

June 5, 1928.

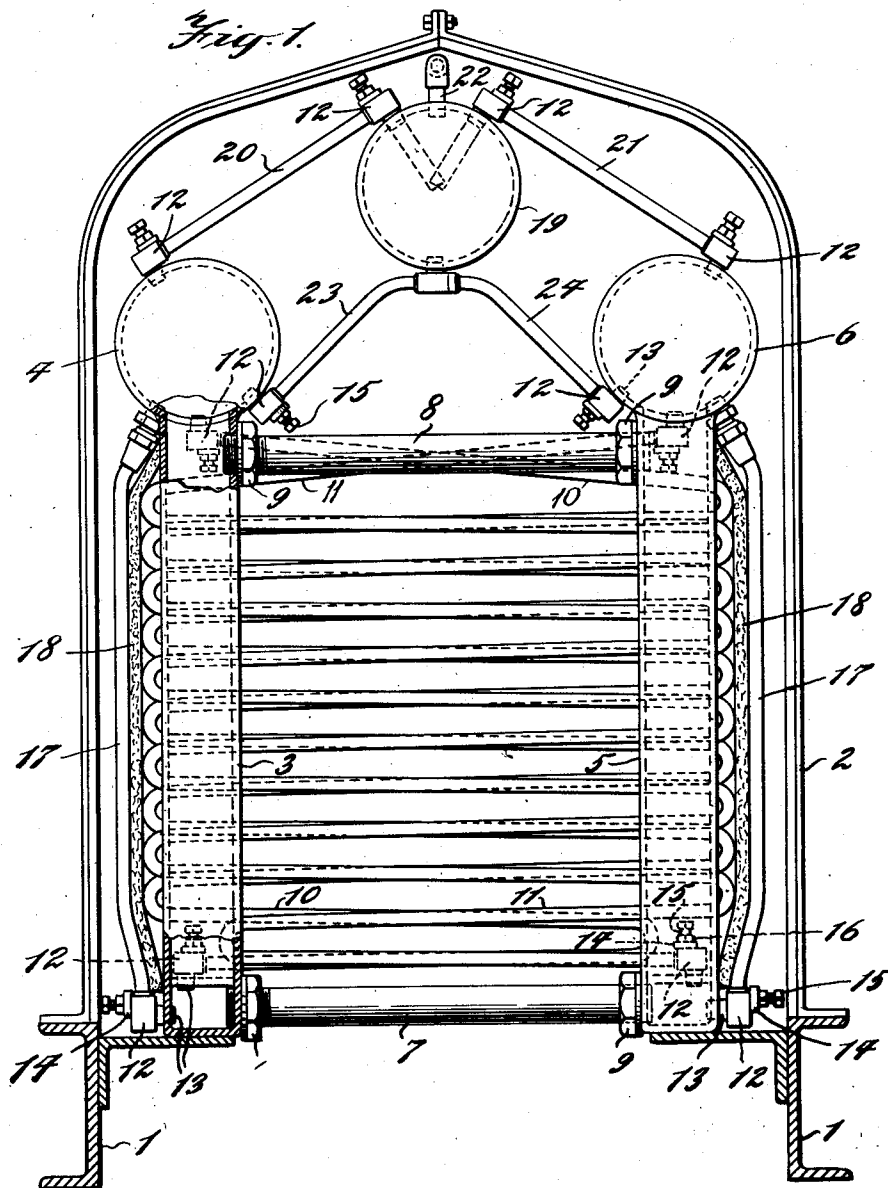
1,672,480

G. A. BRYAN

STEAM GENERATOR

Filed Aug. 6, 1921

2 Sheets-Sheet 1



INVENTOR.

George A. Bryan

BY

Rosenbaum, Stocking & Borst
ATTORNEYS.

June 5, 1928.

1,672,480

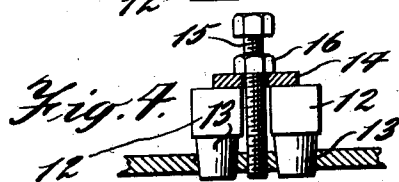
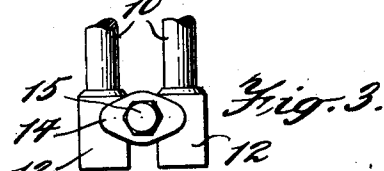
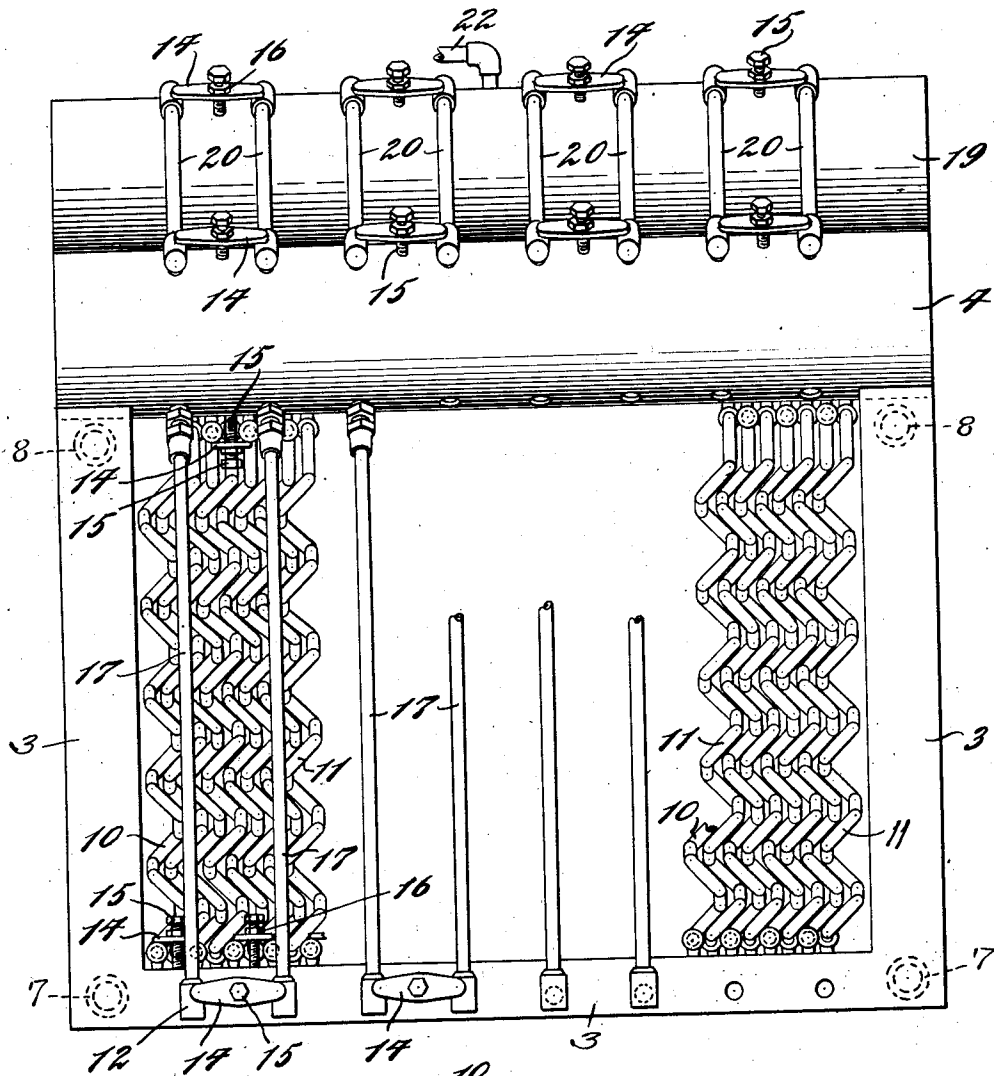
G. A. BRYAN

STEAM GENERATOR

Filed Aug. 6, 1921

2 Sheets-Sheet 2

Fig. 2.



INVENTOR.

George A. Bryan

BY

Rosenbaum, Perin & Sons

ATTORNEYS.

UNITED STATES PATENT OFFICE.

GEORGE ALFRED BRYAN, OF PERU, INDIANA, ASSIGNOR TO BRYAN HARVESTER COMPANY, A CORPORATION OF NEW MEXICO.

STEAM GENERATOR.

Application filed August 6, 1921. Serial No. 490,354.

My invention is particularly applicable to portable steam generators adapted for use in steam tractors, trucks, automobiles and the like, although applicable to other uses, and employs the water tube principle disclosed in my co-pending application Serial No. 339,945, filed Nov. 22, 1919, which became Patent No. 1,497,973, June 17, 1924.

Objects of my invention, in general are to obtain efficient circulation of the water, dryness of the steam, thorough absorption of the heat, safety from explosion, and sufficient water and steam capacity. Certain other mechanical objects are facility in assembling and disassembling the generator or any parts thereof, freedom from expansion, and sufficient durability and rigidity of construction. Still other objects and advantages of my invention will appear from the following description.

In accordance with this invention the steam is collected first in a steam-separating drum and passed over from this first drum into a steam drum from which steam is taken to the engine, thereby separating the water from the steam and preventing any water from being drawn over into the engine. Preferably there are two such separating drums, one on each side and welded or otherwise secured on top of U-shape water frames, the bases of which form headers for the water tubes.

Down or return pipes may join each steam separating drum with its header and, to facilitate circulation, I have found it advantageous to insulate these down pipes from the heating space by sheets of asbestos or the like between the down pipes and ends of the water tubes.

As a means for eliminating leaky connections my invention contemplates a special form of connection for all the detachable tubes, consisting of a taper nipple or plug fitting into taper holes in the header or other member to which the tubes are connected, the taper fitting being attached to the end of the tube, and means, such as a plate engaged by a nut or a threaded stem, for adjustably exerting pressure on the plate to force the plug into the hole. Preferably the plate overlies two adjacent taper fittings.

My invention also comprehends various other features of construction, as will hereinafter more fully appear.

I shall now describe the illustrated em-

bodiment of my invention and shall thereafter point out my invention in claims.

Fig. 1 is a front end elevation, partially in section, of a generator embodying my invention;

Fig. 2 is a side elevation of the same; and

Figs. 3 and 4 are details, in plan and elevation, of the taper coupling construction.

The generator is shown as supported on the frame or chassis 1 of a self-propelled vehicle and covered by a suitable removable hood 2 which is made in two sections, as shown, and supported upon the frame of the vehicle. The burner may be arranged directly underneath the generator, or a fire box construction may be used in conjunction with the generator such as disclosed in my co-pending application Serial No. 475,989, patented Aug. 30, 1927, Patent No. 1,640,346, which delivers the gases of combustion underneath the boiler, the gases giving up their heat to the water tubes as they rise through them.

The water distributing system consists essentially of two unitary side structures which are joined together and balanced by removable cross tubes. Each side structure consists of a substantial U-shape tubular casting having a drum welded or otherwise secured to the upper ends of the casting, the U-shape casting 3 on the left side of the generator (as viewed from the front in Fig. 1) being welded to the drum 4, and the U-shape casting 5 on the right hand side of the generator being welded to the drum 6. The water level is normally in the two drums 4 and 6. The water legs 3 and 5 are connected at the top and bottom at both their front and rear ends by cross tubes 7 and 8 which serve to balance the two side sections and tie them together, being provided with right and left hand threads for the purpose. In this way they can be easily inserted or taken out to assemble the generator or to disassemble it, as in taking off one of the sides for the purpose of repair. The packing nuts 9 serve as stays to the generator and also hold a suitable gasket.

The water tubes are arranged in two series 10 and 11 which alternate with each other, the first series being detachably connected at their lower ends to the bottom leg of the U-shape member 3 as a header and at their upper ends to the drum 4, and the series 11 being detachably connected at their lower

ends to the bottom leg of the U-shape casting 5 as a header, and at their upper ends to the drum 6. These water tubes are generally of the form and arrangement described in my above mentioned Patent No. 1,497,973. They are made of flexible tubing bending upon themselves back and forth several times across the heating chamber as they rise from their connections in the lower headers to those in the drums. The runs are inclined upwardly so as to facilitate circulation, and the coils are so shaped that the succeeding runs are offset from each other. The bends connecting the runs are inclined successively in opposite directions and the corresponding bends of two adjacent tubes which are on opposite sides of the heating chamber are inclined in the same direction, thereby effecting the staggered relation. From this it results that each run except the lowermost is above a space between two runs, which in the construction shown, are those of two adjacent coils. The runs are thus exposed to the fullest extent to the heat from the gases which pass upward through the coils.

The construction of the connections between these tubes and the members to which they are joined at their ends is the same as that shown for all of the detachable tubes in the generator and is shown in detail in Figs. 3 and 4. On each end of each tube is welded a taper fitting 12 which has a hollow tapered plug or nipple 13 extending at right angles to the direction of the tube, and this taper plug is inserted into a tapered hole in the member to which the connection is made. Overlying the back face of two adjacent taper fittings 12 is a bearing plate 14 which has a hole therein fitting over a threaded stem or stud bolt 15 carried by the member to which the connection is made. This stud bolt may, as shown, be screwed into a hole tapped in the casing, or it may be secured in a boss on the casing or in any other suitable way. An adjustable nut 16 on the stem 15 bears upon the outer face of the plate 14 and serves to adjustably press the two nipples into their tapered opening. There is therefore one stud bolt for each two tubes, and it is evident that expansion and contraction cannot affect the tightness of the connection, nor is there likelihood of the joint being made leaky by vibration. The stud bolts, being well out to the edge, are easily accessible.

It is evident that if one of the tubes bursts it is merely necessary to loosen the two couplings, and the top and bottom bends may, if necessary, be made shorter than the rest to afford access to the coupling. The broken tube may then be withdrawn and a new tube inserted without entailing any material delay.

In order to facilitate the return circula-

tion of the water I preferably employ a plurality of down pipes 17 connecting the drums 4 and 6 with their respective base headers. These down pipes are shown as connected with the same tapered fittings as described above in connection with the water pipes. In order to retain the heat within the heating chamber and at the same time keep the down pipes 17 at a lower temperature than the water tubes, thereby causing a speedy return of the water to the bottom water header, a sheet of heat insulating material 18, such as asbestos, may be inserted between the ends of the water tubes and the down pipes 17 on both sides of the generator. In removing a broken water tube in the manner above described, the heat insulating sheet 18 must be removed, which is easily done due to its pliable nature, and in most instances it will also be necessary to remove one of the down pipes 17.

Midway between the two side drums 4 and 6 and at a higher level is a steam drum 19 which communicates with both of the two side drums through steam pipes 20 and 21 which enter the tops of the drums. These pipes 20 and 21 have the same tapered fittings as already described and in addition the plugs in the drum 19 are extended to substantially the center of the drum 19, as indicated in Fig. 1. The purpose of these extensions is to carry any water that comes through the pipes 20 and 21 well down into the drum 19, so that it will be collected at the bottom and not pulled out into the engine. Steam for the engine is taken out of the top of the drum 19 through the pipe 22. Water of condensation is drained from the drum 19 back into side drums 4 and 6 through the pipes 23 and 24.

Heretofore steam generators of the general type to which the present invention belongs have commonly been made by attaching together a large and substantially innumerable number of small individual parts apparently without regard to convenience in renewing these parts, and no provision being made for taking the generator apart in substantially large sections, for convenience in handling and effecting repairs. Such generators have commonly been made largely or substantially altogether from ordinary piping and pipe fittings screwed together. According to the present invention, as illustrated in the drawings and hereinbefore described, it is to be noted that the individual parts of the generator may be separately removed for renewal and also that the generator may be readily taken apart in larger sections when desired for the purpose of repair or for a general overhauling. Any one of the water tubes 10 and 11 may be conveniently removed and replaced by a new one from the same side of the generator without any necessity for the mechanic hav-

ing to walk back and forth around the generator from one side thereof to the other. For example, to renew one of the water tubes 10, it is merely necessary to loosen the lower coupling 12 by which the lower end of this tube is connected to the header formed by the lower horizontal portion of the hollow U-shaped member 3, and to loosen the upper coupling 12 by which the upper end of this tube is connected to the steam separating drum 4 at the same side of the generator, whereupon the disconnected tube 10 may be slipped out at the same side of the generator and replaced by a new tube, the heat insulating sheet 18 first being slipped out and also one of the down tubes 17 being removed should one of these tubes happen to be in the way of the particular water tube to be renewed. Likewise the steam pipes 20 and 21 and the drain pipes 23 and 24 may be similarly readily disconnected at one or both of their ends for the renewal of these pipes individually, or if desired for the removal of the steam drum 19. When the steam drum 19 has been disconnected from the separating drums 4 and 6, the water distributing system of the generator may be separated laterally into two sections or side parts merely by unscrewing the right and left hand screw threaded connecting tubes 7 and 8. The tubular U-shaped side member 3 then carries with it the separating drum 4 and all of the water tubes 10 together with the down tubes 17, and likewise the side member 5 will carry with it the separating drum 6 and all of the water tubes 11, as well as the down tubes 17 at that side of the generator. It is to be noted in this connection that the U-shaped side members 3 and 5, rigidly connected together by the strong transverse tubes 7 and 8, provide a strong and rigid framework for supporting all of the other parts of the generator, which as a whole may be supported from the strong and rigid side pieces 3 and 5, as is clearly shown in Fig. 1 in which the lower horizontal header portions of the members 3 and 5 are shown as mounted upon brackets secured to the frame pieces 1 of the motor vehicle chassis. It is also to be noted that the construction of the generator is such as to enable each base header and its two up-standing water legs, comprising the members 3 and 5 at the opposite sides of the generator to be cast in a single piece, thereby adding to the strength and rigidity as well as reducing the number of parts and facilitating the assembling and disassembling of the generator. Furthermore to be noted is the exceedingly great compactness of the generator of applicant's invention, by reason of which a maximum of power can be obtained for a minimum of space occupied by the power plant, thereby rendering the generator particularly suitable for installation

in motor cars, as well as for other uses. For example, among the uses to which the device of the present invention has been advantageously applied, is for heating purposes in dwellings and other buildings, for which use it has been found highly efficient and where the small amount of space occupied is a decided advantage.

It is obvious that various modifications may be made in the construction shown in the drawings and above particularly described within the principle and scope of my invention.

I claim:

1. In a steam generator, two unitary side pieces each comprising a substantially U-shape tubular member and a drum secured to the top ends thereof, removable cross tubes joining the ends of the side pieces at top and bottom, water tubes running back and forth across the generator and connecting the drum and base of each side piece, a plurality of down pipes connecting each drum with the base of its tubular member at intervals along their length, a removable sheet of heat insulating material between the ends of the water tubes and each series of down pipes, and a steam drum communicating with both of the two said drums.

2. In a steam generator, two side pieces each comprising a substantially U-shape tubular member and a steam separating drum secured directly upon the ends thereof and provided in its under side with openings registering with said ends, removable cross tubes joining the ends of the side pieces at top and bottom, separately disconnectible and removable water tubes running back and forth across the generator and connecting the drum and base of each side piece, a steam drum disposed between and at a higher elevation than the two steam separating drums, inclined drain pipes disconnectibly connecting the bottom of the steam drum with the bottom of each of the steam separating drums, and separately disconnectible and removable steam tubes extending at an inclination and connecting the top of each steam separating drum with the top of the steam drum at intervals along their length.

3. In a steam generator, two side pieces each comprising a substantially U-shape tubular member and a steam separating drum secured directly upon the ends thereof and provided in its under side with openings registering with said ends, removable cross tubes joining the ends of the side pieces at top and bottom, separately disconnectible and removable water tubes running back and forth across the generator and connecting the drum and base of each side piece, a steam drum disposed between and at a higher elevation than the two steam separating drums, means for draining water from the bottom of the steam drum, and separately

disconnectible and removable steam tubes extending at an inclination and connecting the top of each steam separating drum with the top of the steam drum at intervals along their length, the upper ends of said steam tubes being provided with downward extensions entering the steam drum in the top thereof and removably extending a substantial distance down into the steam drum, said extensions being carried by the steam tubes to be withdrawn from the steam drum and removed with the steam tubes as a part thereof.

4. In a steam generator, the combination with a water distributing system comprising two side members, each including a base header and a top drum and water legs joining the same, cross tubes joining the side members, and a series of water tubes joining each header with its respective drum, the water tube being bent upon themselves to run back and forth substantially across the generator and being detachably connected at their two ends and having their bends inclined back and forth at opposite inclinations at opposite sides of the generator so as to bring the runs into staggered relation to each other, thereby to enable the tubes as a whole to nest one within another.

5. In a steam generator, the combination with a water distributing system comprising two side members, each including a base header and a top drum and water legs joining the same, cross tubes joining the side members, a series of water tubes joining each header with its respective drum, the water tubes being bent upon themselves to run back and forth substantially across the generator and being detachably connected at their two ends and having their bends inclined so as to bring the runs into staggered relation to each other, a frame supporting the generator, and a removable hood covering the generator and supported by said frame.

6. In a steam generator, a water distributing system comprising the combination of two substantially U-shaped tubular side members each forming at its base a substantially horizontal water header from each end of which rises an upstanding water leg, a steam separating drum carried directly upon the upper ends of the water legs of each said member and into the lower side of which said legs directly open, two sets of serpentine water tubes running back and forth across the generator and the tubes of one set being arranged in alternate relation to the tubes of the other set along the length of the generator and the lower ends of all of the water tubes in one set being connected to the water header of one of said members and the upper ends of these same tubes being connected to the steam separating drum carried by the water legs of the same member and the lower ends of all of the water tubes

of the other set being connected to the water header of the other said member and the upper ends of all of these latter tubes being connected to the steam separating drum carried by the upper ends of the water legs of the same said other member, a plurality of water circulating down pipes connecting the bottom of each steam separating drum with the base header of its tubular member at intervals along their length, and substantially rigid cross tubes rigidly but disconnectibly connecting together the ends of said members at the top and bottom thereby to form a substantially rigid rectangular tubular framework, whereby the said water distributing system may be separated into two major sectional parts by disconnecting said cross tubes from said side members and so that each of said members then carries with it one of the steam separating drums and one of the sets of water tubes and down pipes.

7. In a steam generator, in combination, two substantially U-shaped tubular side members each forming at its base a substantially horizontal water header from each end of which rises an upstanding water leg, a steam separating drum carried directly upon the upper ends of the water legs of each said member and into the lower side of which said legs directly open, two sets of serpentine water tubes running back and forth across the generator and the tubes of one set being arranged in alternate relation to the tubes of the other set along the length of the generator and the lower ends of all of the water tubes in one set being connected to the water header of one of said members and the upper ends of these same tubes being connected to the steam separating drum carried by the water legs of the same member and the lower ends of all of the water tubes of the other set being connected to the water header of the other said member and the upper ends of all of these latter tubes being connected to the steam separating drum carried by the upper ends of the water legs of the same said other member, substantially rigid cross tubes rigidly but disconnectibly connecting together the ends of said members at the top and bottom thereby to form a substantially rigid rectangular tubular framework, a steam drum between and at a higher elevation than the steam separating drums, steam tubes disconnectibly connecting the top of each steam separating drum with the steam drum at intervals along their length, drain pipes disconnectibly connecting the steam drum at its bottom with each of the steam separating drums, and a plurality of water circulating down pipes connecting the bottom of each steam separating drum with the base header of its tubular member at intervals along their length, whereby the generator may be separated into

three major sectional parts by disconnecting and removing the steam drum and by disconnecting the said cross tubes so that each said U-shaped side member then carries with it one of the steam separating drums and one set of the water tubes.

8. In a steam generator, in combination, two substantially U-shaped tubular side members each forming a water base header with upstanding water legs, a steam separating drum carried directly upon the upper ends of the water legs of each said member and into the lower side of which the upper ends of said water legs directly open and which exclusive of said base header forms the only direct intercommunicating connection between the water legs of said member, two sets of bent serpentine water tubes running back and forth across the generator with the upper and lower ends of the respective sets of tubes connected respectively to the steam separating drum and base header at the same side of the generator with the tubes of the two sets alternating with each other along the length of the generator and the tubes of each set having their bends inclined back and forth at opposite inclinations at opposite sides of the generator so as thereby to bring the runs of the tubes into staggered relation with the tubes of one set nesting into the tubes of the other set along the length of the generator, four water circulating cross tubes rigidly disconnectibly connecting together adjacent ends of said members with one cross tube

at the upper ends of the water legs and with another cross tube at the junction of the water legs with the base headers and such cross tubes forming the only direct intercommunicating connection between said members, a steam drum between and at a higher elevation than the steam separating drums, steam tubes disconnectibly connecting the top of each steam separating drum with the top of the steam drum at intervals along their length, and drain pipes disconnectibly connecting the steam drum at its bottom with the bottom of each of the steam separating drums, whereby the generator may be separated into three major sectional parts.

9. The invention defined in claim 4, in which a separable clamp coupling connection is provided for detachably connecting the ends of said water tubes with the base header and the top drum to provide for the removal and replacement of such tubes.

10. The invention defined in claim 7, in which a releasable taper nipple clamp coupling connection is provided for the ends of said water tubes, said steam tubes, said drain pipes, and said water circulating down pipes, thereby to provide for the individual removal and replacement of said tubes and pipes while the generator as a whole is in an assembled condition.

In witness whereof, I hereunto subscribe my signature.

GEORGE ALFRED BRYAN.