

J. T. NICOLSON.

STEAM BOILER.

APPLICATION FILED APR. 22, 1910.

1,003,059.

Patented Sept. 12, 1911.

2 SHEETS—SHEET 1.

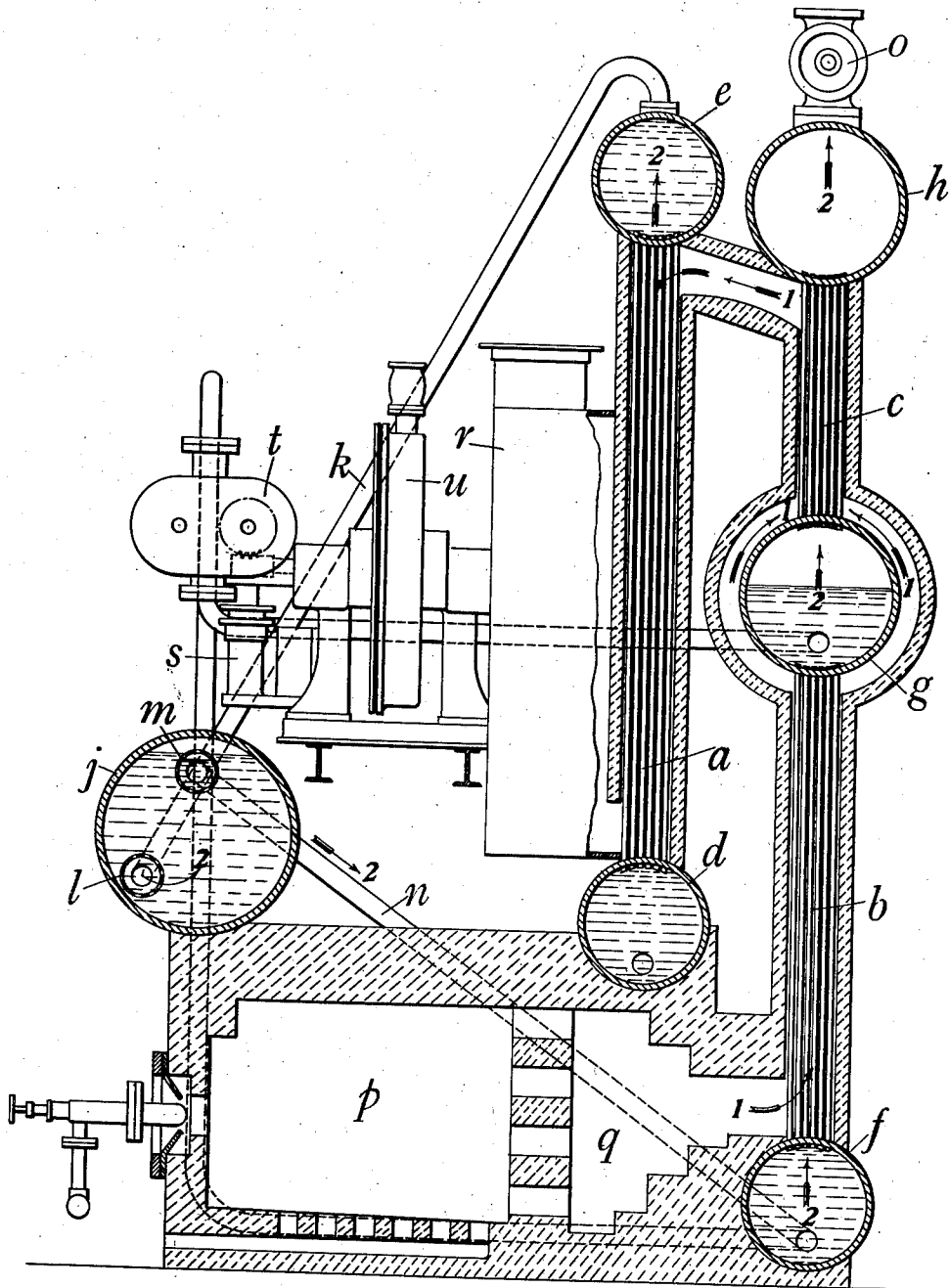


Fig.1

Attest:

Edw. C. Tolson
Edward M. Sarita

Inventor:

John Thomas Nicolson,
by Spear, Mudd & Co., Donaldson & Spear
Attys

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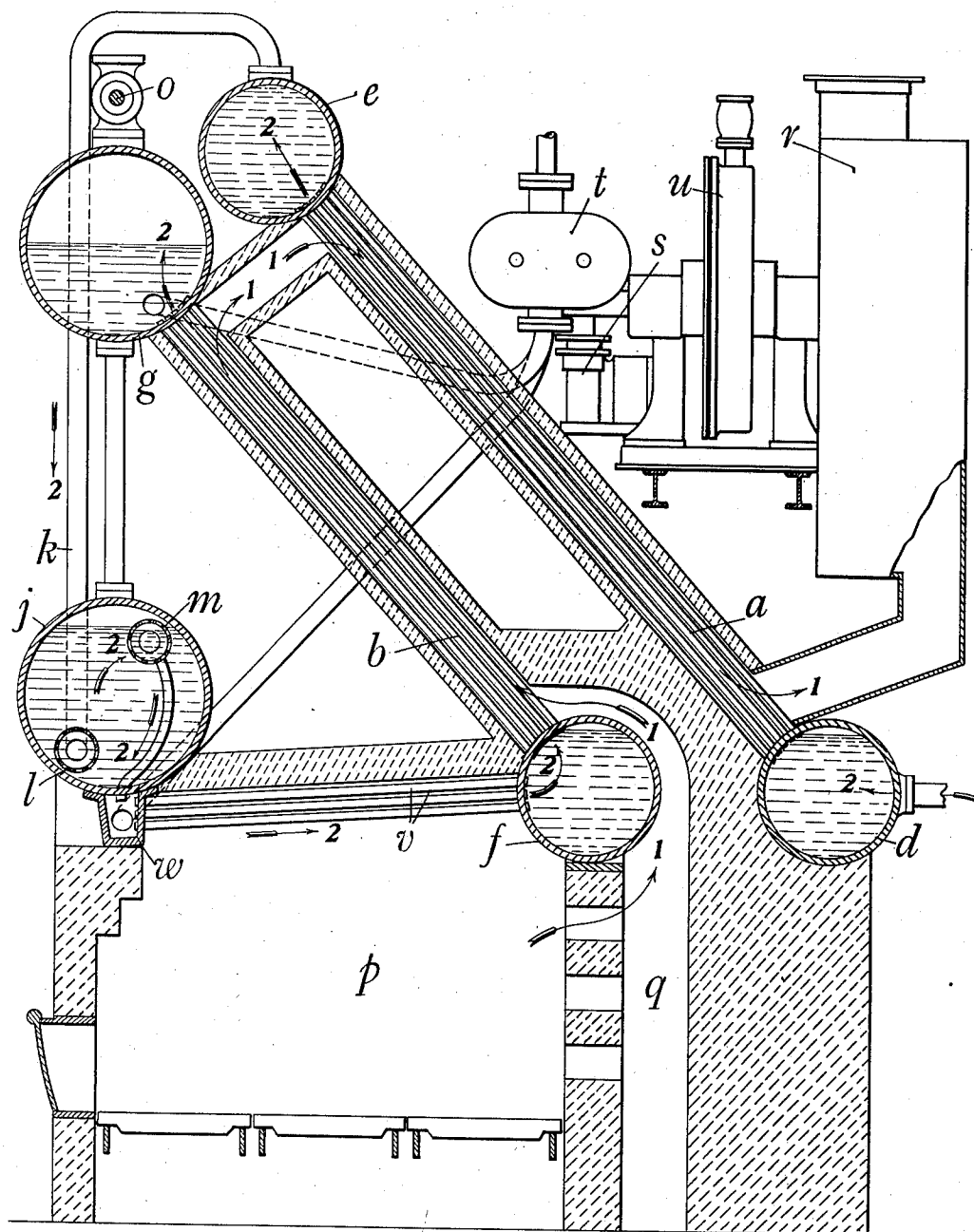


Fig. 2.

Attest:
Edw. L. Tolson.
Edward A. Sinton

Inventor:
John Thomas Nicolson,
by Spear, Muddleton, Dumasson & Spear
Attys.

UNITED STATES PATENT OFFICE.

JOHN THOMAS NICOLSON, OF MARPLE, ENGLAND.

STEAM-BOILER.

1,003,059.

Specification of Letters Patent. Patented Sept. 12, 1911.

Application filed April 22, 1910. Serial No. 556,934.

To all whom it may concern:

Be it known that I, JOHN THOMAS NICOLSON, D. Sc., a subject of Great Britain, residing at Marple, in the county of Chester, England, have invented certain new and useful Improvements Relating to Steam-Boilers, of which the following is a specification.

This invention relates to steam boilers of the water tube type and has for its object to provide for great steaming capacity with simplicity and convenience in construction, and economy both of fuel consumption and of space occupied by the boiler.

On the accompanying sheets of explanatory drawings:—Figure 1 is a sectional side elevation of one form of boiler (with oil burning furnace) as constructed in accordance with this invention. Fig. 2 is a sectional side elevation, illustrating another form of the boiler having a furnace adapted for burning coal or solid fuel.

The same reference letters in the two views indicate the same or similar parts.

Referring to Fig. 1, three nests of tubes *a b* and *c* are employed, each nest consisting of a rectangular group of numerous straight small bore tubes with an inclosing flue. The lower ends of the tubes forming the nest *a* are connected to the drum or chamber *d* and the upper ends to the drum or chamber *e*. Similarly the ends of the tubes of the nest *b* are connected to the drums *f* and *g* respectively, and the ends of the tubes of the nest *c* to the drums *g* and *h* respectively. The feed water is admitted to the drum *d* and passes therefrom through the tubes of nest *a* to the drum *e*. As it thus flows through the interior of the said tubes the water is heated by the hot gases flowing, in a contrary direction, along the exterior surfaces of the tubes and parallel therewith; the water is thereby raised to boiling point.

From the drum *e* the boiling feed is led into the settling or interception drum *j* by way of the pipe or conduit *k*. In the said drum *j* the hot water is in a state of quiescence and in such state any mud or solid matter will separate from the water and be-

come deposited in the drum from whence it may be readily removed through mud holes which are provided with detachable covers in any ordinary manner. The quiescence of the water in the drum *j* is insured by the provision of long perforated pipes as *l* and *m* respectively for the entry and egress of the water.

From the interception drum *j* the hot water passes through the pipe or conduit *n* to the drum *f* and from thence by way of the tubes of the nest *b* to the drum *g*. In passing through the interior of the said tubes the hot water is subjected to the heat of the hot gases flowing along the exterior surfaces of the tubes and parallel therewith and is thereby evaporated. The saturated steam thus produced flows on from the drum *g* by way of the tubes of the nest *c* to the drum *h* and while so passing through the said tubes it becomes superheated by the hot gases flowing along the exterior surfaces of the tubes and parallel therewith. The superheated steam is withdrawn as required through the outlet or stop valve *o*.

The complete course of the hot gases flowing in series through the respective tube nests (on the exterior of the tubes) between the furnace *p* (with combustion chamber *q*) and the fan *r* is indicated by the arrows 1; similarly the course of the water and steam as it flows in series through the tube nests (within the tubes) between the admission drum *d* and the outlet valve *o*, is indicated by the arrows 2. Both of the said flows are at high velocities, the gases under the action of the fan *r* and the water under the action of the feed pump *s*. The said fan and pump and also the auxiliary water circulating pump *t* are driven by the steam turbine *u*. The fan is coupled directly to the turbine; the pumps are operated through worm gearing. The purpose of the auxiliary water circulating pump *t* is to return unevaporated water from the drum *g* to the drum *f*.

The rate of steam generation can be instantly varied by throttling the pressure of the steam supply to the turbine *u*.

Referring to Fig. 2 the boiler there shown

is provided with a furnace for the combustion of coal or solid fuel and no provision is made for superheating the steam generated. The conduit between the interception drum *j* and the drum *f* comprises a group of tubes such as *v* between the perforated egress pipe *m* within the drum *j* and a header *w* beneath the said drum. From the said header *w* the water flows through the group of tubes *v* (wherein it is subjected to radiated heat from the furnace *p*) to the drum *f*.

The complete course of the hot gases between the furnace *p* and the fan *r* is indicated by the arrows 1; similarly the complete course of the water and steam is indicated by the arrows 2.

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

1. In steam generators, in combination, two water drums, a nest of water tubes connecting said water drums, an inclosing flue around said nest of tubes, an interception drum or chamber out of the path of the hot gases, a water conduit between one of said drums and said interception chamber, a further water drum, a water conduit between the latter and said interception chamber, a steam-and-water drum, a nest of tubes connecting said steam-and-water drum with said further water drum, and an inclosing flue around the latter nest of tubes, as set forth.

2. In steam generators, in combination, a water drum, a steam-and-water drum, an interception drum out of the path of the hot gases, a nest of water tubes delivering water from said water drum to said interception drum wherein it remains quiescent, an inclosing flue for said nest of water tubes, a furnace, further water tubes passing in part through said furnace and delivering the water from the interception drum to the steam-and-water drum, an inclosing flue for a part of the length of said water tubes between the furnace and the steam-and-water drum, means for causing the hot gases after passing over the tube surface within the furnace to flow at high speed in series through the tube nests and their inclosing flues in contact and in parallel with the tubes, and means for causing a high speed flow of the water through the tubes, the water flow in one nest being in a counter-direction to the gas flow through that nest, as set forth.

3. In steam generators, in combination, two water drums, a nest of water tubes connecting said water drums, an inclosing flue around said nest of tubes, an interception drum or chamber out of the path of the hot gases, a water conduit between one of said drums and said interception cham-

ber, a furnace, a further water drum, a water conduit passing through said furnace and connecting the latter drum with the interception chamber, a steam-and-water drum, a nest of tubes connecting said steam-and-water drum with said further water drum and an inclosing flue around the latter nest of tubes, as set forth.

4. In steam generators, in combination, two water drums, a nest of water tubes connecting said water drums, an inclosing flue around said nest of tubes, an interception drum or chamber out of the path of the hot gases, a water conduit between one of said drums and said interception chamber, a furnace, a further water drum, a water conduit passing through said furnace and connecting the latter drum with the interception chamber, a steam-and-water drum, a nest of tubes connecting said steam-and-water drum with said further water drum, an inclosing flue around the latter nest of tubes, means for causing the hot gases from the furnace to flow at high speed in series through the said tube nests in contact and in parallel with the tubes, and means for causing a high speed flow of the water through the tubes—the water flow in one nest being in a counter direction to the gas flow through that nest, as set forth.

5. In steam generators, in combination, two water drums, a nest of water tubes connecting said water drums, an inclosing flue around said nest of tubes, an interception drum or chamber out of the path of the hot gases, a water conduit between one of said drums and said interception chamber, a furnace, a further water drum, a water conduit passing through said furnace and connecting the latter drum with the interception chamber, a steam-and-water drum, a nest of tubes connecting said steam-and-water drum with said further water drum, an inclosing flue around the latter nest of tubes, and means for drawing water from said steam-and-water drum and delivering same to said further water drum, as set forth.

6. In steam generators, in combination, two water drums out of the path of the hot gases, a nest of water tubes connecting said drums, an inclosing flue around said nest of tubes, an interception drum or chamber out of the path of the hot gases, a water conduit between one of said water drums and the lower portion of said interception chamber, a furnace, a further water drum supported within said furnace, a nest of water tubes passing through said furnace and delivering water from the upper part of said interception chamber to said further water drum, a steam-and-water drum, a nest of tubes connecting said steam and water drum with said further water drum, an inclosing flue around the latter nest of

tubes, means for circulating the water in series through the said tube nests and also the said water drums and interception chamber, and means for circulating heating
5 gases in series through the nests, the flows of the gases and of the water in one nest being counter-current, as set forth.

In testimony whereof, I affix my signature in presence of two witnesses.

JOHN THOMAS NICOLSON.

Witnesses:

EDWARD MARKS,
ARTHUR HUGHES.