

(No Model.)

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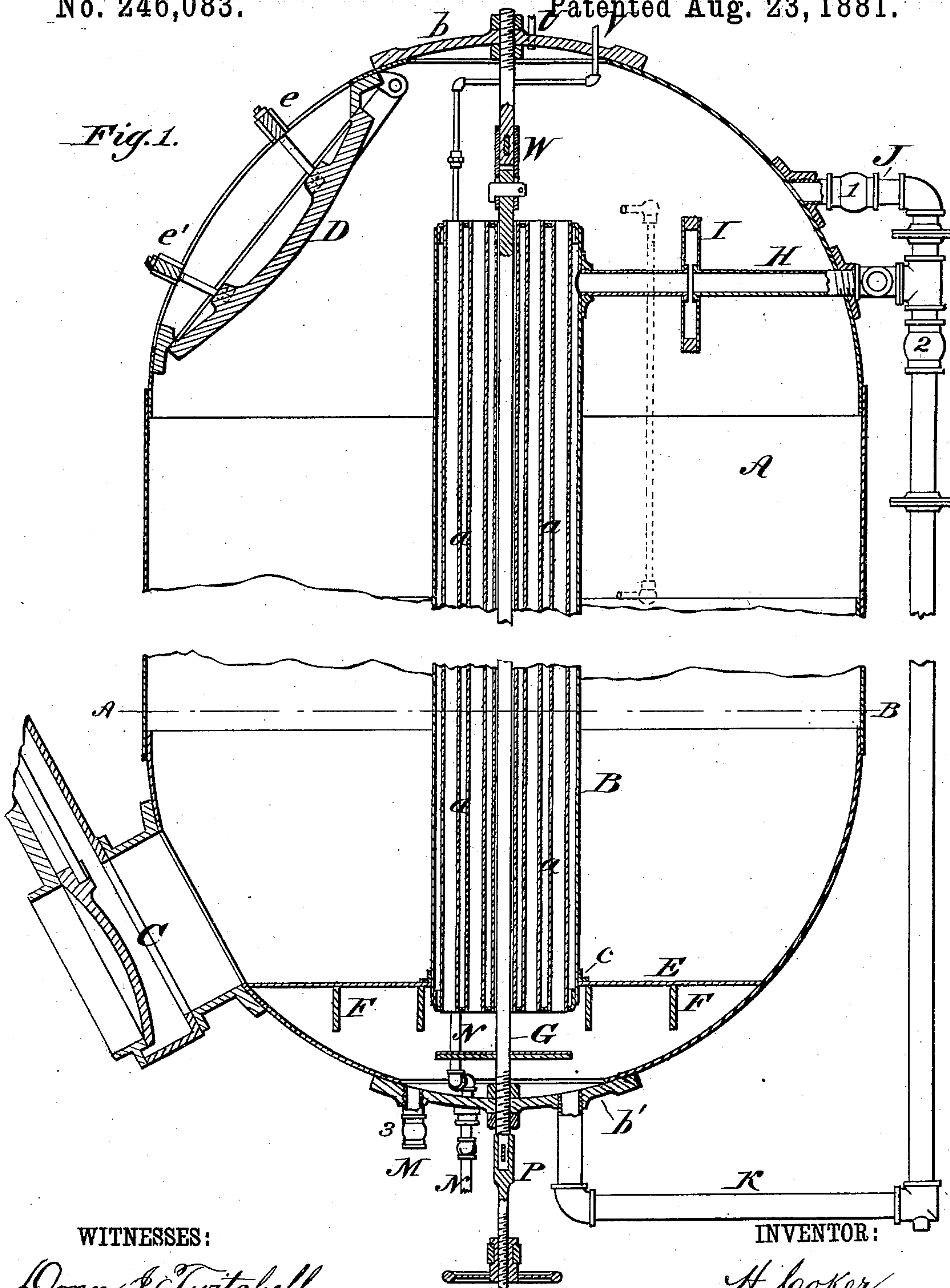
H. COKER.

APPARATUS FOR BOILING AND DIGESTING PAPER STOCK.

No. 246,083.

Patented Aug. 23, 1881.

Fig. 1.



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Fig. 2.

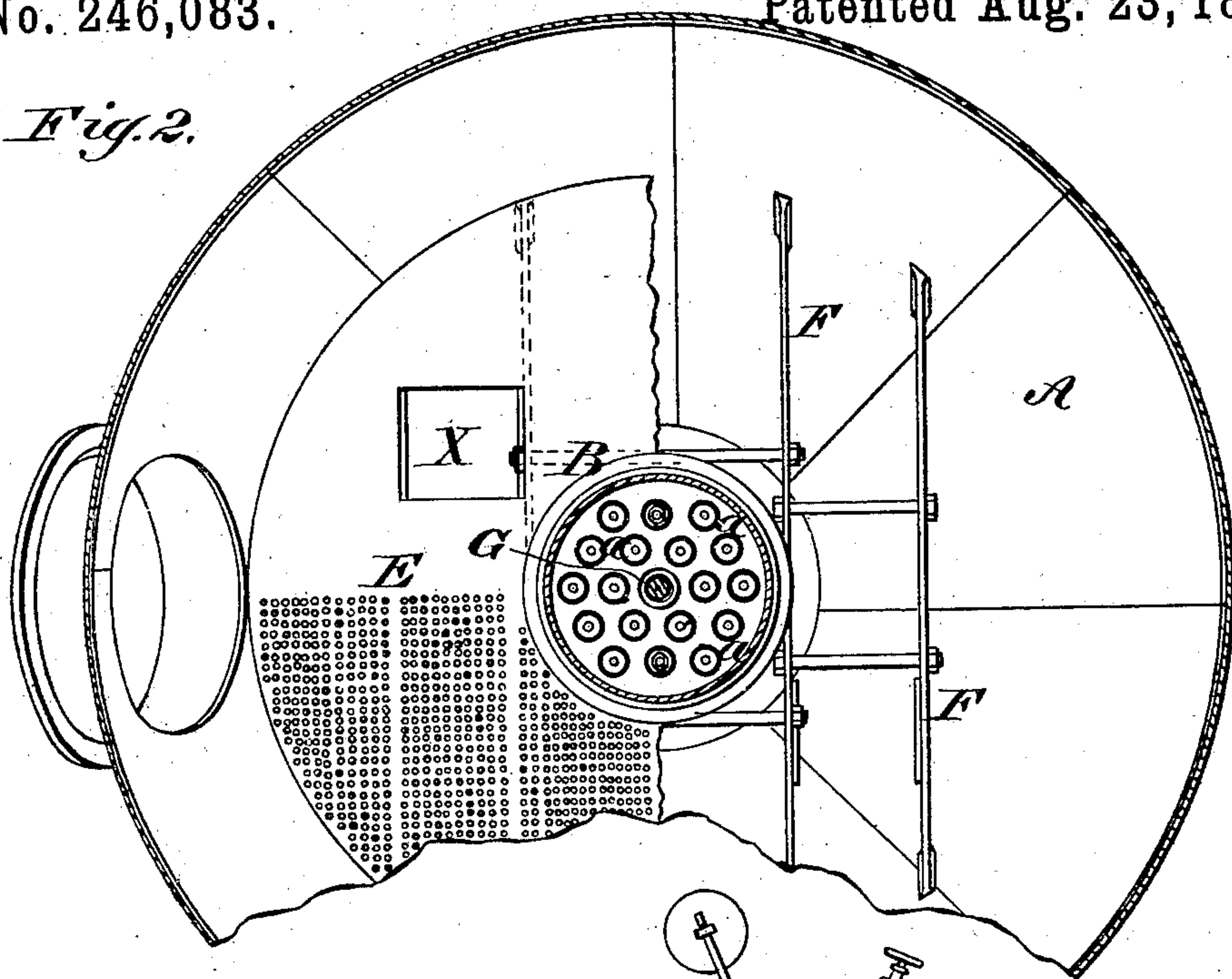
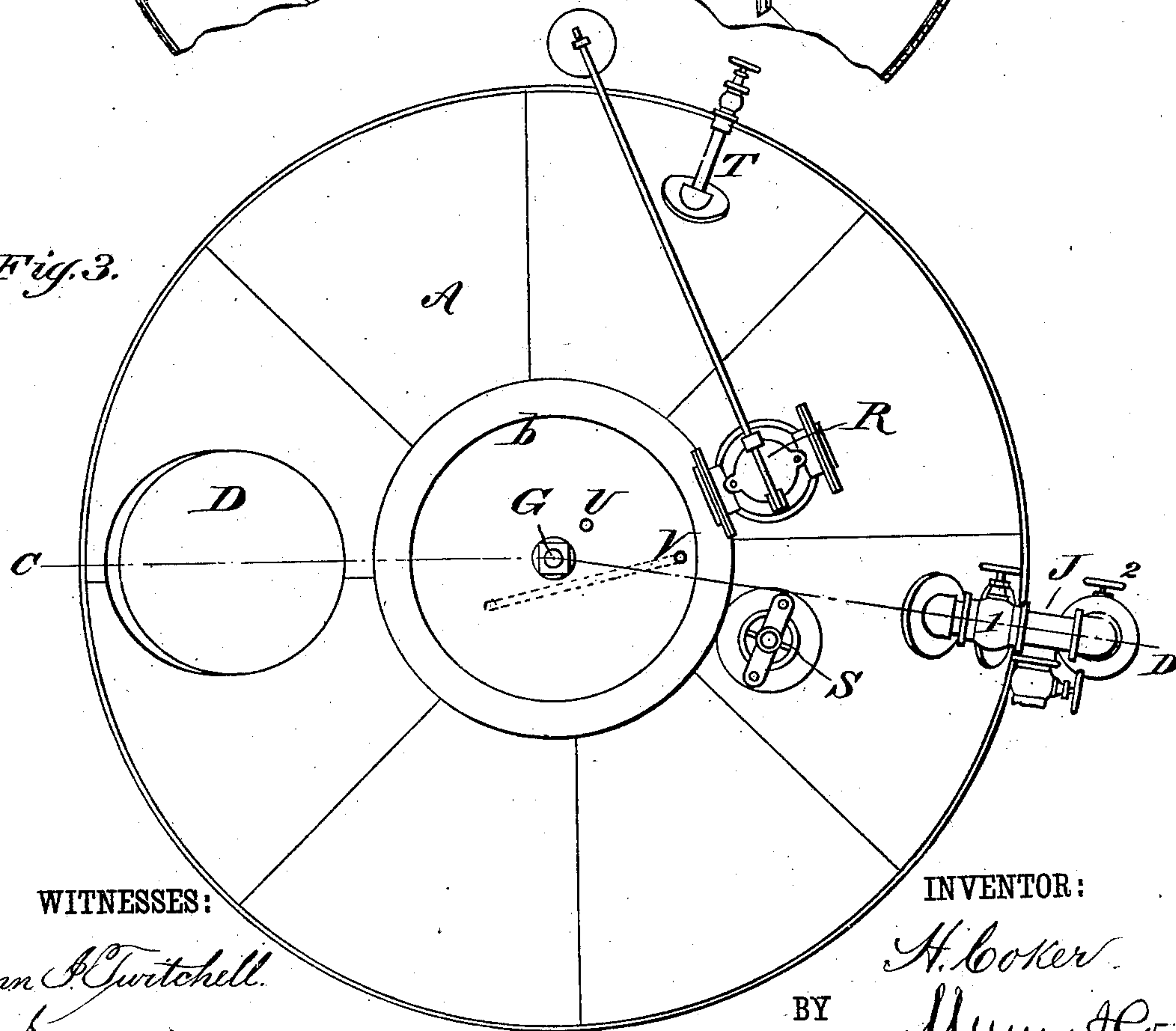


Fig. 3.



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Fig. 4.

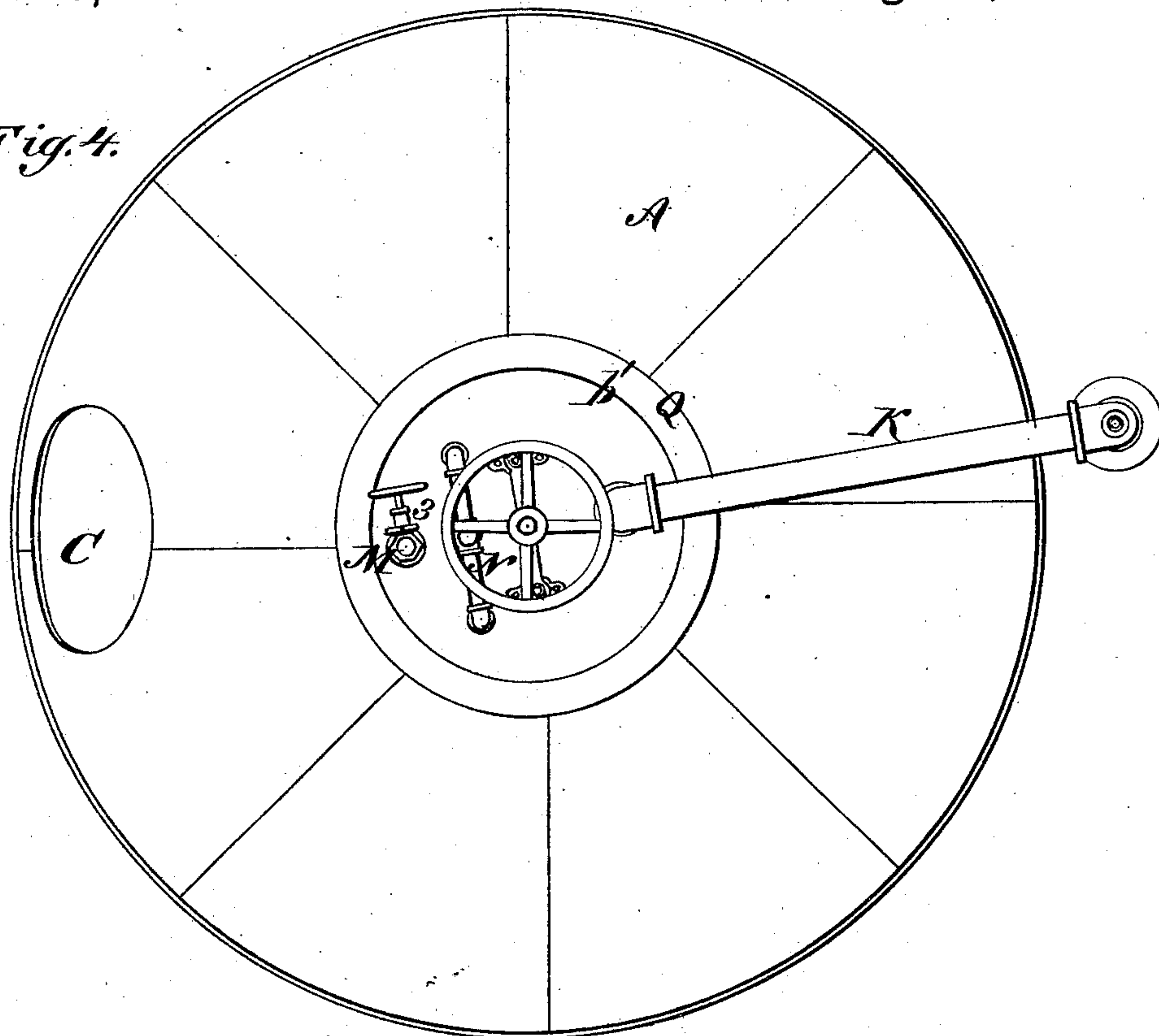
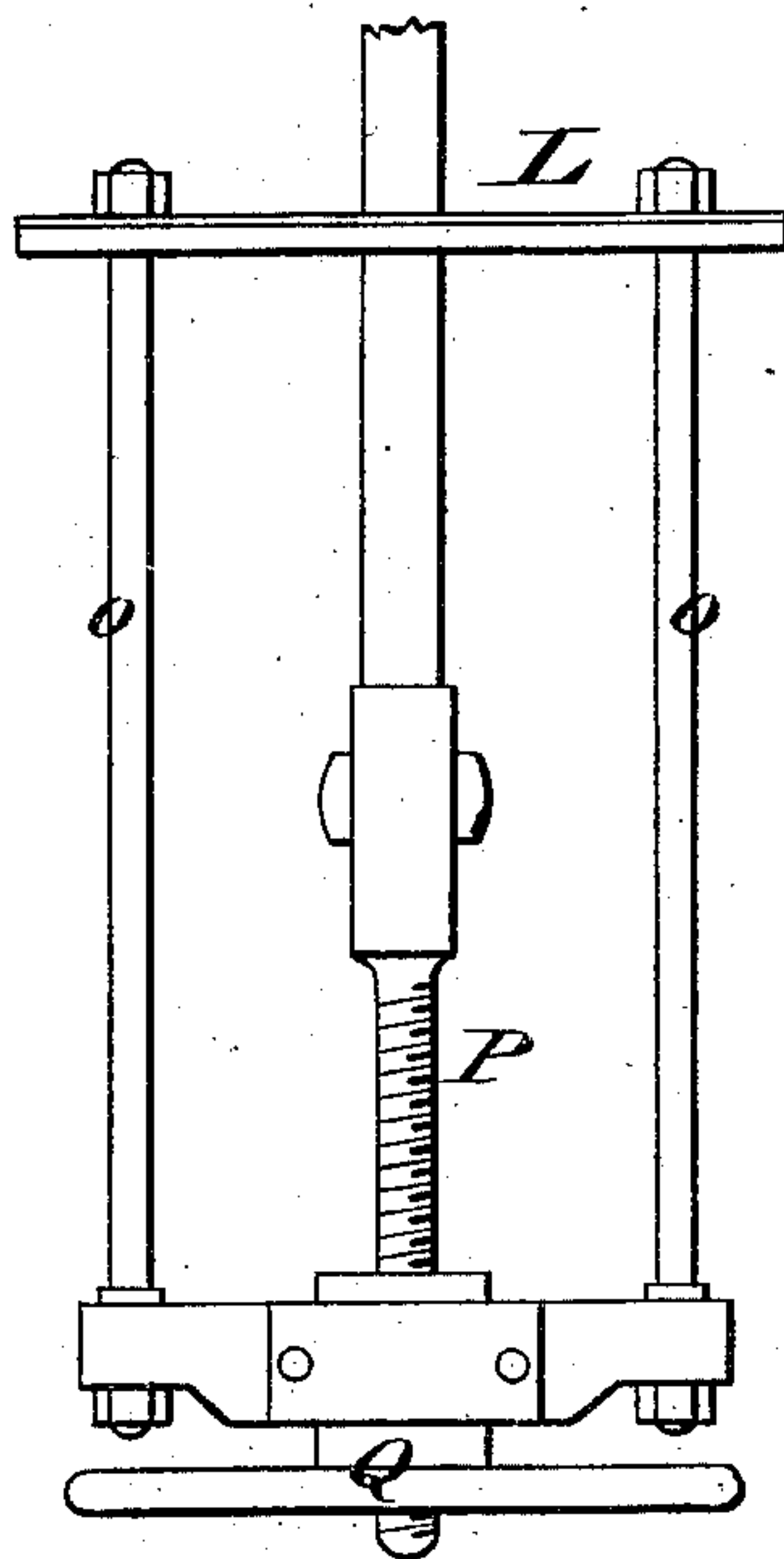


Fig. 5.



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UNITED STATES PATENT OFFICE.

HENRY COKER, OF WEST POINT, NEBRASKA.

APPARATUS FOR BOILING AND DIGESTING PAPER-STOCK.

SPECIFICATION forming part of Letters Patent No. 246,083, dated August 23, 1881.

Application filed February 3, 1881. (No model.)

To all whom it may concern:

Be it known that I, HENRY COKER, of West Point, in the county of Cuming and State of Nebraska, have invented a new and useful
5 Improvement in Apparatus for Boiling and Digesting Paper-Stock, of which the following is a specification.

My improvements relate to boilers or digesters for paper-stock, which heretofore have been
10 both open or closed vessels, into which the material has been placed with the lye, and the mass heated by direct application of steam. With such apparatus and process the steam, being injected directly into the digester, is condensed, and the lye is thus weakened by the
15 addition of the condensed water to such an extent that chemicals of much greater strength have to be used to allow for such dilution, and there is, besides, a waste of heat, and the chemicals are so much diluted that their recovery is not profitable.

The object of my invention is to avoid the difficulties connected with digesters as heretofore constructed, as briefly stated above, and
25 to perform the work more rapidly, effectively, and economically.

The nature of the invention consists in heating the mass in the digester by a steam-heater and obtaining a circulation of the lye by the
30 variations in specific gravity.

The invention consists in a closed vessel fitted centrally with a closed steam-heater containing tubes for the circulation of the chemical or caustic lye through it, the heater being
35 in connection with a steam-generator, and suitable valves and gages provided for regulating the operation and showing the pressure, all as hereinafter described and claimed.

In the accompanying drawings, Figure 1 is
40 a vertical transverse section through C D of a digester for paper-stock fitted with my improvements. Fig. 2 is a horizontal transverse section of the same through A B. Fig. 3 is a top-end view. Fig. 4 is a bottom-end view;
45 and Fig. 5 is a side view of disk-valve screw, &c.

Similar letters of reference indicate corresponding parts.

The digester or boiler A is made in cylin-

drical form with spherical ends, and of suitable size in any proper proportion of length and diameter.

The shell is made of boiler-iron with cast-iron heads *b b'*, that are tied by a rod, G, extending through the boiler and heater. To
55 allow of expansion and contraction without injury to the boiler, the rod G is fitted, near the upper head *b*, with expansion socket and keys W.

The digester A is used in a vertical position.
60 At the upper portion, near the top, a furnishing valve or gate, D, is provided, hinged at the upper end to swing inward, and fitted with clamping-bars *e e'*, by which the valve can be closed tightly.

Near the bottom of digester A is a discharge-valve, C.

The digester is fitted near the top with a pressure safety-valve, R; also a vacuum safety-valve, S, opening inward to allow inlet of air
70 and prevent collapse by sudden condensation; a large glass water-gage, T, to show action of water in A; a pressure-gage, V, will also be fitted for indicating the pressure in the digester, and a cock to allow escape of air when
75 steam is thrown directly into it; also a pressure-gage, U, and air-cock for the same purpose in heater B.

Near the lower end of the digester is fitted a perforated false bottom, E, which bottom, as
80 shown in Figs. 1 and 2, is supported by cross-bars or joists F F, &c., that rest on the semi-circular end of the digester.

To give access below the perforated bottom E, two trap-doors, X X, will be arranged in
85 the bottom.

From the false bottom E rises the heater B, the same being placed central of digester A, extending a short distance below false bottom E, on which the shell is supported by an angle-iron, C, and rising to near the upper end of the digester. The heater consists of a hollow cylinder, closed at the ends, and fitted with numerous tubes, *a*, that extend through and are secured to the closed heads. The steam-
95 space in the heater outside of tubes *a* is to be connected with a steam-generator by means of a pipe, H, that passes through the side of di-

gester A to the heater B; and to provide against expansion and contraction a double-disk expansion-joint, I, is used on pipe H, and from the lower end of the heater a pipe, N, passes through the bottom of the digester for returning the water of condensation to the generator.

In addition to the steam-connections through pipe H described, the boiler A is fitted near its upper end with a pipe, J, and at the bottom with a pipe, K, all of which pipes connect with the steam-generator and are fitted with suitable stop-valves, 1 1' 2, for operation by hand to admit or cut off steam. A pipe, M, and stop-valve 3 are also provided at the bottom of the boiler or digester A, for carrying off the dirty water and the spent or partially-spent lye when desired.

The operation is as follows: The boiler having been furnished through the upper opening with paper-stock—such as straw, wood, rags, waste paper, &c.—and the necessary quantity of caustic lye or other chemical solution added, the gate D is to be closed and the liquid portions of the mass in the boiler, passing through the perforated bottom E, will rise in tubes *a* and stand at the same level in both tubes and digester. Steam is then to be admitted to the heater by pipe H at a pressure of sixty pounds, (more or less, according to the nature of the stock,) and the tubes *a* becoming heated, the lye in the tubes has its temperature raised by indirect action of the steam, and, becoming specifically lighter, rises and is discharged through the upper ends of the tubes upon the mass in the digester, and a circulation is thus established, which becomes violent when the heat reaches the boiling-point. This circulation insures the contact of the heated lye with every portion of fiber, so that its work is done rapidly and effectually. At the same time the lye is not diluted by condensation of steam. The steam first admitted to the heater rapidly condenses, and the water returns to the generator; but the rapidity of condensation decreases as the mass in the digester becomes heated, until only boiling water is returned to the generator, thus effecting a great saving of heat, which would be entirely lost by the direct process. The condensed steam is not only hot but pure distilled water, thus avoiding incrustation of generator, and at the same time contributing to economy of fuel. The steam-pressure-recording indicators show the pressure, which is to be regulated, as required, until the stock is cooked or it is necessary to change the lye, when the blow-off pipe M at the bottom and steam-pipe J at the top are to be opened. The steam admitted by pipe J upon the material will force the lye out, either to waste or to a suitable vessel for recovery of the chemicals. The lye being undiluted, its treatment for the recovery of the chemicals will be comparatively inexpensive and profitable. The cooked stock is to be removed by the opening C; but before removal, and, if de-

sired, during the cooking process, the valve of pipe K may be opened to admit steam below the stock for lifting and agitating the mass. This may be continued for a suitable length of time, and to obtain more effective action a disk-valve, L, faced with rubber, is provided to close the pipes *a* in heater B, to be operated from the outside by tube-valve screw *o p q*, Fig. 5, and thereby cause the steam to force the lye through the mass instead of through the pipes *a*.

The apparatus described is adapted for treating all materials used for paper, the process being varied as required, and the work will be done rapidly and effectually, and with a saving of time, labor, heat, and chemicals.

This apparatus may also be used for cooking food for cattle.

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

1. The boiler or digester for paper-stock, consisting of closed cylinder A, provided with a false bottom and furnishing and emptying valves or gates, and the closed steam-heater B, combined for use and provided with the separate steam-supply pipes, substantially as shown and described.

2. In apparatus for boiling or digesting paper-stock, the cylindrical steam-heater B, provided with longitudinal tubes *a* and pipes H and N, for connection with a steam-generator, combined with digester A, having perforated false bottom E, substantially as described, and for the purposes set forth.

3. The hinged valve or gate D, provided with clamps *e*, combined with the paper-stock digester A, substantially as described, and for purposes set forth.

4. The tie-rod G, provided with expansion-socket W, combined with the closed cylindrical digester A, having heads *b b'*, substantially as described, and for purposes set forth.

5. The branch steam-pipe J, in combination with digester A and discharge-pipe M, substantially as described, and for the purposes set forth.

6. The branch steam-pipe H, in combination with digester A and heater B, substantially as described, and for the purposes set forth.

7. The branch steam-pipe K, in combination with digester A and perforated false bottom E, substantially as described, and for the purposes set forth.

8. The disk-valve L, in combination with digester A, heater B, and steam-pipe K, substantially as described, and for the purposes set forth.

9. The pipe V, in combination with digester A and a recording steam-gage, substantially as described, and for the purposes set forth.

10. The pipe U, in combination with heater B, tubes *a*, and a recording steam-gage, substantially as described, and for the purposes set forth.

11. The pipes U and V, with the recording

steam-gages, in combination with a recording steam-gage on the generator, substantially as described, and for the purposes set forth.

5 12. The condensed-steam pipe N, in combination with heater B and steam-generator, substantially as described, and for the purposes set forth.

13. The application of indirect steam heat in closed digester A through the medium of

the heater B, in combination with steam-generator for digesting or cooking paper-stock, substantially as described, and for the purposes set forth.

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Witnesses:

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