(No Model.) 3 Sheets—Sheet 1.

W. E. KELLY.

STEAM GENERATOR.

No. 523,793. Patented July 31, 1894.

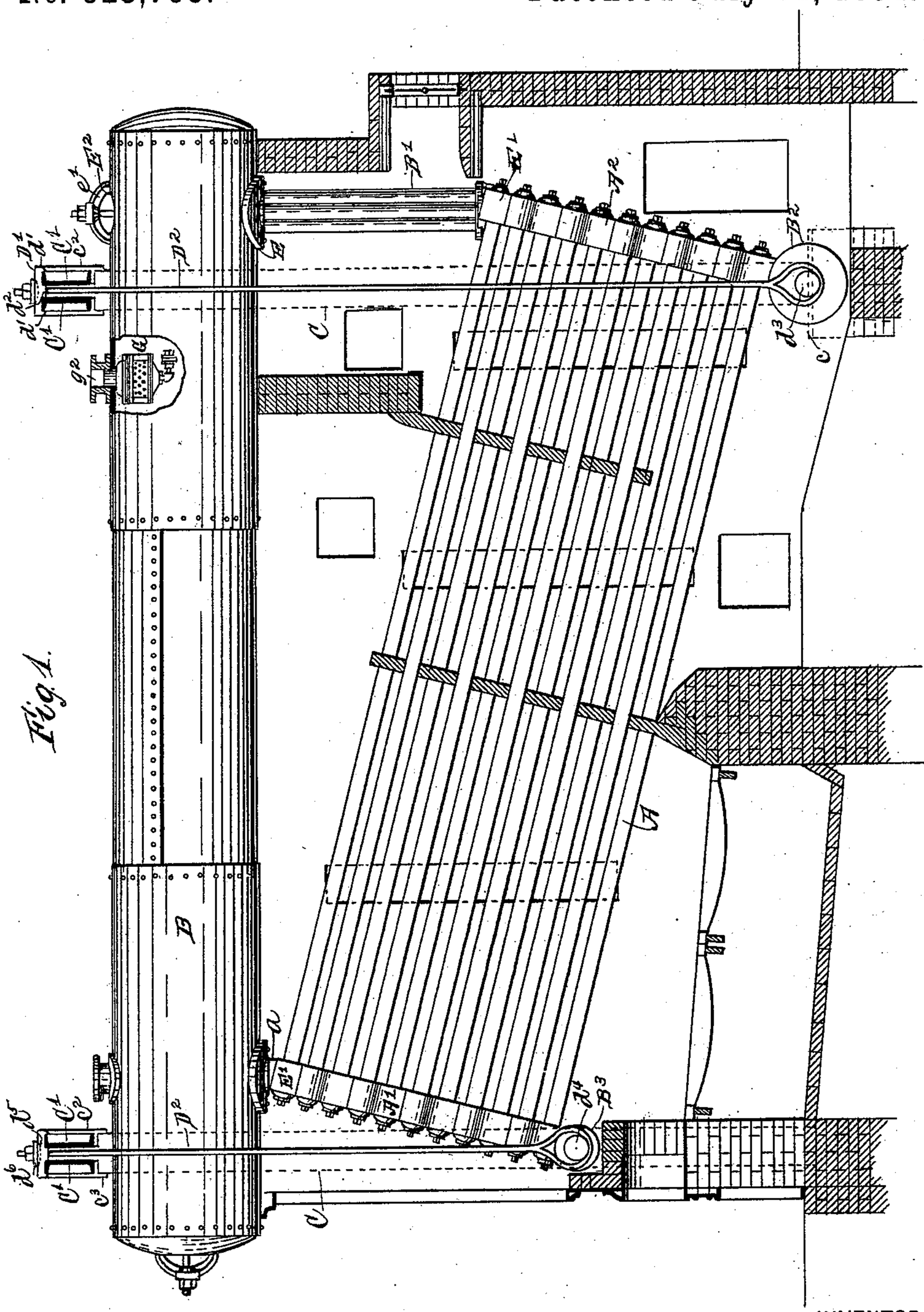

Fig. 1.

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Fig. 2.

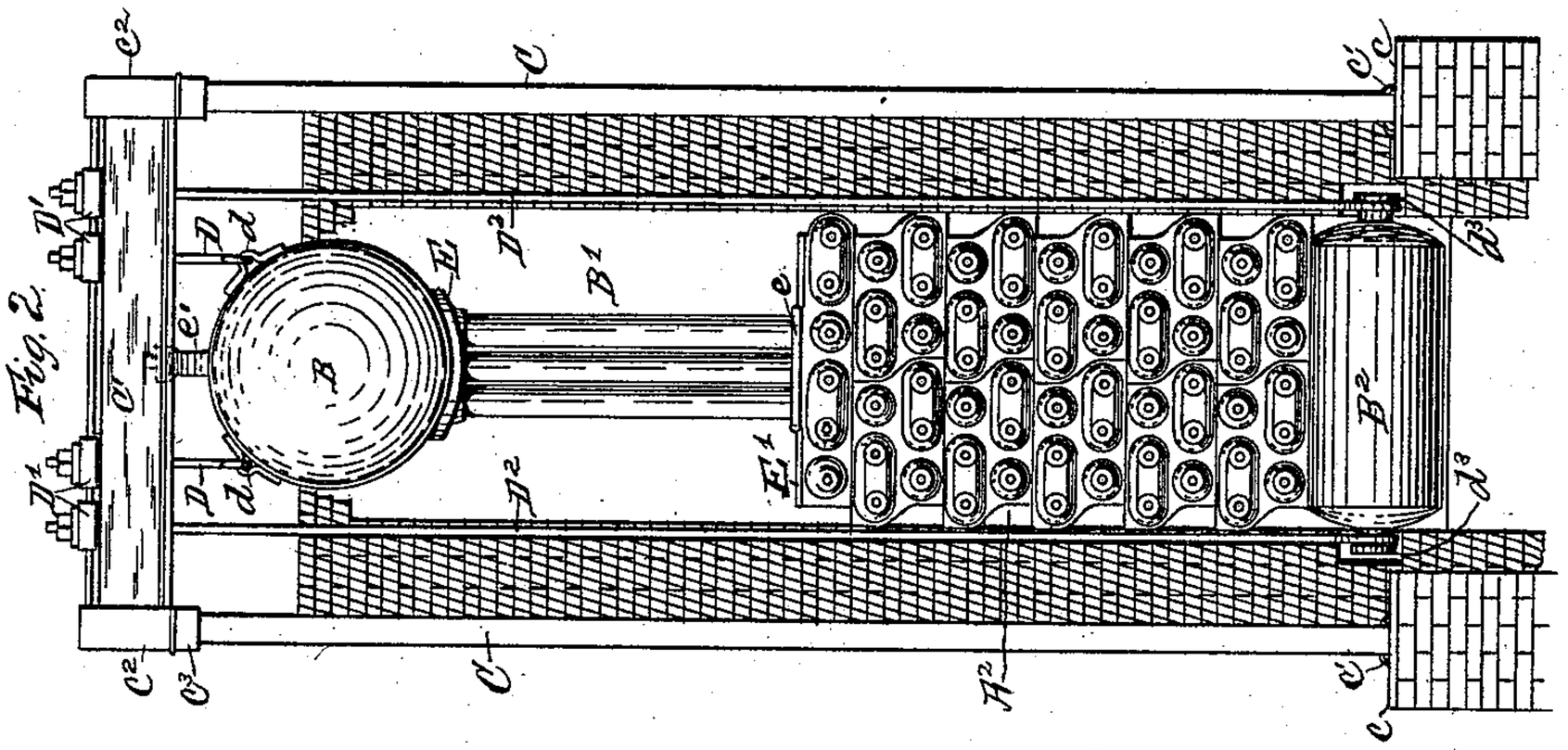


Fig. 4.

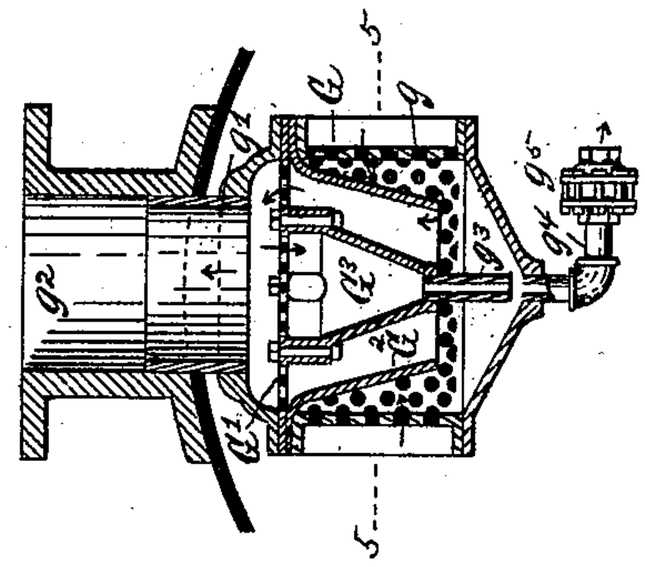


Fig. 5.

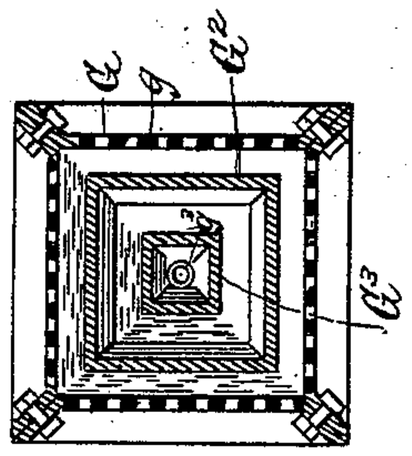


Fig. 6.

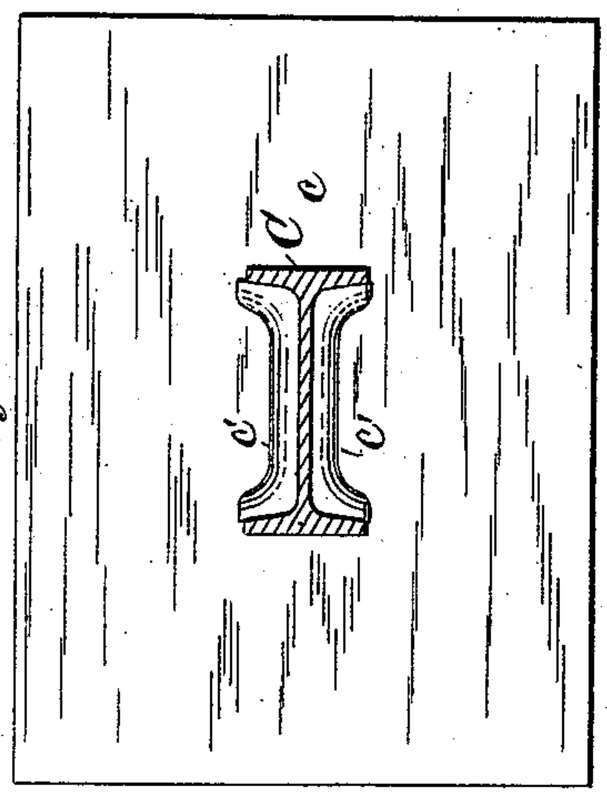
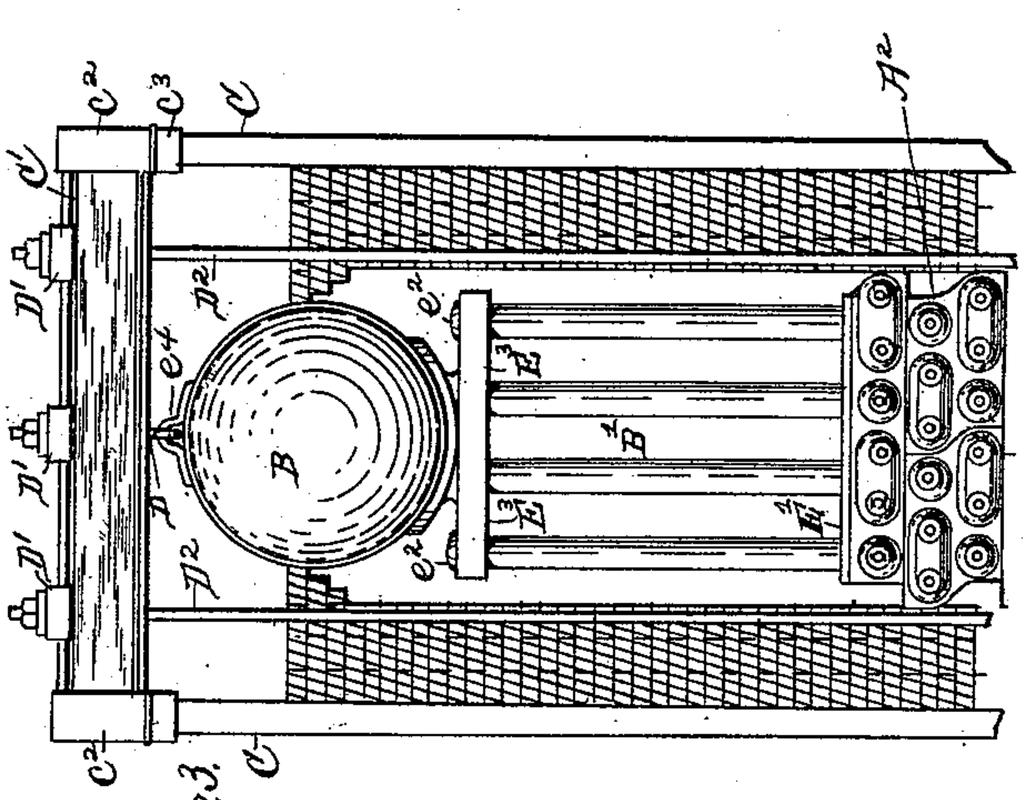


Fig. 7.

Fig. 3.



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STEAM GENERATOR.

No. 523,793. Patented July 31, 1894.

Fig. 9.

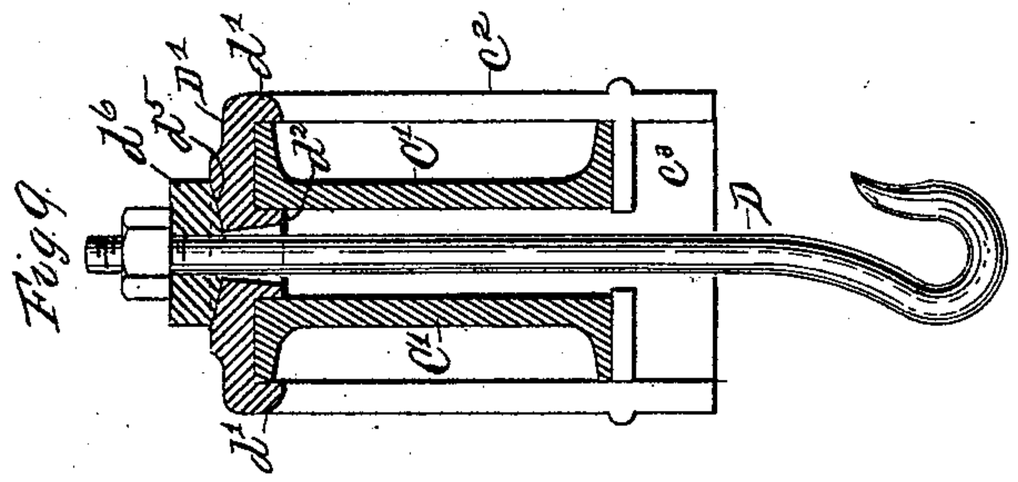
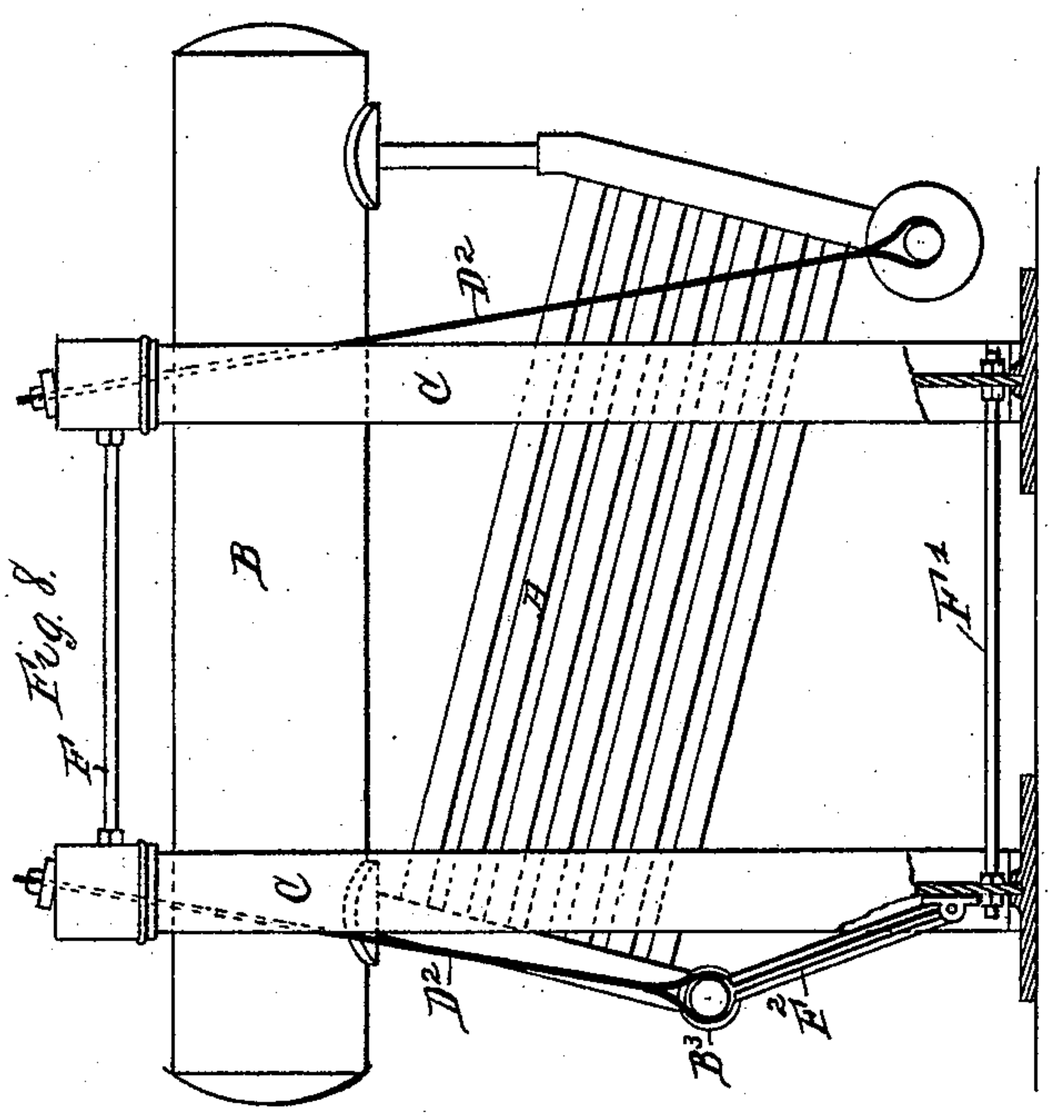


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM E. KELLY, OF NEW BRUNSWICK, NEW JERSEY.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 523,793, dated July 31, 1894.

Application filed December 8, 1892. Serial No. 454,438. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. KELLY, of New Brunswick, county of Middlesex, in the State of New Jersey, have invented a certain new and useful Improvement in Steam-Generators, of which the following is a specification.

I will describe a steam generator embodying my improvement and then point out the novel features in claims.

In the accompanying drawings Figure 1 is a side elevation, partly in section, of a steam generator embodying my improvement. Fig. 2 is a rear elevation thereof. Fig. 3 is a rear elevation showing a modification. Fig. 4 is an enlarged sectional detail of a steam separator employed. Fig. 5 is a section on the line 5—5 of Fig. 4. Fig. 6 is a plan view of a plate upon which certain supporting beams rest. Fig. 7 is a side view of the same. Fig. 8 shows a modified form of supporting the water and steam drum and the water tubes. Fig. 9 is a section on an enlarged scale of a hanger plate and rod.

Similar letters of reference designate corresponding parts in all the figures.

Referring by letter to the drawings, A designates a number of water tubes, which are arranged upon an incline in a suitable furnace. These tubes A are connected at their front ends by headers A′ and at their rear ends by headers A^2. The headers A′ communicate one with another and have connection through a pipe *a* with a steam and water drum B. The rear end of the drum B communicates with the rear headers A^2, which also communicate one with another, through downtakes B′.

B^2 shows a mud drum connected by nipples in the ordinary manner to the lower series of the rear headers A^2.

In the ordinary practice of supporting boilers the mud drum and water tubes rest upon a solid foundation, consequently they are stationary and there will necessarily be a difference in the expansion and contraction between the steam and water drum and the inclined tubes, owing to the fact that they are made of different thicknesses of metal and subjected to different degrees of heat. This difference of expansion and contraction causes a more or less forward and backward movement of the downtake tubes. The movement of the downtake tubes will be the greater at the upper ends and the constant oscillation tends to loosen the joints and cause leakage. I overcome this objection by suspending the steam and water drum from an overhead support and also suspending the mud drum and the rear end of the water tubes independently of the steam and water drum. I will now describe the means for suspending these parts.

C designates uprights consisting as here shown of metal **I** beams seated in the side walls of the furnace. The lower ends of these supports rest upon plates *c* which have ribs *c′* cast on them and embracing the sides of the supports to prevent a lateral movement. Channel beams C′, arranged above the steam and water drum B, are attached to the upper ends of the supports C. I have shown them so attached by means of cap pieces c^2, placed over and secured to the ends of the beams C′, by means of rivets or bolts, and resting on the top of the supports C. Preferably the caps c^2 have downwardly extended box-shaped portions c^3 to engage around the ends of the supports. It will be seen that there is a space between each pair of channel beams C′.

The steam and water drum B is suspended from the channel beams C′ by means of bolts D engaging at the lower ends by means of hooks with catches *d* secured to the sides of the steam and water drum. The upper ends of the hook-bolts D are shown as screw-threaded and passed through holes in suspension plates D′. Above the suspension plates each hook-bolt is provided with a nut.

The suspension plates D′ have downwardly extended side flanges *d′* to engage the outer edges of the channel beams C′ and a central rib d^2 engaging between the channel beams. These flanges and ribs prevent the lateral displacement of the plates and the flanges also prevent spreading of the beams.

The mud drum B^2 and the rear ends of the tubes A are suspended from the beams C′ by means of suspension rods D^2, the upper ends of which are connected to suspension plates D′ like those before described.

Preferably the top of each plate D′, around the hole, will have a concave recess d^5 and a hemi-spherical washer d^6 will surround the link or rod below the nut at the end and have

its seat in the concavity. This forms a ball and socket joint so that the parts may move easily.

The lower ends of the suspension rods D^2 have loops or rings engaging loosely with trunnions or similar devices d^3 extending from the ends of the mud drum. These trunnions are preferably cast integral with the ends of the mud drum.

While it is not absolutely necessary, and I do not wish to be confined thereto, the front ends of the tubes A may be suspended. At the forward portion of the furnace I have shown supporting beams C, the channel beams C′, the hook bolts suspending the steam and water drum, and the suspension rods D^2 like the same parts heretofore described.

The forward suspension rods D^2 engage with trunnions d^4 or similar devices on the ends of a drum B^3. This drum B^3 may be connected to the under side of the front headers by means of nipples having their ends expanded, or it may be connected with some other part of the boiler or with a feed water pipe so that water may circulate through it and prevent its being burned by the heat of the furnace.

It will be seen that all of the suspension rods D^2 are seated loosely in vertical channels in the side walls of the furnace.

Another feature of my improvement consists in arranging the downtake tubes in a cluster as it facilitates inserting and cleaning, as will hereinafter appear, and in employing a cross saddle or header on the top of both the rear and front headers, whereby space is economized and provision is made for an extra horizontal row of tubes.

In certain figures the downtake tubes B′ are shown as connected at their upper ends to a pad or plate E, secured to and opening into the steam and water drum B. The ends of the downtakes are expanded in the openings of the pad or plate E.

The cross-headers or saddles E′ are box-like structures, each preferably cast in one piece, and communicating with the headers upon which they are mounted. The cross-header or saddle E′ for the rear headers has a series of holes *e* arranged in a circle or oval to receive the lower ends of the cluster of downtakes B′, and each cross-header or saddle has its inner wall perforated to receive the ends of the upper water tubes A. This provides for an extra row of tubes A.

The steam and water drum B has in its upper side, directly in line with the downtakes B′ a manhole E^2 provided with a suitable cover *e′*. This provides for the easy insertion and cleaning of the downtakes.

In Fig. 3 I have shown the downtakes B′ as arranged in a straight row connected at the lower end with a cross-header or saddle E′ having a straight row of perforations in its upper wall, and the upper ends of the downtakes are connected to a saddle E^3 secured to and communicating with the drum B. In this example the central downtakes are arranged in line with the manhole E^2, and the saddle E^3 has manholes e^2 provided with suitable covers in its upper wall directly above the outer downtakes. By this construction the outer downtakes may be easily inserted and cleaned.

In Fig. 3 I have shown a modification in the manner of suspending the steam and water drum B. In this example only two suspension hook-bolts D are employed, one at each end, connected to an eye or loop e^4 secured to the top of the steam and water drum.

In Fig. 8 I have shown a modified form of suspending the drum B and the water pipes. In this example the channel beams C′ are arranged closer together and are braced by a stay rod F extending from the rear pair of channel beams C′ to the forward pair of channel beams C′, and the lower ends of the supports C may be braced by a stay rod F′. In this example the suspension rods D^2 hang at an angle. That is, the rods are deflected outward from the top to the bottom. To maintain the rods in this deflected position I employ brace rods F^2 extended from the lower end of the forward supports C to the trunnions of the drum B^3.

In connection with the steam and water drum B I employ a steam separator which I will now describe.

The steam separator consists of a box like structure or casing G, here shown as substantially rectangular, and having perforations *g* through its side walls. It is arranged within the drum B and at its top has a communication *g′* with the steam outlet g^2. Arranged within and across the upper portion of the outer casing G is a perforated plate G′. Suspended from the plate G′ is a casing G^2 having downwardly and inwardly inclined sides and open at top and bottom. This casing, it will be observed, does not extend to the bottom of the outer casing G. Within the casing G^2 a funnel G^3 is suspended from the plate G′ and a tube g^3 extends from the bottom of the funnel G^3 to near the bottom of the outer casing which is shown as inclined toward the center. From the bottom of the outer casing G a tube g^4 leads downward and outward to a valve box g^5, which has an outwardly opening valve arranged in it. This valve is to allow the return back to the drum B of the water extracted from the steam within the separator.

In operation the wet steam is forced through the perforations *g* against the outer side of the casing G^2 which will separate some of the moisture from the steam, as it is deflected downward. The steam then passes up through the casing G^2 and through the perforations of the plate G′, which will separate the remainder of the moisture from the steam. The dry steam will then discharge through *g′*, g^2, and the water will fall through the funnel G^3 and through the tube g^3 to the bottom of the outer casing G. Of course the accumulated

water will discharge through the valve seat g^5 into the steam and water drum.

The combined area of the perforations in the plate G′ is less than the area of the outlet g' whereby the plate G′ retards a too free outlet of the steam and thus causing a complete separation of the water from the steam.

Having described my invention, what I claim is—

1. In a steam generator, the combination with supports, of a steam and water drum, water tubes provided with headers at their ends, a drum communicating with the lower set of rear headers and having trunnions on its ends, suspension rods which engage directly with said trunnions and support the drum and the rear headers, a piece underneath the lower set of front headers upon which the front headers rest, suspension rods which engage directly with this piece and support the headers, and suspension rods for supporting the steam and water drum independently of said drum and water tubes, substantially as specified.

2. In a steam generator, the combination with supports, of a steam and water drum, water tubes provided with headers at their ends, a drum communicating with the lower set of rear headers and having trunnions on its ends, a piece underneath the lower set of front headers upon which the front headers rest, independent suspension rods engaging directly with said trunnions and said piece, and other rods for supporting said steam and water drum, said rods being so connected with their supports as to permit of their oscillation, substantially as specified.

3. In a steam generator, the combination with supports, of a steam and water drum, water tubes provided with superimposed sets of headers at their ends, the headers in each set interlocking with each other, cross headers or saddles connecting the headers in the uppermost set of the front and rear headers respectively, tubes connecting the front and rear cross headers or saddles, a drum communicating with the lower set of rear headers and having trunnions on its ends, a piece underneath the lower set of front headers upon which the front headers rest, independent suspension rods engaging directly with said trunnions and said piece, and other rods for supporting said steam drum, substantially as specified.

4. In a steam generator, the combination with supports, of water tubes provided with headers at their ends, a drum communicating with the lower set of rear headers and having trunnions at its ends, a piece underneath the lower set of front headers upon which the front headers rest, a steam and water drum, cross-headers or saddles connecting the headers in the uppermost set of the front and rear headers respectively, clusters of tubes arranged one on the front and one on the rear saddle and communicating with said steam and water drum, said steam and water drum having an opening or man-hole above and in line with said tube clusters, independent suspension rods engaging directly with said trunnions and said piece, and other rods for supporting said steam and water drum substantially as specified.

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

WILLIAM E. KELLY.

Witnesses:

CLARENCE R. FERGUSON,

ANTHONY GREF.