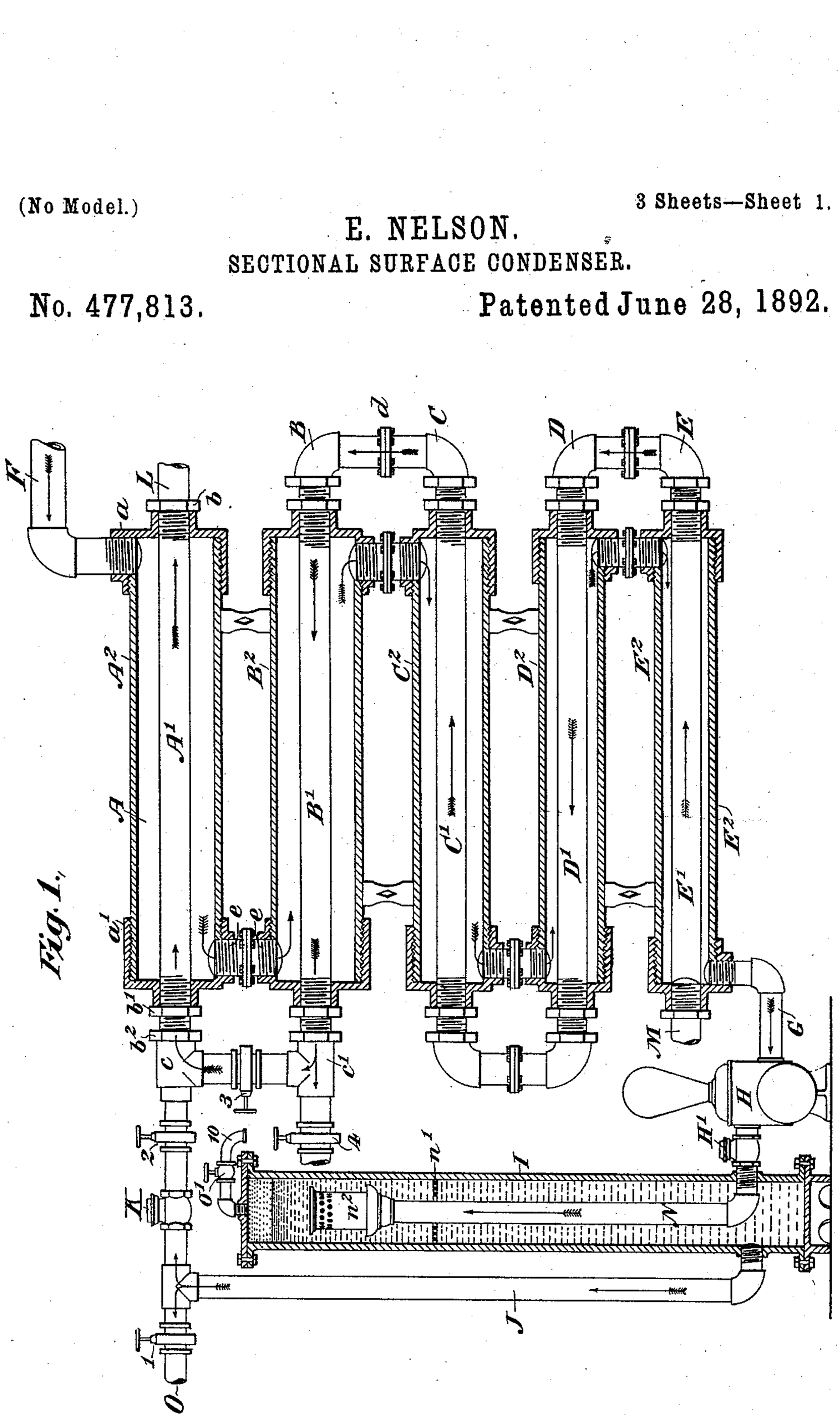
(No Model.) 3 Sheets—Sheet 1.

E. NELSON.

SECTIONAL SURFACE CONDENSER.

No. 477,813. Patented June 28, 1892.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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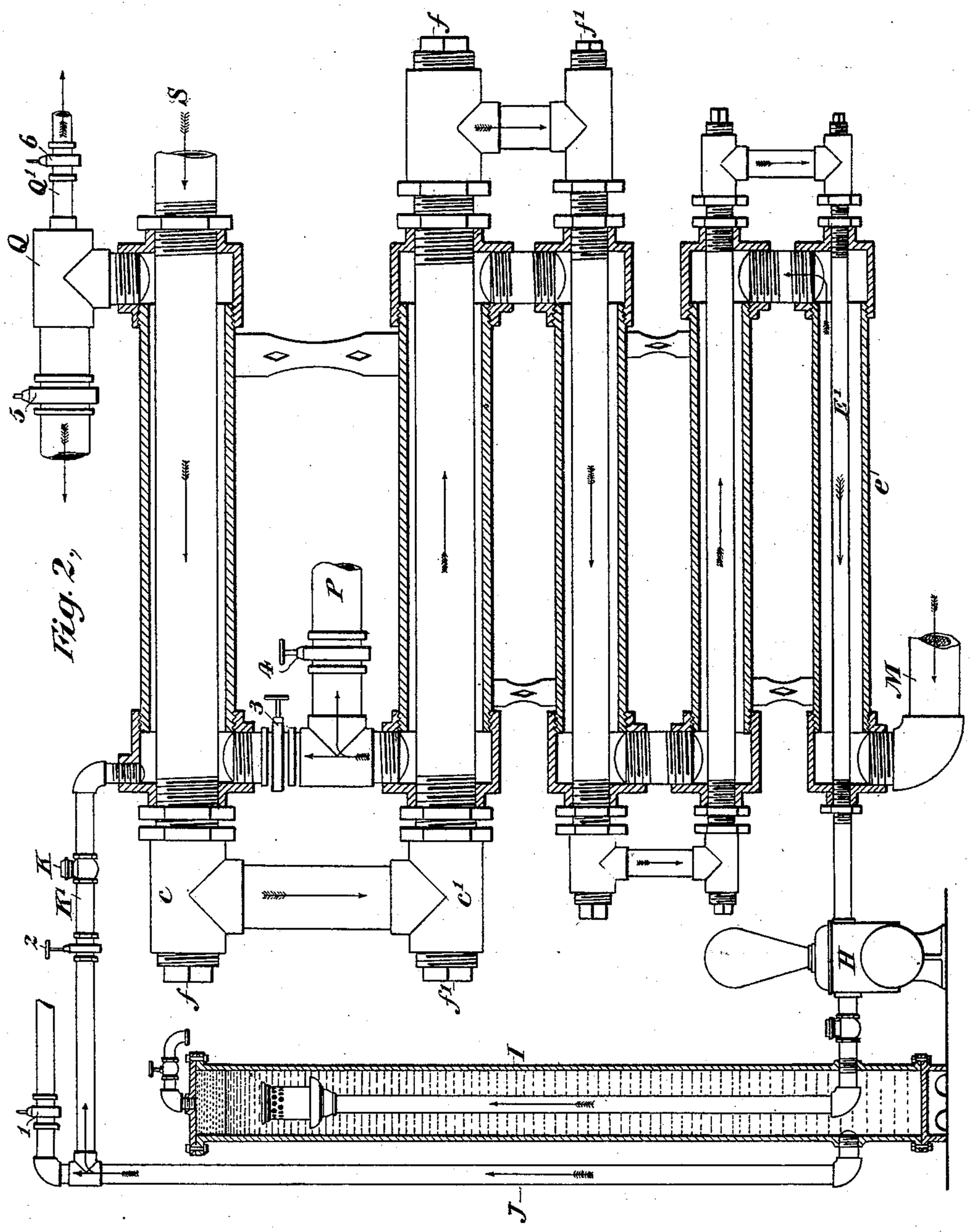

Fig. 2.

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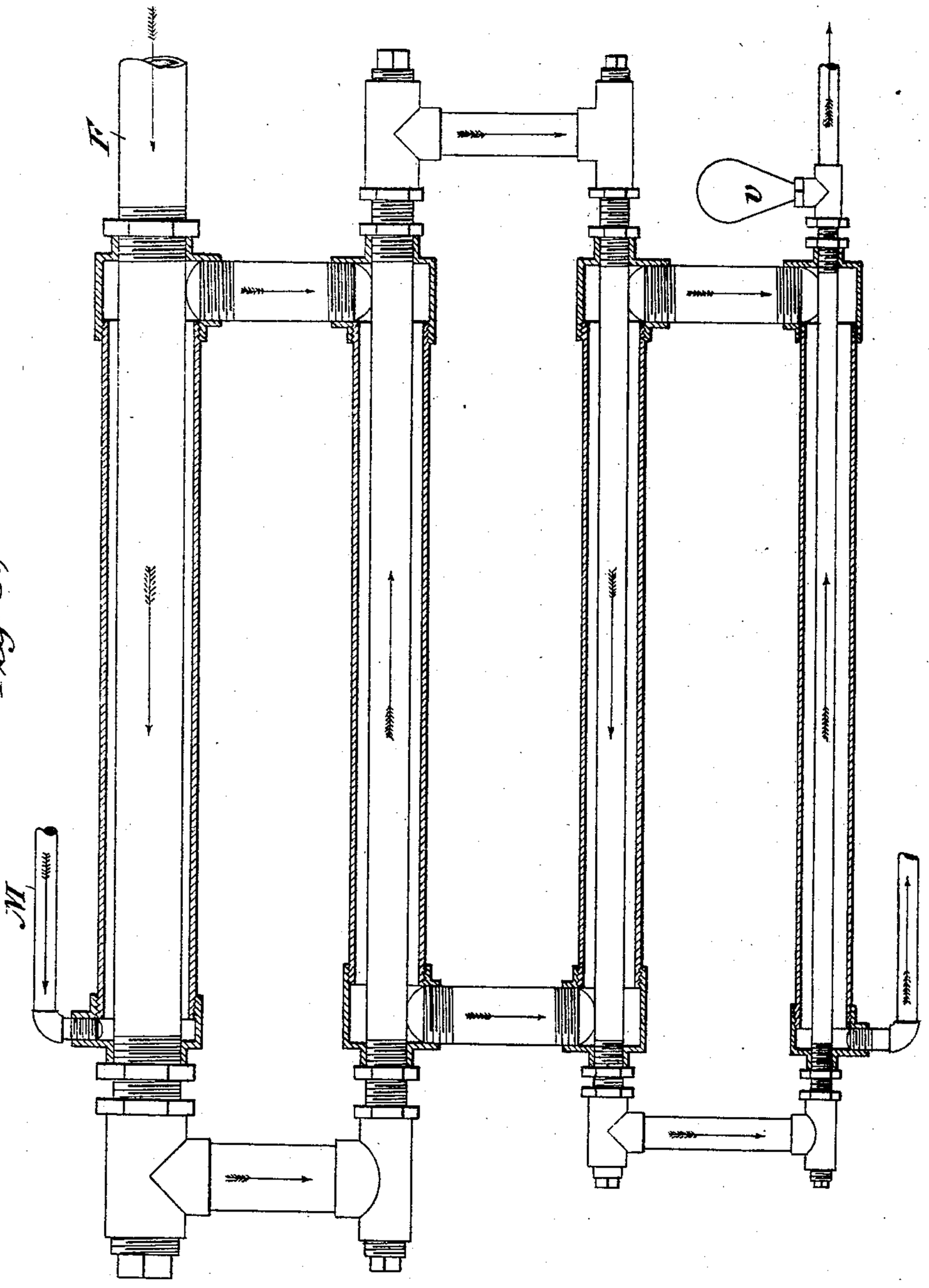

Fig. 3.

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ELIHU NELSON, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO WILLIAM M. MACBEAN, OF SAME PLACE.

SECTIONAL SURFACE CONDENSER.

SPECIFICATION forming part of Letters Patent No. 477,813, dated June 28, 1892.

Application filed August 1, 1891. Serial No. 401,407. (No model.)

To all whom it may concern:

Be it known that I, ELIHU NELSON, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Sectional Surface Condensers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention is concerned more especially with making a surface condenser for use in marine engines for returning the water of condensation to the boiler; but it may be employed with other engines, and the water of condensation may be carried off to any point whatever, as will appear hereinafter. It is a double-chambered-pipe sectional surface condenser made in a series of double-chambered-pipe sections and jointed together one above the other, forming one condenser.

One feature of my invention relates to the mode of coupling the different parts of the condenser, the object being to make the joining of the pipes which form my condenser easy, certain, and secure. With this object in view I make the cooling-chamber and the condensing-chamber of two pipes, one within the other, forming a double-chambered pipe, and I provide the said pipes with screw-threads of similar pitch, so that they can be united to a common T or L simultaneously or otherwise, as may be most convenient.

My invention embraces other features, which will be fully set forth in the specification which follows.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is a partly sectional elevation of one form of apparatus embodying my invention. Fig. 2 is a modification showing a different arrangement of the steam and water pipes and other novel features. Fig. 3 illustrates in elevation and section a different mode of coupling from that employed in the other figures.

Referring to the drawings by letters and figures, and especially to Fig. 1, A is the first section of my condenser, and it is made up of an inner pipe A′ and an outer pipe A^2. This section may be used either as a condenser-section or as a heating-section, provision being made for this by means of devices which will be described farther on. The succeeding sections of my condenser are lettered, respectively, B, C, D, and E, and they are made up each and all of them of two pipes, one within the other, just like section A. It is evident that by reason of this construction a circular chamber is formed within the inner pipe and an annular chamber between the two pipes. In the present instance I use the annular chamber for the steam and pass the induction-water through the inner pipe. Now as the steam becomes gradually condensed it will be a matter of economy in construction to make the successive condensing-chambers smaller. Inasmuch, however, as the first section is liable to be used for a heating-section and inasmuch as the steam during such use will be condensed comparatively little, I make the sections A and B of the same dimensions—that is, the steam, being only slightly condensed in passing through the first section, will require nearly as much space in the second.

The condenser is constructed, mainly, of pipes, L's, T's, and valves, there being a pipe within a pipe, one for the induction-water and one for the passage of steam. The threads of the pipe, T's, and L's are of the same pitch, so that the parts are readily put together. Taking section A as an example, I screw onto the right-hand end of the pipe A′ a T *a*. I screw it on in such a manner that it makes a joint and leaves enough thread on the inside pipe outside the T to receive a lock-nut *b*. I then screw the T upon the outside pipe (the inside pipe turning with the coupling) until a perfectly-tight joint is formed. On the opposite end I screw a similar T *a′* first on the inside pipe and then on the outside pipe, the coupling during the latter part of its movement being screwed upon both pipes at once, which is rendered possible by the threads being of the same pitch. In this way a double-chambered pipe is formed, one of the chambers being circular and the other annular, as above described. Outside the T *a′* two lock-nuts *b′* b^2 are screwed, one of which is forced up tight against the outer end of the T *a′* and the other of which is after-

ward screwed tight against a T *c*, which is screwed onto the end of pipe A′ to form a part of the connection between that pipe and the inner pipe B′ of the next succeeding section.

The above description is sufficient to indicate the construction in every one of the chambers. On the inner end of the pipe B′, for example, is a T *c′*, which is joined to the T *c* through a valve 3. Between the other sections of my condenser the L's are joined by flanged joints, as clearly shown at *d*. The outer pipes and the couplings which cover their ends are provided with corresponding openings, into which are screwed short pipes *e e* for making connections between the outer pipes. The pipes *e e* are united by flanged joints. At the outer end of the pipe A^2 and at the inner end of the pipe E^2 pipes F and G are respectively screwed into the T's, the former constituting the inlet-pipe for the exhaust-steam and the latter constituting the exit-pipe to the air-pump H, which passes the water of condensation first into the oil-extractor I and then through the vertical pipe N and the nozzle n^2 to the bottom of the oil-extractor and out through the pipe J either through the valve 1 overboard or through the check-valve K, valve 2, and pipe A′ out at L. The discharge at L may take place into the boiler or wherever else desired. The induction-water enters at M and passes in the direction of the arrows through the inner pipe until it arrives at the T *c′*. There it either takes the direction through the valve 4 overboard in case that valve is open, or, if that valve be closed, together with the valve 2 and the valve 3, and 1 be open, the induction-water passes up through the T's *c′* and *c* and the pipe A′ and is discharged at L.

When the last-described arrangement of valves exists, all the sections A, B, C, D, and E are used as condenser-sections, the inner pipe in every instance carrying the induction-water for condensing the steam. When, however, the valves 2 and 4 are open and valves 1 and 3 are closed, then the first section is used as a heating-section. In this case the water of condensation and not the induction-water passes through the pipe A′ and out at L. This water, being less cold than the induction-water, will have less condensing effect upon the steam, and for this reason, as already stated, I have made the first two sections of the same dimensions.

I have not thought it necessary to describe the course of the steam from the inlet-pipe F to the exit-pipe G, as it is sufficiently indicated by the arrows.

I make the oil-extractor I as high as the space will allow—from four to eight feet, or even higher. I use this extractor in connection with the condenser when it is not desired to return the water of condensation to the boiler, as I save the oil, which can be used again in the engine-cylinder. The extractor is a closed vessel, preferably of cylindrical form. The end of the entering pipe N is turned up vertically and closed at the end and perforated, as shown at N^2. The pipe may be braced within the extractor by a perforated cylindrical partition *n′* or of a suitable device. At the top of the extractor is a suitable pipe *o*, fitted with a stop-cock *o′* for removing at proper intervals the oily matters which by reason of their smaller specific gravity accumulate at the top of the extractor. The pipe J, forming the outlet-pipe of the extractor, is led out from a point near the bottom of the extractor, so as not to carry away any of the oily matters in the water of condensation. At H is shown the air-pump for forcing the water of condensation through the oil-extractor, the pump being joined to the pipe N, as shown. I use the check-valve K to keep the water which is passing through the open valve 2 from falling back when the engine is stopped.

The different sections of my condenser are adequately supported at alternately-opposite ends by means of the connecting-pipes *e e*. To prevent sagging at the other ends, I employ suitable braces *x x*, as shown clearly in the drawings.

In Fig. 2 I still employ the double-chambered-pipe sectional surface condenser; but I pass the induction-water through the annular outside chamber and the steam through the center pipe or inside chamber. As before, I make the first two sections of the same dimensions and the remaining sections of successively smaller dimensions. The object has already been explained as being one of economy, it not being necessary to have the steam-chambers so large after the steam has become partially condensed. In the construction shown in Fig. 1 I accomplish the reduction called for by making the outer pipes successively smaller, while the inner pipes remain of the same size to conduct a constant quantity of cold water. In the present instance I reduce successively the size of the inner pipe to provide for the gradually-condensing steam, and at the same time for obvious reasons I am able to reduce also somewhat the size of the outer pipes and still have the necessary area for the induction-water to flow. As before, the first section can be used either as a heating-section or a condensing-section. At the ends where the sections are joined together I use T's, as *c c′*, for coupling the sections together. The T's at their ends have plugs *f f′* screwed in, which plugs can be removed whenever it becomes necessary to clean the pipes which convey the steam. The steam first enters the inside chamber or steam-pipe at S, taking the direction indicated by the arrows and passing through all of the center pipe's chambers of the series of sections. By the time it has passed through the last section E′ of the series it has become condensed and the air-pump H draws the water of condensation from the section E′ and passes it into the oil-

separator I, through the intermediate parts, and up through the pipe J. If the valve 1 is open, the water is passed through the valve overboard. If this valve is closed and the valve 2 is open, the water passes through this valve and through the check-valve K in the pipe K′ into the outer chamber of my first section. From there it passes out by the pipes Q and Q′ and valve 6 to the boiler or elsewhere. When the first section is to be used as a condensing-section, valves 1, 3, and 5 are open and valves 2, 4, and 6 are closed. The valve 5 is in the pipe Q, which is connected to the outer chamber or pipe of the first section. The operation of the steam and the water of condensation has already been described. The induction-water enters at M and flows in the direction of the arrows through all the outer chambers, passing through the valves 3 and 5 on its way to an exit overboard. The valve 3 is placed in the pipe which connects the first two sections in my condenser. The valve 4 is placed in a pipe P, which leads off between the sections last named and before the valve 3 is reached. When now it is desired to use the first section as a heating-section, the valves 1, 3, and 5 are closed and the valves 2, 4, and 6 are open. In this case the induction-water passes out at the end of the pipe P overboard and the water of condensation passes through the outer chambers of the first section and is subjected to the heat of the steam entering at S.

In Fig. 3 the double-chambered-pipe sections are made similar to the sections in Figs. 1 and 2, but are connected together differently. On one end the sections are joined together by the steam-pipe and on the other by the pipe which conducts the water of induction. The connecting-pipe for the passage of the steam is screwed into T's on the inside or steam pipe, and the connecting-pipe for the passage of the induction-water is screwed at the opposite end into T's on the outside or water-induction pipes. The T's are provided with lugs, as before, and for the same purpose. The connection between the outer and inner pipes is made substantially as before by means of screw-T's, as shown. The inlet-pipe J for the induction-water is screwed into one of these T's on the end of the last section. Connection is made between the outer pipes by cross-pipes R R, as clearly shown in the drawings. The double-chambered-pipe sections are preferably reduced gradually in size as the steam becomes condensed to cheapen the cost of construction. It may be stated once for all that the arrangement is such in every instance as to cause the induction-water to flow in an opposite direction from the steam.

The arrangement of lock-nut in Fig. 3 is clear from an inspection of the drawings.

On the extremity of the inside or steam pipe of the last section I place a vacuum-chamber *v*.

The course of the steam and that of the water of the induction will be evident from an inspection of the arrows in connection with what has already been said regarding Figs. 1 and 2.

Having now described my invention, I claim—

1. In a double-chambered-pipe sectional surface condenser, each section consisting of a pipe within a pipe, the combination of the different sections, the first two sections being of the same dimensions and the remaining sections gradually diminishing in size, the central pipe of the first section being joined to the water-induction pipe coming from the second section as a continuation thereof and being also joined to the pipe which carries off the water of condensation and both the connected pipes having suitable valves and connections, substantially as shown and described.

2. In a double-chambered-pipe sectional surface condenser, a series of sections the first of which has a central pipe which is connected both to the water-induction pipe and to the pipe which carries off the water of condensation, suitable valves being interposed, and the said pipe which carries off the water of condensation having, also, an outlet through the separate valve to the air.

3. In a double-chambered-pipe sectional surface condenser, a series of sections through all of which the steam is adapted to pass successively, an air-pump beyond the last section, and a pipe connected beyond the said air-pump and passing vertically through an oil-extractor to a point about two-thirds of the way up the inside of the said oil-extractor, the exit from the said oil-extractor being by means of a pipe, as J, which pipe is branched at the top to pass through a valve to the open air in one direction or through a pipe-section connected to the center pipe of the first section, substantially as described.

4. In a double-chambered-pipe sectional surface condenser, a series of sections, each consisting of a pipe within a pipe, the center pipe having a running thread cut on each end and extending at both ends through the outside pipe, T's that screw on both ends of the outside and inside pipe together, lock-nuts screwing on the end of the inside pipe, and T's or L's screwing on the end of the inside pipe beyond the lock-nuts for making connections between succeeding sections, as and for the purpose set forth.

5. In a double-chambered-pipe sectional surface condenser, a condensing-section consisting of a pipe within a pipe, the central pipe being longer than the outer pipe and the two pipes having screw-threads of similar pitch, in combination with T's or other couplings for making a closed chamber of the outer pipe.

6. In a double-chambered-pipe sectional surface condenser, a condensing-section consisting of a pipe within a pipe, the central pipe being longer than the outer pipe and

the two pipes having screw-threads of similar pitch, in combination with T's or other couplings for making a closed chamber of the outer pipe and with T's or other couplings with interposed lock-nuts for making connection between the central pipe and succeeding pipes, substantially as described.

7. In a double-chambered-pipe sectional surface condenser, a condensing-section consisting of a pipe within a pipe, the central pipe being longer than the outer pipe and the two pipes having screw-threads of similar pitch, in combination with T's or other couplings with interposed lock-nuts for making connection between the central pipe and the central pipe of the adjoining section, the last-named T's or couplings being provided with plugs, as and for the purpose set forth.

In testimony whereof I have signed my name, in the presence of two witnesses, this 29th day of July, A. D. 1891.

ELIHU NELSON.

Witnesses:
H. A. ACKEN,
G. H. STOCKBRIDGE.