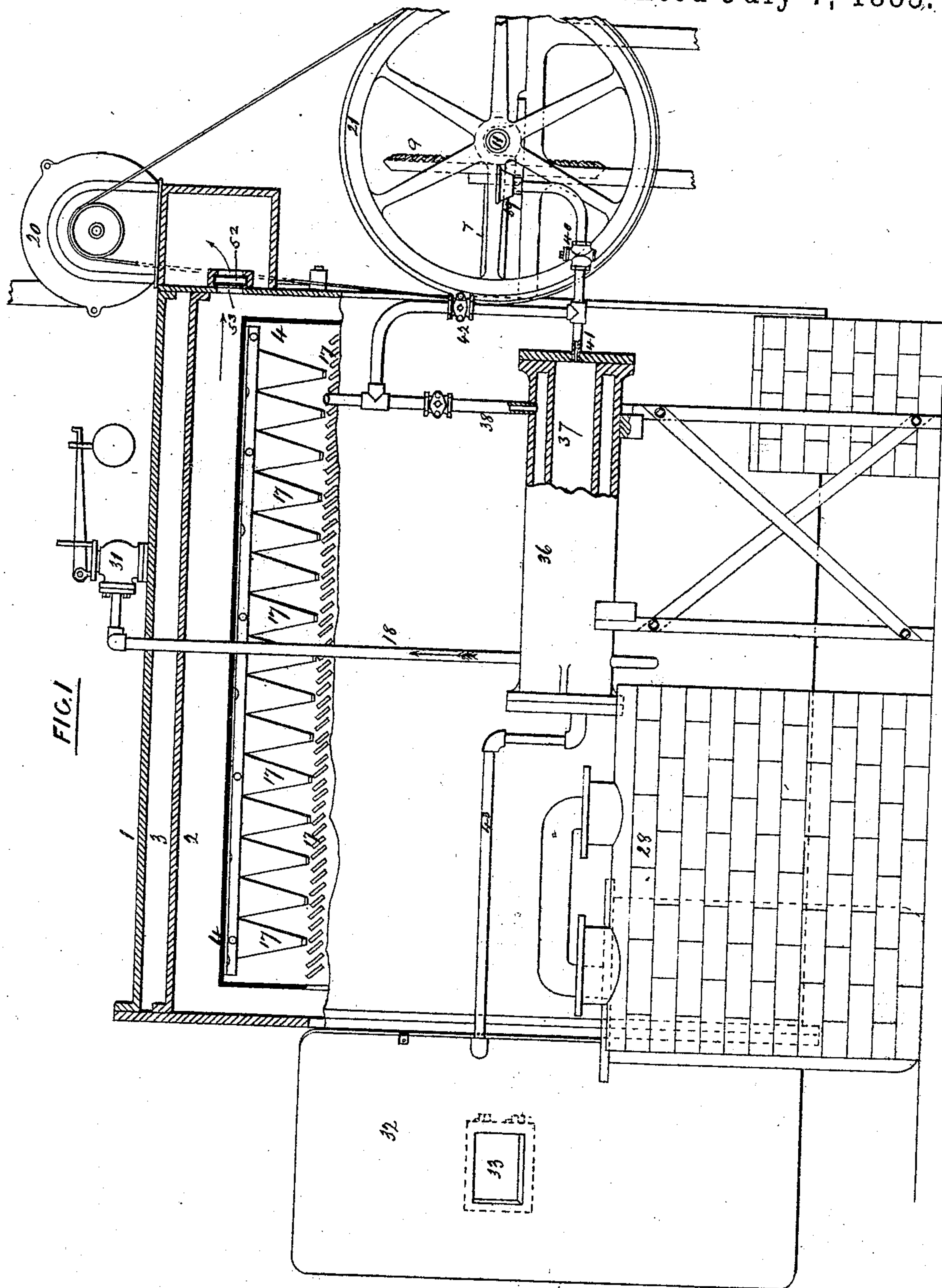


(No Model.)

4 Sheets—Sheet 1.

J. ILLINGWORTH.
APPARATUS FOR REMOVING VEGETABLE FIBER FROM WOOL.
No. 321,899.
Patented July 7, 1885.



WITNESSES:

E. B. Bolton
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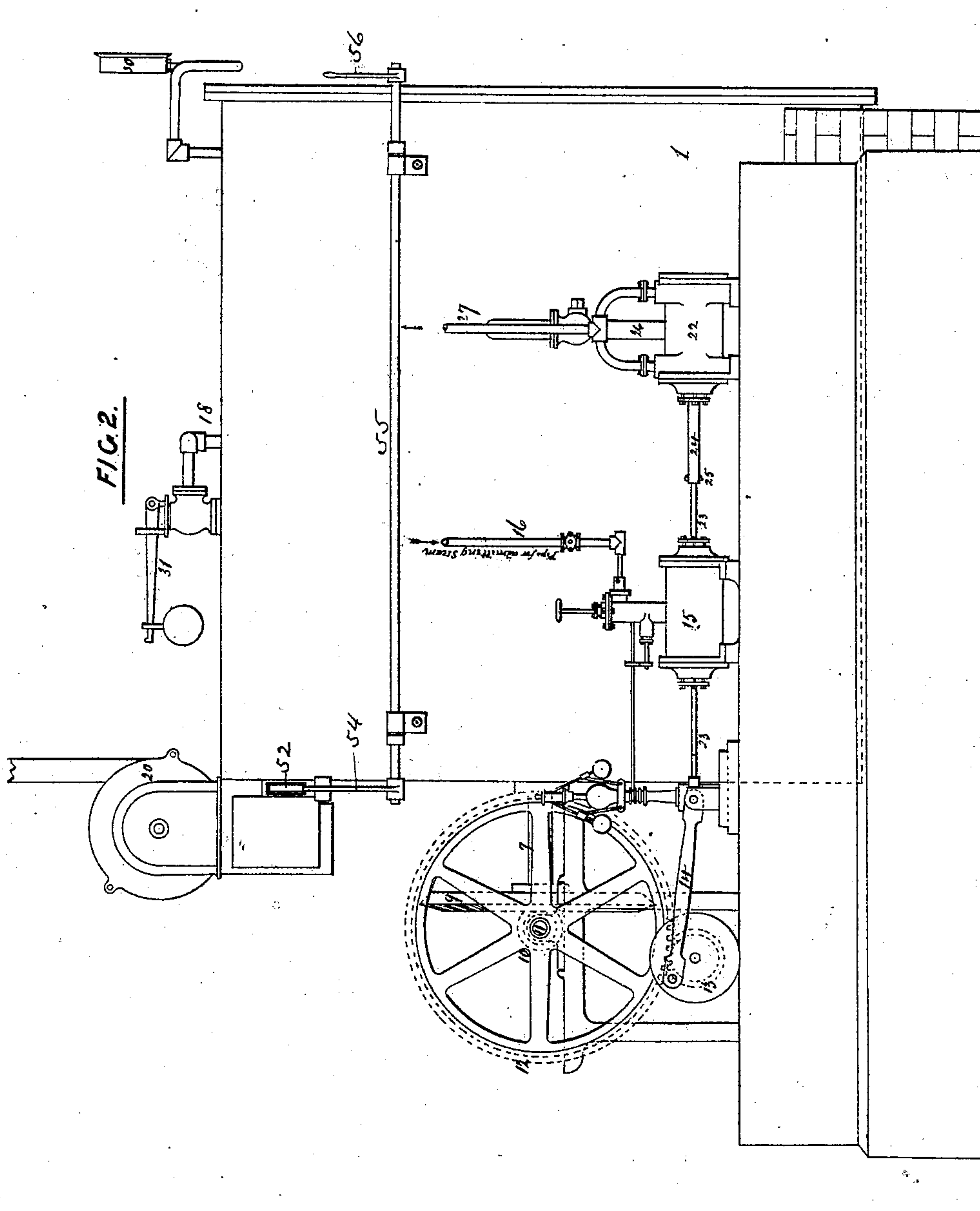
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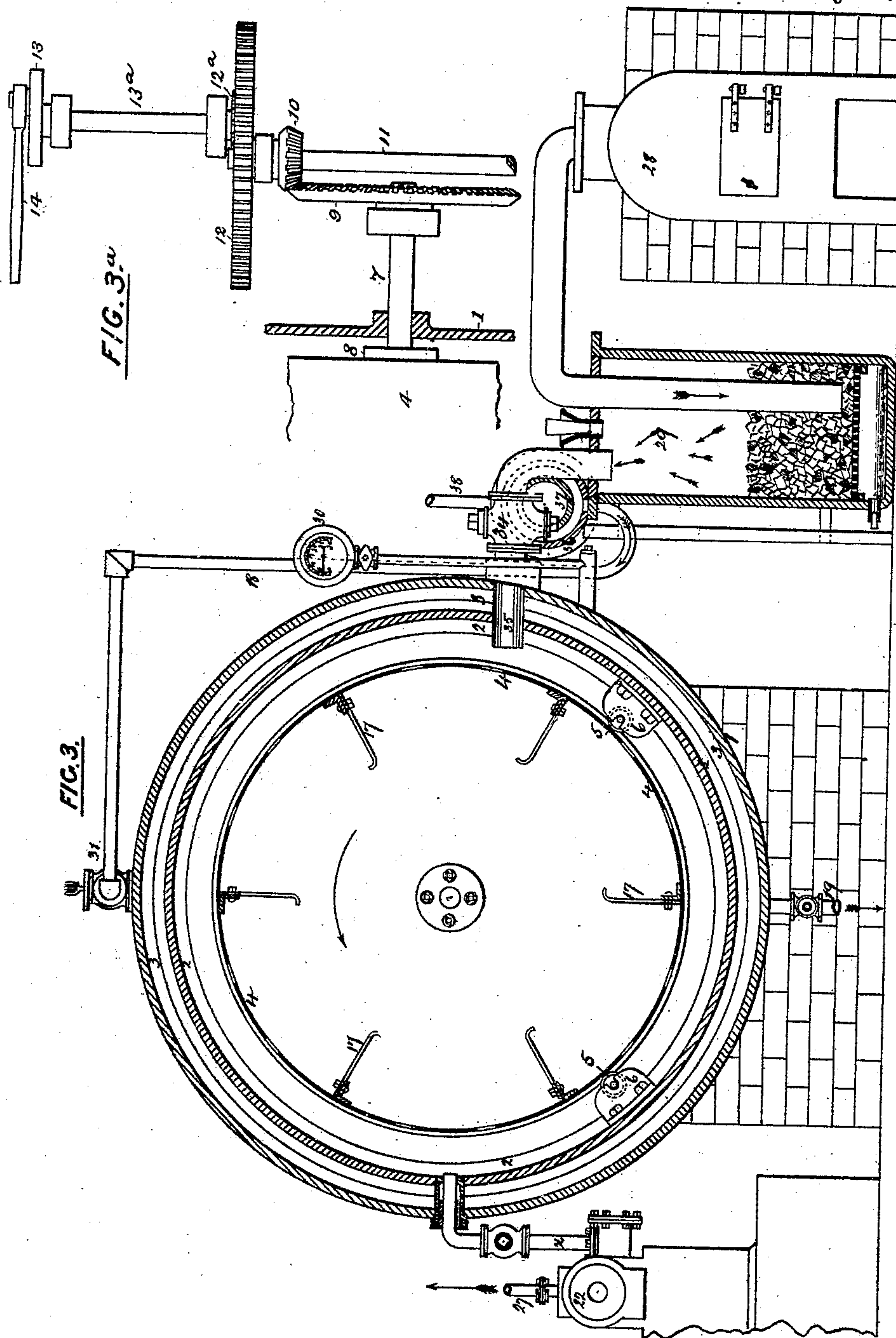
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FIG. 5.

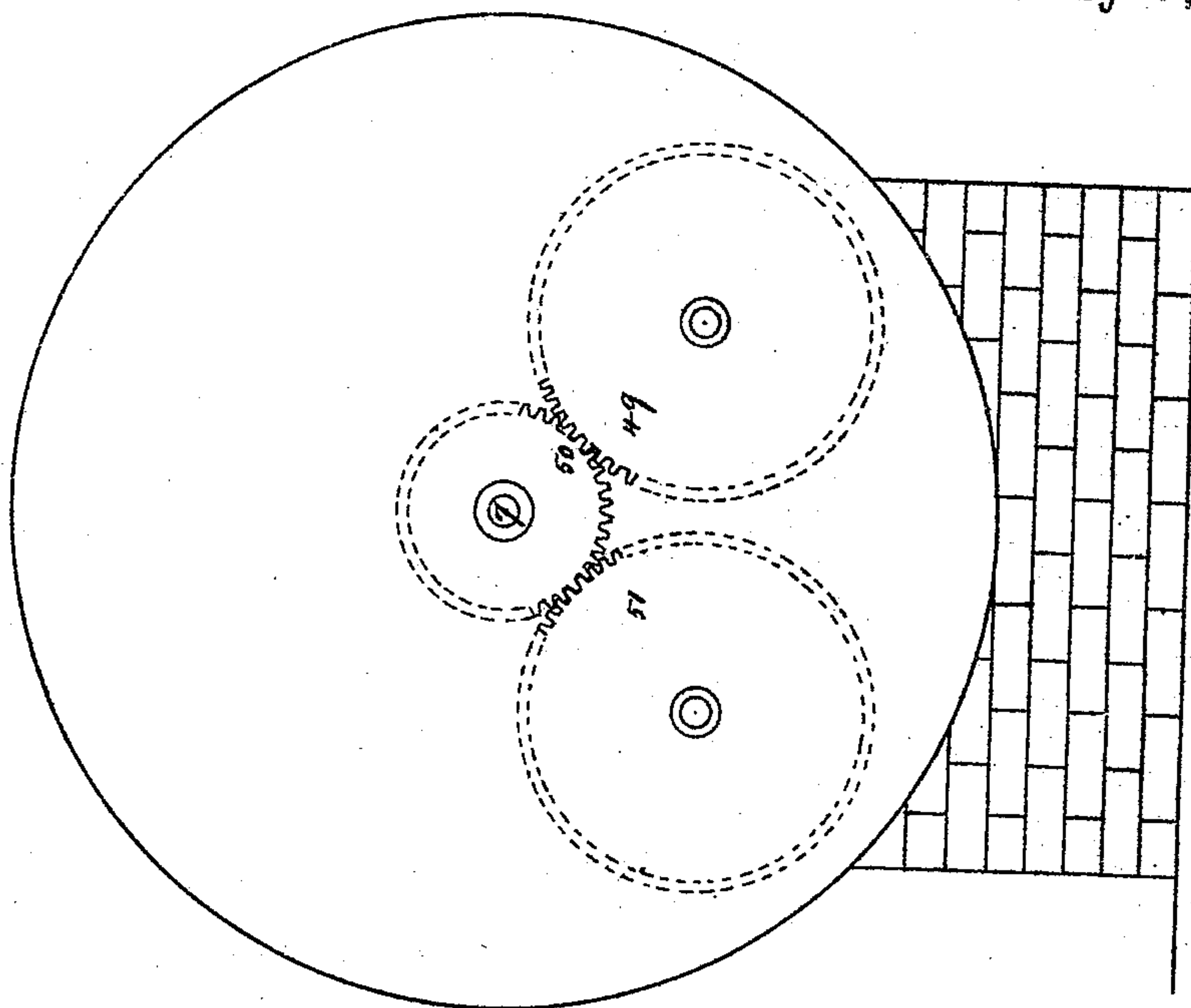
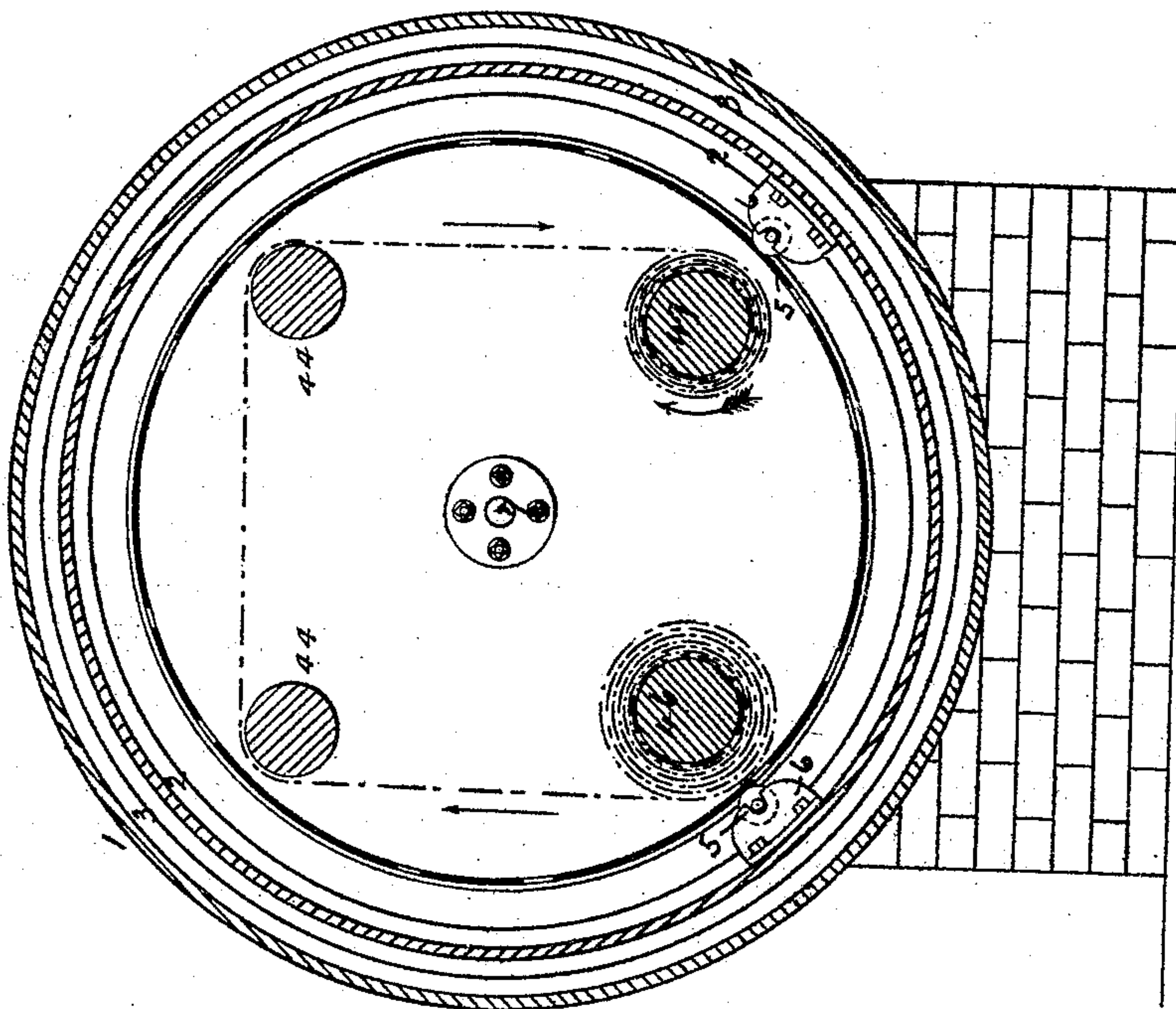


FIG. 4.



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UNITED STATES PATENT OFFICE.

JOHN ILLINGWORTH, OF BATLEY, COUNTY OF YORK, ENGLAND.

APPARATUS FOR REMOVING VEGETABLE FIBER FROM WOOL.

SPECIFICATION forming part of Letters Patent No. 321,899, dated July 7, 1885.

Application filed December 15, 1884. (No model.) Patented in Belgium July 31, 1884, No. 65,919; in Germany July 31, 1884, and in France August 2, 1884, No. 163,611.

To all whom it may concern:

Be it known that I, JOHN ILLINGWORTH, a subject of the United Kingdom of Great Britain, and a resident of Batley, in the county of York, England, flock-manufacturer, have invented certain Improvements in the Apparatus for Treating Fibers, Rags, and Woven Fabrics, of which the following is a specification.

10 The object of my invention is to destroy or carbonize cotton, jute, flax, or other vegetable matter when mixed with animal fibers, woolen rags, or woven piece goods, and also for the destruction of such vegetable matter when mixed with yarn, wool, and waste.

15 In order that my invention may be the better understood, I herein give reference to the accompanying drawings, illustrative thereof, wherein—

20 Figure 1 is an elevation of one side of my apparatus, a portion of the upper part of the boiler, flue, and rotary cage being in longitudinal vertical mid-section, so as to exhibit the interior construction. Fig. 2 is an elevation of the opposite side of the apparatus. 25 Fig. 3 is a transverse section taken in several planes, as will be hereinafter indicated, the better to illustrate the construction. Fig. 3^a is a detached fragmentary plan of the driving-gear. Figs. 4 and 5 illustrate a modification, 30 which will be hereinafter fully described.

1 represents the outer shell of a boiler, preferably cylindrical in form, and 2 is a flue fixed in said boiler so as to leave a space, 3, 35 between them, which, as herein shown, is annular. This space is adapted to receive steam or hot water, or both, and forms a steam-jacket for the flue 2.

40 Within the flue 2 is a perforated rotary cage, 4, which bears upon rollers 5, supported by suitable brackets, 6, Fig. 3, secured by bolts or otherwise to the inner side of the flue.

The shaft 7, for driving the cage, does not pass through it, but is secured to one end thereof by a flange, 8, Fig. 3^a, the said shaft 45 being driven by bevel-wheels 9 and 10 from the shaft 11, which receives its motion, by spur-wheel 12, direct from a pinion, 12^a, on the rotary crank-disk 13 on shaft 13^a, operated by connecting-rod 14 of the steam-engine 15.

In order to make the apparatus complete I have attached thereto a small steam-engine, as will be seen in the drawings, steam being conveyed to the same by a pipe, 16, from any convenient source. The apparatus may, however, 55 be operated by a belt or wheels, and any power may be employed to drive it, according to requirement.

Within the cage are a series of spikes, prongs, grates, or serrated plates, 17, employed for the purpose of lifting or carrying 60 the fibrous materials above the center of the cage, when they will fall back again to the bottom thereof, thereby being well agitated and thoroughly exposed to the action of the carbonizing-gases, as hereinafter explained. 65

Steam is admitted to the boiler by pipe 18, from whence it escapes at 19; and 20 is an exhaust-fan driven at a rapid rate by a belt from pulley 21, keyed on the cross-shaft 11, 70 the said exhaust-fan being employed for causing a current of air to pass through the apparatus, thereby removing any acid and dust which may remain in the animal fiber after the vegetable fiber has been destroyed, and for clearing out the air and gases from the flue or 75 chamber 2, so that it is more accessible for the workman to enter, (as it is necessary for him to do so from time to time in order to remove the fiber from the cage and refill it again,) or for forming a partial vacuum therein. A 80 more perfect vacuum, however, may be formed by the air-pump 22, operated, when required, by the piston-rod 23, which for this purpose passes entirely through the cylinder, the pump-rod 24 being connected to the piston-rod by a 85 cotter or key, 25, which, when not required, is removed and the parts disconnected. The said air-pump is connected by pipe 26 to the flue 2, the air removed therefrom being carried 90 away by pipe 27 to any convenient place.

The carbonizing-gases, which may be various, are made in the retort 28 and conveyed therefrom to the purifier 29, which contains pumice-stone and liquid sulphuric acid, or sulphuric acid without pumice-stone, somewhat 95 after the manner of a "Wolff's bottle," or calcium sulphate, through which the carbonizing vapors pass for the purpose of refining them or extracting all the moisture therefrom, pro- 100

ducing thereby a dry gas, which I find very suitable for the purpose. In Fig. 3 I have shown the purifier 29 in section and the retort 28 in elevation.

5 The apparatus is provided with a steam-gage, 30, and blow-off valve 31, to ascertain the pressure of steam and to guard against overpressure, as will be well understood.

The *modus operandi* is as follows: The space
10 3 or boiler proper is supplied with steam or hot water, or both, until the temperature of the flue or chamber 2 is sufficiently hot—say 240° Fahrenheit—when the fibrous materials to be operated upon are placed within the rotary cage 4, after which the door 32 of the
15 flue is closed and the cage set in motion, whereby the materials are carried around the heated chamber by the projecting prongs or serrated plates 17 in the cage, which distributes and agitates the fibers, making them
20 more accessible to the hot air and gases. A small door, 33, in the main door 32 is now opened for the admission of air, and the exhaust-fan 20 set in motion, which draws air
25 (if preferred, previously heated) through the fibers, whereby they are expeditiously and thoroughly dried. The doors and apertures of the flue are now closed, and a partial vacuum
30 formed therein by the continued action of the exhaust-fan. If, however, the vacuum is not sufficient, the pump-rod 24 is connected to the piston-rod 23, and the pump set in motion, which immediately forms a vacuum in the flue,
35 causing the temperature therein to rise, and withdrawing the moisture from the fibers, which are now rendered ready to absorb any gases or vapors which may be admitted to them. After having, therefore, prepared the
40 fibers and got them into a proper condition for the carbonizing-gases, I now admit the latter by opening the valve 34 in the pipe 35, one end of said pipe being in connection with the gas-purifying chamber 29, while the other end
45 is in connection with and open to the flue 2, whereat the gases enter the chamber, and through the perforations in the cage 4, which gases are readily absorbed by the fibers, which
50 have been previously prepared, the said gases entering and penetrating to the very core thereof, by which means the vegetable part of the fiber is absolutely and thoroughly destroyed, nothing but fine dust or ashes remaining, while the animal fiber remains intact. When the destruction of the vegetable
55 fiber is complete, the valve 34, for admitting the carbonizing-gas, is closed, the door 33 opened, and the exhaust-fan 20 set in motion again, drawing through the heated chamber and the fiber another current of air, and as
60 the cage continues to revolve and agitate the fiber the acid which may be adhering to the animal fiber is removed, together with the fine dust, thereby leaving the said fiber practically free from acid.

65 In cases where the acid has not been perfectly removed from the animal fiber, it is subjected to a further process or treatment for

the more effectually neutralizing the said acid, and for this purpose I employ a large pipe or a cylinder, 36, which is shown in side elevation, partially broken away, in Fig. 1, and in cross-section in Fig. 3, where it is seen directly under the valve 34. Within this cylinder is a similar cylinder, 37, of smaller diameter. The annular space between these cylinders receives
75 steam under high pressure, conveyed thereto by pipe 38, whereby the smaller inner pipe, 37, becomes hot and forms a heating-chamber, in which is placed liquid ammonia or other compound containing the same elements. 8c

The ammonia is fed into the cup 39, (shown in Fig. 1,) and on opening the cock 40 flows along the pipe 41 until the cylinder 37 is sufficiently full, when the cock 40 is closed. After the ammonia in the hot cylinder is sufficiently heated, the cock 42 is opened, admitting steam into the pipe 41 at a high pressure, which intermingles with the ammonia in the cylinder, and forces same, in combination with the steam, through the pipe 43 into the flue 2,
85 where it is freely discharged into and among the fiber, absolutely neutralizing any of the acid remaining in the same. 90

In Figs. 1 and 2 I have shown the means I usually employ for regulating the exhausting action of the fan 20. This comprises a cut-off
95 slide, 52, arranged to more or less close the opening 53, which connects flue 2 with the fan. To this slide is coupled an arm, 54, on a rock-shaft, 55, the other end of which is provided with an operating-lever, 56. The operation will be readily understood. 100

When operating upon woven piece goods, the same gases and substantially the same form of apparatus are employed as that already described, except that in addition thereto I employ
105 the devices shown in Figs. 4 and 5, the former of which is a transverse section and the latter an end view of the boiler and its interior parts. In these views I have omitted all the extraneous features of the apparatus, as these
110 are sufficiently illustrated in Figs. 1 to 3. The woven pieces pass over the rollers 44, the vegetable matter contained therein—such as “burrs,” seeds, and other vegetable “bits”—being destroyed by the gases as the piece travels
115 around the rollers. Previous to the piece being placed in the apparatus it is wound upon a beam, 46, and placed within the cage in the flue 2 in such manner as to run loosely therein. 120 One end of the piece is then connected to the beam 47, which is caused to rotate so as to unwind the piece off the beam 46 and wind it on beam 47, the said beam receiving a positive rotary motion by spur-wheel 49 from the pinion-wheel 50, secured to the flue-head concentric with the axis of the cage 4. 125

The rollers 44 and beams 46 and 47 are shown in Fig. 4 as arranged within the cage 4, and having bearings in its ends, the projections 17 being omitted from the cage. 130

If by once traveling through the machine the burrs and vegetable matter are not destroyed, the rotary motions of the winding-

rollers are reversed, which is easily effected by taking the key out of the wheel 49 and placing it into wheel 51, which now becomes the winding-on roller. These operations of making first one roller and then the other to be the winding-on roller may be adopted as often as required until the burrs are effectually destroyed.

I have stated that the rotary cage 4 is perforated, and this description I deem sufficient, as it is not essential how it shall be constructed so long as free passage for the gases through its drum be provided. It may be of stout wire-gauze, or of sheet metal perforated with holes, as indicated in Fig. 3. In this figure the section of the boiler and flue at the left is taken in the plane of pipe 26, and at the right in the plane of pipe 35.

The pressure-gage 30 may be placed in any convenient position. In Fig. 2 I have shown it placed in one position, and in Fig. 3 in another.

The end of the cage 4, which is at the left in Fig. 1, is provided with an opening large enough to insert the material heated.

Any of the well-known acid gases may be employed to carbonize the vegetable matter—as, for example, vapor of hydrochloric acid, and this may be generated in any ordinary retort, 28.

I do not claim herein the carbonization or decomposition of vegetable matter mixed with animal fiber in order to remove the former, as this is well known.

I am also aware that it has been proposed to rotate foraminous cages for the fiber within stationary heated chambers, and to treat said fiber with carbonizing-gases under such conditions. This I do not claim.

Having now particularly described and ascertained the nature of my invention, I claim—

1. In an apparatus for treating animal fiber, or materials made therefrom, for the carbonization and removal of the vegetable matter mixed therewith, the combination of the flue 2, the boiler 1, constructed as shown, to surround flue 2 and form a steam-jacket, 3, around the same, the foraminous cage 4, rotatively mounted in flue 2, the blower 20, connected with flue 2, the mechanism, substantially as described, for rotating the cage and driving the blower, the gas-generating apparatus 28, connected with flue 2 by a pipe, and the apparatus for forcing a mixture of ammonia and steam into the flue 2, comprising the jacketed ammonia-receptacle 37, its feed-pipe 41, provided with cock 40, its outlet-pipe 43, and the steam-pipe controlled by cock 42, said flue 2 being provided with a door, 32, and all constructed and arranged to operate substantially as set forth.

2. The combination, with the jacketed flue 2, the blower 20, the foraminous cage 4, mounted rotatively in the flue, the mechanism, substantially as described, for rotating the cage and driving the blower, and the gas-generating apparatus, of the rollers 44, mounted in the cage 4, the beams 46 and 47, mounted in the cage 4 and bearing on their projecting axles the spur-wheels 49 and 51, constructed to be readily detached therefrom, and the pinion 50, mounted on and fixed to the flue concentric with the axis of the cage, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOHN ILLINGWORTH.

Witnesses:

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U. S. Consular Agent.

A. B. CROSSLEY,
Market Place, Huddersfield.