a series of parallel corrugated or grooved portions J to give flexibility in the direction of the length of the boiler and the flat portions J' intermediate of the corrugations J are stayed to the sides and top of the boiler-shell by stays H. The corrugations J terminate at a short distance above the bottom edge of the sheet where it is riveted to the leg through the bushing I. In practice these corrugations J, when used,

would be most advantageous when they extend somewhat below the level of the bottom of the tubes F.

The end of the sides and crown-sheet of the fire-box C where it connects with the tube-sheet is preferably formed with an ogee shape as at K, so that, with a cross section of fire-box no greater than that formerly required, the requisite riveted connection can be made with the flange L in its new position. In this manner the advantages of my yielding construction may be employed in the tube-sheet without enlarging the mean cross sectional area of the fire-box. Where there is plenty of room above the fire-box and between it and the shell this ogee bend K may be omitted.

The back-head E is constructed similarly to the fire-box tube-sheet D, except that it is circular and fits the barrel A of the boiler, and hence is flanged and grooved all around. The flange is indicated at O and the grooved portion at P. The flange is riveted at R to the barrel or shell. I have shown the grooved portions P of this back-head directed in an opposite manner to the corresponding part N of the tube-sheet, but this is immaterial as they may point in the same or opposite directions as preferred. While the back-head had its portion carrying the tubes thus made with capacity for yielding longitudinally of the boiler, it is evident that, where the tube-sheet D has sufficient flexibility, the grooved portion P of the back-head may be omitted. This would be especially so where the length of the tubes was short and where the corrugations K were employed in the fire-box. Similarly, it is evident that if the back-head is given sufficient capacity to adjust itself for the expansion and contraction of the tubes, the grooved portion N may be omitted from the tube-sheet. Also, where the fire-box is made with great capacity for longitudinal expansion and contraction and the leg is sufficiently deep to give movement to the tube-sheet at the area of the tubes, the grooves N may be omitted from the tube-sheet. I, however, prefer in all cases to use the grooved tube-sheet, whether the grooved back-head and corrugated fire-box, or either of them be employed, or not.

By my improvements, the locomotive may have a much longer life in active service before requiring repairs and the danger from explosions is very materially lessened. The construction is such that the tubes may occupy the same relative position to the fire-box as heretofore, because the ogee flange K permits the introduction of the grooved portion N outside the tube area without enlarging the general cross section of the fire-box.

While I have shown the construction of my invention in connection with a locomotive type of boiler, it is to be understood that my invention is intended for use with all

types of tubular boilers, and while I prefer the construction herein set out the details thereof may be modified without departing from the spirit of the invention.

5 Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a steam boiler the fire-box made with a flue-sheet having its top and side 10 edges provided with a flange riveted to the sides and crown of the fire-box and having the metal between the tubes and flange pressed into grooved form in which the direction of the depth of the groove is substantially at right angles to the general surface of 15 the tube-sheet, whereby the tube area of the sheet may yield under the expansive influence of the tubes relatively to the flange.

2. In a steam boiler the fire-box made 20 with a flue-sheet having its top and side edges provided with a flange riveted to the sides and crown of the fire-box and having the metal between the tubes and flange pressed into grooved form in which the direction of the depth of the groove is substantially at right angles to the general surface of 25 the tube-sheet and having its surface near its lower edge also similarly pressed into grooved form, whereby the tube area of the 30 sheet may yield under the expansive influence of the tubes relative to the flange.

3. In a steam boiler the fire-box made with a flue-sheet having its top and side 35 edges provided with a flange riveted to the sides and crown of the fire-box and having the metal between the tubes and flange pressed into grooved form in which the direction of the depth of the groove is substantially at right angles to the general surface of 40 the tube-sheet combined with a back-head provided with a flange and a groove pressed into the body of the head between the flange and tubes in which the direction of the depth of the groove is substantially at right angles 45 to the general surface of the back-head, and tubes rigidly secured at one end to the back-head and at the other end to the tube-sheet, whereby the tube area of the back-head, and tube-sheet may yield under the expansive 50 influence of the tubes relatively to the flange.

4. A steam boiler provided with a back-head having its perimeter flanged and riv-

eted to the shell of the boiler and also having an annular grooved portion pressed into the sheet between its flange and tube area and 55 having the direction of its depth at right angles to the general surface of the back-head sheet.

5. In a steam boiler, a fire-box having the lower edges of its sides made straight and riv- 60 eted to the leg of the boiler and its sides and crown provided with a series of parallel outwardly grooved portions pressed therein and extending continuously over the crown and 65 down the sides and terminating at some distance from the bottom, combined with stay bolts secured at one end to the sides and crown of the fire-box between the grooved portions and at the other end to the boiler-shell. 70

6. In a steam boiler, a fire-box having its tube-sheet formed with a flange on its top and side edges and a grooved portion between said flange and tube area and extending 75 in the direction of the tubes, combined with the crown and side sheets having their edges made in ogee form and directly riveted to the flange of the tube-sheet.

7. In a steam boiler, a fire-box having its tube-sheet formed with a flange on its top 80 and side edges and a grooved portion between said flange and tube area and extending in the direction of the tubes, combined with the crown and side sheets having their edges made in ogee form and directly riveted 85 to the flange of the tube-sheet and having their surface made with a series of parallel outwardly extending narrow grooved portions arranged at intervals and with interposed wide flat portions for the stay bolts. 90

8. A tube-sheet for a boiler having a series of apertures for the tubes and its sides and top edges flanged and its surface between the tube apertures and flanges pressed into 95 grooved form with the depth of the groove at right angles to the general plane of the surface of the tube-sheet.

In testimony of which invention, I have hereunto set my hand.

WM. H. WOOD.

Witnesses:

R. M. HUNTER,
R. M. KELLY.