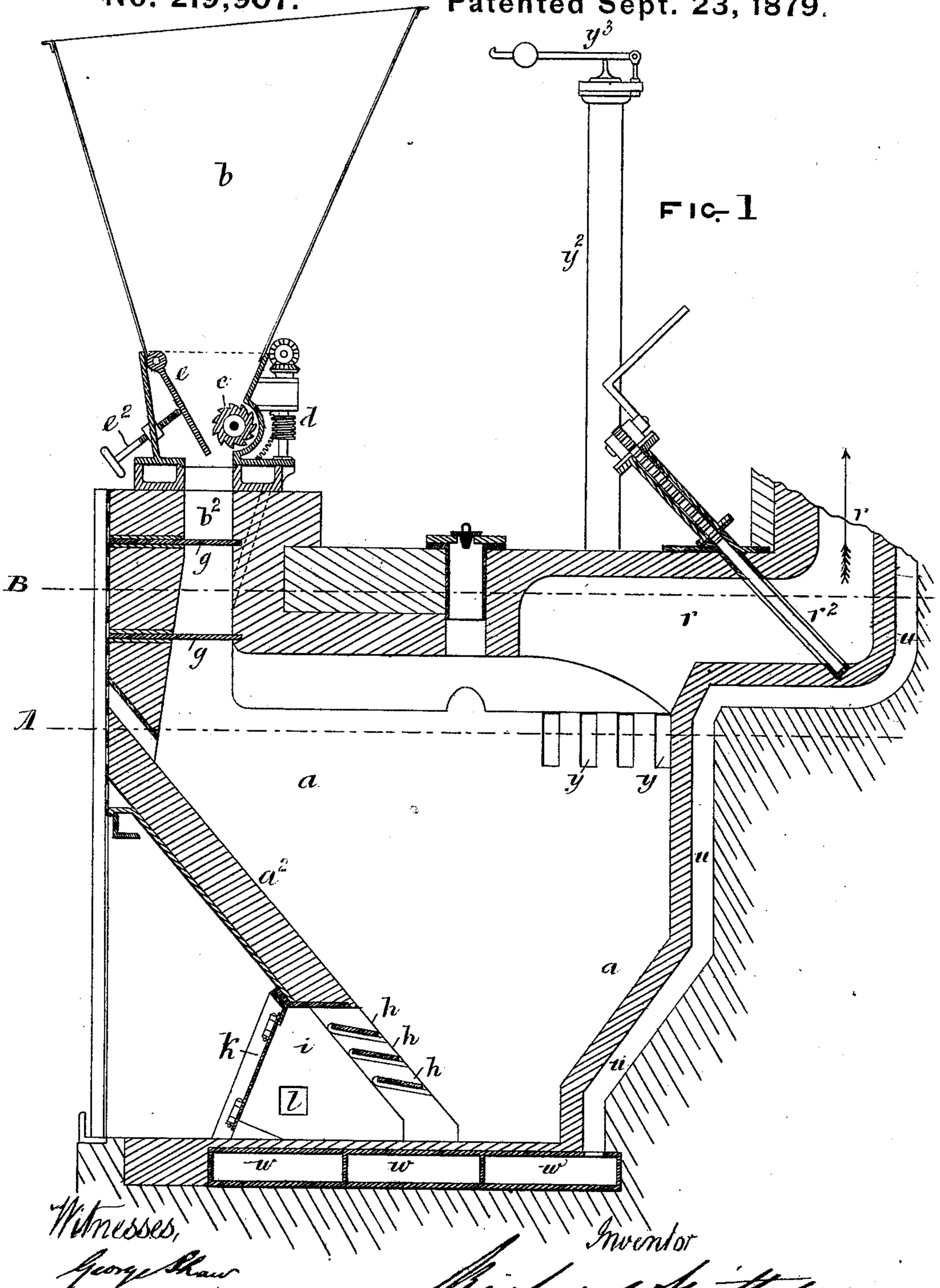
5 Sheets—Sheet 1.

R. S. CASSON.

Puddling and Heating Furnace.

No. 219,907. Patented Sept. 23, 1879.

FIG. 1



Witnesses,
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Richard Skerrett

Inventor
Richard Smith Casson

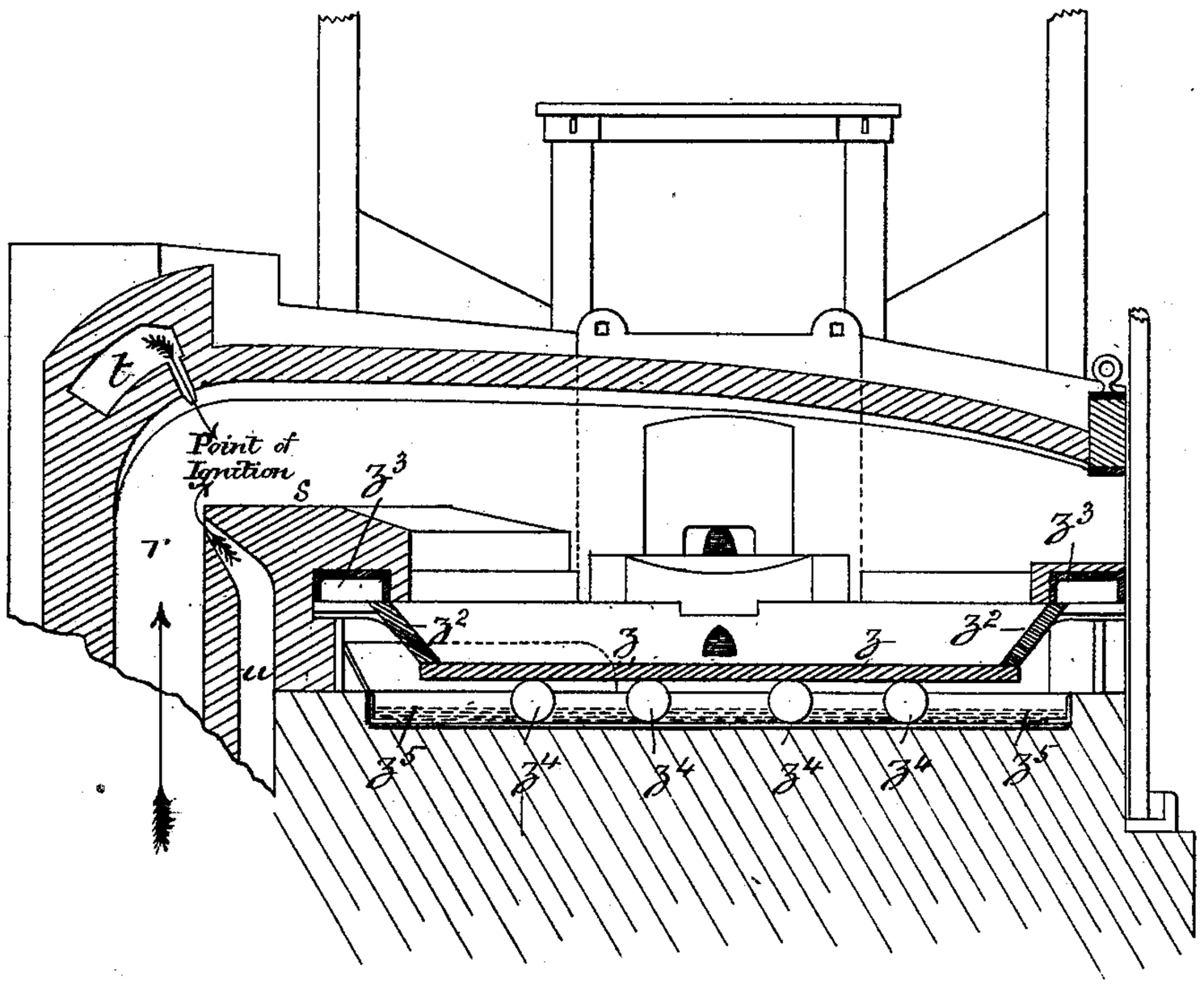
5 Sheets—Sheet 2.

R. S. CASSON.

Puddling and Heating Furnace.

No. 219,907. Patented Sept. 23, 1879.

FIG—1A



Witnesses,
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R. S. CASSON.

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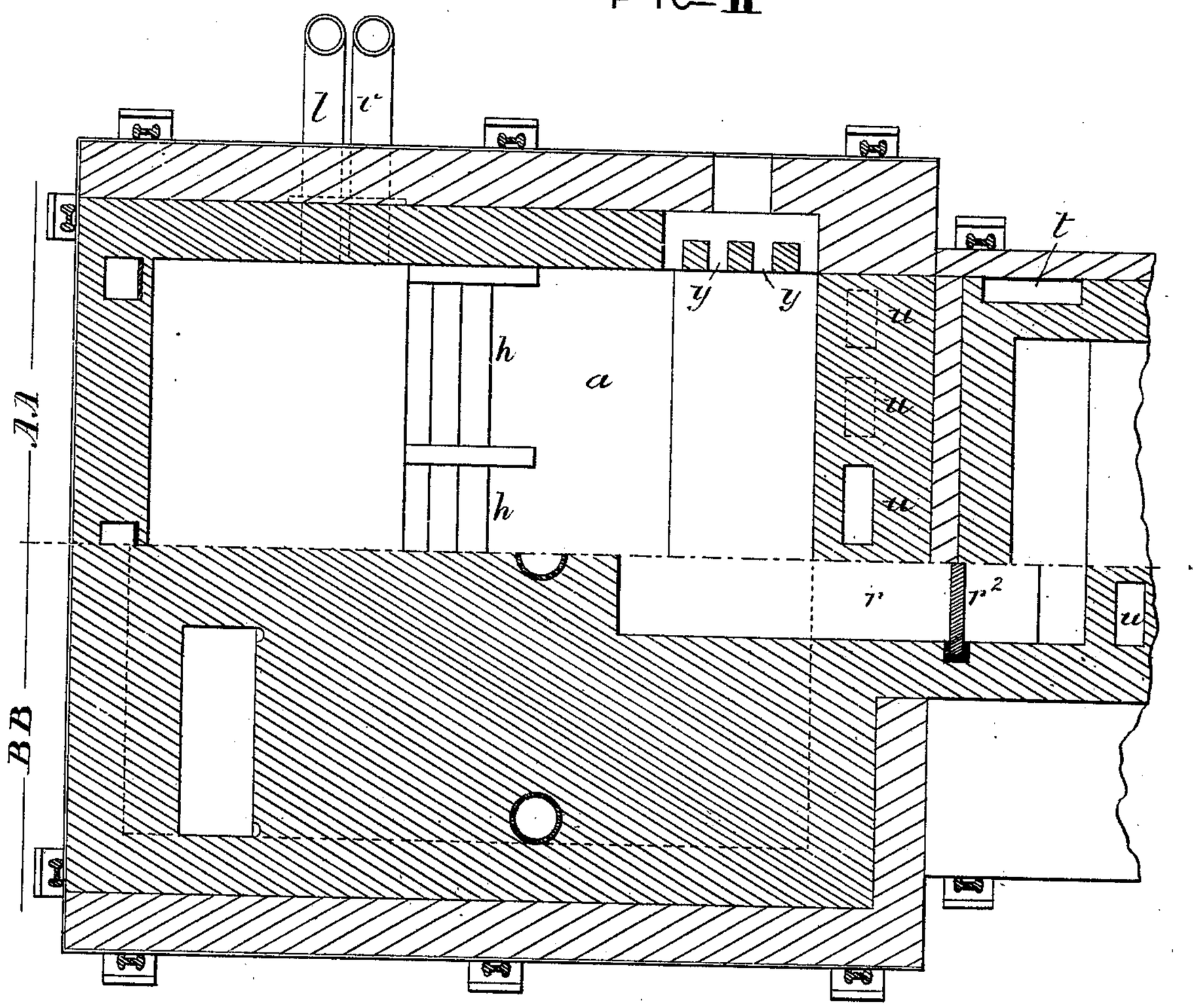
FIG—II



Witnesses,
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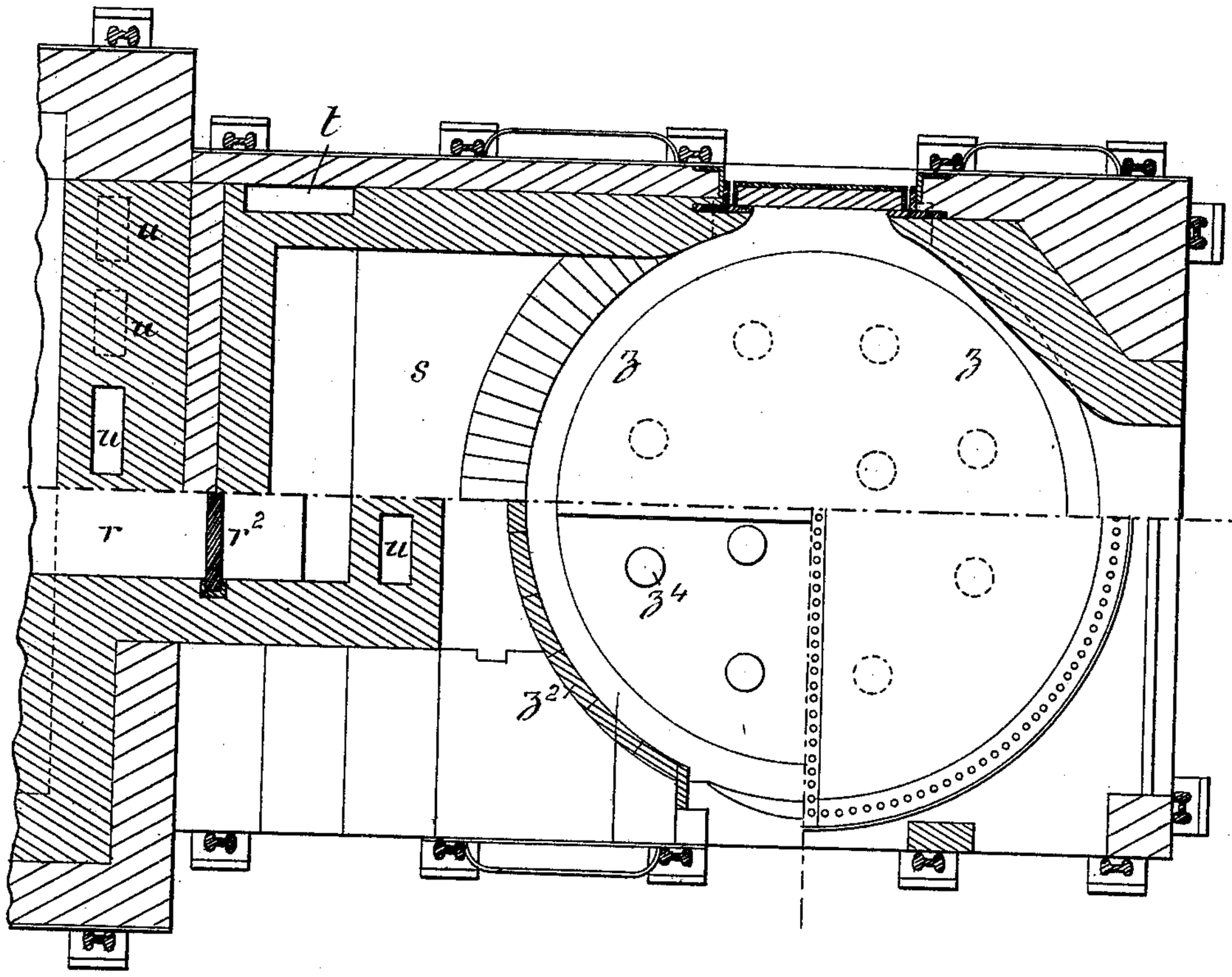
5 Sheets—Sheet 4.

R. S. CASSON.

Puddling and Heating Furnace.

No. 219,907. Patented Sept. 23, 1879.

FIG—II A



Witnesses,
George Skerrett
Richard Skerrett

Inventor
Richard Scott Casson

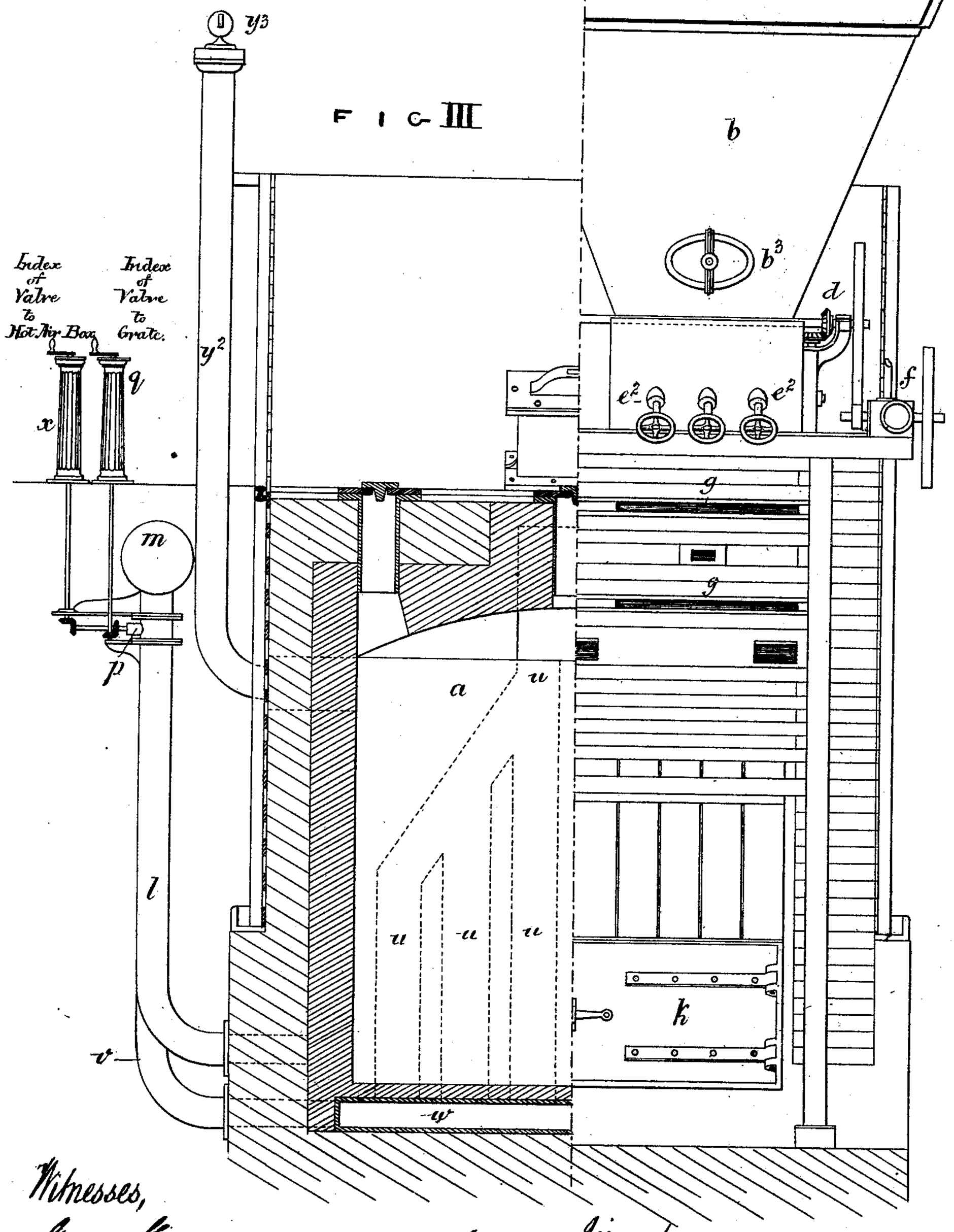
5 Sheets—Sheet 5.

R. S. CASSON.

Puddling and Heating Furnace.

No. 219,907. Patented Sept. 23, 1879.

FIG. III



Witnesses,
George Shaw
Richard Skerrett

Inventor
Richard Smith Casson

UNITED STATES PATENT OFFICE.

RICHARD S. CASSON, OF ROUND OAK WORKS, BRIERLEY HILL, COUNTY OF STAFFORD, ENGLAND.

IMPROVEMENT IN PUDDLING AND HEATING FURNACES.

Specification forming part of Letters Patent No. **219,907**, dated September 23, 1879; application filed August 31, 1878; patented in England, November 9, 1875, and January 21, 1876.

To all whom it may concern:

Be it known that I, RICHARD SMITH CASSON, of Round Oak Works, Brierley Hill, in the county of Stafford, England, manager of iron works, have invented new and useful Improvements in Puddling and Heating Furnaces, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings.

My invention consists of the construction and combination of the parts hereinafter described, and illustrated in the accompanying drawings, of puddling-furnaces heated by gaseous fuel, my said invention consisting principally of a mechanical feeder for feeding the fuel to the gas producer or generator; combination and arrangements of parts of the gas-producer and for heating and conducting the air or blast by which the combustion of the gaseous fuel is effected; and also the construction and arrangement of the parts of the puddling or heating chamber or basin.

My said improvements are combined in the puddling-furnace represented in the accompanying drawings, Figures 1 and 1^{A} representing a longitudinal section, and Figs. 2 and 2^{A} a horizontal section, of the furnace, Figs. 1 and 2 showing the gas producer or generator, and Figs. 1^{A} and 2^{A} the puddling-chamber, which puddling-chamber forms, with the gas producer or generator, a single structure. The horizontal section, Figs. 2 and 2^{A}, is taken on different levels, the part at A A being taken on the dotted line A A, Fig. 1, and the part at B B being taken on the dotted line B B, Fig. 1. Fig. 3 is a transverse vertical section, partly in elevation, of the gas producer or generator.

The same letters of reference indicate the same parts in the several figures of the drawings.

a is the generator in which the gaseous fuel is produced, the said generator being supplied with fuel from the hopper *b*, through the stoking-hole b^2. The fuel fed to the generator *a* consists of slack or small coal or fuel of an inferior quality. In the hopper *b* is a man-hole, and lid, at b^3, for gaining access to it.

The fuel is fed to the generator *a* from the hopper by a mechanical feeder constructed, preferably, as follows: In the base of the feeding-hopper *b* is a roller, *c*, having teeth or projections of the form represented on its periphery. A slow rotation is given to the feeding-roller *c* by the worm and toothed gearing at *d*, the said gearing being driven from a small steam-engine at *f* on the generator, as seen in Fig. 3, or by a band and pulley. As the feeding-roller *c* slowly rotates the slack or small coal resting in the spaces between the teeth or projections on its upper face is carried down and delivered to the generator through the stoking-hole b^2, so as to maintain a column of fuel always in the generator.

For the purpose of regulating the quantity of fuel fed to the generator by the feeding-roller *c* without altering the speed of the said roller, the space at the feeding side of the said roller is made adjustable in the manner represented in Figs. 1 and 3—that is to say, at the feeding side of the base of the hopper is a hinged flap or feed-plate, *e*, and by means of rotating screws e^2 e^2 bearing against the said plate or flap the latter may be adjusted nearer to or farther from the feeding-roller *c*, and the feeding-space thereby increased or diminished, as will be understood by an examination of Fig. 1. The said adjustable plate or flap *e* also serves to crush any large coal which may be fed between the roller and the said flap. *g g* are dampers or slides in the stoking-hole b^2, for shutting off the supply of fuel when required.

The fire-grate of the generator is constructed as follows: The wall a^2 of the generator is inclined, and at the bottom of the said inclined wall is a series of step-like bars, *h h*, through the openings between which air or blast is delivered for effecting the low combustion of the solid fuel in the generator and the production of gaseous fuel. In place of the step-like bars *h h* an ordinary grate-bottom may be employed in the generator. The spaces between the fire-bars *h h* open in front into the closed chamber *i*, formed by the hinged fire-doors *k k* and the side walls of the generator. Air or blast is delivered into the chamber *i* from the pipe *l*, the said pipe receiving blast from the

main blast-pipe *m*, which is supplied by a fan or other blast-producing apparatus.

A regulated quantity of blast is admitted to the pipe *l* by a valve at *p*, the quantity passing through the said valve and pipe and being supplied to the generator being indicated by the index at *q*.

By means of the blast thus supplied to the grate a low combustion of the fuel in the generator is effected, and a gaseous fuel consisting essentially of carbonic oxide produced. The stream of gaseous fuel passes from the generator by the gas-flue *r*, which gaseous fuel, meeting and being thoroughly mixed with currents of heated air, supplied as hereinafter described, is ignited, and a perfect and vigorous combustion of the said fuel effected.

The flame and heated air pass over the bridge *s* to the puddling-chamber. The currents of heated air described are delivered on the upper and lower sides of the stream of gaseous fuel. These currents of air are heated and conducted to the gas-flue in the following manner: The upper current of heated air is delivered by the side vertical flue, *t*, in one side of the wall of the gas-flue *r*, while the lower current of heated air is delivered by the vertical flues *u*, the upper flue, *t*, being in communication with and receiving air from the said flues *u*. The flue *t* passes down at the side of the flue through which the stream of gaseous fuel passes, the communication with flue *u* being made at any suitable point between the heating-chamber and the bridge-wall.

The air supplied to the flues *t* and *u* is heated in the following way: *v* is a blast-pipe in connection with the main blast-pipe *m*, and provided with a valve at *p* for regulating the quantity of air passing to the furnace, the said valve being connected with the index at *x*. The lower end of the blast-supply pipe *v* passes into the hot-air box *w*, underneath the floor of the gas-generator, the said box being heated by the said generator. The said box *w* opens into the vertical flues *u u*. By the passage of the air or blast through the box *w* the said air is heated thereby, and by traversing the heated flues *u u* of the generator the air is further heated before it is delivered to the gaseous fuel in the gas-flue *r*.

The heated air may be delivered to the gaseous fuel either in sheets or jets. *y y* are waste-gas outlets from the generator, in connection with the pipe y^2, passing from the roof of the generator, and being provided with a safety or escape valve at y^3.

By means of the damper r^2 in the gas-flue *r*, worked by the rack and pinion represented, the gaseous fuel passing through the gas-flue may be regulated or cut off. Instead of feeding the gaseous fuel into the puddling-chamber at the low point indicated, it may be introduced where convenient at a higher point.

I will now describe the puddling-chamber. It consists of a circular basin, $z\,z^2$, which is built up of a series of curved side plates, z^2, bolted together by flanges, the curved side plates resting on a flat circular bottom, *z*, made in one or more parts. Around the summits of the side plates, z^2, of the circular puddling-chamber are hollow bridge-plates z^3. The puddling-chamber $z\,z^2$ is supported by its bottom resting upon a series of spheres or balls of iron, z^4, resting in a shallow water-dish, z^5.

The construction described of the puddling-chamber permits the sides $z^2\,z^2$ and bottom *z* to expand and contract freely on change of temperature. There is, in consequence, little or no strain upon any of the parts, and the puddling-chamber lasts a long time, there being no liability to fracture by change of temperature.

By the evaporation of the water in the water-dish z^5 the bottom of the puddling-chamber is kept cool and the water in the water-dish circulates freely.

The waste heat from the puddling-chamber may pass to a "dandy" or preliminary heating-chamber, in which the pig iron is heated before it is passed into the puddling-chamber.

My improved furnaces are particularly applicable to double furnaces, or furnaces having the said dandies or preliminary heating-chambers; but I do not limit myself to the use of the said dandies in combination with my improved furnaces.

Having now described the nature of my invention, and the manner in which the same is to be performed, I wish it to be understood that I claim as my invention of improvements in puddling and heating furnaces to be heated by gaseous fuel—

1. In a gas-generator, the combination, with the fuel-chamber having an inclined wall and grate formed of step-like bars at one side, and provided with a closed ash-pit and means for regulating the supply of air to said ash-pit, of a continuous mechanical feeder, adjustable as to its rate of speed, the same being composed of a hopper, adjustable feeding devices for delivering the fuel from said hopper to aforesaid fuel-chamber, and means, such as a steam-engine, for continuously and regularly operating said feeding devices, substantially as described.

2. In a gas-generator, the combination of parts for heating and conducting air or blast, and for delivering the said heated air on one or more sides of the stream of gaseous fuel, so as to produce a vigorous combustion thereof, the said parts consisting of the air-heating chamber, located directly beneath the fuel-chamber of the generator, the top or roof of said heating-chamber being the bottom of said fuel-chamber, and a flue or flues connected with said heating-chamber and arranged to deliver air therefrom to the stream of gaseous fuel, substantially as described.

3. In a puddling-furnace, the puddling chamber or basin, resting on supporting spheres or balls, substantially as described.

4. The puddling or heating chamber or basin, of circular form, constructed in parts for allowing freedom of expansion and contraction, in combination with an open water-dish and a

number of spheres or balls placed in said dish for supporting said puddling chamber or basin, substantially as described.

5. The combination of the following elements, viz.: first, an automatic feeding mechanism; second, a generator for supplying gaseous fuel; third, a heating-chamber and distributing-flues arranged so that the heat from the partial combustion in said generator elevates the temperature of the air therein; and, fourth, a puddling-furnace with circular puddling-chamber resting on spheres or balls in an open water-dish, and provided with a bridge-wall of shape to correspond therewith, substantially as described.

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Witnesses:

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Of 37 Temple Street, Birmingham.