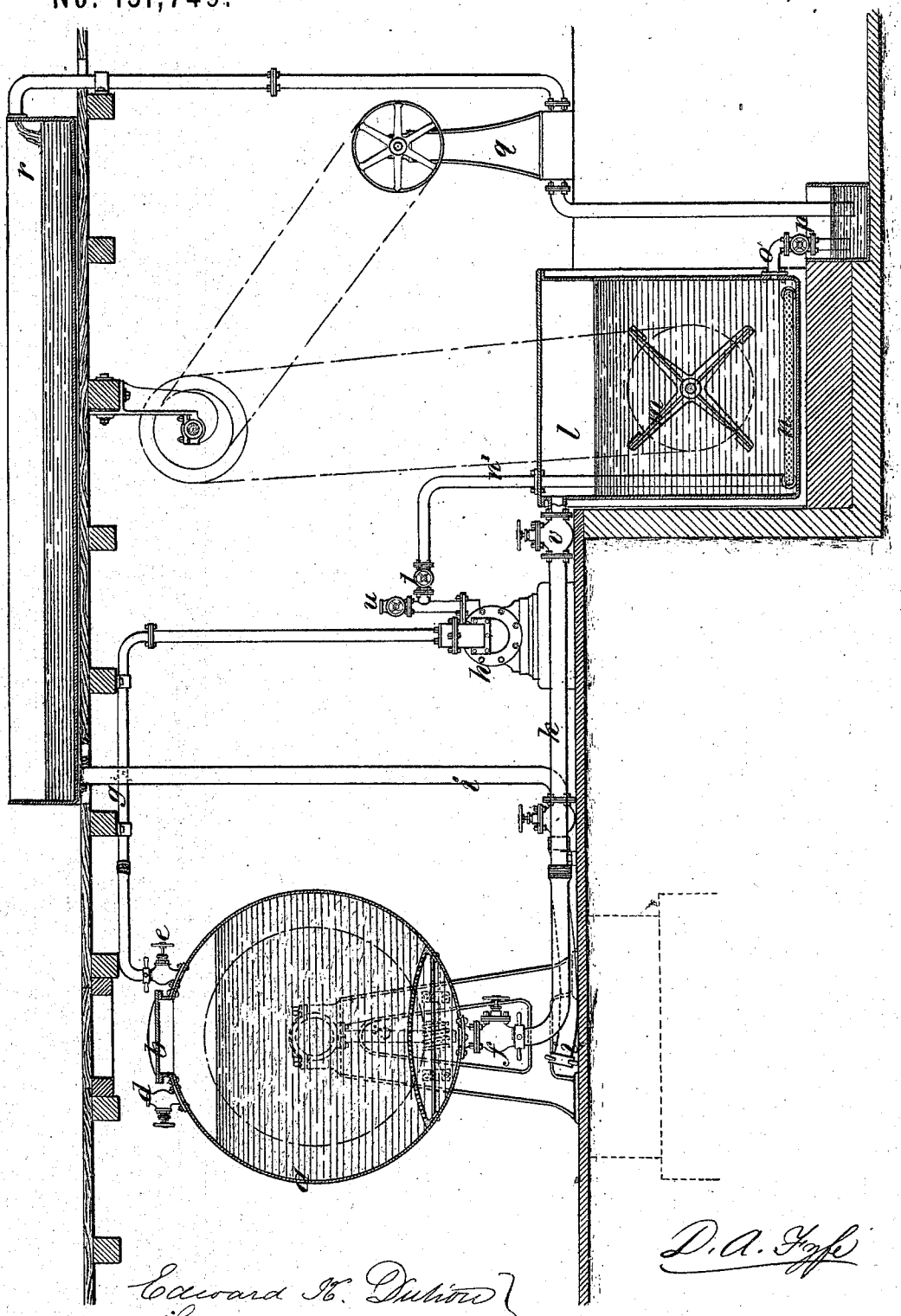
D. A. FYFE.

Improvement in the Manufacture of Paper-Pulp.

No. 131,749. Patented Oct. 1, 1872.



D. A. Fyfe

Witnesses:
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UNITED STATES PATENT OFFICE.

DAVID ADAM FYFE, OF MANCHESTER, ENGLAND.

IMPROVEMENT IN THE MANUFACTURE OF PAPER-PULP.

Specification forming part of Letters Patent No. **131,749**, dated October 1, 1872.

To all whom it may concern:

Be it known that I, DAVID ADAM FYFE, of Manchester, in the county of Lancaster, Kingdom of Great Britain, have invented a certain Process for Converting Wood and other Substances into Pulp, of which the following is a specification:

My invention has for its object more particularly to reduce wood into pulp or half-stuff suitable to be used in the manufacture of paper; but the same process may be employed in the manufacture of pulp from straw, esparto, and other substances. The nature of the process can be better explained with reference to the accompanying drawing illustrative of the apparatus employed by me in carrying my invention into effect.

In the said drawing, *a* is a spherical vacuum-keir, made of iron, and lined with lead, and mounted on standards in such a manner as that it may be rotated on its axis. The keir is formed with a man-hole, *b*, fitted with a cover capable of being made air-tight, and with air and gas valves *d* and *e*, and with a water-valve, *f*. The valve *e* is represented as being coupled with the pipe *g*, which is in communication with the inlet-valves of an ordinary steam air-pump, *h*, by means of which a vacuum may be produced within the keir. The valve *f* may be coupled with the pipe *i* or with the pipe *k* or with other pipes, not represented, which convey hot and cold water and alkaline solution. The pipe *k* communicates with a covered cistern, *l*, in which a solution of chloride of lime is made. The said cistern is fitted with a revolving agitator, *m*, and with a perforated pipe, *n*, which communicates, by means of the pipe *n'*, with the delivery-valves of the air-pump. The clear solution of chloride of lime is allowed to flow through the pipe *o* into the cistern *p*, whence it is raised, by an ordinary pump, *q*, into the cistern *r*, from which it is allowed to flow, when required, through the pipe *i* into the keir.

The operation, when producing pulp from wood, is substantially as follows: The wood having been reduced to thin shavings, the said shavings are beaten in an engine until the said shavings are broken up into narrow strips or shreds. The said shavings after the said treatment are introduced into the keir through the man-hole, which is then secured in an air-tight manner. Water is then admitted into the keir until the shavings are immersed therein, and steam is admitted through a passage in one of the trunnions, and, flowing through the pipe *s*, enters the keir. The contents of the keir are boiled by the agency of the said steam under a pressure of, say, twenty pounds per square inch, for a period of about three hours, after which the water is allowed to drain from the mass of shavings within the keir. A solution made of chloride of lime and water will previously have been made in the cistern *l*, and the clear solution, of a strength of about 10° Twaddel, will have been raised into the cistern *r*. At this stage the valve *e* must be coupled with the pipe *g* and the air-pump put into action, the valve *u* being opened to permit the air exhausted from the keir to be discharged into the atmosphere, the valve *t* being closed. When a partial vacuum has been obtained within the keir—say, for example, one marking twenty-four to twenty-eight inches on a mercury gage—the valve *e* is closed and the valve *f*, previously coupled with the pipe *i*, is opened to allow the chlorine solution from the cistern *r* to flow into the keir until the shavings are immersed. The said solution is allowed to act upon the said shavings for about one hour, and the said solution is then run into the cistern *l*, the valve *d* being opened to admit air. The agitator *m* is now put in motion, the valves *f*, *u*, and *v* being closed and the valves *e* and *t* being opened. The air-pump is now put into and maintained in action until a vacuum is again produced within the keir, the gases withdrawn from within the said keir being discharged through the pipes *n'* and *n* into the solution contained in the cistern, and the chlorine or the greater part thereof becomes absorbed thereby, the action of the agitator *m* promoting the said absorption partly by the agitation of the water when in contact with the gas and partly by stirring up the sediment of lime, and thus bringing the said lime into contact with the said gas. The solution may be restored to its former strength by the addition of fresh chloride of lime, the required amount of which I have found to be about an ounce and a half to each gallon of solution. The contents of the keir are now to be washed with hot water and afterward with cold water—that is to say, with water that has not been arti-

ficially heated. The valve *f* is now to be coupled to a pipe, through which a solution of soda-ash in water may be run into the keir, the said solution being of a strength such as would mark about 1° Twaddel. The woody fiber within the keir is now to be boiled in the said solution for about two hours, after which the said fiber is to be drained and to be well washed. The clear solution from the cistern *l* having in the meantime been raised into the cistern *r*, a partial vacuum is again formed within the keir, and the said solution is admitted into the keir, and is allowed to act upon the contents of the said keir for the space of about four hours, and is then discharged into the cistern *l*, the same steps being taken for the recovery of the chlorine, as herein aforesaid. The woody fiber within the keir having again been washed both with hot and with cold water is to be again boiled in a solution of soda-ash, of the strength about as hereinbefore indicated, for about two hours. After being again drained and washed the woody fiber will be found to be in a suitable condition to be placed in the beating-engine, wherein it may be reduced to pulp suitable for the manufacture of paper. The apparatus, as shown in the drawing, may be greatly modified—as, for example, ordinary non-revolving keirs may be employed; but I prefer to use a revolving keir when making paper-stuff, as I find it to be of advantage to cause the said keir to revolve at intervals, in order that the contents thereof may be more equally acted upon. If found to be convenient, a partial vacuum may be produced within the keir when the solution of soda-ash or the washing waters have to be admitted to within the keir. The chlorine solution may be used for successive charges, its strength being restored as aforesaid; but I prefer at intervals, after having drawn off the clear solution out of the cistern *l*, to replace the sediment washed out with a portion of fresh lime.

When operating upon esparto, straw, or other material used in the manufacture of paper, I employ the same process, as hereinbefore described, but the strengths of the solutions and the duration of the times of action of the said solutions and the duration of the boilings may require to be varied. An important feature of my invention is the recovery of the chlorine gas remaining within the keir after the discharge of the solution of chloride of lime, as the consumption of chloride of lime is thereby greatly reduced and the cost of producing the pulp greatly lessened. Although chloride of lime has been herein mentioned chloride of soda may be used, or any suitable solution containing chlorine gas, as the said gas is the most active agent in the process of disintegrating the wood; also, some other alkali may be used instead of soda-ash, if preferred, or found to be more suitable. I would also remark that I do not confine myself to the apparatus represented in the accompanying drawing, as the said apparatus may be greatly varied, the essential parts being a vacuum keir and an air pump or exhauster, both of which may be of an ordinary construction, and the arrangements for blowing the chlorine gas into a cistern in which the chlorine solution is prepared.

Claims.

1. The revolving keir *a*, with stop-cocks *d*, *e*, and *f*, in combination with the pipes *g* and *i*, as described, for the purpose set forth.

2. The keir *a*, pump *h*, tank *l* with wheel *m*, and tank *r* with the connecting-pipes, as described.

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