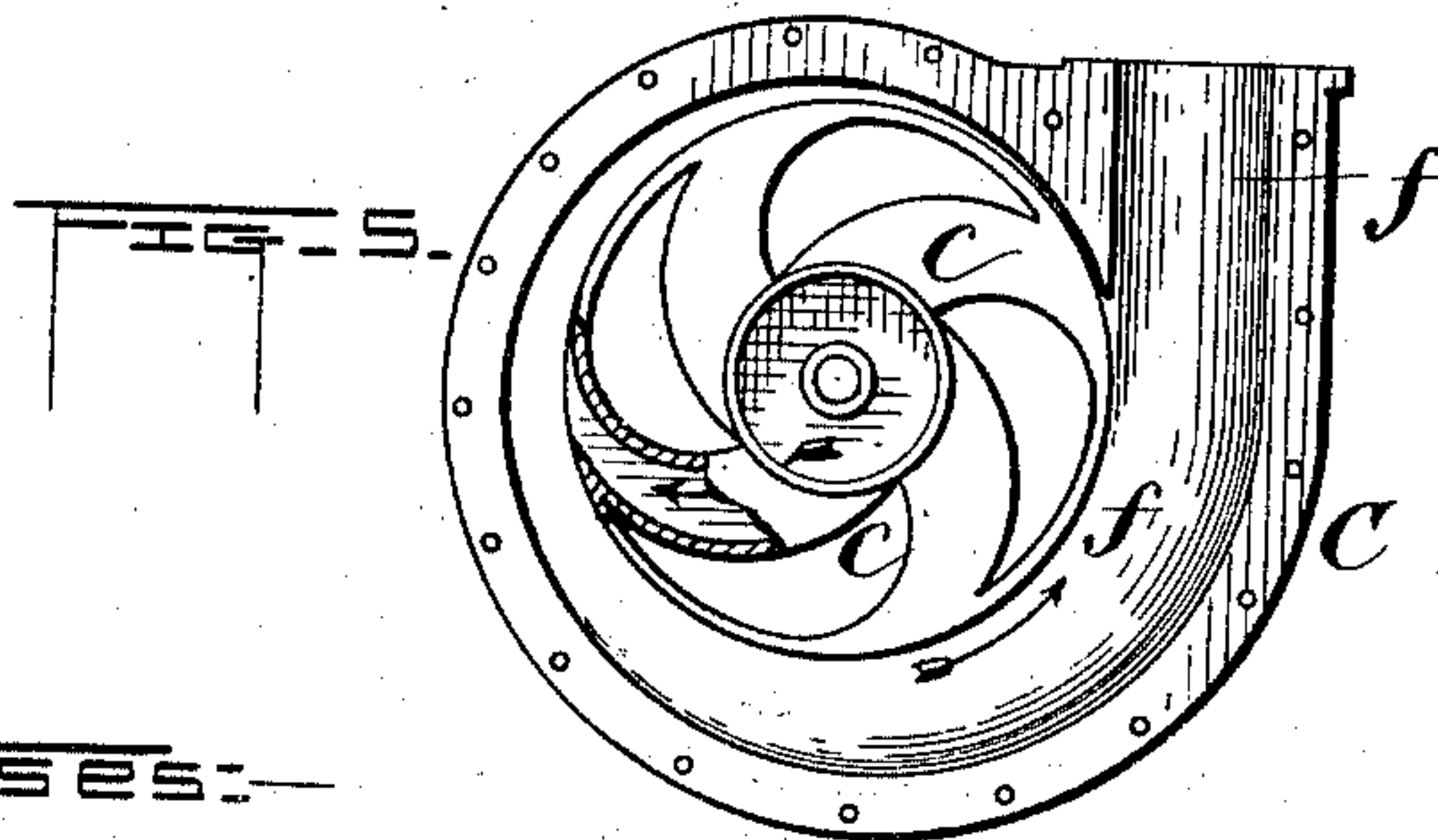
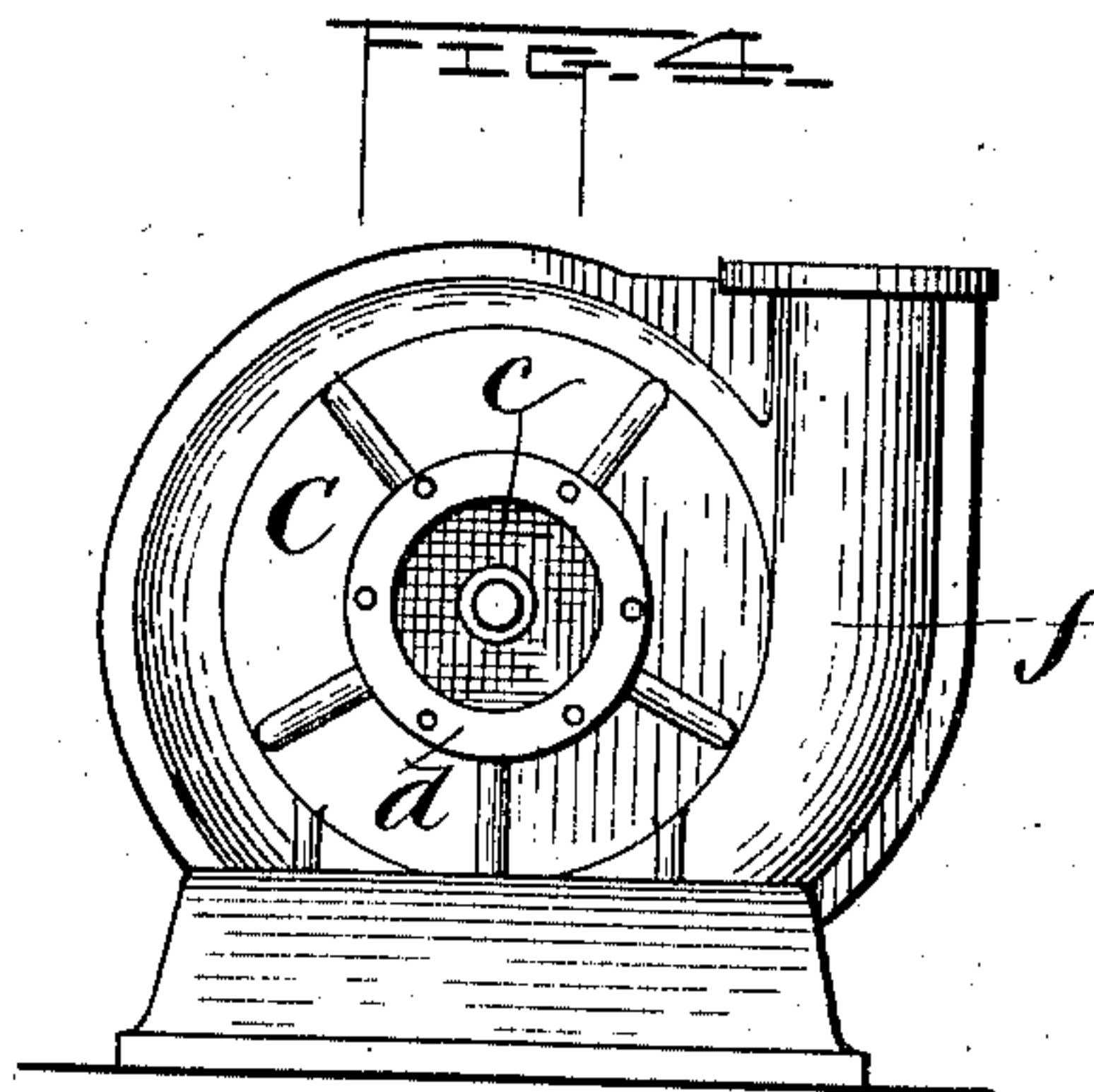
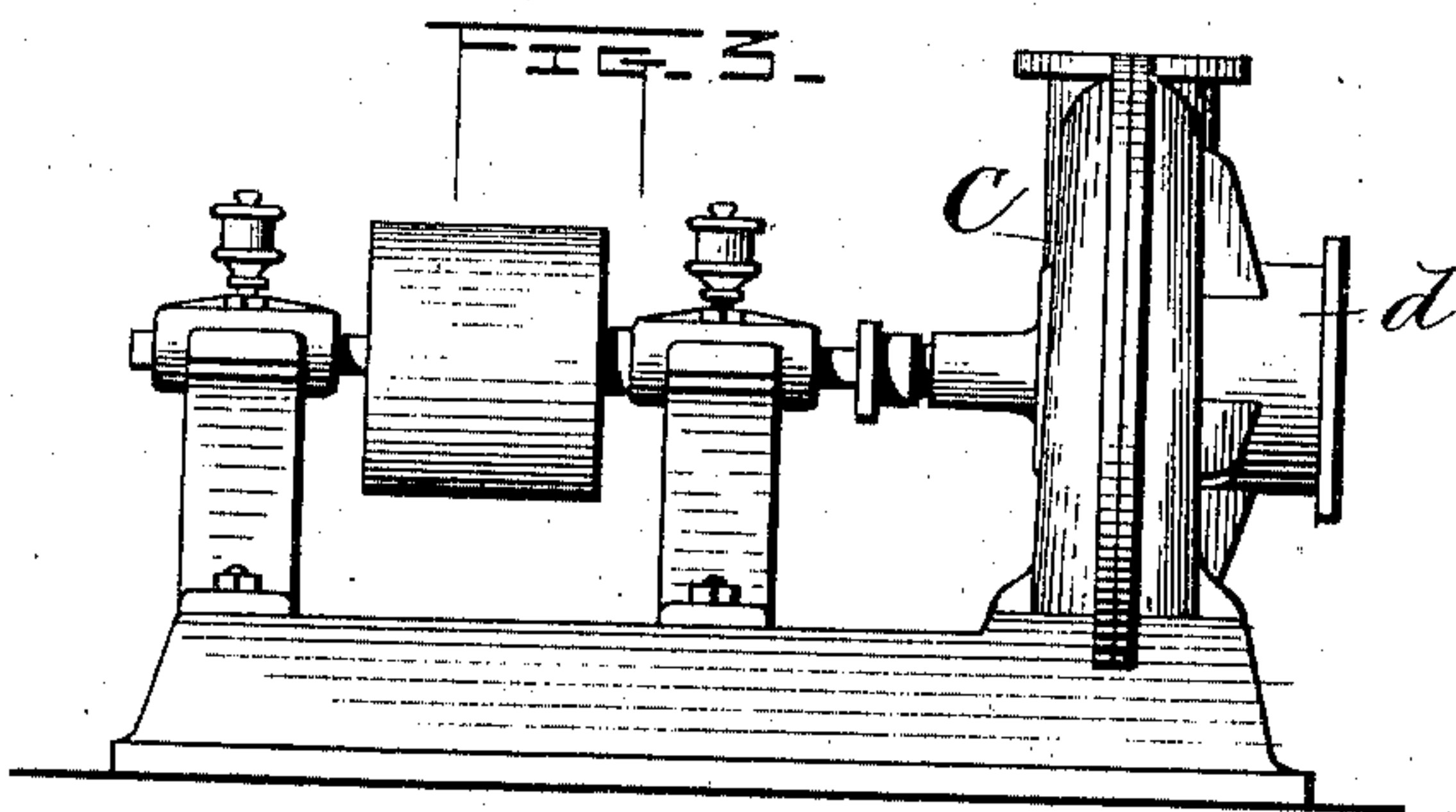
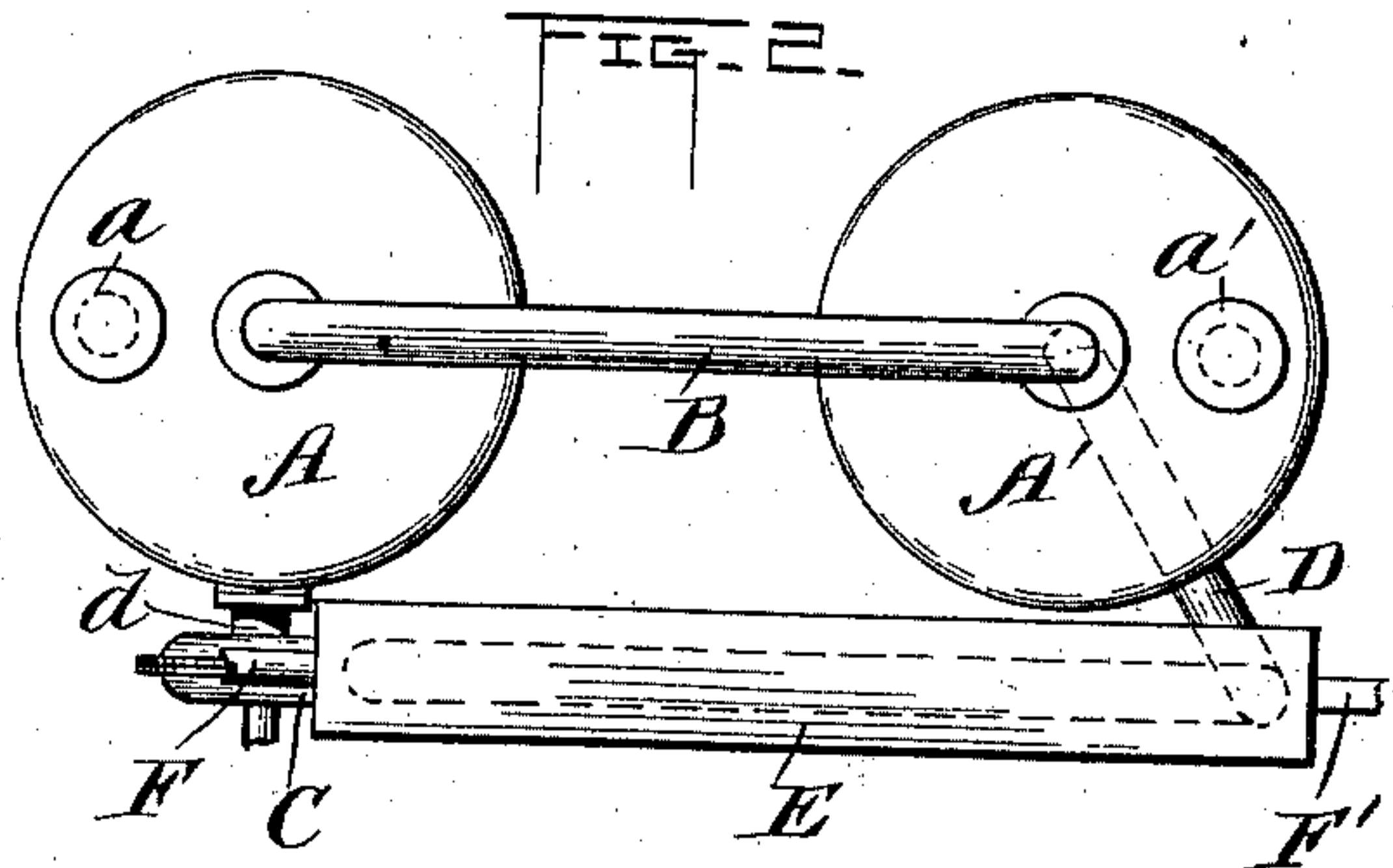
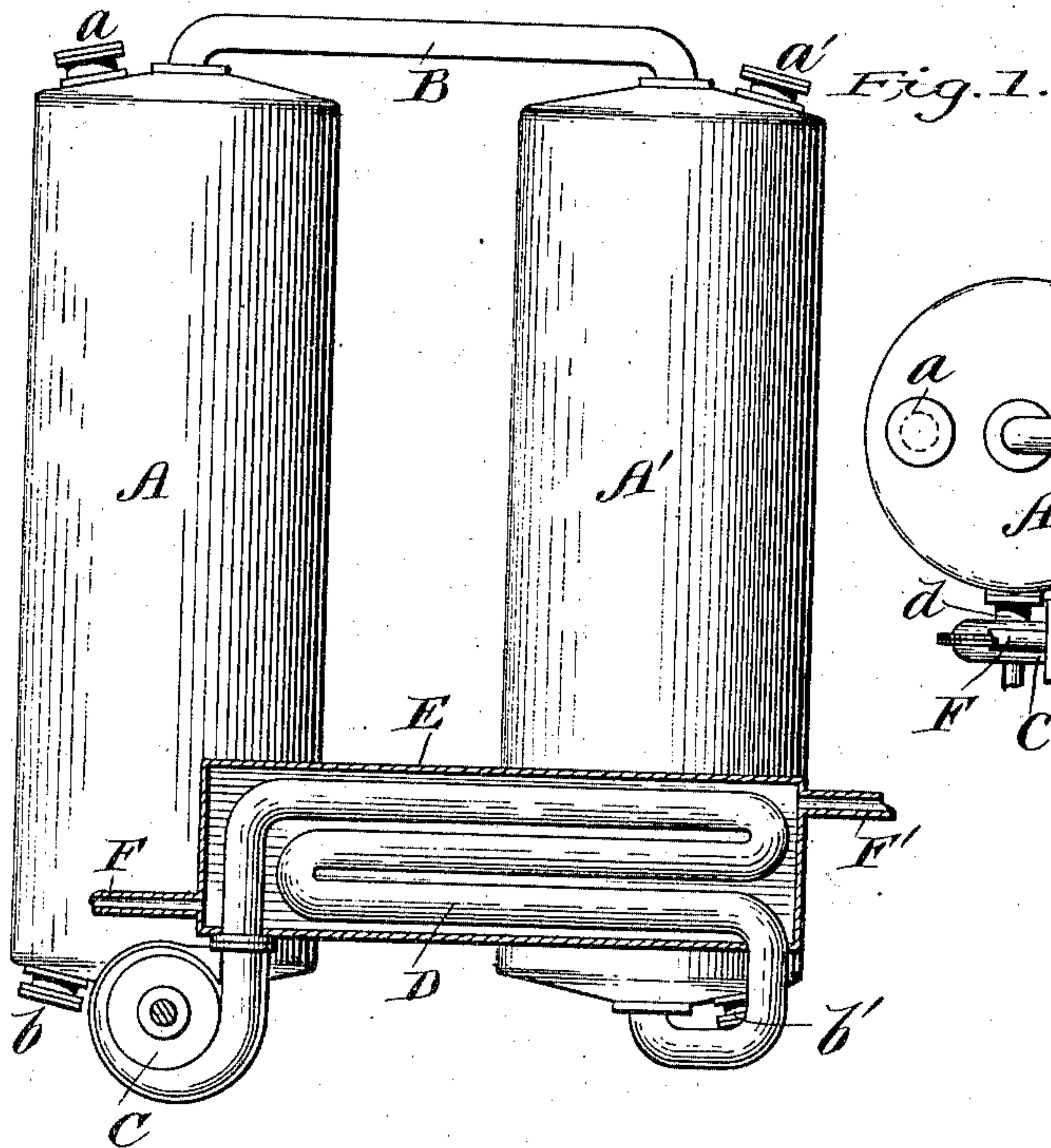


(No Model.)

3 Sheets—Sheet 1.

S. W. ROWELL.
METHOD OF AND APPARATUS FOR PRODUCING PAPER STOCK.
No. 500,617. Patented July 4, 1893.



WITNESSES:

Attestance:
E. J. Fenwick

INVENTOR:

Le ducy W. Rowell
by his Attys
Mason, Fenwick & Kearney

(No Model.)

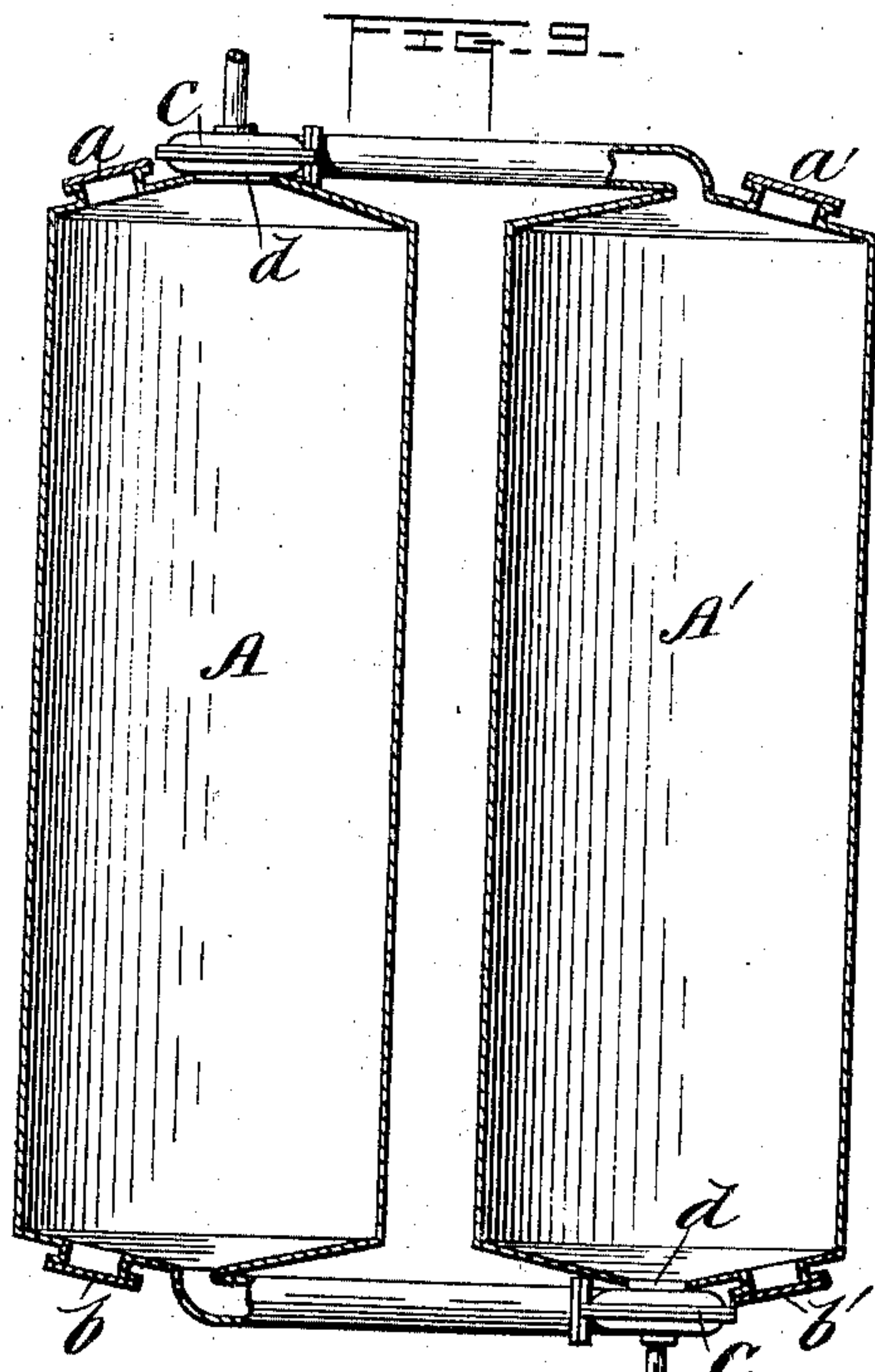
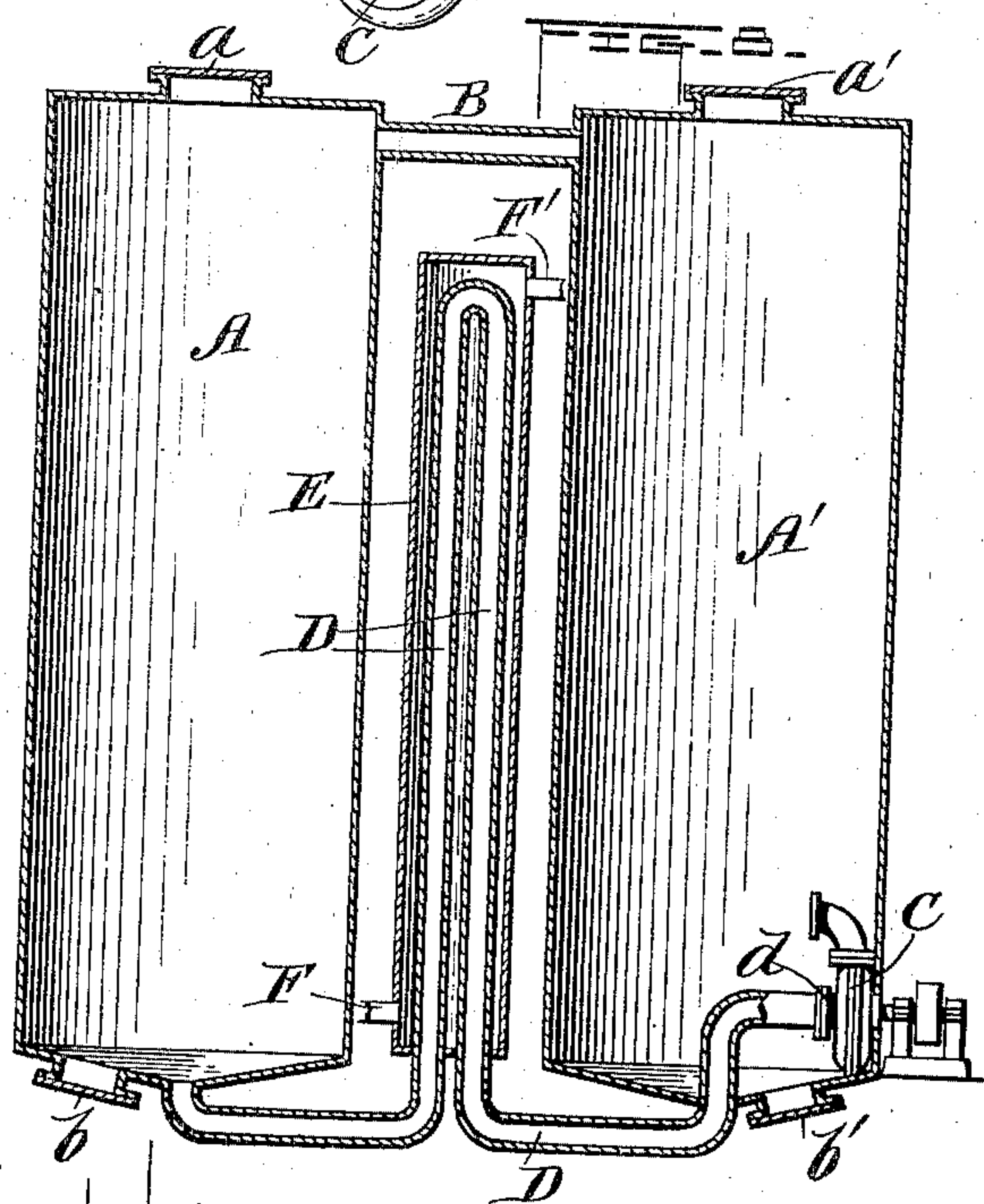
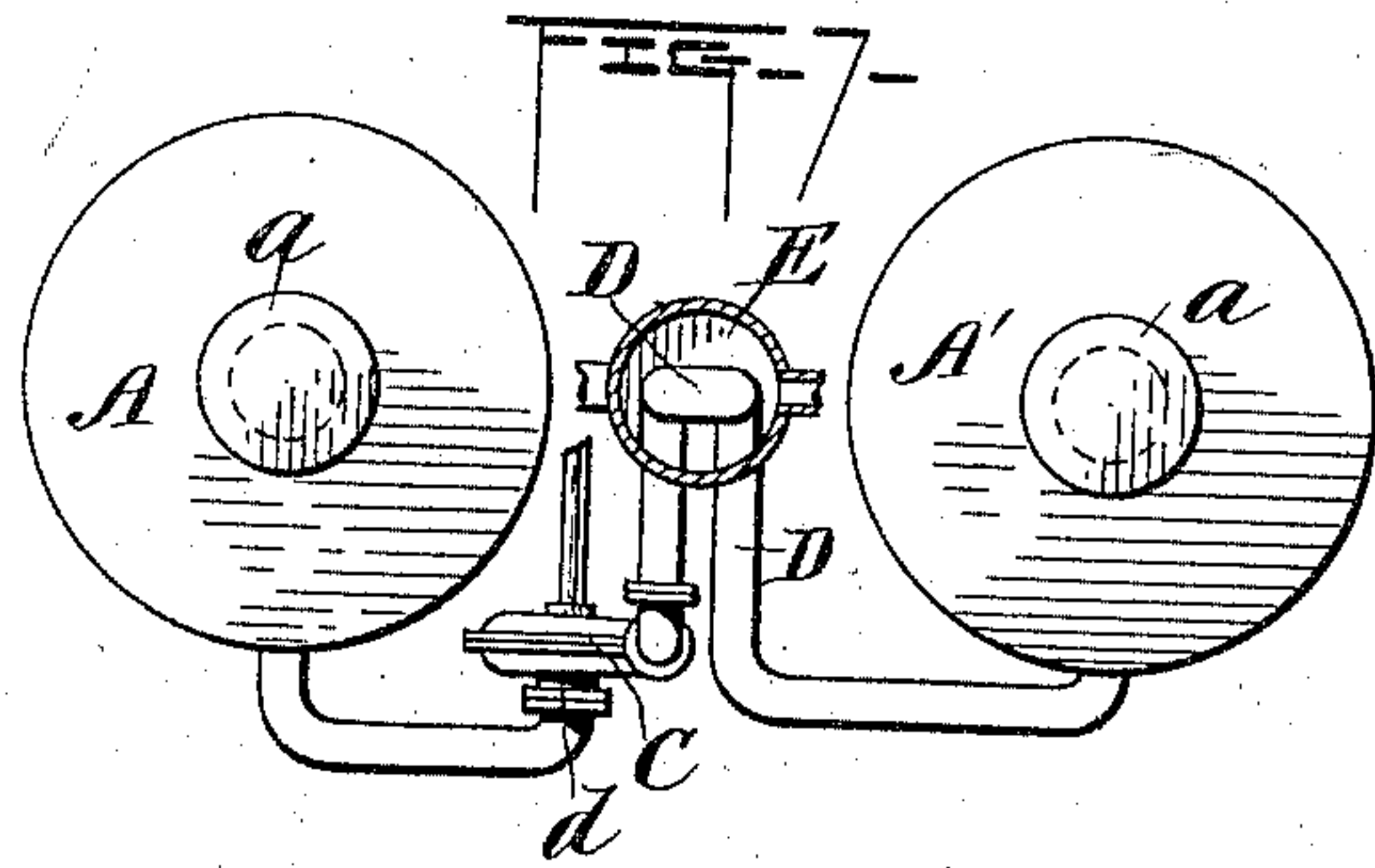
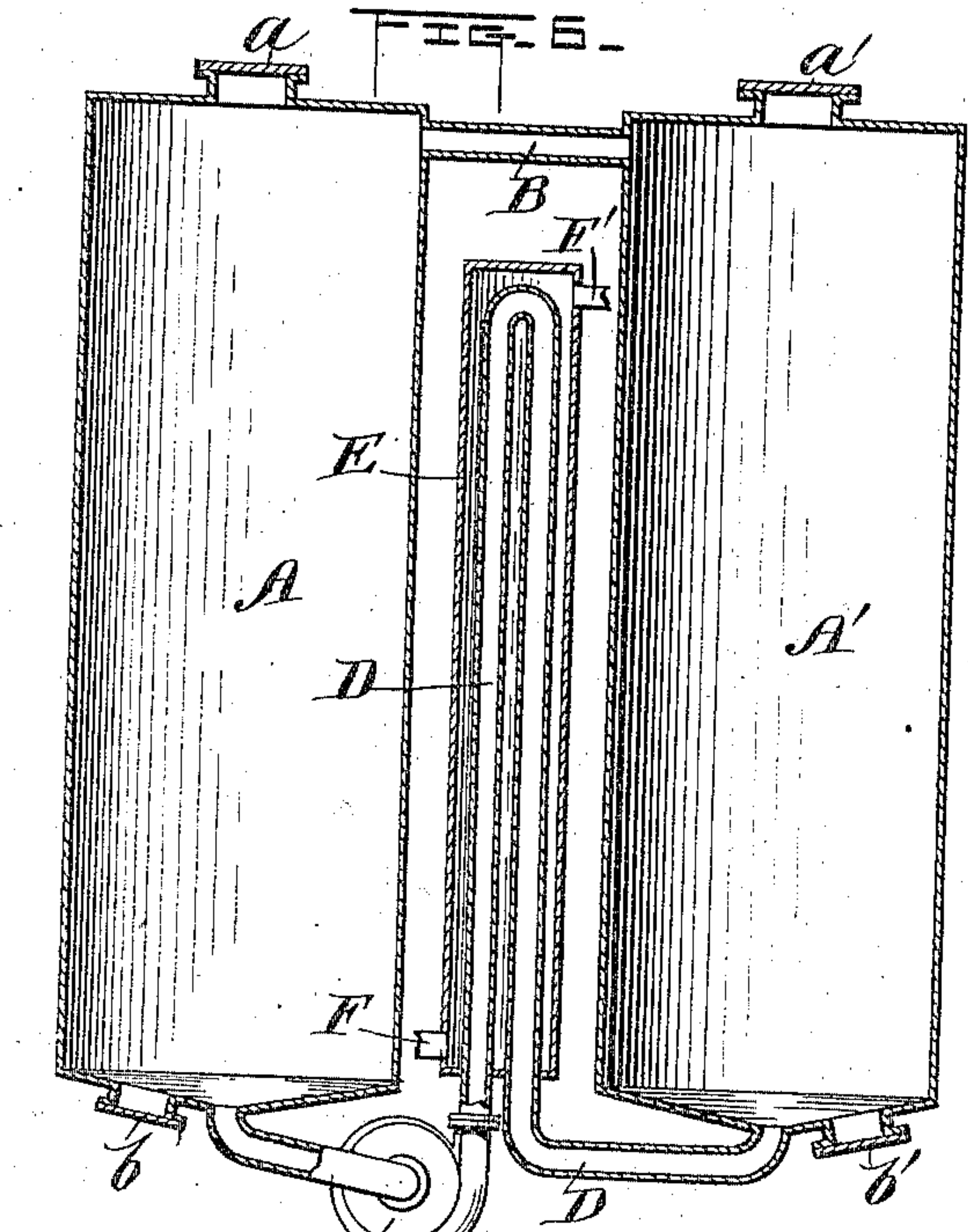
3 Sheets—Sheet 2.

S. W. ROWELL.

METHOD OF AND APPARATUS FOR PRODUCING PAPER STOCK.

No. 500,617.

Patented July 4, 1893.



WITNESSES:

Attestance.
C. J. F. Munk

Sidney W. Rowell
by his Atty
Marion, Jewick & Lawrence

No Model.)

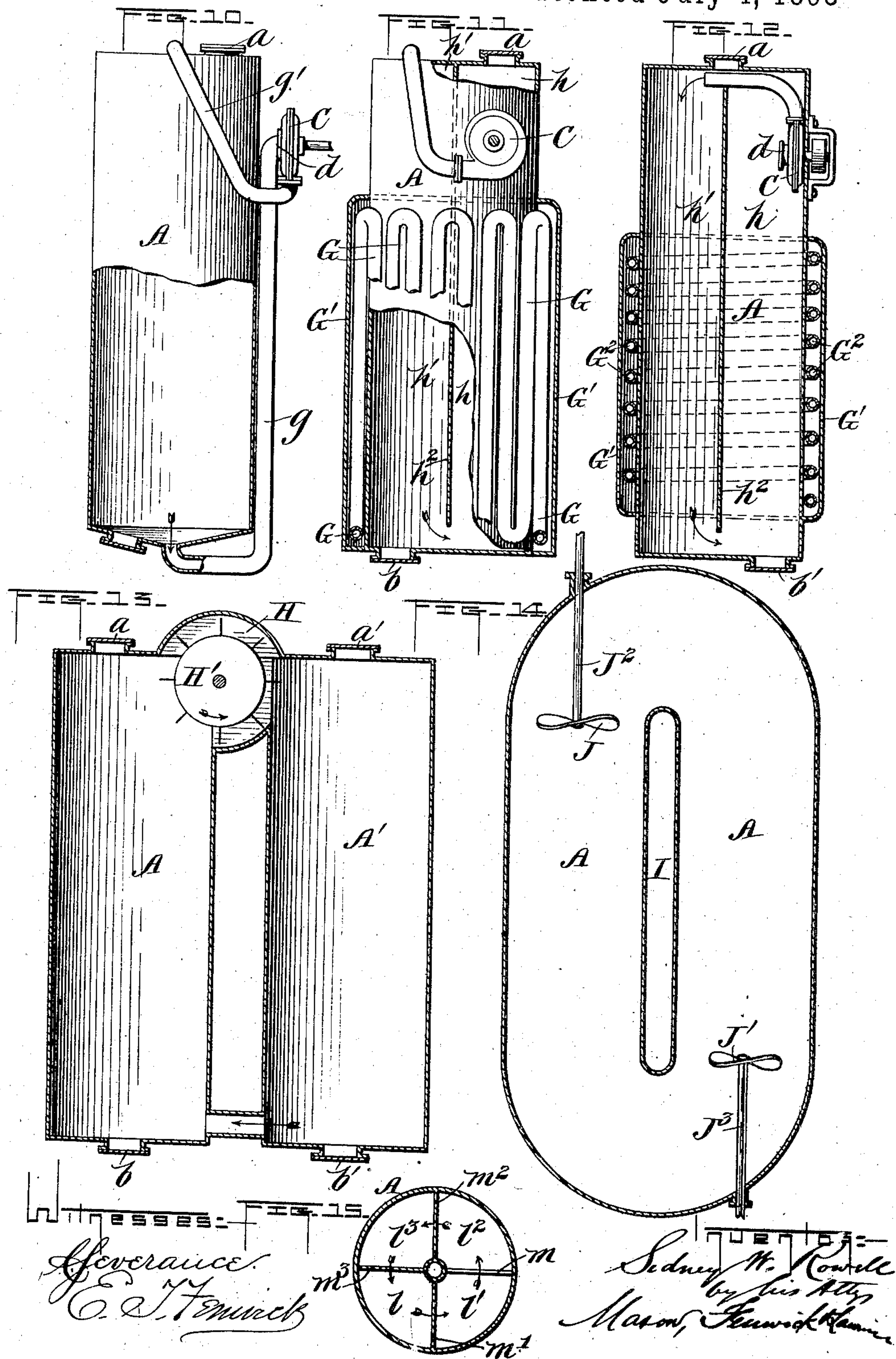
3 Sheets—Sheet 3.

S. W. ROWELL.

METHOD OF AND APPARATUS FOR PRODUCING PAPER STOCK.

No. 500,617.

Patented July 4, 1893



UNITED STATES PATENT OFFICE.

SIDNEY W. ROWELL, OF ALBANY, NEW YORK.

METHOD OF AND APPARATUS FOR PRODUCING PAPER-STOCK.

SPECIFICATION forming part of Letters Patent No. 500,617, dated July 4, 1893.

Application filed March 3, 1892. Serial No. 423,647. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY W. ROWELL, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for Producing Paper-Stock; 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 relates to an improvement in methods of and apparatus for producing cellulose or paper stock from wood, jute, straw or other suitable vegetable fiber; and my improved method consists in mixing and causing a forced circulation, together, of the fibrous material and chemical liquor, and heating the same outside the digester during its circulation, as will be hereinafter described, and my apparatus comprises one or more receptacles or digesters, in which are placed the fiber materials to be heated and the chemical liquor, together with a positive forcing means, and external heating means, whereby the whole of the said fiber material and chemicals are caused to circulate in the digester or digesters, and the fibrous materials thereby thoroughly permeated by the liquor, and cooked by means applied outside of the digester in such a manner as not to obstruct the circulation of the mass. It also comprises certain other novel combinations and arrangements of parts as will be hereinafter fully described and specifically claimed.

The object of my invention is to produce a positive circulation of the fibrous material and chemical agents in a digester, so as to thoroughly expose every part of the fibrous material to the action of the chemicals commonly used; to heat the mass externally of the digester-receptacle or receptacles, and maintain an equal temperature throughout the same, and thus quicken the digestive process, and reduce the material to fibers of an even and stronger quality. In this way I effect a great saving in fibrous material, much of which is destroyed in other digesters by the imperfect circulation of the chemical liquor in contact therewith, or by the overheating of parts of the fibrous material while other parts remain uncooked. The fibrous mate-

rial often becomes crusted or discolored where it comes in contact with heated surfaces, and is thereby rendered useless, but, by my invention I obviate this difficulty, for, by the forced circulation of the fibrous material and chemicals together in a chamber or chambers offering no obstacle internally, no part of the mass is allowed to stand upon the heated surface, but is kept in motion over the same in a manner to prevent any sticking of the material at any point; and, as this forced circulation may be continued indefinitely, or until the fibrous material is properly prepared ready to be discharged, a very satisfactory result can be obtained.

In the accompanying drawings, Figure 1 represents a side elevation of my digester in which two receptacles are employed, the heating apparatus being partly in section. Fig. 2 represents a top plan view of the digester shown in Fig. 1. Fig. 3 represents a side elevation of a rotary pump, which is my preferred form of forcing means. Fig. 4 represents an end view of said pump. Fig. 5 represents a central vertical section of the pump, showing the piston thereof. Fig. 6 represents a central section through a digester similar to the one shown in Fig. 1, but with the heating apparatus placed between the two receptacles. Fig. 7 represents a top view and partial horizontal section of the digester shown in Fig. 6. Fig. 8 represents a vertical central section of a digester similar to that shown in Fig. 6, but with the pump placed within one of the receptacles. Fig. 9 represents a partial central section of a digester having two receptacles and a pump placed centrally at one end of each receptacle. Fig. 10 represents a partial side elevation and section of a digester having but one receptacle and a pump arranged so as to force the contents from one end of the digester to the other end. Fig. 11 represents a partial side elevation and section of a digester having but one receptacle, but with a partition extending nearly the entire length of same with a space below its lower end, and a pump so arranged as to circulate the fibrous material from one compartment of the receptacle to the other; and also showing heating pipes arranged around the outside of the digester. Fig. 12 represents a digester similar to Fig. 11, but with the pump placed inside

of the digester and the heating pipe arranged in a slightly different manner. Fig. 13 represents a vertical central section through a digester having two receptacles, and with a paddle wheel arranged near the top, for circulating the contents from one receptacle to the other. Fig. 14 represents a horizontal central section through a digester having a continuous passage, and provided with two immersed screw propellers near its opposite ends, for forcing a circulation of the fibrous material. Fig. 15 is a horizontal section through a digester having but one receptacle, but divided by partitions into four compartments.

A A' in the drawings, Figs. 1 and 2, represent two cylindrical digester receptacles provided respectively with filling caps *a a'* at top and discharging caps *b b'* at bottom. These receptacles are connected at top by a circulation pipe B, and at bottom by a pump C having a hollow piston and a coiled pipe D, the latter being inclosed by a steam heating jacket E which has inlet and outlet pipes E' E², the former for connection with a live steam supply, and the latter for the escape of the waste or exhaust steam. The pump is of the rotary type, and the hollow hub and arms of its piston *c* are connected by a tubular collar *d* with the digester receptacle A, while its scroll chamber *f* is connected with the digester receptacle A' by means of the coiled circulating pipe D. The heating means, D E, are arranged outside the digester-receptacles, and thus no obstruction is offered, inside the same, to the circulation of the fibrous material mass and chemical liquor, as in apparatuses where the heating or cooking is effected by heating means arranged partly within one or the other, or both of the receptacles. A heater could be constructed outside the digester receptacle by using the jacket for the mass to circulate through, while a steam circulating coil is employed within the jacket for heating the mass of fibrous material and chemical liquor circulating through the jacket from one digester receptacle to the other.

In operating with the apparatus described, the fibrous material and chemical liquors or agents are placed together in the digester receptacle A; steam is then supplied to the heating coil D, and the pump set in motion. The pump causes the mass, consisting of vegetable fibrous material and chemical liquor or agents, to circulate from chamber A to chamber A', and from A' back to A, and so on, until the operation is completed. During the circulation, the mass comes in contact with the heating surface of the coiled pipe, outside of the digester-receptacle, and is thereby cooked, while the chemical liquors or agents are, by the circulation of the same along with the fibrous material, caused to mingle with and permeate every portion of the fibrous material mass, and thus a very perfect and uniform action upon the fibrous material

is produced and a superior product secured. When the operation is completed the charges in the digester receptacles are discharged by blowing the same out by known methods into proper receptacles, and thereupon a fresh charge is placed in the digester.

In Figs. 6 and 7, the same construction of digester as that shown in Figs. 1 and 2 is adopted, but the steam heater is placed vertically between the two receptacles. In all other respects the construction and operation are substantially the same as hereinbefore described. In Fig. 8, the pump is shown placed inside one of the digester-receptacles at one side and near the bottom. In Fig. 9, the heater is not shown, but it is always contemplated to have an external heater surround the circulatory pipe, or other equivalent external heating means, combined with the circulating pipes substantially as hereinbefore described. In this view, a pump is arranged at the upper end of the digester receptacle A, and at the lower end of the digester receptacle A'.

In Fig. 10, the digester has but one receptacle, a pipe *g* leading from the bottom; and a pipe *g'* leading from the top of the digester receptacle and connecting with the pump, and by this construction the circulation of the mass of fibrous material and chemical liquor can be produced in a single receptacle. With this construction an external heating means will be provided, and the same may be substantially as hereinbefore described, or a coiled pipe as G in Figs. 10 and 11 be placed around the digester receptacle.

In Fig. 11 another form of single cylinder digester is shown, the pump being placed outside the digester receptacle a heating zig zag pipe G inclosed by a non-conducting jacket G' is made to surround a greater portion of the cylinder A; and central of the cylinder a vertical partition *h²* is applied, so as to allow a circulation beneath it from a compartment *h* to a compartment *h'*.

In Fig. 12, substantially the same construction as is shown in Fig. 11, is shown, but the pump is placed under the cylinder and the heater is a coil as G². In Fig. 13 two digester receptacles A A' are adopted, and they are connected by a paddle wheel chamber or housing II at their tops, and, in said housing, a paddle wheel H' is employed for producing the circulation. With this construction, external heating means, as in Figs. 11 and 12, will be employed, or any other suitable equivalent external heating means may be adopted.

In Fig. 14, an elliptical digester receptacle A having a partition I at its center is shown. At opposite sides of this partition, and at diagonally opposite positions on the digester-receptacle, screw propellers J J are arranged on horizontal shafts J² J³, so as to be submerged in the fibrous and chemical mass. By revolving these propellers in opposite directions, the circulation of the mass is produced, and, by reversing their movements,

respectively, the same results will be produced. With this construction external heating or cooking means, similar to those described, will be employed.

In Fig. 15, a digester having a single cylinder or receptacle, and with its chamber divided into four compartments l, l', l^2, l^3 is shown. The partition m terminates below the top of the cylinder while the partitions m', m^2 terminate above the bottom of the same, as illustrated in Figs. 11 and 12; and through the partition m^3 the pipe of a pump is passed after the manner illustrated in Fig. 12. By this construction the pump causes the mass to circulate downward in compartment l , under partition m' then in compartment l' up over partition m , then down in compartment l^2 under partition m^2 , and so on until the operation is completed. In connection with this construction, an external heating means, and a pump, will be employed as hereinbefore described.

What I claim as my invention is—

1. In an apparatus for producing cellulose or wood fiber, a digester consisting of one or more internally unobstructed circulation and digesting chambers, adapted to receive the fibrous material and the chemical liquor, and

provided with means for causing a direct forced circulation together, or at the same time, of both the fibrous material and the chemical liquor, and a cooking means outside the digester, substantially as and for the purpose described. 30

2. The combination of one or more directly connected circulation and digesting chambers which are unobstructed internally, a pump, circulating pipes, and an external heating or cooking coil for heating the mass while in circulation from the outside of the digester, said mass consisting of fibrous material and the chemical liquor, and a steam chamber inclosing the coil, substantially as described. 35 40

3. The within described method of mixing the chemical liquor and the fibrous material within the digester, forcibly and directly circulating together the said liquor and fibrous material and heating the same by means outside the digester while in circulation, substantially as described. 45 50

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

SIDNEY W. ROWELL.

Witnesses:

G. A. VAN ALLEN,
C. TREMPER, Jr.