No. 616,369. Patented Dec. 20, 1898.

D. H. STREETER.

BOILER FURNACE.

(Application filed Dec. 6, 1897.)

(No Model.) 2 Sheets—Sheet 1.

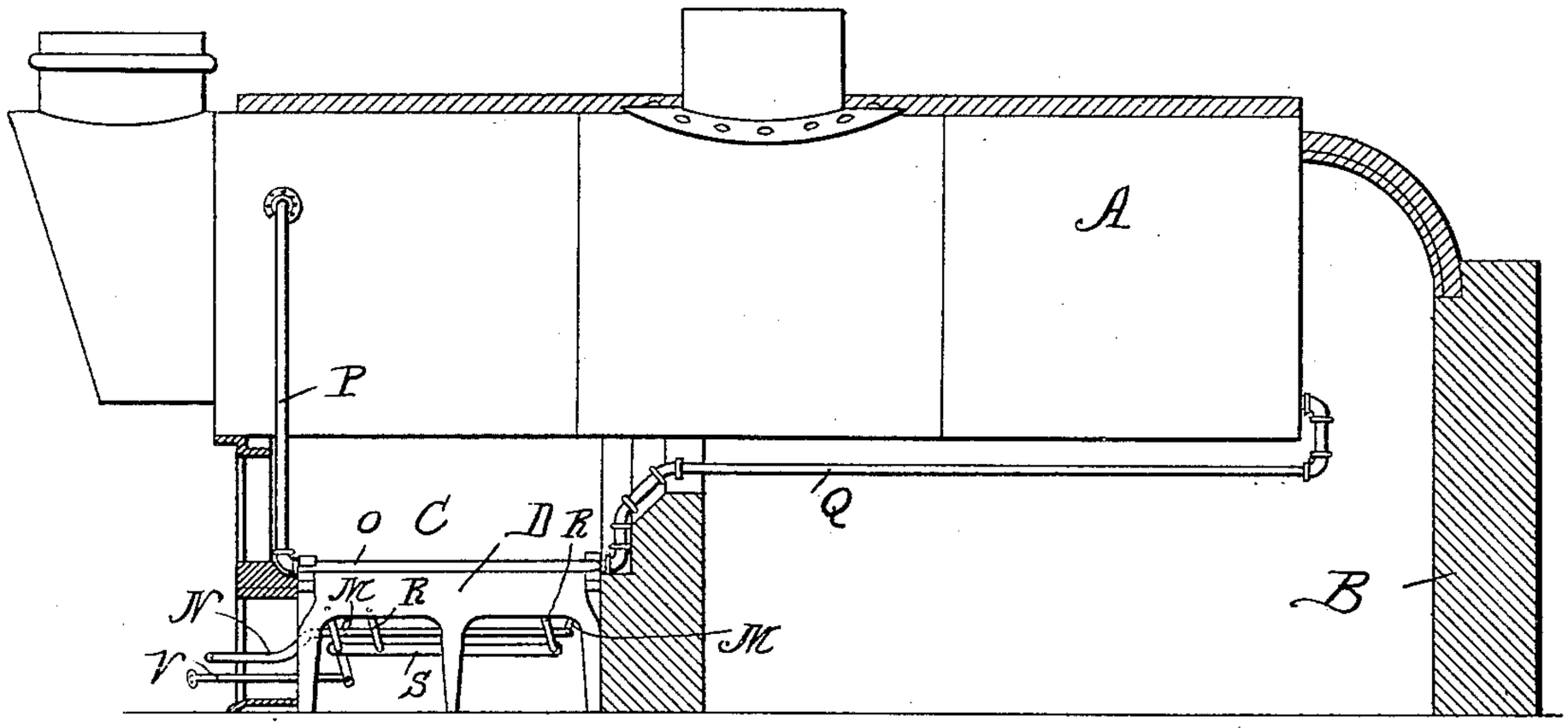

Fig. 1.

Fig. 5.

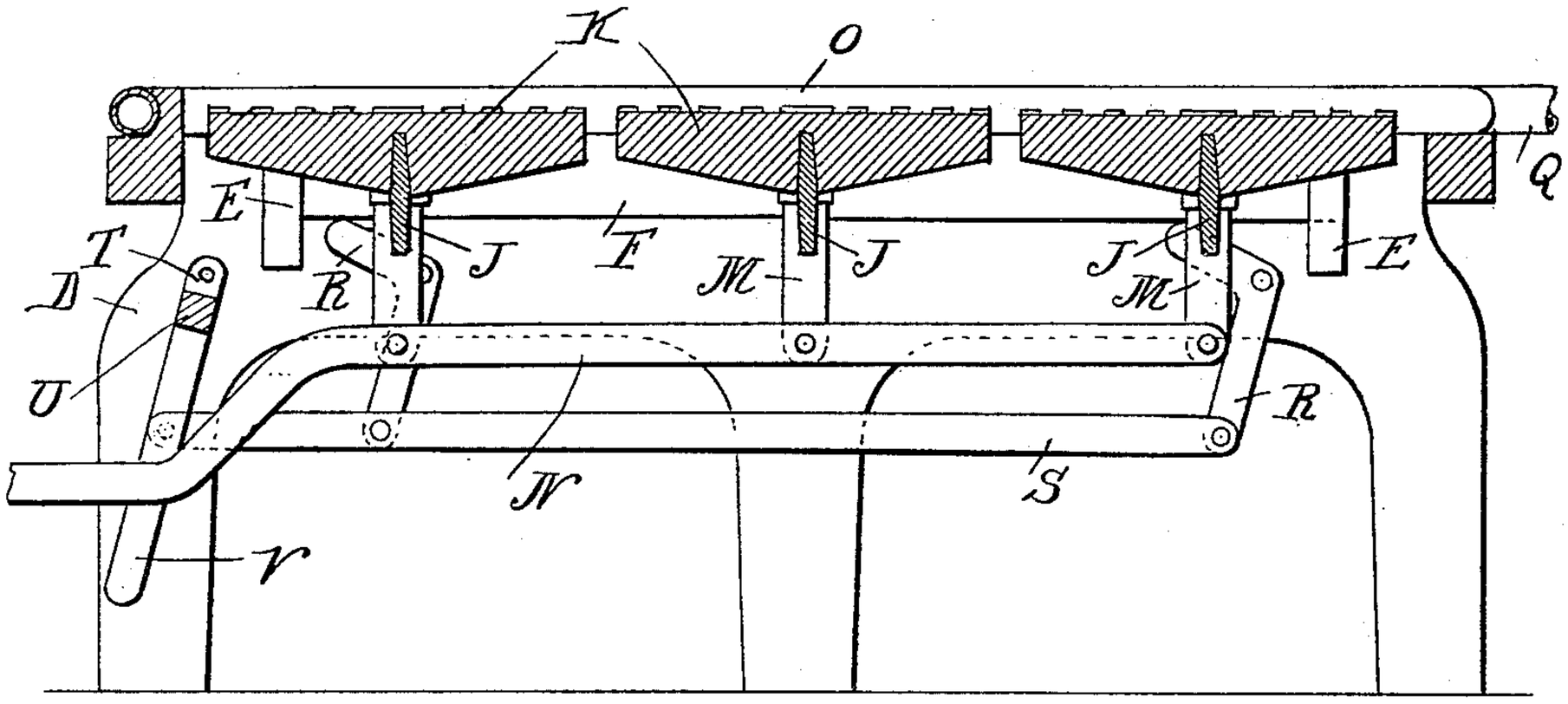

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Fig. 2.

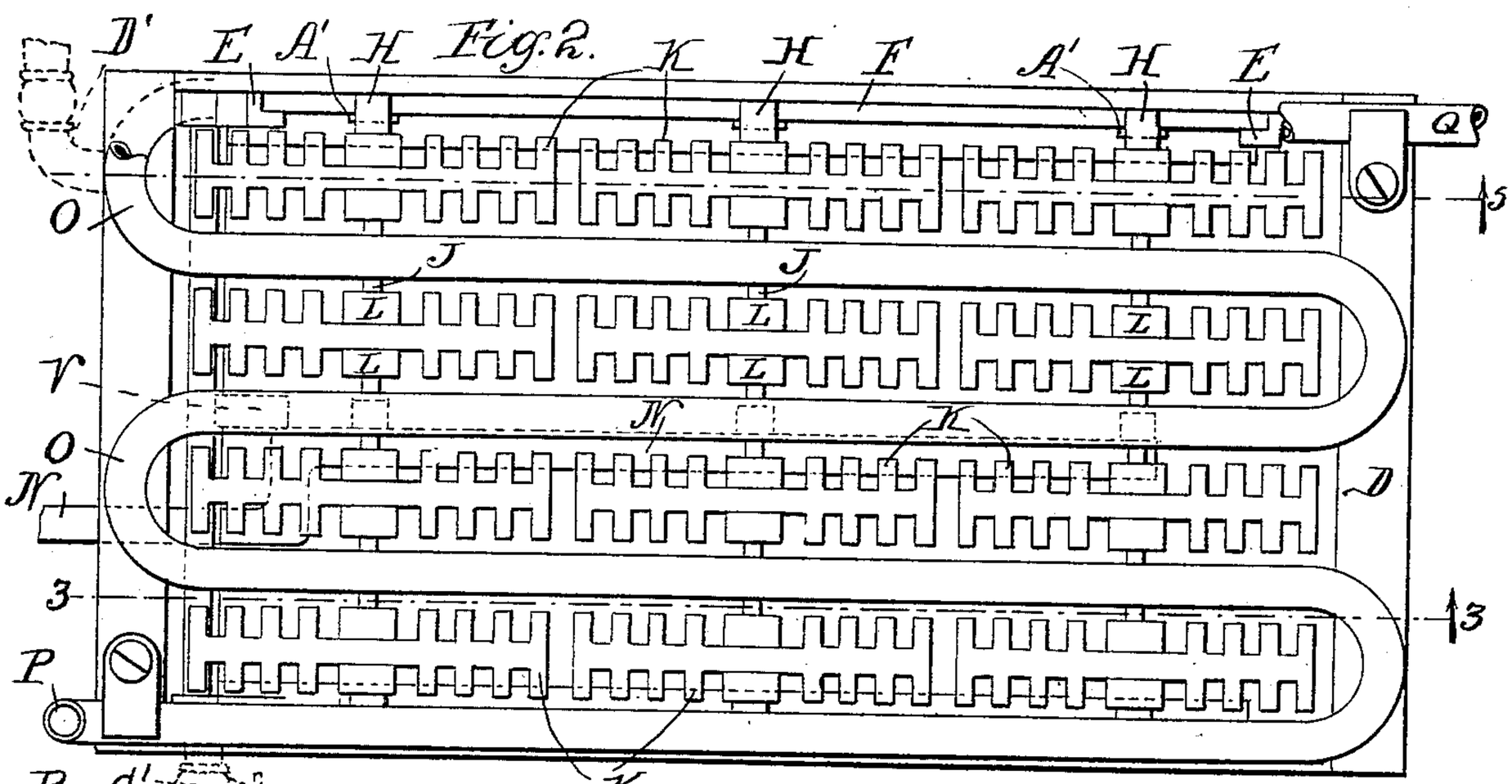


Fig. 3.

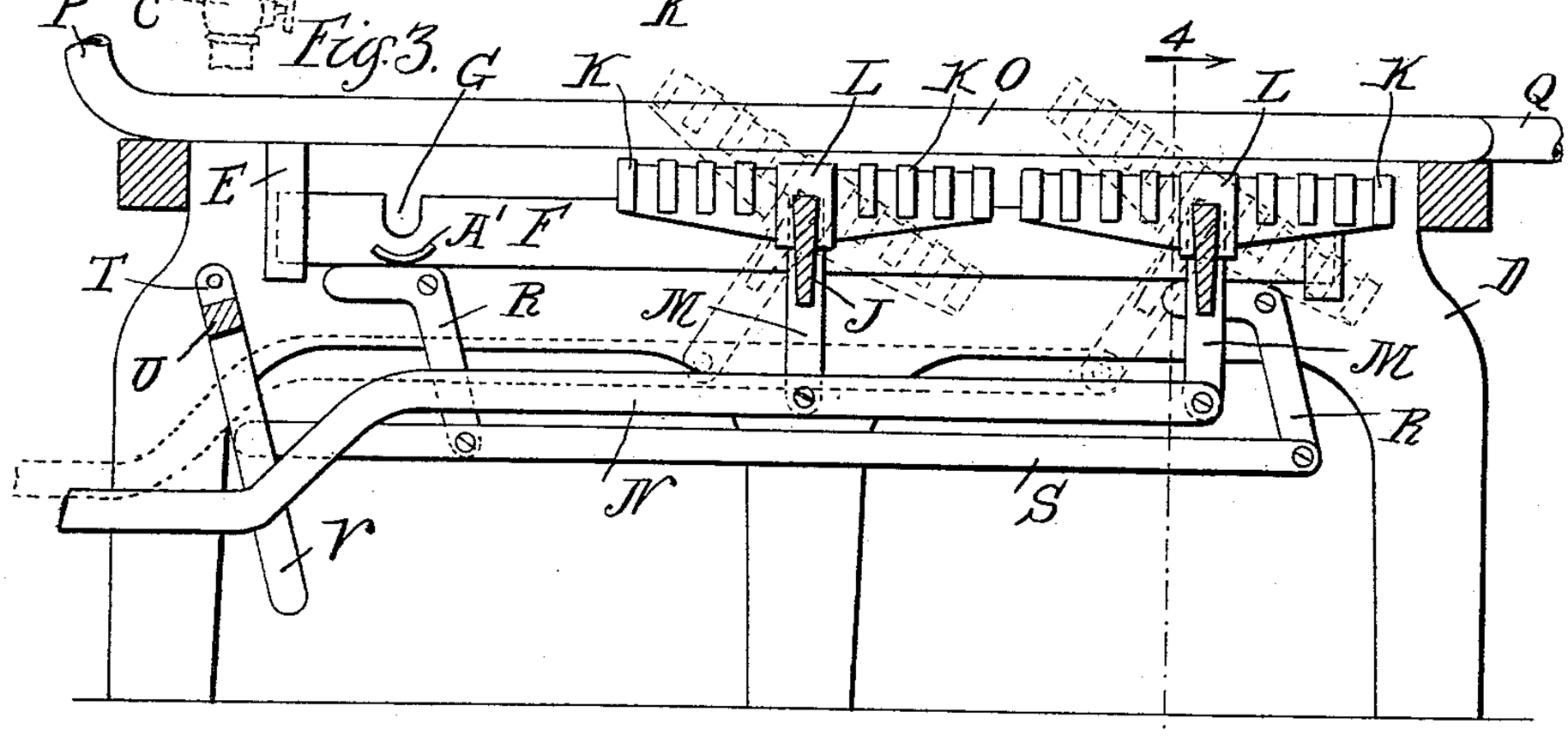
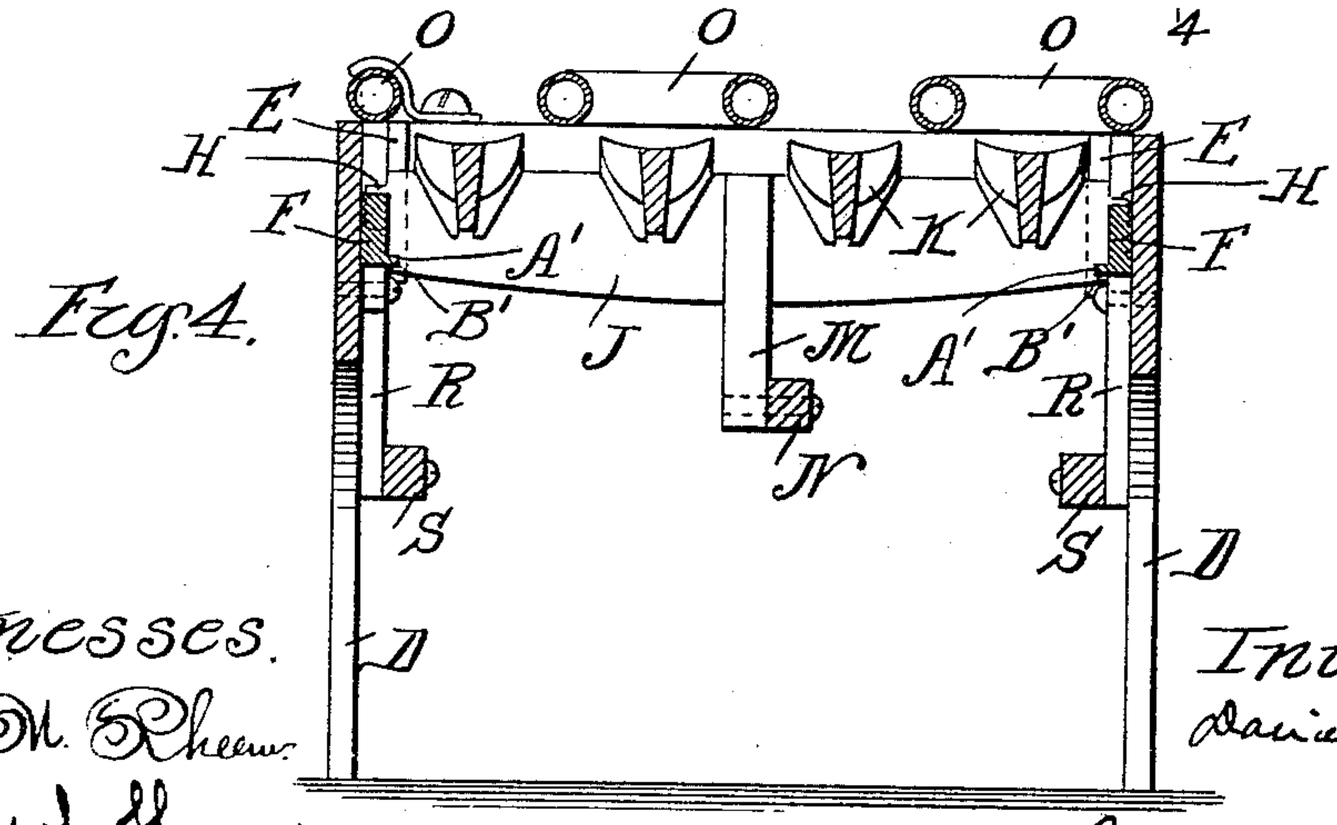


Fig. 4.



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UNITED STATES PATENT OFFICE.

DANIEL H. STREETER, OF CHICAGO, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO CHARLES E. MANNING, OF SAME PLACE.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 616,369, dated December 20, 1898.

Application filed December 6, 1897. Serial No. 660,925. (No model.)

To all whom it may concern:

Be it known that I, DANIEL H. STREETER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Boiler-Furnaces, of which the following is a specification.

This invention relates to boiler-furnaces.

The object of the invention is to provide an arrangement of grate-coils in a boiler-furnace so connected to the boiler as to secure an efficient circulation therethrough.

A further object of the invention is to provide a grate-surface wherein the air-draft may be regulated and controlled.

A further object of the invention is to provide a grate-surface wherein cleaning of the same of ash or clinkers may be easily effected.

A further object of the invention is to improve the construction and arrangement of the grates of boiler-furnaces whereby the same is rendered more perfect and efficient in effecting steam generation.

Further objects of the invention will appear more fully hereinafter.

The invention consists, substantially, in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally specifically pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and reference-signs appearing thereon, Figure 1 is a view in vertical longitudinal section of a boiler-furnace with the invention applied thereto. Fig. 2 is a plan view of the fire-grate, showing the arrangement thereon of the circulation-coil. Fig. 3 is a vertical sectional view on the line 3 3, looking in the direction of the arrow, showing in dotted lines a displaced position of the dumping-grate bars. Fig. 4 is a transverse sectional view of same on the line 4 4, Fig. 3, looking in the direction of the arrow. Fig. 5 is a longitudinal sectional view on the line 5 5, Fig. 2, looking in the direction of the arrow.

The same part is designated by the same reference-sign wherever it occurs throughout the several views.

In the practical, efficient, and economical operation of steam-boilers and in order to maintain the same free from deposits of scale, mud, or other sediment, to the end that the highest efficiency of the heat in effecting steam generation may be secured, it is exceedingly desirable to maintain a constant and efficient circulation of the water through the boiler. In order that this result may be accomplished without involving loss of heat, the circulating-coils are arranged in the furnace-chamber and are heated by the furnace-fire. If the circulating-coils form the grate-surface, it is evident that only a portion of the surface thereof is exposed to the fire, while an equally large portion is presented to the draft-air, whereby the efficiency of the heat in effecting steam generation in the coils is materially decreased and impaired in overcoming the cooling effect of the draft-air coming in contact with the under surface of the grate-coils. Moreover, different sizes, grades, and quality of coal require different degrees of air-draft in order that the full steam-generating power of the heat produced therefrom may be utilized to the best advantage. In the case of the circulating-coils forming the grate-surface the desired regulation of the draft is difficult of efficient attainment. Moreover, ash and cinders collect in and around the grate or circulating coils, thereby making it difficult to clean the same of clinkers and the like, the presence of which materially and injuriously affect the degree of steam generation.

It is the purpose of the present invention to provide a construction and arrangement of grate whereby the objections above noted are avoided and wherein the coils in the furnace-chamber are employed not only for circulation-coils during the generation of steam, but for the purpose of heating the feed-water supplied to the boiler and for the purpose of blowing off in order to clean the boiler of sediment or deposit, thereby maintaining not only the boiler, but also the coils and pipes, free from such deposits, and hence utilizing every available heat atom for steam generation. I also provide means whereby the draft may be regulated to suit the exigency of any particular size, grade, or quality of coal, and whereby the degree of steam generated may

be regulated easily and quickly, and whereby the grate or circulation coil may be entirely surrounded by the fire, whereby ample provision is made for expansion and contraction, removal, and renewal of worn or burned grate-bars and for easily and readily cleaning the grate-bars of ash, clinkers, and the like.

In the accompanying drawings, illustrating an operative embodiment of means in accordance with the invention, reference-sign A designates a boiler, B the boiler-setting, and C the furnace-chamber. Arranged to be received in the furnace-chamber is a removable framework D for supporting the grate-surface and the circulating-coils presently to be described. Suitably formed on or otherwise secured to the side pieces of the grate-supporting framework D are hangers E, in which are received side bars F. At the upper edge of Fig. 2 the overlying circulating-coil is broken out in order to show the arrangement of hangers E and the side bars F, the arrangement being such that said side bars F are permitted a free vertical movement, being guided in such movement by the hangers E, said hangers receiving the ends of said side bars. These side bars F are provided with seats G, (see Fig. 3,) in which are received gudgeons or journal ends H of transversely-arranged rocking bars J, one end of each of said transverse bars J being received in a seat or bearing G, formed in a side bar F on one side of framework D, and the other end of said transverse bar being received in a corresponding seat or journal-bearing formed in the side bar F on the opposite side of framework D, as most clearly shown in Fig. 4. Upon each transverse bar J is independently mounted two or more sections of grate-bars K. In order to facilitate the removal of individual grate-bars for repair or renewal in case it should become injured, broken, or burned out, each grate-bar section K is provided with a kerf or seat formed on the under side thereof and about midway its length, which is arranged to straddle its transverse supporting-bar J, as most clearly shown in Fig. 5. By this construction it will be readily seen that each grate-bar may be readily and independently removed by merely lifting it out of its seat on its transverse supporting-bar J. In order to properly receive and support the grate-bars K, each transverse bar is provided with lugs L, arranged on opposite sides of each grate-bar K, as most clearly shown in Figs. 2 and 3.

From the foregoing description it will be seen that I provide a grate-surface composed of separate and independently-mounted sections of grate-bars, which may be independently removed in case of necessity.

In order that the grate may be readily and easily cleaned of ash or clinkers, I provide means for rocking the transverse bars J. This result may be effected in any suitable or convenient manner, and either independently or simultaneously. In the particular form shown, to which, however, I do not desire to be limited or restricted, I form with or otherwise suitably secure to each transverse bar J an arm M, (see Figs. 3, 4, and 5,) to which I secure an operating connection N. From this construction it will be seen that when connection N is reciprocated endwise all the transverse bars J are rocked about their trunnions or gudgeons, thereby rocking each set of grate-bars K, as clearly indicated in dotted lines in Fig. 3. In this manner the grate-surface may be kept clean and free from ash, clinkers, or the like.

Reference-sign O designates a continuous coil of pipe arranged to be suitably supported upon the framework D and above the surface of the grate-bar sections K, and in order that this coil may not interfere with the proper action of the grate-bars when being rocked I so suitably arrange said coil and grate-bar sections that said sections will rock in the space between adjacent legs of the coil O, as most clearly shown in Figs. 2 and 4. The coil O is preferably a continuous pipe bent into **S**-coils. The front end of this coil on one side of the furnace-chamber is connected through pipe P with the front end of the boiler at a point about the water-level, as clearly shown in Fig. 1, and the rear end of this grate-coil on the opposite side of the furnace-chamber is connected through pipe Q to the rear end of the boiler at its lowest point, as indicated in Fig. 1. This is a most important arrangement, for the reason that the circulating or grate coil is connected at one end to the boiler at a point—viz., the lowest part of the rear end of the boiler—and hence at a point where the water contained in the boiler is coldest, and hence the heaviest, while the other end of the circulating or grate coil is connected to the front end and at the upper part of the boiler, where the water is hotter, and hence lighter, than the rear-end connection of the circulating-coil with the boiler. From this construction and arrangement it will be seen that water is drawn from the boiler at a point where it is coldest and heaviest, passes through the fire-chamber, where it is heated to a high degree, and hence converted into steam, whence it rises through pipe connection B and delivers into the boiler at a point where the boiler heat is greatest. Therefore a constant and efficient circulation of water is maintained not only throughout the boiler, but also throughout the heating or circulating coils O, thereby preventing the deposit of scale, mud, or the like upon the boiler or the circulating-pipes, and hence enabling every atom of heat applied to the boiler to perform work in generating steam and not requiring such heat to become dissipated in heating through scale or mud deposits. Moreover, by the provision of continuous or **S** coils in the fire-chamber the circulation of the water through such coils is free and unobstructed, and the use of joints, which rapidly get out of order, due to the expansion and con-

traction of such coils under the influence of the heat to which they are subjected, is avoided. By arranging the grate-coils O above the surface of grate-bars K, I am enabled to completely surround said coils with the fire and avoid the objection of said coils becoming embedded in ash or clinker, and therefore I utilize to the very best possible advantage every atom of the heat produced from the fuel. The pipes P and Q are arranged within the boiler-casing, and hence there is no appreciable loss of heat in the passage from the grate-coils to the boiler.

In order to secure the best possible results and adapt my construction to the use of fuel of different sizes, grades, and qualities, and also in order to properly and suitably regulate the amount of air-draft, it is important to provide means for adjusting the grate-surface toward and away from the grate or circulating coils O. In order to accomplish this result, I suitably and pivotally mount upon side pieces of framework D the angle or cam levers R, arranged in position to engage when rocked the side bars F and to raise or lower the same. By suitably arranging these angle or cam levers R in series to engage the side bars F at various points throughout the length thereof and suitably connecting up all the angle or cam levers R to be simultaneously actuated it will be seen that the side bars F, carrying with them the transverse bars J and the series of grate-bars K, will be bodily raised or lowered toward or from the circulating or grate coil O. This result may be attained in many specifically different arrangements. In the particular form shown, to which, however, I do not desire to be limited or restricted, I connect all the angle or cam levers R on the same side of framework D with a common rod or connection S, said rods or connections S being pivotally connected to links *t*, suitably connected together by a cross-bar U and adapted to be swung or rocked, as occasion may require, by means of an operating-handle V or in any other suitable or convenient manner. Thus it will be seen that when the operating-handle V is operated or rocked the bars or connections S are projected longitudinally, thereby rocking angle or cam levers R, and hence raising or lowering side bars F, carrying with them transverse bars J and grate-bars K, and hence adjusting the grate-surface toward or away from the grate-coils O, thereby regulating the supply of air to the fire. It will be observed that this adjustment does not affect or impair the capability or the facility with which the grate-surface may be rocked.

Many different arrangements may be provided for maintaining transverse bars J or the gudgeons or journals thereof in the seats G in side bars F. For instance, said side bars F may be provided with a flange A′, adjacent to and beneath each seat G, (see Figs. 3 and 4,) under which engages a lip or projection B′, formed on the end of the transverse bar J.

If desired, coil O may be provided with a blow-off connection C′, (see Fig. 2,) and also, if desired, a feed-water connection may be made with said coil, as indicated at D′, whereby the feed-water may be run through the grate-coils before being delivered to the boiler, thereby heating the same; but of course it will be understood that when the blow-off is in operation the connection P should be closed and when feed-water is being introduced to the boiler the boiler connection Q should be closed.

It will be seen that the grate and also the heating-coils are wholly supported upon framework D. This framework is arranged to be place within the furnace-chamber and therefore in the use of my invention it is unnecessary to provide a special construction of fire-arch or bridge-wall, as the grate and also the grate-coils are supported wholly independently of the brickwork, masonry, or setting of the boiler. This is a material and an advantageous feature of the invention, for the reason that the entire construction of grate may be easily and readily removed from the furnace for repairs or renewal without in any manner injuring or altering the setting or brickwork or the fire-arch of the boiler.

Many variations, alterations, and changes in the particular details of construction may readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of the invention. I do not desire, therefore, to be limited or restricted to the exact details of construction and arrangement shown and described; but,

Having now set forth the object and nature of my invention and a form of apparatus embodying the same and having described the construction, function, and mode of operation thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent of the United States, is—

1. In a boiler-furnace, a heating-coil arranged in the furnace-chamber and having circulating connection with the boiler, in combination with a movable fire-grate arranged beneath said coil and in a plane parallel therewith, and means for raising and lowering said grate toward and from said coil whereby the fire-draft and the area of said coils to be exposed to the fire may be regulated, as and for the purpose set forth.

2. In a boiler-furnace, a heating-coil arranged within the furnace-chamber and having circulating connections with the boiler, a grate-surface and pivotally-mounted levers arranged to raise and lower said grate-surface toward and away from said coils, and means for rocking said levers, as and for the purpose set forth.

3. In a boiler-furnace, a framework inde-

pendently and removably arranged within the furnace-chamber, a fire-grate movably mounted on said framework, a heating-coil carried by said framework and having circulating connection with the boiler, and means for adjusting said fire-grate toward and from said coil, as and for the purpose set forth.

4. In a boiler-furnace, a framework arranged within the furnace-chamber and having guiding-hangers, side bars arranged to be received loosely in said hangers and having journal-seats, transverse bars arranged to be journaled in said seats, grate-bars carried by said transverse bars, and means for raising and lowering said side bars, in combination with a heating-coil mounted on said framework and above said grate, said coil having circulating connection with the boiler, as and for the purpose set forth.

5. In a boiler, a continuous pipe bent into S-coils, arranged in the furnace-chamber, one end of said continuous coiled pipe connected with the lowest point of the boiler at the rear end thereof, and the other end of said pipe connected to the front end of the boiler at about the water-level, in combination with a fire-grate arranged beneath said coil and in a plane parallel therewith, and means for raising and lowering said grate toward and from said coil, as and for the purpose set forth.

6. In a boiler, a heating-coil arranged in the furnace-chamber and having circulating connection with the boiler, in combination with a frame arranged in the furnace-chamber, grate-bars supported upon said frame and arranged beneath and in a plane parallel to said coil, means for raising and lowering said grate-bars bodily toward and from said coils, and means for relatively rocking said bars, as and for the purpose set forth.

7. In a boiler-furnace, a heating-coil arranged in the furnace-chamber and having circulating connection with the boiler, in combination with a frame arranged in the furnace-chamber, grate-bars mounted in said frame, said bars being arranged beneath said coil and in a plane parallel therewith, means for raising and lowering said frame, and means for relatively rocking said grate-bars in said frame, as and for the purpose set forth.

8. In a boiler-furnace, a heating-coil arranged in the furnace-chamber and having circulating connection with the boiler, in combination with a frame arranged in the furnace-chamber, a grate mounted in said frame and arranged beneath and in a plane parallel to said coil, said grate comprising side bars and transverse bars, said transverse bars being journaled at their ends in said side bars, and grate-bars mounted on said transverse bars, means for raising and lowering said grate toward and from said coil, and means for rocking said transverse bars, as and for the purpose set forth.

9. In a boiler-furnace, a heating-coil arranged in the furnace-chamber and having circulating connection with the boiler, in combination with a frame arranged in the furnace-chamber, side bars movably mounted in said frame, said side bars arranged beneath said coil and in a plane parallel therewith, transverse bars journaled in said side bars, grate-bars independently and removably supported upon said transverse bars, means for raising and lowering said side bars toward and from said coil, and independent means for rocking said transverse bars, as and for the purpose set forth.

In witness whereof I have hereunto set my hand, this 1st day of December, 1897, in the presence of the subscribing witnesses.

DANIEL H. STREETER.

Witnesses:
E. C. SEMPLE,
S. E. DARBY.