

(No Model.)

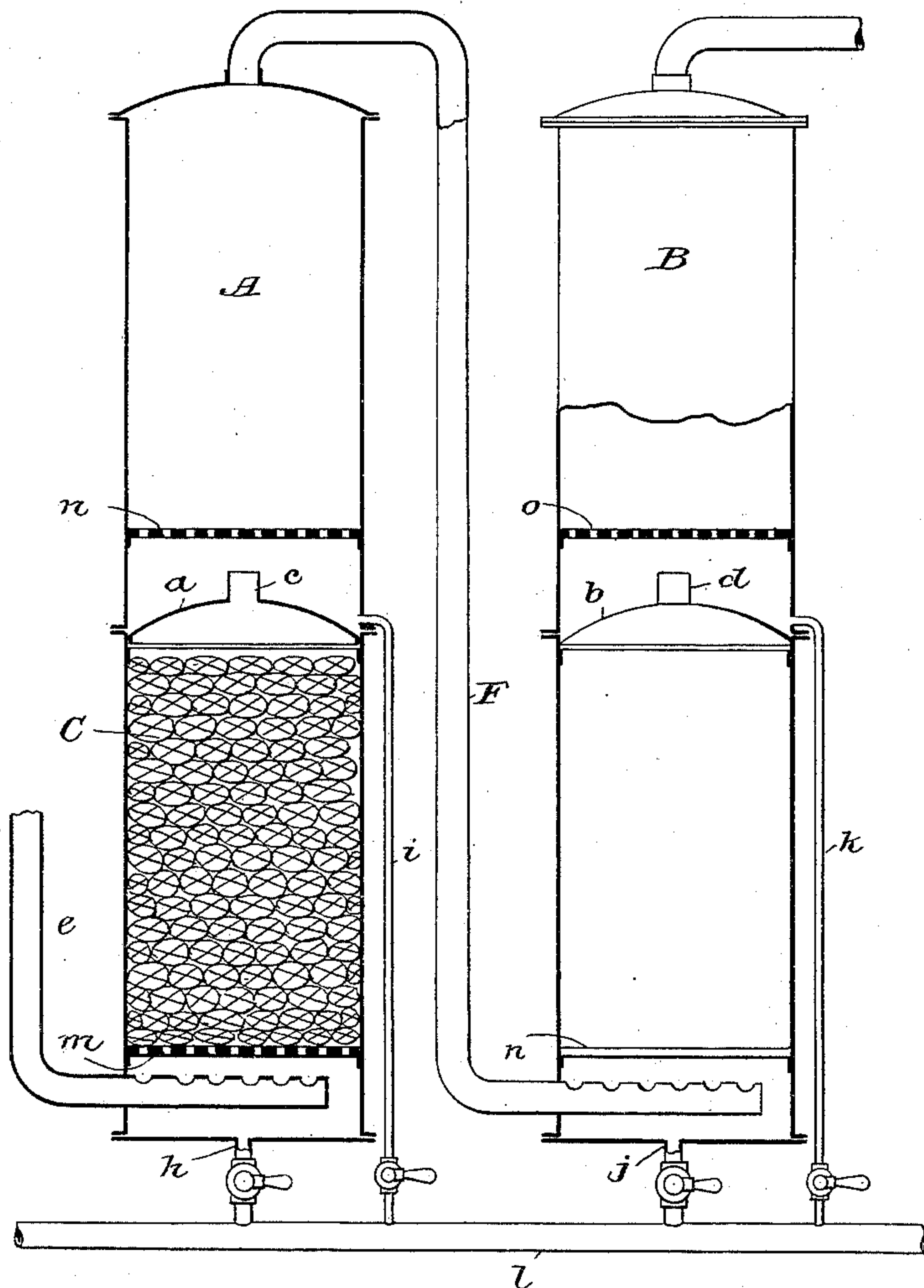
2 Sheets—Sheet 1.

B. HOFF & J. FROMMEL.  
RECTIFYING APPARATUS.

No. 475,961.

Patented May 31, 1892.

*Fig. 1.*



WITNESSES:

*E. B. Bolton*

*John H. Kingston*

INVENTORS:

*Rogden Hoff*  
*Julius Frommel*  
BY *Richard R.*  
ATTORNEYS

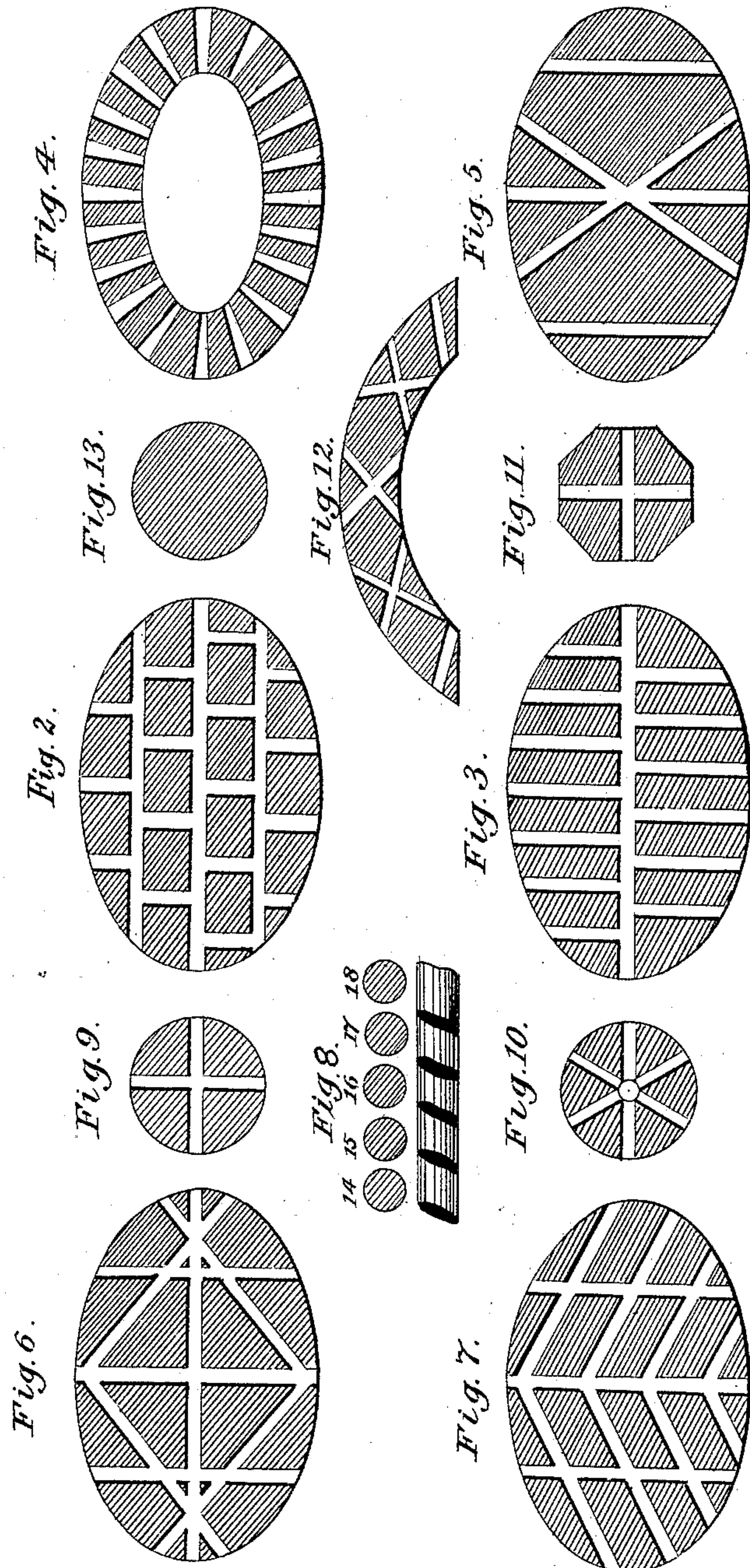
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WITNESSES:

E. R. Bolton.  
C. L. Richards

INVENTORS:

Bogden Hoff  
Julius Frommel  
By *Richardson & Co.*  
their Attorneys.



# UNITED STATES PATENT OFFICE.

BOGDAN HOFF, OF JAROSLAU, AND JULIUS FROMMEL, OF PAWLOSIOW,  
AUSTRIA-HUNGARY.

## RECTIFYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 475,961, dated May 31, 1892.

Application filed June 3, 1890. Serial No. 354,303. (No model.) Patented in Germany May 3, 1889, No. 53,700, and in Switzerland January 18, 1890, No. 1,902.

*To all whom it may concern:*

Be it known that we, BOGDAN HOFF, residing at Jaroslau, and JULIUS FROMMEL, residing at Pawlosiow, Austria-Hungary, both subjects of the Emperor of Austria-Hungary, have invented new and useful Improvements in Rectifying Apparatus, (patented in Germany May 3, 1889, No. 53,700, and in Switzerland January 18, 1890, No. 1,902,) of which the following is a full, clear, and exact description.

The object of our invention is to provide a rectifying apparatus which shall present a very large amount of condensing or cooling surface in a small compass, so arranged that the waste and by-products will be successively separated and the chief product will be finally discharged in an extremely pure state.

The apparatus comprises two or more tanks made from some material not affected by the fluid which is to be rectified. Every tank is divided into two or more compartments by means of arched or dome-shaped diaphragms, which are provided at their centers or highest part with short pipes for conducting the vapors from the lower compartment into the upper one. The vapors which are to be rectified are admitted into the first tank by way of a pipe entering near the bottom and pass out at the top through a pipe communicating with the lower part near the bottom of the next tank of the series, and so on until they are discharged from the last tank of the series through a pipe at the top.

The details of our improved apparatus will be hereinafter more fully described with reference to the accompanying drawings, in which—

Figure 1 represents two tanks of a series constituting our invention. When only two tanks are required, this figure may represent the rectifying apparatus in which the inlet, the outlet, and the waste discharge-pipes are broken off. Figs. 2 to 18, inclusive, represent various forms of the condensing bodies, hereinafter more fully described.

A indicates the first and B the last tank of a series; *e*, the inlet-pipe; *f*, the pipe by which the interior of one tank near the top discharges into the next succeeding tank of the series near its bottom.

*a* and *b* indicate the arched or dome-shaped diaphragms.

*c d* are the short pipes through which the vapors pass from below to above the diaphragm.

The waste-condenser during the process of distillation is discharged through the pipes *h i j k* into the collecting-pipe *l*.

*m, n, o*, and *p* are sieves or grates carrying the condensing bodies, hereinafter more particularly described, said bodies being shown in place in Fig. 1 only in the lower compartment of the tank A.

The dimensions of the tanks, their number, and also the number of compartments into which they are divided by means of the arched or dome-shaped diaphragms or other similar suitable devices depend upon the volatility of the fluid under treatment, and must consequently be especially determined for every different fluid. The sieves or grates carry a bed of condensing bodies, made from some material which is not affected by the fluid under treatment, such as stone or glass and sometimes copper, or even iron. These bodies may have any suitable or convenient form—such as the polyhedral or cylindrical, or they may be spheroidal or ovaliform or annular—and can be made either solid, as represented in Figs. 13, 14, 15, 16, 17, and 18, or provided with openings, grooves, or passages, as represented in Figs. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.

The arrangement of the passages, grooves, or openings in the condensing-bodies has for its purpose to bring the vapors under treatment in contact with the largest possible cooling-surface, and at the same time provide passages for the discharge of the condensed waste products. The condensing bodies are arranged so as to form in every tank an uninterrupted system of channels from the top to the bottom. We do not know of any apparatus where the important matter of the discharge of the waste products has been so fully considered as in our apparatus.

The condensing bodies should all have smooth surfaces and have such a dense structure that they cannot absorb any fluid. The different shapes of these bodies, and also the direction of the crossing of the passages,



whether the latter are straight or curved, can be varied indefinitely.

The dimensions of the condensing-bodies, their number, and shape are regulated according to the volatility of the fluid which is to be treated.

The following advantages are presented by the increased surface and canalization, which is attained by the perforation of the condensing bodies: first, a quicker cooling of the vapors in consequence of the larger surface; second, a more effective partial condensation of the less volatile constituents of the treated mixture of vapors in consequence of the quicker cooling; third, a continuous strengthening and purification of the principal product by the repetition or continuance of this process, so that the same is carried up to the highest degree of purity when a sufficient number of condensing bodies are used; fourth, a quick discharge of the frequently bad-smelling condensed waste products, (propyl, butyl, &c., alcohols,) while at the same time the movement of the waste product in the channels promotes a more complete purification of the principal product.

In consequence of the multiple operation of these condensing or rectifying bodies the problem of the manufacture of pure alcohol directly from the mash and at the place where the latter is produced may be considered as solved.

Another important feature of our apparatus is that it does not require any artificial cooling. The by-products are separated without the use of condensing water or pressing cold air into the apparatus.

The mode of operation of the above-described apparatus (represented in Fig. 1) is as follows: When a mixture of vapors of different condensation-temperatures—as, for instance, impure alcohol vapor, consisting of alcohol, (which condenses under 78.4° centigrade,) water, (under 100° centigrade,) and fusel-oil, (amylic alcohol, condensing under

132° centigrade)—is conveyed through the admission-pipe *e* into the apparatus, it will pass through the grate *m* to the condensing or rectifying bodies. On the large surface of these bodies will be effected a fractional or partial condensation—that is, of the more easily condensed constituents of the mixture—namely, the water and the amylic alcohol—while the alcohol vapor in a purer and stronger state will rise and continue the process of purification until it is discharged from the apparatus as pure alcohol vapor, to be then liquefied in the condenser. The condensed by-product flows through the numerous channels of the condensing or rectifying bodies to the discharge-pipes *h i j k*, and is then removed by the shortest way through the collecting-pipe *l*.

Having fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

A rectifying apparatus consisting of a plurality of tanks divided into several compartments by means of dome-shaped diaphragms, inlet-pipes entering at the bottom thereof for the passage of vapors, a filling for the same, consisting of special grooved condensing bodies of refractory material having smooth surfaces and of a dense structure and provided with openings, grooves, or passages passing therethrough and so arranged as to present a system of channels from the top to the bottom, discharge-pipes at the tops of said tanks, and a collecting-pipe, substantially as set forth.

In witness whereof we have hereunto set our hands in presence of two witnesses.

Signed at Jaroslau this 6th day of December, 1889.

BOGDAN HOFF.  
JULIUS FROMMEL.

In presence of—

JOSEF KRZECZKOWSKI,  
F. FANISROWSHEIM.