April 3, 1928. 1,665,097

A. HUGUENIN

CIRCULATION PUMP OF THE ROTARY TYPE

Filed Jan. 31, 1927

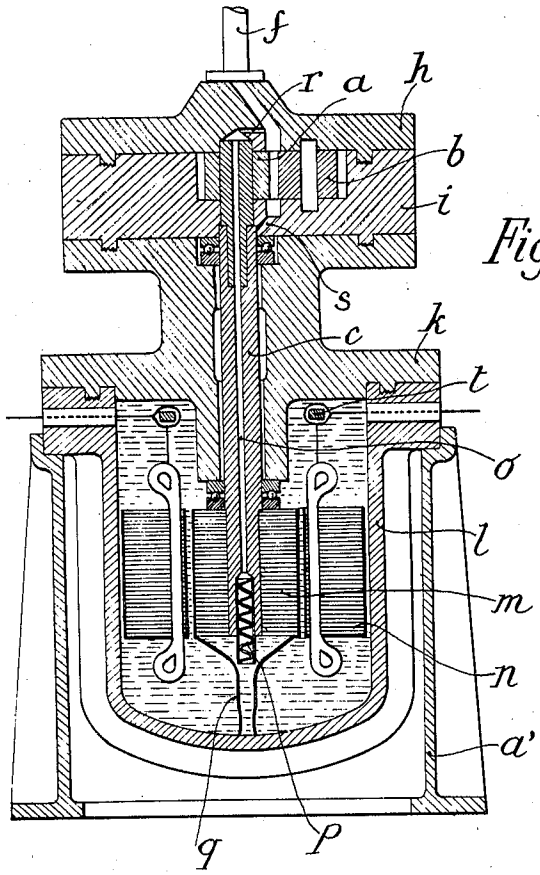


Fig.1

Fig.2

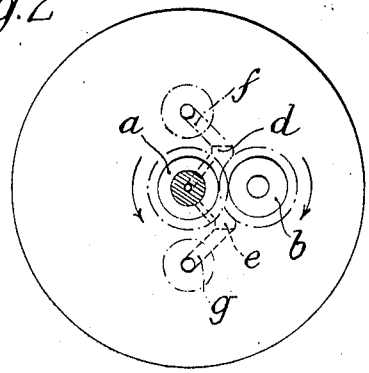
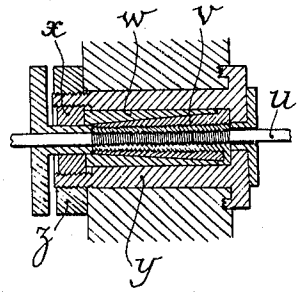


Fig.3



A. Huguenin INVENTOR

By: Marks & Clark Atty's.

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UNITED STATES PATENT OFFICE.

ALBERT HUGUENIN, OF PARIS, FRANCE.

CIRCULATION PUMP OF THE ROTARY TYPE.

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In the different methods of synthetic manufacture, only a part of the gases traversing the apparatus can be combined upon the catalyst, so that it becomes necessary to again circulate through the apparatus the gases which have not been subjected to a reaction upon the said catalyst, since the use of the proper amount of gas circulated in the apparatus is the only practical method of regulating the temperature. Each industrial synthetic operation thus requires, so to speak, a constant circulation of a quantity of gas which is always a multiple of the quantity entering into the reaction, and which must also be variable at will for properly regulating the temperature of the catalyst itself. It is a known fact that all the industrial operations of catalysis are effected at very high pressures, for instance several hundred atmospheres, which represents a great difficulty in the functioning of the gas circulation pumps, since the use of stuffing-boxes for such high pressures is always attended with a leakage of gas which is not only dangerous but represents a great pecuniary loss, due to the great cost of the gas which is specially prepared for catalysis.

For this reason, such pumps have been made the subject of considerable research, and it has already been proposed to combine the pump with the compressor properly so called, either by adding another stage to the compressor, or by constructing the latter in such manner that it will act as a pump. Since the pump is only required to overcome a very small difference in pressure corresponding only to the loss of pressure due to the circulation of the gas through the catalysis apparatus, this combination of the pump with the last stage of the compressor will have a marked effect upon the functioning of the said stage, so that it becomes necessary to resort to certain artifices of construction, which are however within the limits of practice.

A serious defect still remains, however, which consists in the difficulty of separately regulating the output of the compressor at will, this regulation being quite necessary for the practical operation of the catalysis, and of regulating in like manner the output of the gas circulation pump, which is another essential feature in the catalysis, and especially in the inverse direction, i. e. by increasing the output of one apparatus and diminishing the other (or inversely), and in all such cases the apparatus must be regulated for different outputs in either direction of flow.

The maximum advantage as concerns the regulation can be obtained by the use of an independent gas pump, since the two machines can be separately regulated at will, but it becomes necessary to dispense with the use of stuffing boxes, these being found impracticable for the usual industrial applications.

The present invention relates to a separate gas circulation pump whose speed can be varied and in which all use of stuffing-boxes is obviated, which features distinctly characterize the said invention as offering the proper solution of the problem.

Fig. 1 is a vertical section, and,

Fig. 2 a combined plan and section of the pump itself.

Fig. 3 represents on a larger scale the arrangement of the casing where it is traversed by a conductor.

The pump properly so called comprises two spur gear wheels *a* and *b* whereof the first is directly coupled to the shaft *c* of the electric motor *m n* and the second is actuated by the wheel *a*. For the direction of rotation which is shown by the arrows in Fig. 2, *d* is the suction chamber and *e* the delivery chamber; *f* is the suction conduit and *g* the delivery conduit. The pump is completed by the two covers *h* and *i* which are bolted together around the edges.

The electric motor is a three-phase motor of the squirrel cage type which is entirely enclosed by the casing *l* whose cover *k* is rigidly secured to the two covers of the pump; the rotor *m* is mounted on the shaft *c* (which is overhung at its lower part) and it carries a squirrel cage winding. The shaft *c* is guided by two guide bearings in the cover *k*, and it is maintained in the axial position by a pair of thrust ball bearings. The stator *n* carries the windings required to produce at least four revolving fields having different speeds, thus offering four speeds for the pump and four different rates of delivery. Since all the windings have stationary terminals as in a static transformer, the motor may be entirely immersed in oil or pure glycerin, both of which are insulating. It is also feasible to employ the oil or glycerin for the lubrication of the pump, and also to assure fluidtight conditions, so that it will be well adapted for the compression of gases.

For this purpose the shaft *c* is pierced axially with a circular aperture *o* which is enlarged at the lower end to receive the screw conveying device *p* which is supplied with the oil or glycerin by the tapered conduit *q* which comprises suitable ducts at the lower part of the tube connecting it with a point near the bottom of the said casing. The lubricant rises through the central conduit *o* to the upper end of the shaft *c* and passes through duct *r* into the suction chamber *d* in which it mingles with the gas which then circulates—charged with lubricant—upon the periphery of the toothed wheels *a* and *b* so as to lubricate the whole surface of their teeth, and it further renders the different spaces between the teeth gastight by reason of its capillary action. Upon attaining the delivery chamber, the lubicant is obliged to settle, by means of baffle devices (not shown) after which it is circulated through the duct *s* around the shaft *c*; it lubricates the four bearings and then returns to the interior of the casing *l* by proceeding at the exteror of the stator *n* which comprises suitable ducts for the purpose. Due to the small circumferential speed of the rotor, its friction with the lubricant is quite negligible. The shaft *c* obviously carries a suitable coupling arrangement between the motor and the pump.

For the four fields which rotate at different speeds, there will be required at least 12 conductors, which must pass through the cylindrical wall of the casing *l*; said conductors are separately attached to a ring *t* consisting of insulation. Fig. 3 shows the detail of the portion in which the insulated conductor traverses the casing.

The bare copper conductor *u* comprises annular grooves, preferably of a triangular cross section, and upon the whole portion traversing the casing it is surrounded by a layer of a slow-hardening insulating compound, which is maintained upon its outer face by annular grooves, preferably of a triangular section, which are formed in the two-part tapered sleeve *v* upon which pressure is exercised by a one-piece tapered sleeve *w* by means of a nut *x* screwed upon a sleeve *y*, which latter is provided, within the casing, with a strong flange carrying a packing member which will withstand the great pressure, said flange being held from the outside by the nut *z*. A micanite sleeve provided with a flange is employed at each end of the portion of the casing traversed by the conductor.

The all-enclosed motor pump device as constructed is disposed on a base or frame *a'*, and the outfit is completed when pressure gauges are mounted on the suction and delivery conduits for observation of the functioning of the apparatus.

The description and appended drawings are given solely by way of indication and as an example of the construction of the device.

As will be observed, the apparatus consists of elements of an extremely simple character, both for the pump and for the motor, with the minimum number of parts, which are either stationary or are simply rotatable. All slack valves or other valves, rings, contacts or the like are entirely obviated, whereby the apparatus will be operated in a most reliable manner.

Having thus described my apparatus, what I claim as new therein, and my own invention, is:—

1. In a rotary gas circulation pump, the combination of coacting gear wheels, a variable speed induction motor of the squirrel-cage type, means for connecting said gear wheels to said motor, and an absolutely tight casing in which the whole is enclosed, said casing being adapted to withstand the delivery pressure of the pump.

2. In a rotary gas circulation pump, the combination of coacting gear wheels, a variable speed induction motor of the squirrel-cage type, means for connecting said gear wheels to said motor, and an absolutely tight casing in which the whole is enclosed, said motor being entirely submerged in an electrically insulating liquid also adapted for securing the tightness towards the gaseous fluid, a completely immerged screw pump located on the side of said motor and adapted to lubricate the said pump and to provide the fluidtight conditions which are necessary for the circulation of the gaseous fluid through the said pump.

In testimony whereof I have hereunto affixed my signature.

ALBERT HUGUENIN.