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J. H. C. DE BREY

PROCESS FOR SEPARATING THE PHASES OF EMULSIONS, PARTICULARLY OF PETROLEUM, BY MEANS OF AN ELECTRIC CURRENT

Filed April 11, 1924

Fig. 1.

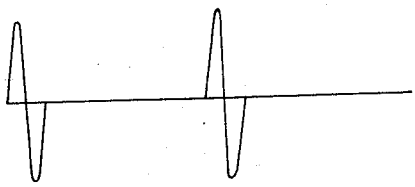


Fig. 2.

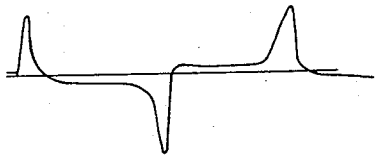


Fig. 3.

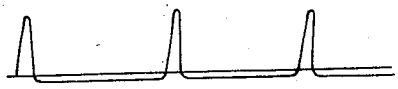


Fig. 4.

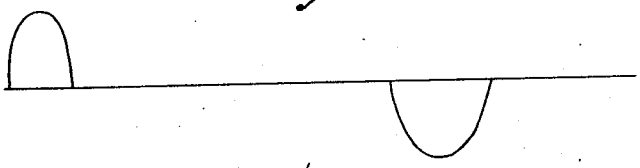
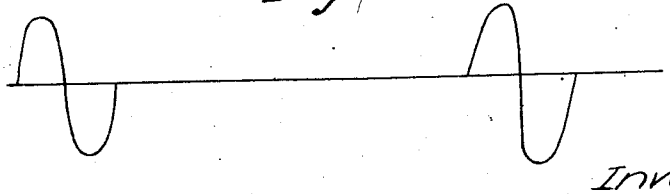


Fig. 5.



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UNITED STATES PATENT OFFICE.

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PROCESS FOR SEPARATING THE PHASES OF EMULSIONS, PARTICULARLY OF PETROLEUM, BY MEANS OF AN ELECTRIC CURRENT.

Application filed April 11, 1924. Serial No. 705,958.

To all whom it may concern:

Be it known that I, JAN HEINRICH CHRISTOPH DE BREY, a subject of the Queen of the Netherlands, residing at The Hague, Netherlands, have invented certain new and useful Improvements in Processes for Separating the Phases of Emulsions, Particularly of Petroleum, by Means of an Electric Current, of which the following is a specification.

My invention relates to a process for separating the phases of emulsions and particularly of petroleum, by means of an electric current and besides comprises a suitable apparatus for this purpose.

It is known that some emulsions and especially those of petroleum stubbornly retain a portion of the water contained therein; numerous attempts have therefore been made to break up these emulsions, in order that the water might be separated by the action of gravity or in another manner. A great number of processes are based on the application of an electric current.

A method is known for the separation of emulsions whereby a current of one or more phases is limited and rectified by means of a valve tube. This process is in fact based on the application of a pulsating direct current of high voltage, with which, owing to the quickly succeeding short current impulses under high tension, a very rapid separation of the emulsion is attained. The strength of the current is limited for the purpose of making it independent from the resistance of the liquid to be treated. In applying this process important advantages have been obtained; in practice however it met with various difficulties.

In the first place the capacity of the present day valve tubes is limited, so that for a large scale application too large a number of valve tubes would have to be used, which involves technical difficulties. In the second place, when applying a pulsating direct current an electrolytical by-phenomenon occurs, which has a disturbing effect on the process when operating with greater power and on a commercial scale.

My invention also possesses the advantage of the quickly succeeding impulses, resulting in an extra-ordinarily rapid separation. Moreover the current limiting property as previously disclosed, is also obtained, but in such a way as to obviate the disadvantages referred to.

According to my invention the essential feature of the process consists in the application of a pulsating alternating current, the peak voltage of which is a multiple, but at least the double, of the effective voltage. My invention is diagrammatically illustrated in the drawings, wherein;

Fig. 1 is a voltage curve of one form of current usable in the invention.

Fig. 2 is a voltage curve of a second form of current.

Fig. 3 is a voltage curve of a third form of current pulsating in but one direction.

Figs. 4 and 5 are voltage curves of two different forms of sinusoidal current each usable with a plurality of emulsion tanks.

According to my invention it is also possible to apply an alternate current, pulsating in one direction only, the peak voltage of the positive part of the curve being a multiple of the positive effective voltage, whereas the negative part of the curve shows an even course without peak, but of such a form that the effective negative voltage is equal to the effective positive voltage. (See Fig. 3.)

In applying the process according to my invention it is preferable to use an apparatus, which in accordance with my invention, possesses the feature that the one or more phase pulsating alternate current of normal to middle frequency is either directly generated by means of a generator with a peaky asymmetrical voltage curve or, by means of a generator with a sinusoidal voltage curve, in which latter case the generator is directly coupled to a synchronously running current interrupter, which

interrupts the current at the moment that the voltage=0, whilst in both cases one or more emulsion separators can be connected with the generator either direct or by intermediate transformers.

In employing this latter apparatus the process according to my invention may also be applied in such a manner that by the intermediary of the synchronously running interrupter each of the emulsion separators remains connected only during one single period, whereupon a number of periods elapses during which each particular emulsion separator is not supplied with energy, while in each of these periods a different emulsion separator is connected up, so that for each individual emulsion separator the peak voltage reaches a multiple which is at least double the effective voltage. (See Figs. 4 and 5.)

The following will serve to further explain my invention.

It is known that the phases of an emulsion may be separated by an electric current of sufficient voltage and that the higher the voltage, the more complete will be the separation. The higher the voltage however, the greater will be the intensity of current, i. e. the energy consumption, required for an emulsion of a certain electrical resistance. Watery emulsions of low electrical resistance soon result in such a great consumption of energy as to make the process no longer practicable. It has now been found that the effect to be obtained, i. e. the less or greater degree of completion in the separation, does not depend on the effective voltage, (often called middle-voltage), but is exclusively determined by the degree of the peak voltage, i. e. the highest momentary value of the voltage.

If the peak voltage is taken to be e_{max}, and the effective voltage E, and the relation

$$\frac{e_{max}}{E}=f,$$

then it follows that if r represents the electric resistance of the emulsion to be treated, (measured with the voltage E), the energy consumption for the separation of the emulsion is:

$$\text{energy}=\frac{E^2}{r}=\frac{e^2_{max}}{2r}$$

If the separation of the emulsion is now effected with alternate current of a sinusoidal or an almost sinusoidal course then, as f for a sinusoidal voltage curve is equal to

$$\sqrt{2},$$

it follows that the consumption of energy

$$=\frac{e^2_{max}}{2r}$$

i. e. the technical effect of the process increases with the first power, but the energy consumption is proportional to the second power of the peak voltage used, with the result that the process becomes economically impracticable unless the resistance of the emulsion is very large. This latter is not generally the case with watery emulsions; hence the failures in the employment of known processes of emulsion separation.

According to my invention a pulsating current is used for separating the emulsion, the peak voltage being at least double and preferably the 5 to 10 fold of the effective voltage, i. e. the above mentioned factor may then e. g. be = 5.

The energy consumption is then equal to:

$$\frac{e^2_{max}}{25r}$$

and for $f=10$ the energy consumption

$$=\frac{e^2_{max}}{100r}$$

as compared with an energy consumption of

$$\frac{e^2_{max}}{2r}$$

in applying an ordinary alternate current; it is thus apparent that only 8% resp. 2% of the power is now necessary.

The electrolytical by-effect which occurs with a pulsating direct current is eliminated by the use of a pulsating alternate current or by using an alternate current pulsating in one direction only, in such a manner that the positive part of the curve has a peak voltage of 5–10 times the effective positive voltage, and the negative part of the curve shows a slightly varying voltage, but without peak so that the effective negative voltage is equal to the effective positive voltage.

It is to be understood that the process and apparatus as set forth in this specification and the claims may be used in connection with other processes and with apparatus known in the art.

I claim:

1. A process for separating the phases of emulsions, and more particularly of petroleum emulsions, comprising, applying to the emulsion to be treated a pulsating alternating current having a peak voltage which is a multiple of the effective voltage.

2. A process for separating the phases of emulsions, and more particularly of petroleum emulsions, comprising, applying to the emulsions to be treated a pulsating alternat-

ing current, said current pulsating in but one direction, and in which the peak voltage of the pulsating part is a multiple of the effective voltage of this part, and the part of opposite sign has an even course free from peaks and of a form such that its effective voltage is equal to the effective voltage of the peaked part.

3. A process for separating the phases of emulsions, and more particularly of petroleum emulsions, comprising, applying a single continuous pulsating alternating current to a plurality of emulsion containers, the current being applied to the containers intermittently and successively, whereby for each separate emulsion container the peak voltage of the current supplied to the container is a multiple of the effective voltage of such current.

In testimony whereof I affix my signature.

JAN HEINRICH CHRISTOPH de BREY.