

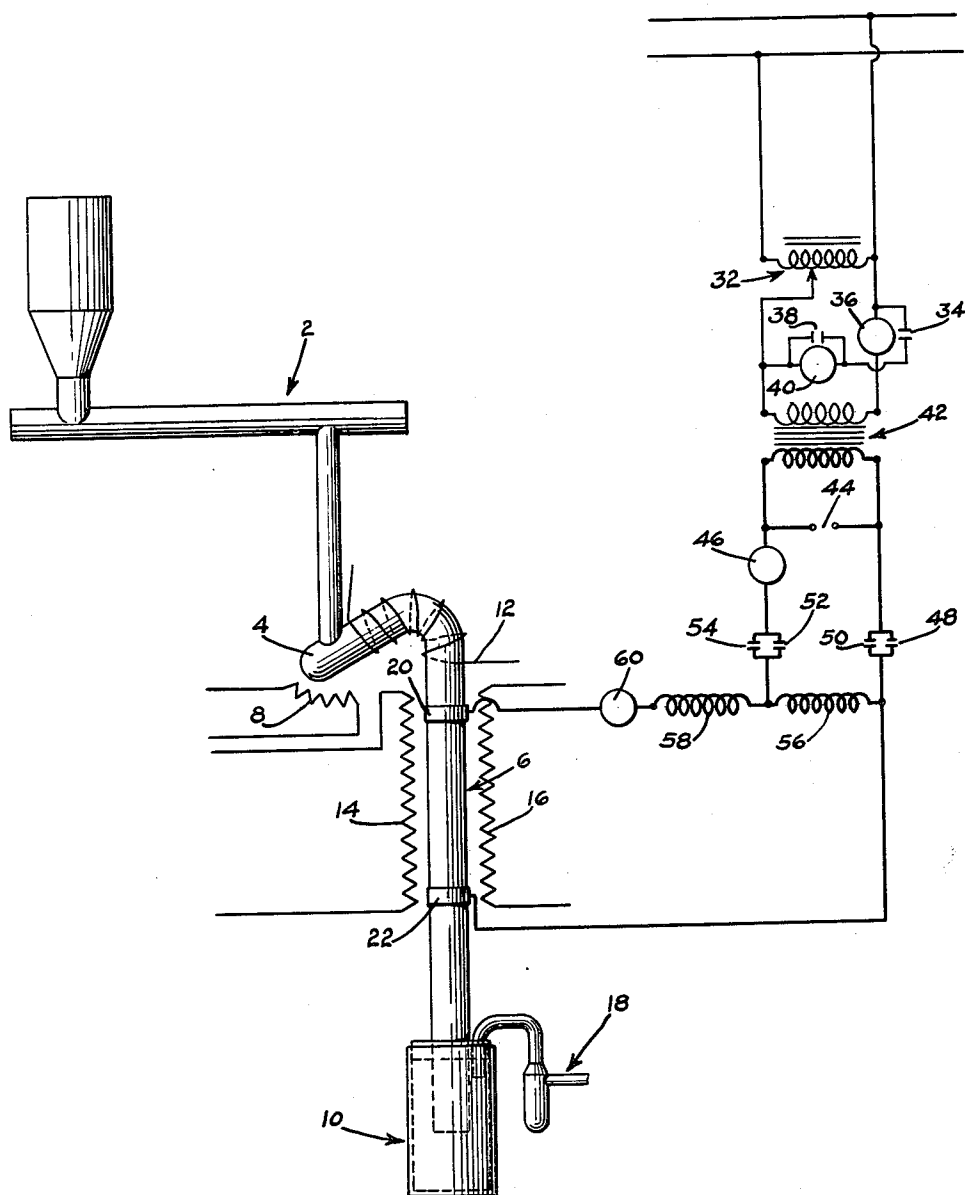
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METHOD OF PRODUCING ANTIRACHITIC MATERIAL

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METHOD OF PRODUCING ANTIRACHITIC MATERIAL

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This invention relates to the production of anti-rachitic material (vitamin D) and concerns itself more particularly with a new and improved process for the treatment of activatable substances in order to impart anti-rachitic properties thereto.

It has been known heretofore that an activatable substance, i. e. a substance that is susceptible to anti-rachitic activation, as for instance ergosterol or ergosterol containing material, may be subjected to a variety of treatments which impart thereto the physiological property of preventing or curing rickets. By experimentally inducing rickets in test animals it has been found that an activatable substance may not possess the ability to cure rickets prior to treatment, but that it will acquire this property as a result of being subjected to treatment. Among the various treatments which impart to the activatable substance this physiological property may be mentioned those involving the use of certain wave lengths of light, and certain corpuscular discharges. Furthermore, the literature contains some general references to the treatment of activatable substances by means of high frequency currents, and it has been proposed to treat activatable material by means of a high frequency electrodeless discharge.

More specifically, anti-rachitic substances have been heretofore produced from anti-rachitic materials by vaporizing the same and subjecting the vapors to the action of a high frequency electrodeless discharge. This form of treatment is attended by a number of disadvantages among which may be mentioned the fact that variation of the field strength for experimental purposes involves coil rewinding, and calculation of field strength under any given set of operating conditions is difficult. Furthermore the necessary activating coil which is external to and spaced from the activating vessel requires relatively large equipment for maintaining the activatable material in the vapor state during treatment. Also, any variation in the relative positions of the activating coil and activating vessel will cause variations in the electrical phenomena taking place within the vessel. In commercial operation it is necessary to occasionally remove the activating vessel for cleaning purposes and it is therefore necessary to replace the same in identical position with reference to the activating coil if uniform results with respect to activation are to be obtained.

The present invention concerns itself with the provision of a new process of electrically treat-

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ing activatable material such as ergosterol while in the true vapor state in order to produce anti-rachitic material, which obviates the disadvantages hereinbefore referred to.

The invention is based upon the discovery that ergosterol or ergosterol containing material can be activated by subjecting the same, while in the vapor state, to the action of a high frequency electrical discharge between spaced electrodes, and the invention accordingly provides an improved process of so treating activatable substances in order to form anti-rachitic material.

An electrical discharge of this general type is effective in treating vaporized activatable material both in the situation wherein the electrodes between which the discharge takes place are inside the activating chamber and either in contact or out of contact with the material under treatment, and the situation wherein the electrodes are located outside of and preferably in contact with a vessel in which the material is contained. The use of both of these specific types of discharges is therefore within the purview of the invention and for convenience of description the latter type, which is preferred, will be referred to as an external electrode discharge, and the former will be referred to as an internal electrode discharge.

The drawing illustrates diagrammatically a form of apparatus which may be used in carrying out the preferred form of the invention. Referring more particularly to the drawing numeral 2 indicates generally an apparatus for continuously supplying small amounts of activatable material such as finely divided ergosterol under vacuum to the vaporizing chamber 4 of an activating vessel generally indicated at 6. When the ergosterol reaches the vaporizing chamber 4 it is heated and vaporized by the heater 8 and then passes through the activating vessel to a discharge receptacle generally designated at 10 wherein it is collected in liquid or solid form. During its passage through the activating vessel the ergosterol is heated and maintained in the vapor state by means of heating coils 12, 14 and 16. The discharge receptacle 10 has an outlet generally designated at 18 which is connected to any suitable source of vacuum.

The activating vessel 6 is preferably formed of glass or other insulating material and has mounted thereon a pair of spaced electrodes 20 and 22, each formed of a band of conducting material such as tinfoil which is tightly wrapped around and preferably in contact with the external surface of the vessel 6. A high frequency

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and high voltage current is applied to these electrodes from any desired source. The circuit described in the drawing is illustrative, however, and will be described specifically by way of example.

Referring now more particularly to this circuit, numeral 32 designates generally a 110 volt 2 kva. step-down auto transformer which has its terminals connected to the usual source of 110 volt 60 cycle alternating current. This is connected to a 2 kva. step-up transformer (25,000 volts on secondary with 110 volts on primary) designated by numeral 42, by means of circuit conductors also connecting a 1 microfarad by-pass condenser 34, a 0-20 ampere A. C. ammeter 36, a 1 microfarad by-pass condenser 38, and a 0-150 volt A. C. voltmeter, as shown. The transformer 42 is connected to the Tesla coils 56 and 58 by means of circuit conductors also connecting a 16-point series spark gap (8 gaps) of 2 kva. capacity designated by numeral 44, a 0-8 ampere radio-frequency ammeter designated by numeral 46, and Leyden jars 48, 50, 52 and 54 of 0.0012 microfarad capacity as illustrated. One end of the Tesla secondary coil 58 is connected to the external electrode 20 and one end of the Tesla primary coil 56 is connected to the external electrode 22, a thermo-galvanometer 60 with proper shunt being placed in the connection between the secondary and the electrode 20.

The Tesla primary coil is constructed of $9\frac{3}{4}$ turns of $\frac{1}{4}$ inch copper tubing, the diameter of the coil being $9\frac{3}{4}$ inches, the distance between turns from center to center being $\frac{5}{8}$ inch, and $4\frac{1}{2}$ turns being used. The Tesla secondary coil, which is placed on the axis of the primary, consists of $55\frac{1}{2}$ turns of No. 20 double cotton covered copper wire wound on a Bakelite tube 3 inches in diameter.

In operation the activating vessel 6 is evacuated, current is applied between electrodes 20 and 22, and the heating coils 8, 12, 14 and 16 are energized whereupon ergosterol, for example, is gradually supplied to the vaporizing chamber 4 by feeding means 2. The ergosterol vapor thus continuously formed passes through the tube or vessel 6 as a result of which it is subjected to the high frequency discharge occurring between the electrodes 20 and 22. After leaving the discharge it is condensed and collected in the receptacle 10. The material so obtained possesses a high degree of anti-rachitic potency.

As will be evident from the foregoing description of the energizing circuit for the electrodes 20 and 22, which was given above by way of example, they are supplied with current of a high frequency, i. e. of the order of two million cycles per second, and while it is possible to operate with lower frequencies it is nevertheless necessary to work with a frequency of the order of many thousands of cycles per second. Furthermore it will be appreciated that higher frequencies may be used. It is also preferable to work with high voltages. As an example one may work with a voltage of from 100,000 to 200,000 volts between the electrodes but it will of course be appreciated that it is possible to vary these currents to a great degree. Furthermore, the amperage is a factor which may be greatly varied and it is noted, by way of example, that in the above mentioned circuit radio-frequency currents ranging from 2 to $5\frac{1}{2}$ amperes have been used. Again, in order to obtain the best results it is desirable to keep the activating vessel 6 under a very high vacuum. The apparatus shown

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has been operated with a vacuum of the order of from 5×10^{-2} millimeters of mercury to 1×10^{-4} millimeters of mercury but it will be appreciated that this range of vacuum can also be varied, especially in the direction of higher vacuum.

As previously stated the process can be carried out with electrodes inside the activating chamber, as well as with the external electrodes as shown in the drawing. If it is desired to work with internal electrodes rather than with external electrodes, the external electrodes shown in the drawing may be simply replaced by electrodes extending into the activating chamber and which are similarly connected to the energizing circuit shown, or by electrodes inserted in side tubes so as to be out of the zone of the material under treatment. In most instances the use of the external electrodes will be preferable inasmuch as it is impossible for the material under treatment to cake or char upon these electrodes.

From the foregoing description it will be apparent that an activating vessel fitted with either external or internal electrodes may be removed from its mounting and cleaned from time to time without disturbing the relationship of the vessel and the electrodes, thus insuring uniform activating results in commercial operation.

By the term "vaporized activatable substance" as used herein and in the claims is meant an activatable substance which has been converted to the molecular dispersed or gaseous state as distinguished from a solid or liquid substance which has been sub-divided into separate discrete particles.

Having now described an illustrative example of my invention what I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. The process of treating an activatable substance to develop therein the anti-rachitic (vitamin D) property, which comprises heating and vaporizing said substance, and subjecting the same to solely a high frequency electrical discharge between spaced electrodes, while in the vapor state.

2. The process of treating an activatable substance to develop the anti-rachitic (vitamin D) property, which comprises heating and vaporizing said substance, and passing solely a high frequency electrical discharge through the vapors of said substance between the spaced electrodes.

3. The process of treating ergosterol to develop therein the anti-rachitic (vitamin D) property which comprises heating and vaporizing the ergosterol under reduced pressure, and subjecting the same to solely a high frequency discharge between spaced electrodes.

4. The method of treating ergosterol to develop therein the anti-rachitic (vitamin D) property which comprises the steps of heating and vaporizing the ergosterol at reduced pressure, and submitting the vapors thus produced to the effect of solely a high frequency and high voltage discharge between spaced electrodes.

5. The process of treating an activatable substance to develop therein the anti-rachitic (vitamin D) property which comprises heating and vaporizing said substance, and subjecting the same to solely an external electrode discharge.

6. The process of treating an activatable substance to develop therein the anti-rachitic (vitamin D) property which comprises heating and vaporizing said substance, and subjecting the

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same to solely an external electrode discharge of high frequency.

7. The process of treating an activatable substance to develop therein the anti-rachitic (vitamin D) property, which comprises heating and vaporizing said substance, and subjecting the same to solely an internal electrode discharge.

8. The process of treating an activatable substance to develop therein the anti-rachitic (vitamin D) property which comprises heating and vaporizing said substance, and subjecting the same to solely a high frequency high voltage internal electrode discharge.

9. The process of treating an activatable substance to develop therein the anti-rachitic (vitamin D) property, which comprises heating and substantially completely vaporizing the said substance, passing the vapor so produced through a vessel having external electrode conducting bands tightly wrapped around its outer surface in a substantially continuous stream, and impressing a high voltage high frequency electrical current upon such bands while flowing all of said vapor through the circles of said bands thereby to set up a high frequency discharge in the vapor of said stream.

10. The process of treating an activatable substance to develop therein the anti-rachitic (vitamin D) property, which comprises heating and substantially completely vaporizing the said substance, passing the vapor so produced through a vessel having external electrode conducting bands tightly wrapped around its outer surface in a substantially continuous stream, impressing a high voltage high frequency electrical current upon such bands while flowing all of said vapor through the circles of said bands thereby to set

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up a high frequency discharge in the vapor of said stream, and separately heating the vessel externally to insure maintenance of the vapor condition of said stream in the region of said discharge.

11. A process as claimed in claim 9 wherein the activatable substance is maintained under high vacuum during vaporization and subjection to said high frequency discharge.

12. A process as claimed in claim 9 wherein successive quantities of the activatable substance are heated and substantially vaporized under high vacuum, and maintained under high vacuum during subjection to said high frequency discharge, said substance being subjected to solely an electrodal discharge.

13. The process of treating an activatable substance to develop therein the antirachitic (vitamin D) property which comprises continuously heating and vaporizing successive quantities thereof, passing said vapors between spaced electrodes connected in a circuit traversed by high voltage high frequency current in a continuous uninterrupted stream to continuously maintain an activating high frequency discharge therein, heating said vapors during their passage between said electrodes to insure maintenance of their gaseous state, and collecting the same following their subjection to the discharge at a point removed therefrom and prior to condensation thereof, said activatable substance being maintained under high vacuum during vaporization and subjection to the activating high frequency discharge between said electrodes, and said substance being subjected to solely an electrodal discharge.

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