

L. DÉTRÉ.

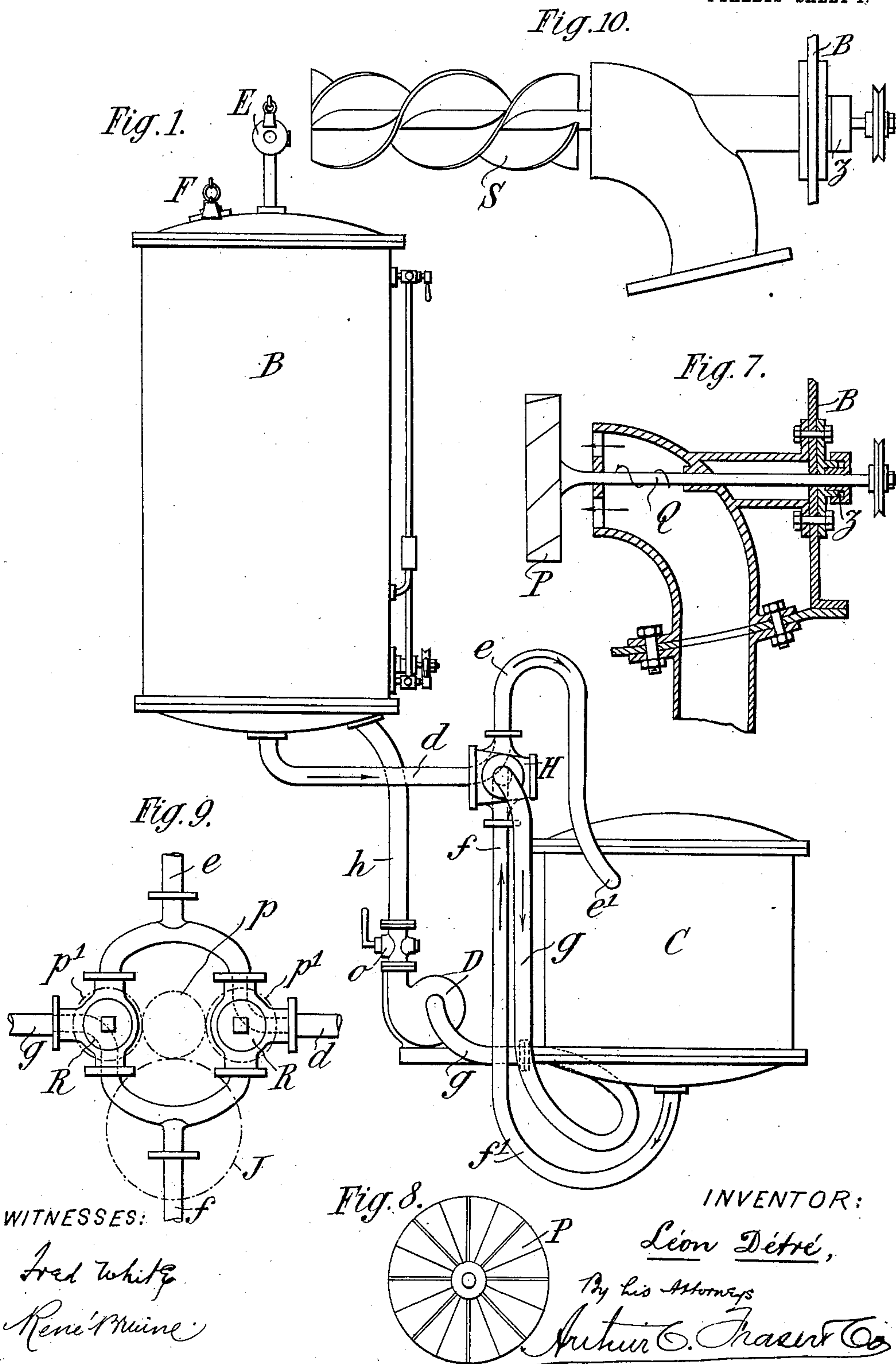
APPARATUS FOR SUBJECTING MATERIALS TO THE ACTION OF LIQUIDS UNDER PRESSURE.

APPLICATION FILED MAY 4, 1905.

898,444.

Patented Sept. 15, 1908.

4 SHEETS—SHEET 1.

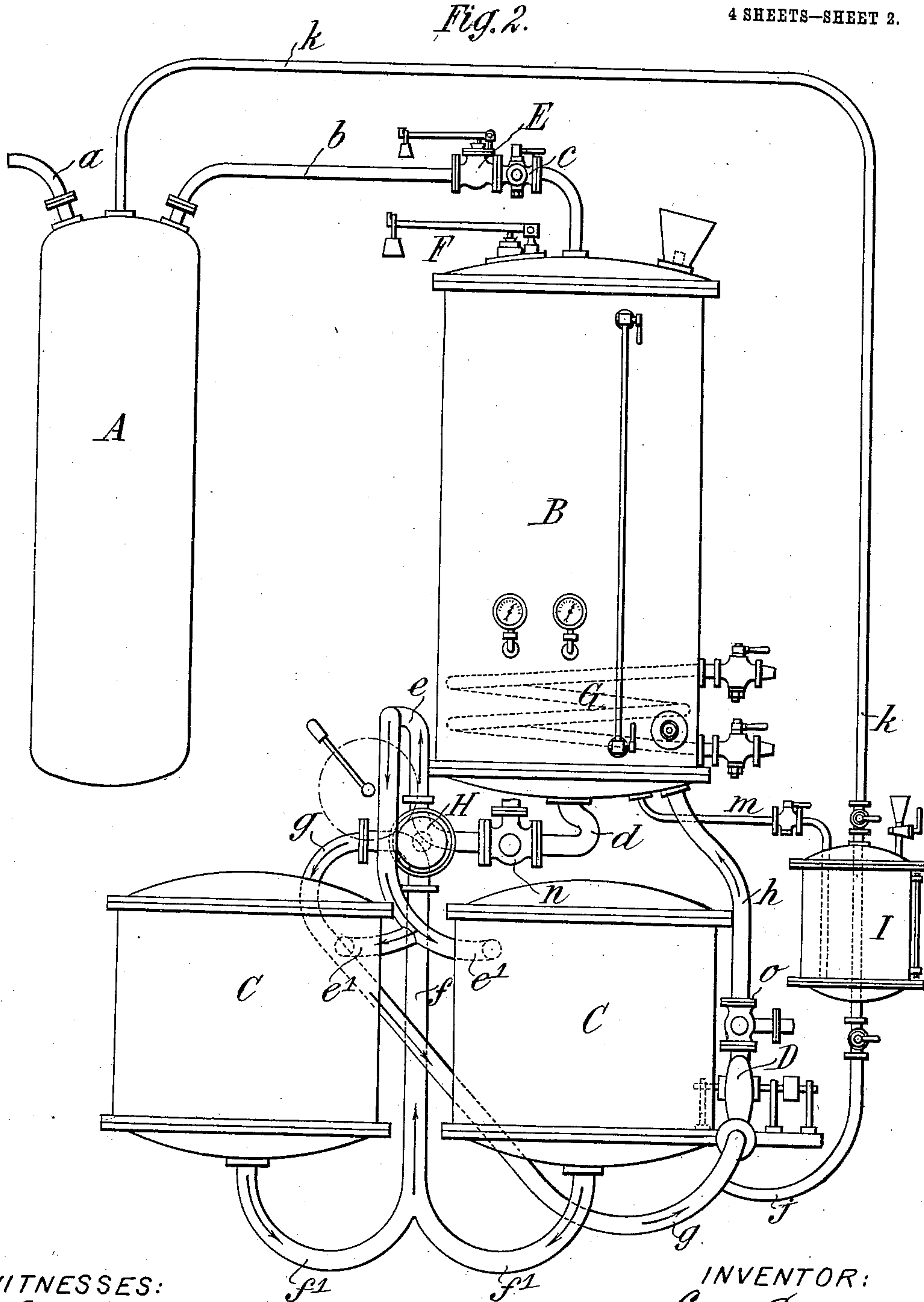


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4 SHEETS—SHEET 2.



WITNESSES:

*Ired White*  
*Rene Gruine*

INVENTOR:

*Léon Détré,*

*By his Attorneys*

*Arthur C. Fraser & Co.*

L. DÉTRÉ.

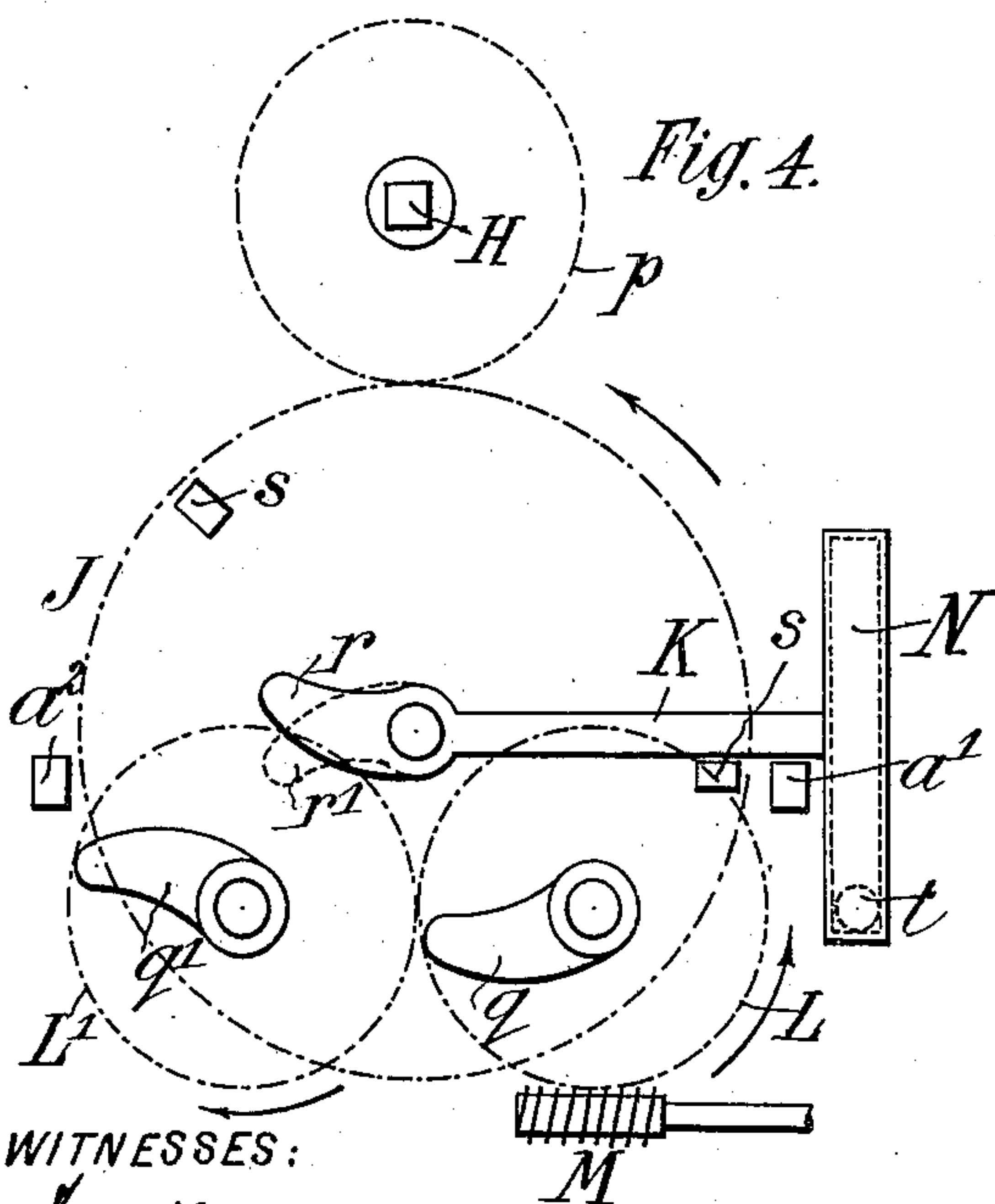
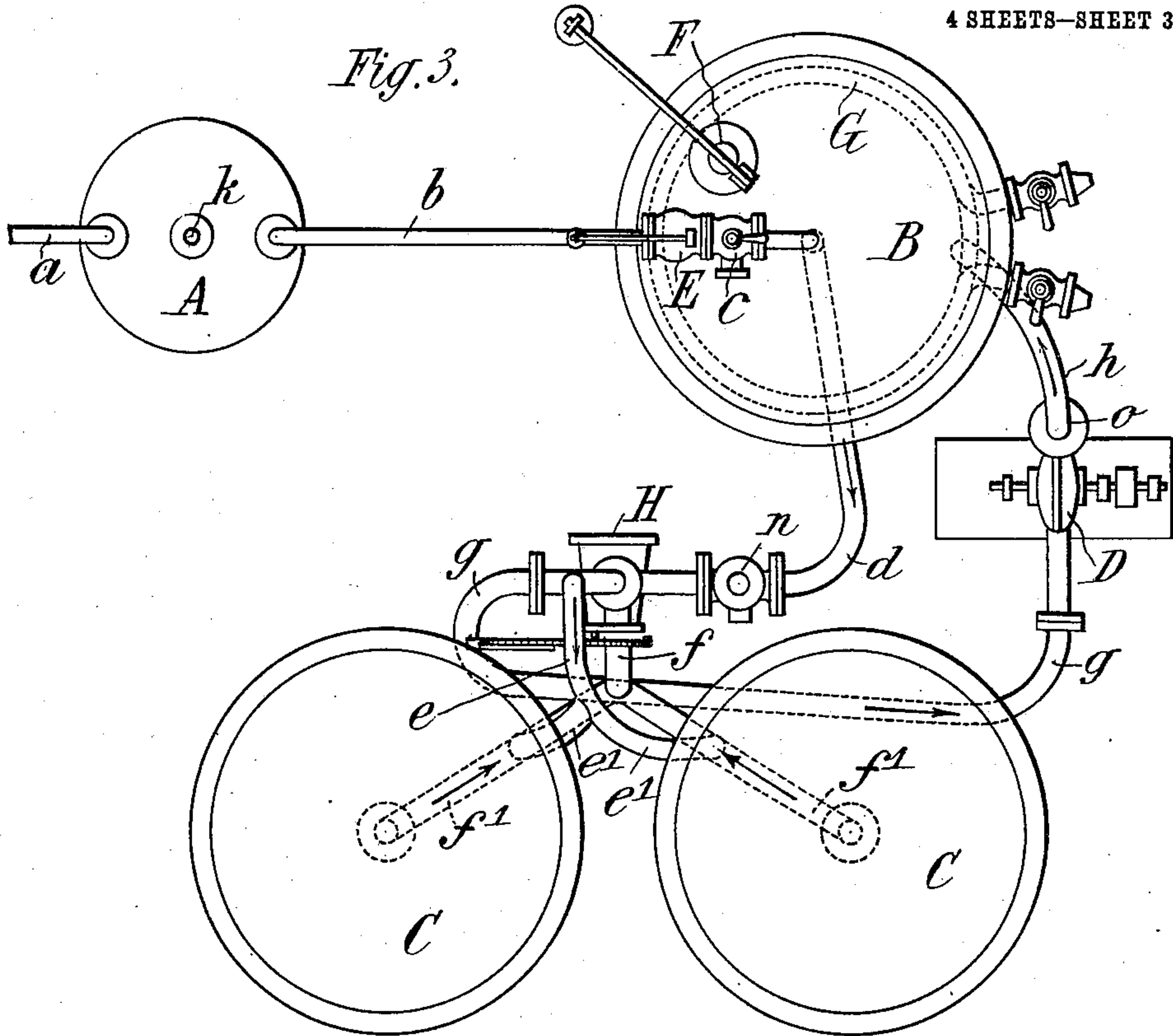
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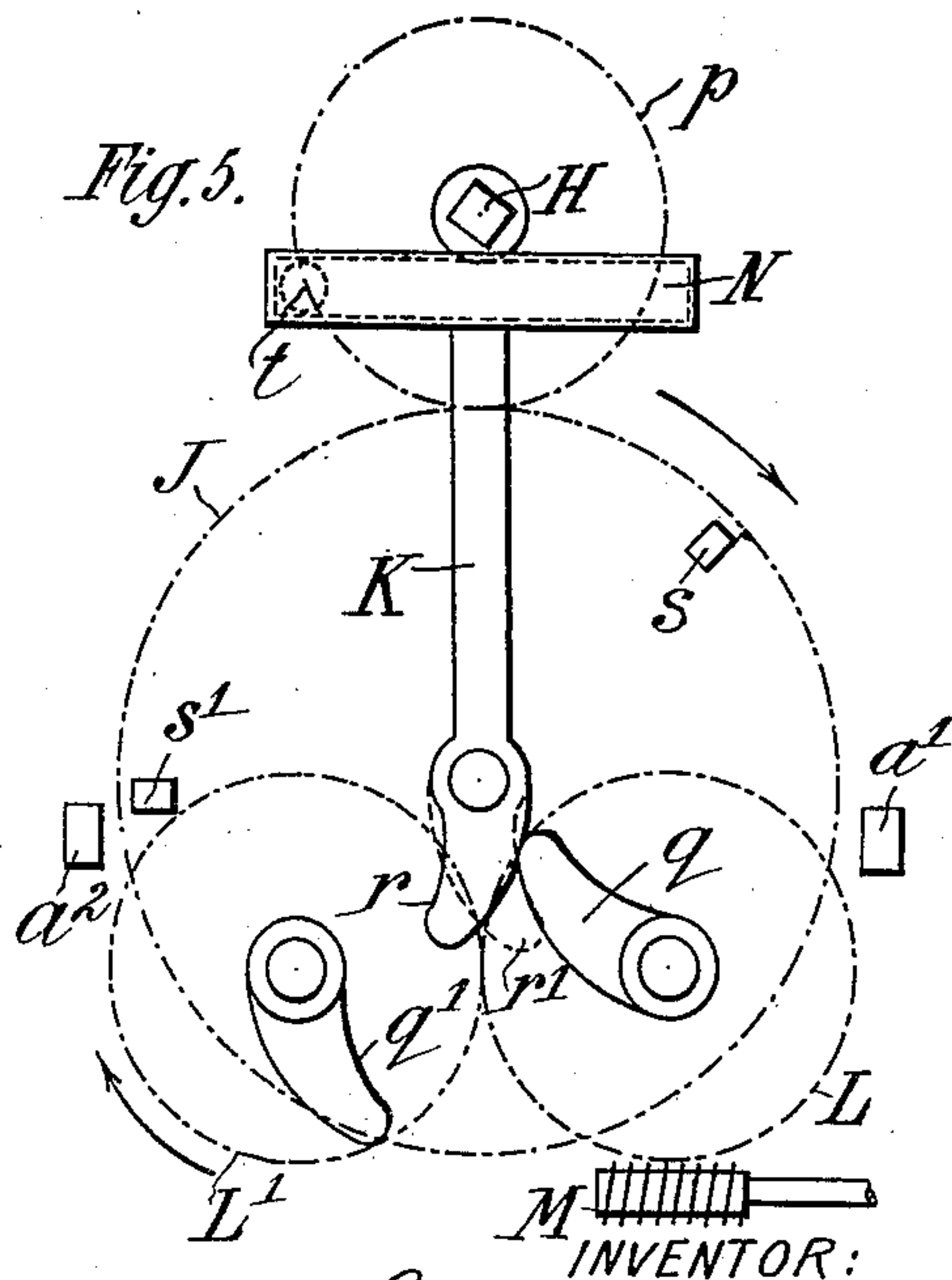
Patented Sept. 15, 1908.

4 SHEETS—SHEET 3.



WITNESSES:

*Ad White*  
*René Muine*



INVENTOR:

*Léon Détré*  
*By his Attorneys*  
*Arthur C. Fraser & Co.*



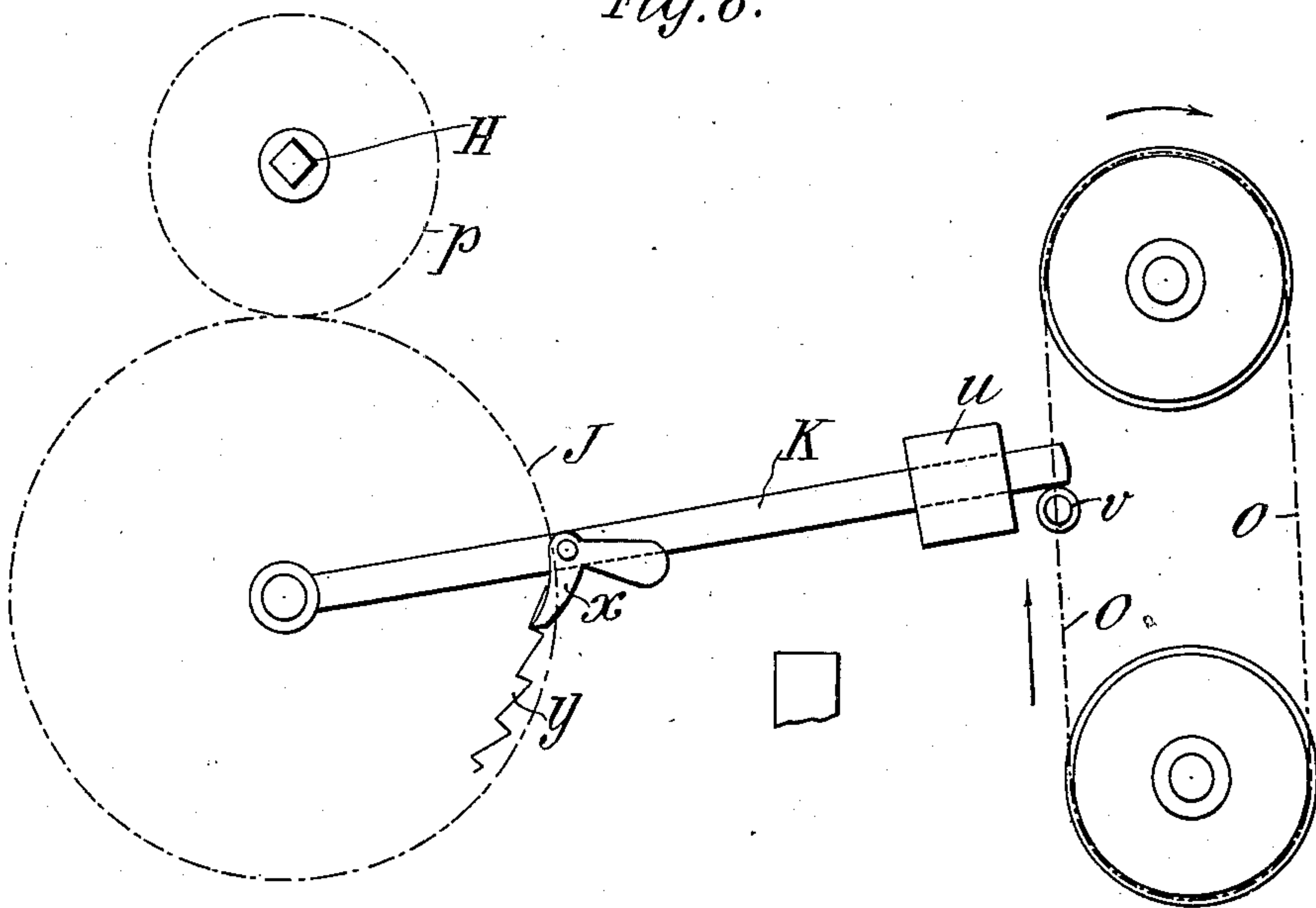
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4 SHEETS—SHEET 4.

Fig. 6.



WITNESSES:

*Ired White*  
*Rene Muine*

INVENTOR:

*Lion Ditré*

*By his Attorneys*

*Arthur C. Fraser & Co*

# UNITED STATES PATENT OFFICE.

LÉON DÉTRÉ, OF RHEIMS, FRANCE.

## APPARATUS FOR SUBJECTING MATERIALS TO THE ACTION OF LIQUIDS UNDER PRESSURE.

No. 898,444.

Specification of Letters Patent.

Patented Sept. 15, 1908.

Application filed May 4, 1905. Serial No. 258,911.

*To all whom it may concern:*

Be it known that I, LÉON DÉTRÉ, a citizen of the Republic of France, residing in Rheims, France, have invented certain new and useful Improvements in or Relating to Apparatus for Subjecting Materials to the Action of Liquids Under Pressure, of which the following is a specification.

This invention consists of improvements in or relating to apparatus for subjecting textile or other materials or substances to the action of liquids, under pressure for the purpose of dyeing, mordanting, bleaching, washing, exhausting, extracting or performing other operations thereon.

In the following specification I will describe the invention as applied to the dyeing, bleaching, mordanting or like treatment of textile material, for which it has been more especially designed. Its application for the other purposes mentioned will then be readily understood.

In apparatus for dyeing, mordanting and bleaching under pressure as hitherto employed, the action of the liquid upon the material cannot be regulated. In point of fact the pressure which serves as the motive power and produces the movements of the liquid, must be sufficiently powerful to balance the weight of the column of liquid which is forced from one reservoir into another, after it has traversed the material to be treated. The consequence is that the action is identical, whether the materials under treatment are readily permeable, as in the case of wool in the fleece or unspun slivers, or very compact, as in the case of yarns in bobbins, or cheeses for example. It is therefore difficult to obtain a satisfactory and uniform result with all kinds of materials, particularly when these latter are liable to be affected by the influence of high pressure, and in the case of delicate shades.

The duration of the period of circulation of the liquid, in either direction through the material to be treated, cannot be modified during working, since the reversal of the direction of the current is dependent on the passage of the liquid from one receptacle to another under the action of the air pressure.

Now by means of the present invention I provide apparatus wherein the pressure for assisting the penetration of the dyeing or other liquid into or through the material,

and also the intervals at which the direction of the circulation is reversed can be regulated at will.

According to the invention the circulation of the liquid is produced or obtained by apparatus which is independent of the pressure exerted on the liquid by compressed air or other fluid, so that this pressure can be regulated at will.

In order to enable the invention to be carried into effect I will describe with the aid of the accompanying drawings and by way of example typical apparatus embodying the same.

Figure 1 is a side view of this apparatus, Fig. 2 a front elevation, and Fig. 3 a plan.

A is a reservoir or receiver for compressed air or other elastic fluid, which may be supplied by any suitable compressor, not shown in the drawings, through a pipe *a*. The pressure in the receiver may vary provided that it is greater than that under which the dyeing, mordanting, bleaching or other operation is to be conducted. The compressor may be provided with any suitable known arrangement for automatically starting it when the pressure falls, and stopping it as soon as the pressure attains a predetermined maximum. If desired the pressure medium may be compressed and if required liquefied, in the receiver by means of any suitable apparatus, previously to use, and this may be effected outside the factory if desired. The liquid or liquids to which the material is to be subjected for dyeing, mordanting or other treatment, is contained in one or more reservoirs B, one such reservoir being shown in the drawings. The reservoir or reservoirs B are supplied with the pressure medium by the receiver A and supply the liquid to one or more vats or vessels C two of which are shown in the drawing. The material to be treated is placed in these vessels C. If the material is in the fleece or in the form of unspun slivers, it may be disposed in the loose state or in bobbins around a central perforated tube in each vessel, an arrangement commonly employed in apparatus for dyeing under pressure, while if the material is in the form of yarns wound in bobbins, cheeses or other compact form, any convenient arrangement employed in known dyeing apparatus may be adopted.

D is a circulating pump which may be of



the rotary type as shown, or of the reciprocating type, and capable of working under a pressure which may attain the maximum intended to be employed in the liquid reservoir

5 B. The pump D supplies all the vats or vessels, or if desired a separate pump may be arranged to serve a group of vessels or it may be each separate vessel.

The receiver A is connected to the receiver  
10 B by a pipe *b* fitted with an automatically operating regulating valve E and with valve *c* disposed either before or beyond the valve E. The valve E is adjusted or set for each operation to the proper pressure for the material to be treated.

15 The reservoir B is fitted with a safety valve F which is adjusted or set to the same pressure as the regulating valve, or to a greater pressure than same. This reservoir  
20 is provided with a coil G connected to a steam or hot water supply or other source of heat to enable the liquid to be kept at the desired temperature, and also with the necessary fittings such as a thermometer, pressure gage  
25 and liquid level gage, for controlling and observing the progress of the operation.

The vessels C for the materials to be dyed or treated are connected to the liquid reservoir B by a pipe *d*, fitted with a four way  
30 valve H, from which leads a pipe *e* connected to the outer walls of the respective vessels C by as many branches as there are vessels C. *f* is a pipe connected to the four way valve H and by branches *f*<sup>1</sup> to the bottom of the  
35 respective vessels C; and *g* is a pipe also leading from the four way valve H to the suction inlet of the pump D.

*h* is a pipe connecting the delivery of the pump D with the bottom of the liquid reservoir B.  
40

The valve H is operated by an oscillating meter or timing device which will be described in detail later. This valve may be replaced by two three way valves R, as  
45 shown in Fig. 9. These two valves bear each a toothed wheel *p*<sup>1</sup> gearing with a wheel *p*, the latter engaging with the wheel J to which is transmitted the reversing movement. One of these valves is connected to the liquid  
50 reservoir by a pipe *d*, and the other one carries the pipe *g* leading to the suction inlet of the pump. The tube *e* leads to the outer wall of the dye vessels, and the tube *f* leads, by means of branch pipes, to the lower part  
55 of the vessels which contain the material to be dyed.

I is a vessel serving for the introduction, during the course of the operation, of the mordants, dyes or other substances or solutions which it may be required to introduce  
60 into the liquid acting on the material to be treated. This vessel is connected by the pipe *j* to the suction inlet of the pump D, and by the pipe *k* to the receiver A. The  
65 pressure of the air or other fluid can be ad-

mitted to the vessel I by the pipe *k* which is fitted with a cock at any suitable point. The vessel I is likewise connected by a pipe  
70 *m* fitted with a cock to any suitable point of the reservoir B, or it may be connected to one of the vessels C, provided that the point of connection is above the level of the liquid.

*n* *o* are three way valves fitted in the pipes *d* and *h* respectively; these two valves are arranged to be operated by hand.  
75

The operation of the apparatus is as follows:—The material to be dyed, mordanted or bleached being placed in the vessels C and the proper quantity of liquid being introduced into the reservoir B, the automatic  
80 regulating valve E and safety valve F are adjusted or set to the right pressure for the work to be done. The steam or other heating medium is then admitted to the coil G to heat the liquid to the necessary temperature.  
85 The valves *n* and *o* being then turned to permit of the circulation of the liquid, the pump D is set in operation and also the meter or timing device which produces the alternate movements of the four way valve H. The  
90 liquid circulates through the material in the vessels C under the pressure chosen. If this pressure should vary a little in consequence of the variations of temperature of the compressed air or other medium in contact with  
95 the liquid, the automatic regulating valve E allows a fresh quantity of air to pass when the pressure falls, and the valve F allows air to escape if the pressure tends to rise. In any case the pressure can only vary, as extreme limits, between that to which the automatic regulating valve E is set and that to which the valve F is adjusted. The reversal  
100 of direction of the liquid circulation through the material to be treated, instead of depending upon the passage under the action of the air pressure of the whole volume of liquid contained in the reservoir or receptacle is independent of the action of this pressure and is regulated or controlled by the timing device which acts upon H and the speed or  
105 period of which can be varied at will or if desired suspended altogether if it is required to pass the liquid through the material always in the same direction.  
115

The composition of the bath can be varied at will by the employment of the vessel I, the operation of which is insured both by the difference of pressure existing between the receiver A and the reservoir B and by the suction of the pump D which likewise insures the perfect admixture of the added substance or solution with the liquid already contained in the reservoir. Owing to the communication which can be established by the pipe *m*  
120 it is possible to introduce at any moment into the vessel I such a quantity of the bath as is necessary to dilute the substance to be added, so that the materials to be added can be introduced as well through the pipe *m* as  
130



through the pipe *j*. The compressed air or fluid which enters the vessel *I* by *k* stirs up or agitates the material and supplies the necessary pressure.

5 With the aid of the valves *n* and *o* the vessels *C* may be cut off from the reservoir *B*; or the liquid contained in the vessels *C* may be drawn away and forced into the reservoir *B*; or the liquid contained both in the vessels *C* and in the reservoir *B* may be drawn away to empty the same, and forced or delivered into auxiliary tanks, where it may be stored for subsequent use; or, further, one liquid may be substituted for another without disturbing the materials; or finally, by connecting one of the unions of the valves *n* with a water supply, the dyed or other material can be rinsed or washed without disturbing it, the water being drawn in by means of the circulating pump *D* and expelled through the union or neck of the valve *o*.

The apparatus can be applied in all cases where it is required to circulate a liquid under pressure to act upon a solid material, as for example for the purpose of washing, or exhausting mineral or organic substances, leaching or extracting soluble substances, sponging woollens and many other operations. It can also be employed to effect the drying of the treated materials, by circulating compressed air through them so as to deprive them of the greater portion of the liquids with which they are impregnated.

By reason of the small expenditure of compressed fluid which it is necessary to employ, it is possible to employ carbonic acid or other inert gases in cases where it is desirable to avoid oxidation of the liquid as for example in dyeing with reduced indigo.

40 The meter or timing device which actuates the four way valve *H*, and which should impart a quarter turn thereto at each reversal, may be constructed and arranged in various ways. Figs. 4 and 5 show one suitable arrangement with the parts in the two positions, the reversing lever being in two positions at right angles. On the plug of the valve *H* is secured a toothed wheel *p* gearing with a wheel *J* to which the reversing motion is imparted. The wheel *J* is actuated by the reversal of a lever *K* which receives its motion from the wheels *L* and *L'*; these latter are geared together, and one of them, *L'* is driven by a worm *M* actuated by an arrangement of gearing and pulleys not shown. *g* and *g'* are cams carried by the wheels *L* and *L'* respectively; these cams engage in turn with cams *r* and *r'* on the lever *K*, and alternately cause this lever to assume and pass beyond the vertical position, Fig. 5. The cam *g* acts upon *r* to move the lever *K* from left to right while the cam *g'*, disposed behind the wheel *L'*, acts upon *r'*, which is likewise arranged behind *L'* and moves the lever *K* from right to left. In Fig. 4 the lever *K* has fallen over

to the right and the cam *g'* is moving towards cam *r'*, so that when it engages same it will raise the lever *K* towards the left. Fig. 5 shows the lever returning from left to right, with the cam *g* coacting with cam *r*; the lever *K* has reached the vertical position and is just upon the point of falling over to strike the tappet *s* and thus impart the turning movement to the wheel *J*.

The lever *K* carries an elongated box *N*, in which a ball or weight *t* runs or slides; the moment the lever *K* passes beyond the vertical position, the ball or weight *t* rolling on an inclined plane formed by the bottom of the box *N*, strikes the end of the box and precipitates the fall of the lever, which strikes the tappet *s* and imparts the turning movement to the wheel *J*. In the reverse motion, the lever acts upon the tappet *s'* and returns the wheel *J* to its original position. The starting of the ball or weight *t* may be so arranged that it does not roll or slide until the box is sufficiently inclined to give a sufficiently powerful blow to impart the turning movement to the wheel *J*. If desired a weight sliding up on a rod may be employed or it may be two weights sliding on two rods, one on each side of a median rod. In Figs. 4 and 5 the wheel *J* makes one eighth of a turn while wheel *p* makes one fourth of a revolution, the diameter of this last wheel being half that of wheel *J*. The stops *a'* *a''* limit the travel of the lever *K*.

Fig. 6 illustrates another arrangement of timing device in which the wheels *J* and *p* are always turned in the same direction. Here the lever *K* carries a weight *u* and is raised after each fall by a tappet or the like *v* carried by an endless chain *o*. When the tappet *v* releases the lever *K* a spring pawl *x* on lever *K* acts upon a series of ratchet teeth carried by the wheel *J* and imparts the falling motion of the lever to the wheel *J* and consequently to the wheel *p* and four way valve *H*.

Figs. 7 and 8 are detail views illustrating means or apparatus which may be employed for measuring and controlling the current of liquid delivered from the pump into the reservoir for the dye bath or other liquid, and for enabling the current to be utilized, while preventing it from producing too violent a bubbling action in the bath. Fig. 7 is a section of the apparatus and Fig. 8 a face view of the turbine *P*. This apparatus is or may be disposed at the point where the current of liquid delivered from the pump *D* enters the reservoir *B*. *P* is a small turbine, the shaft *Q* of which passes out through a gland *z* in the side of the reservoir *B*; this turbine actuates an indicator or any suitable indicating or recording apparatus and enables the progress and speed of the current to be observed or controlled. This measuring or recording apparatus provides indications which supplement or complete those of the ther-



mometer, pressure gage and liquid gage. The turbine may have the form of a screw S with several threads, as shown on Fig. 10.

I claim as my invention:—

5 1. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination, a reservoir for the liquid, means for maintaining a pressure on the liquid in said reservoir, a vessel for the material and in communication with said reservoir so that the pressure facilitates the penetration of the liquid into or through the material, and means acting independently of the degree of pressure for sucking out the liquid at one side of the material in the vessel, and forcing it in at the other.

2. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination, a reservoir for the liquid, means for maintaining a pressure on the liquid in said reservoir, a vessel for the material and in communication with said reservoir so that the material is in constant contact with the liquid and the pressure facilitates the penetration of the liquid into or through the material, and a circulating pump for sucking out the liquid at one side of the material in the vessel, and forcing it in at the other.

30 3. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination a reservoir B for the liquid, means for maintaining a pressure on the liquid in said reservoir, a vessel C for the material, a circulating pump D, means for connecting one end of said vessel with the bottom of said reservoir and the other end with the inlet of said pump, and means for connecting the delivery end of said pump with said reservoir.

4. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination, a liquid reservoir communicating with the vessel containing the material, means for applying pressure to the liquid in said reservoir, an automatic pressure reducing valve determining a minimum pressure, and an automatic safety valve determining a maximum pressure in said reservoir, whereby the pressure is maintained substantially uniform.

5. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination, a liquid reservoir communicating with the vessel containing the material, suitable valved connections between said reservoir and vessel to enable the direction of the liquid through the vessel

to be altered at desired periods, and means independent of the action of the pressure medium for automatically limiting said periods. 60

6. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination, a liquid reservoir communicating with the vessel containing the material, a pair of three-way valves, and suitable connections for enabling the direction of the liquid through the vessel to be altered at desired periods and means independent of the action of the pressure medium for automatically limiting said periods. 70

7. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination, a liquid reservoir communicating with the vessel containing the material, a pair of three-way valves, suitable valved connections for enabling the direction of the liquid through the vessel to be altered at desired periods, a meter, and means controlled by said meter for automatically limiting said periods. 80

8. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination, a source of compressed air, a reservoir for the liquid, a circulating pump for the liquid, and a vessel for introducing dyes or the like into the liquid during working, said vessel being connected to the suction inlet of the pump, whereby a good admixture of the dye with the circulating liquid is obtained, and being connected also to the source of compressed air and to the reservoir. 85

9. In an apparatus for subjecting textile or other materials to the action of liquids under pressure, in combination, a meter or timing mechanism, a valve actuated thereby for altering the direction of the liquid, said mechanism comprising a lever provided at one end with a box, a sliding weight carried thereby, cams arranged to raise said lever and allow it to fall alternately in opposite directions, toothed wheels driven by said lever in its falling movement, the first of which is turned to the extent of 45 degrees by the sudden fall of the lever, this turning movement causing a quarter turn of the valve by reason of the ratio of the gearing. 100 105

In witness whereof I have hereunto signed my name this 18th day of April 1905, in the presence of two subscribing witnesses. 110

LÉON DÉTRÉ.

Witnesses:

PAUL BUR,  
LOUIS BUR.