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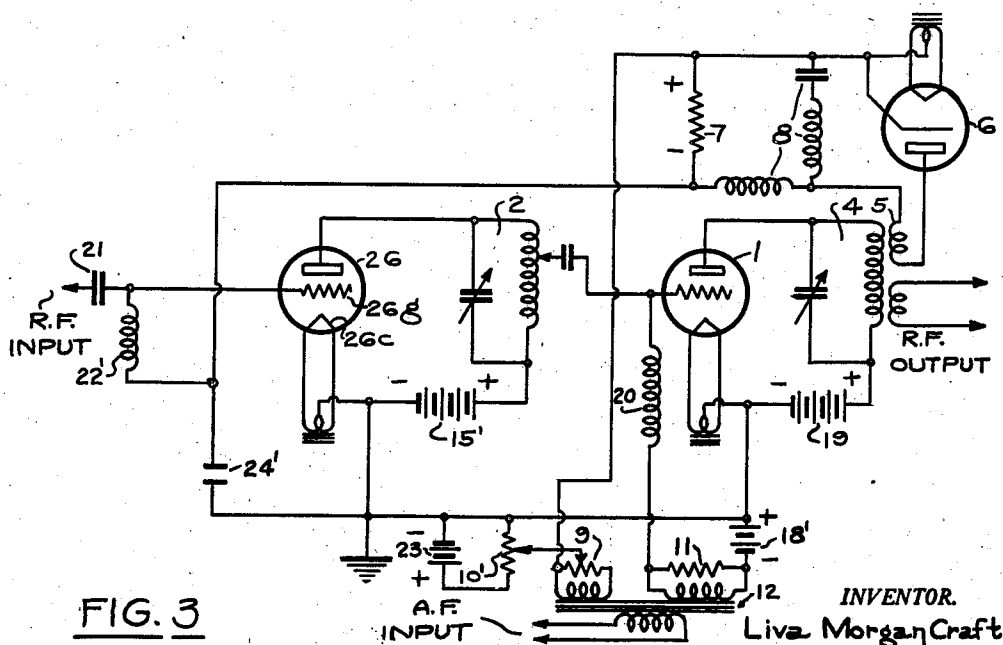
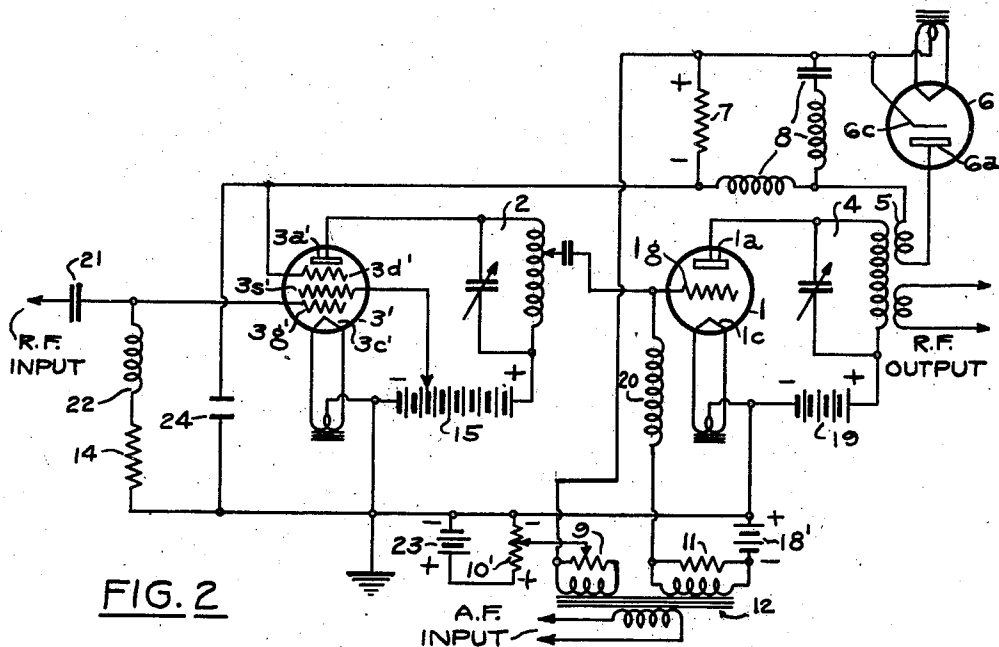
L. M. CRAFT

2,191,454

DISTORTION AND CARRIER SHIFT CORRECTION SYSTEM

Filed March 29, 1938

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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DISTORTION AND CARRIER SHIFT COR-
RECTION SYSTEM

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Application March 29, 1938, Serial No. 198,760

11 Claims. (Cl. 179—171.5)

My invention relates broadly to radio transmitting systems and more particularly to circuits for substantially decreasing the distortion and hum or noise in the output of the transmitting system and simultaneously decreasing any carrier shift which might be produced due to modulation.

This application is a continuation in part of my copending application, Serial No. 154,114, filed July 16, 1937, for "Distortion reducing system for grid-modulated amplifiers."

In a radio transmitting system wherein grid circuit modulation is employed in a radio frequency amplifier stage, a shift in the neutral point of the carrier oscillation may result; that is, the average value of the rectified radio frequency output may vary during modulation. In addition to reduction of distortion and carrier or "ground" noise, as accomplished by the system of my copending application Serial No. 154,114, it is desirable to reduce the carrier shift to a minimum.

One of the objects of my invention, therefore, is to provide a system having means for reducing both the distortion and the carrier shift in a transmitting system employing a grid-modulated amplifier.

A further object of my invention is to provide means for deriving distortion components of modulation from the output of a radio transmitter, and a system, including a triode electron tube for introducing the distortion components as direct modulations on the radio frequency carrier in anticipation of cancellation thereby of substantially all of the distortion in the transmitter output.

Another object of my invention is to provide a means of deriving a voltage proportional to carrier shift during modulation and a system for using this voltage to change the average radio frequency voltage to the grid of the modulated amplifier in order to substantially reduce carrier shift.

A still further object of my invention is to provide means for combining both the derived distortion components and the carrier shift derived voltage, and to provide a system for effecting both reduction in distortion and reduction in carrier shift simultaneously.

Other and further objects of my invention reside in the circuits and arrangements herein-after more fully described, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram showing the circuit connections in a preferred embodiment of

my invention; Fig. 2 is a schematic diagram of the improved system of my invention in a modified form based on Fig. 1 of my copending application Serial No. 154,114; and Fig. 3 is a schematic diagram of a further modified form of the improved system of my invention, based on Fig. 4 of my copending application.

Referring to Fig. 1 in more detail, reference character 1 designates a grid-modulated amplifier stage which may comprise one or more tubes. The modulator 1 is shown as a triode having a grid 1g connected through capacity coupling to the tuned output circuit 2 of a preceding radio frequency amplifier stage 3. Audio frequency modulating voltages are introduced through transformer 12 and applied to the grid 1g and cathode 1c of modulator 1 through a radio frequency choke coil 20 and in series with bias voltage represented by battery 18. The output of the modulator is taken from the resonant circuit 4 connected with the anode 1a and cathode 1c of the modulator in series with plate supply represented by battery 19. It is understood that any suitable source of supply, such as rectifiers, may be employed for all bias and plate supplies instead of batteries.

The system for reducing distortion and carrier shift is energized from the resonant circuit 4 of the modulator 1 through coupling coil 5. A portion of the distorted modulated output is thereby impressed on rectifier 6, shown as an electronic half-wave rectifier having hot cathode 6c and anode 6a. Radio filter means 8 are connected in the output of the rectifier 6, and a resistor 7 completes the rectifier circuit. Both an audio frequency voltage and a continuous or direct voltage appear across resistor 7. The audio frequency voltage consists of signal and distortion components in the modulated output of modulator 1. The direct current component of voltage is proportional to the average value of the carrier output of modulator 1. Audio frequency input transformer 12 has two secondary windings, one for modulating the amplifier and one for balancing against rectified output of amplifier 1. Potentiometer 9 is provided across the secondary of the balancing winding on transformer 12 and a portion of the voltage thereacross is applied to a series circuit including resistor 7, a portion of bias voltage 18 as selected by potentiometer 10, and the grid-cathode circuit of tube 13. Tube 13 is represented as a triode having grid 13g, cathode 13c, and anode 13a, with anode potential supplied by source 15 through ballast resistor 16.

be restricted thereby; and no limitations upon my invention are intended except as may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a radio frequency modulation system, in combination, means for rectifying a portion of the modulated output for producing audio frequency modulation and distortion components and a direct current component corresponding to the average value of the rectified carrier, means for balancing the rectified audio frequency components by a portion of the original modulation energy, means for balancing the rectified direct current component by a direct current corresponding to the normal average value of the carrier, and means for controlling the carrier prior to modulation by any differential resulting from an unbalance of said rectified components; the last said means comprising an electron tube premodulation stage with means for supplying carrier energy to the input thereof, means for applying unbalanced rectified components to said premodulation stage, and means for coupling the output of said premodulation stage to the input of the modulation system.

2. In a radio frequency modulation system, in combination, means for rectifying a portion of the modulated output, the rectified wave including modulation and distortion components of alternating current and a component of direct current corresponding to the average value of the rectified carrier, means for counteracting the modulation components of alternating current in said rectified output wave by a portion of the original modulation energy, a source of direct current, means for balancing the normal direct current component in said rectified output wave by current from said source, and means for controlling the voltage of the carrier prior to modulation thereof in accordance with the unbalanced distortion components of alternating current and variations in the direct component corresponding to carrier shift in the rectified wave; the last said means comprising an electron tube premodulation stage with means for supplying carrier energy to the input thereof, means for applying said unbalanced distortion components of alternating current and direct current to said premodulation stage, and means for coupling the output of said premodulation stage to the input of the modulation system.

3. In a radio frequency modulation system, a source of carrier energy, a source of modulation energy, a modulator stage having an input circuit including both said sources and an output circuit delivering a modulated wave, a rectifier coupled with a portion of said output circuit and a resistor in circuit with said rectifier, a series circuit including said resistor, means coupled with said source of modulation energy connected in phase opposition to the modulation components of voltage across said resistor, and a source of direct voltage connected in opposite polarity to the direct component of voltage across said resistor; and means connected between said source of carrier energy and said modulated stage for utilizing the resulting components of voltage in said series circuit for controlling the voltage of the carrier, prior to modulation thereof, in accordance with alternating components corresponding to distortion arising in said modulator stage and direct components corresponding to carrier shift, the last said means comprising an electron tube premodulation stage having input

means connected with said source of carrier energy and output means connected with the input circuit of said modulator stage, and means for applying said resulting components of voltage to said premodulation stage.

4. In a radio frequency modulation system as set forth in claim 3, in said means for applying said resulting components of voltage to said premodulation stage, phase reversing means comprising an electron tube having a grid-cathode circuit energized by the resulting components of voltage in said series circuit, and an anode-cathode output circuit connected with the said electron tube premodulation stage for controlling the voltage of the carrier, prior to modulation thereof, in accordance with current conditions in said anode-cathode output circuit.

5. In a radio frequency modulation system as set forth in claim 3, in said means for applying said resulting components of voltage to said premodulation stage, an electron tube having a grid-cathode circuit energized by the resulting components of voltage in said series circuit, and an anode-cathode output circuit; electron tube including a screen grid in said electron tube premodulation stage, and a ballast resistor connected with said grid and in said anode-cathode output circuit for controlling the operation of said premodulation stage and the voltage of the carrier applied to said modulator stage.

6. In a radio frequency modulation system, an arrangement as set forth in claim 3, wherein said electron tube premodulation stage includes an electron auxiliary grid energized relative to ground by the resulting components of voltage in said series circuit for controlling the operation of said premodulation stage and the voltage of the carrier applied to said modulator stage.

7. In a radio frequency modulation system, an arrangement as set forth in claim 3, wherein said premodulation stage comprises a triode electron tube including a control grid energized from said source of carrier energy, and said means for applying said resulting components of voltage is connected with said control grid for energizing said control grid relative to ground by the resulting components of voltage in said series circuit for controlling the operation of said premodulation stage and the voltage of the carrier applied to said modulator stage.

8. In a radio frequency modulator system, an arrangement as set forth in claim 3, wherein said source of direct voltage connected in opposite polarity to the direct component of voltage across said resistor has the positive terminal thereof grounded, and wherein said means for applying said resulting components of voltage to said premodulation stage includes phase reversing means comprising a triode electron tube having a control grid connected with the resistor in said series circuit, a cathode connected to ground and an anode connected with the said electron tube premodulation stage for utilizing the resulting components of voltage in said series circuit, and means for connecting said source of direct voltage to said grid for supplying negative bias potential thereto.

9. In a radio frequency modulation system, an arrangement as set forth in claim 3, wherein said source of direct voltage connected in opposite polarity to the direct component of voltage across said resistor has the negative terminal thereof grounded.

10. In a system for reducing distortion in a radio frequency grid circuit modulated amplifier

comprising means for deriving distortion components from the modulated carrier, and a second modulated amplifier connected with the radio frequency input to the aforesaid modulated amplifier, and comprising an electron tube including a screen grid, a control grid, anode and cathode electrodes, means for energizing said anode and said cathode and said screen grid, a ballast resistor connected with said screen grid and with the aforesaid means for deriving distortion components for modulating the radio frequency carrier in phase opposition to the distortion components in the distorted modulated carrier.

11. In a radio frequency modulation system, a premodulation stage in the radio frequency in-

put, means for deriving distortion components from the modulated carrier, means for simultaneously deriving a direct component of voltage due to carrier shift, and means for controlling said premodulation stage in the radio frequency input by both the aforesaid means for modulating the radio frequency carrier in phase opposition to the distortion components and carrier shift in the modulated carrier, said premodulation stage including an electron tube device with means for supplying carrier energy to the input thereof and means for coupling the output of said electron tube device to the input of the modulation system.

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UNITED STATES PATENT OFFICE

2,191,455

EXTRACTING OIL

Arthur L. Davis, near Knoxville, and Luis H.
Bartlett, Knoxville, Tenn.No Drawing. Application September 29, 1938,
Serial No. 232,360

3 Claims. (Cl. 260—412.4)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

The invention herein described may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

This invention relates to the extraction of fats and oils from oleaginous materials of nonmineral origin with low boiling solvent mixtures.

One of the objects of this invention is to produce an extracted fat or oil which has a lighter color than has hitherto been obtained by the extraction of oleaginous material with low boiling solvents. Another object of this invention is to extract oleaginous material with a low boiling solvent in such a manner that the greater portion of the coloring matter is retained by the residue. Other objects of this invention include the provision of a method for extracting oleaginous material in such a manner that the quality of the extract is improved and a higher grade of refined oil may be produced therefrom.

We have discovered a process of extracting oleaginous material with a low boiling solvent mixture in the liquid phase which produces an extract which contains less coloring matter and from which a higher grade of refined oil may be produced by extracting the material with a solvent mixture consisting of a liquid saturated hydrocarbon having 3 to 4 carbon atoms and a small proportion of an ether selected from the group consisting of dimethyl ether, methyl ethyl ether and diethyl ether. We have found this process to be particularly effective for the extraction of oil from oleaginous material of non-mineral origin such as cottonseed in which the oil extracted therefrom by the hitherto known methods carries a considerable amount of coloring matter which is dissolved from the seed during the process of extraction and, therefore, is present in the extracted oil.

One example of the operation of our process is given for the extraction of oil from cottonseed by the use of a solvent mixture of butane and diethyl ether in a conventional type of apparatus for extracting oleaginous materials with low boiling solvents. The extraction apparatus consisted of an extraction chamber fitted with an inlet for charging cottonseed meal and an outlet for the discharge of the same and fitted internally with a diaphragm support for the meal so charged, provided with a valved inlet for admitting solvent to the extractor, provided with a valved outlet for withdrawing the solvent and extract beneath the diaphragm support, with the valved outlet for the solvent and extract connected to a steam heated still equipped with a pressure gage and an outlet for extract, a vapor line from the still to a double valved condenser equipped with a pressure gage so arranged that the condensate is returned into the top of the extractor. Three hundred parts by weight of

cottonseed meal were charged into the extraction chamber and, after evacuation to remove the air, a solvent mixture consisting of 97.5% by weight butane and 2.5% by weight diethyl ether was charged into the extraction chamber. The mixture of solvent and extract was withdrawn continuously from the bottom of the extraction chamber to the still, the solvent vaporized from the latter, condensed in the condenser and the condensate returned to the top of the extraction chamber. The pressure within the system and the temperature in the condenser and extractor were so controlled that the solvent in the extractor was in the liquid phase at the super-atmospheric temperature maintained in the extractor. The temperature at which this extraction is carried out was maintained between 80 to 90° F. and for this temperature a pressure of 50 to 60 pounds per square inch was required to keep the solvent in the extractor liquid. When the extraction was completed, the valved outlet from the extraction chamber was closed, all the solvent was vaporized from the solvent-extract mixture in the still and the extract was then withdrawn from the still. The free acidity of the extract was determined and the amount of 16° Bé. sodium hydroxide solution required for the refining of oil determined by reference to the tables provided by the National Cottonseed Products Association, in this instance, 9.1 grams of sodium hydroxide per 100 grams of oil. The extract and sodium hydroxide solution were heated in a water bath to approximately 70° F. The mixture was agitated at high speed for fifteen minutes with a mechanical agitator. The water bath was then heated quickly to 150° F. and stirred for twelve minutes at slow speed. The agitator was stopped and the oil allowed to settle in the water bath for one hour at 150° F. and the oil was then allowed to settle for twenty-four hours at atmospheric temperature after which the soap stock was filtered from the oil. The yield of refined oil was 84 parts by weight. This operation was repeated using butane alone as a solvent. The color of the oil extracted by subjecting the material to the action of the butane-diethyl ether solvent mixture had a lighter color than the oil obtained by the action of butane alone. Furthermore, the refined oil produced from the butane-diethyl ether extracted oil had a better color than the refined oil obtained by the treatment of the butane extracted oil, this improvement in color being such that the refined oil so produced was at least one grade higher in quality than that which could be produced from an oil obtained by extraction with butane alone.

It is evident that there are numerous factors which will influence conditions for the most satisfactory operation of our invention, the actual limits of which cannot be established except by

a detailed study of each set of raw materials and the intermediate and finished products involved.

The oleaginous material to be extracted may be any fat or oil of nonmineral origin containing coloring matter intimately associated therewith or in the presence of other materials with which such fat or oil is naturally associated. We have found this process to be particularly effective in the extraction of vegetable fats or oils which carry considerable amounts of coloring matter when extracted by known means. In any event, it is desirable to take the precaution of preventing contact of the oleaginous material, the extract or the refined oil, with oxygen or oxygen-containing atmospheres, whenever any of these materials are treated or handled at superatmospheric temperatures. This precaution is of particular importance in the handling of oils containing any appreciable quantities of unsaturated constituents such as the so-called drying oils.

The principal low boiling solvent in the solvent mixture as used in accordance with our invention is a saturated hydrocarbon or hydrocarbon mixture having 3 to 4 carbon atoms. Such hydrocarbons are propane, butane and iso-butane.

The small proportion of low boiling solvent used with the principal low boiling solvent consists of an ether selected from the group consisting of dimethyl ether, methyl ethyl ether and diethyl ether. The amount of such ether used is that required to produce an extracted fat or oil wherein the quantity of coloring matter is substantially less and the character of said coloring matter is substantially more susceptible to removal in subsequent refining than in an extract resulting from subjecting material to the action of butane alone. The amount of such ether required is usually of the order of $2\frac{1}{2}\%$ to 5% by weight.

Generally, an extract, produced by the process herein described and claimed, of lighter color will produce a lighter color refined oil than that obtained by prior art processes. However, there may be instances where the refined oil is of lighter color, even though the extract obtained is not lighter than that hitherto obtained due to the character of the coloring matter contained therein as a result of the use of our novel process.

This process is directed toward an improvement in the art of extracting oils from oleaginous materials with low boiling solvents in the liquid phase. The temperature of the extraction may be superatmospheric but, in any event, the pressure during the extraction is maintained at an amount sufficient to keep the solvent in contact with the material being extracted in the form of a liquid. Some of the ethers used to depress the solubility of coloring matter in a solvent mixture, so that the extract and/or the refined oil is lighter than when using a single solvent, which predominates in the solvent mixture, alone, are not gases at atmospheric temperature and pressure but the quantity used in the solvent mixture is insufficient to lower the boiling point of the mixture, so that the solvent mixture as a whole is low boiling and generally a gas at atmospheric temperature or only slightly above that.

The method of refining the extract will depend on the nature of the oil which comprises the major portion of the extract and may be carried out by any conventional means such as by the use of acids and/or alkalies, adsorption or solvent extraction. The principal distinction between

our invention and known processes is the provision of a method for obtaining an extracted fat or oil from oleaginous material wherein it is extracted with coloring matter which has a smaller quantity of coloring matter present and in which the character of said coloring matter is substantially more susceptible to removal in subsequent refining than in the case of an extracted fat or oil resulting from subjecting the material to the action of the low boiling saturated hydrocarbon alone.

It will be seen, therefore, that this invention actually may be carried out by the use of various modifications and changes without departing from its spirit and scope, with only such limitations placed thereon as are imposed by the prior art.

This application is a continuation-in-part of our application Serial No. 133,268, filed March 26, 1937.

We claim:

1. Process of extracting a fat or oil from an oleaginous material of nonmineral origin containing coloring matter soluble in said fat or oil which comprises subjecting the material to the action of a liquid solvent mixture consisting of butane and a small proportion of diethyl ether adapted to produce an extract containing the fat or oil wherein the quantity of coloring matter in said fat or oil is substantially less and the character of said coloring matter is substantially more susceptible to removal in subsequent refining than in a fat or oil resulting from subjecting the material to the action of butane alone; separating the extract from the residue; and separating the solvent from the extract.

2. Process of extracting a fat or oil from an oleaginous material of nonmineral origin containing coloring matter soluble in said fat or oil which comprises subjecting the material to the action of a liquid solvent mixture consisting of butane and a small proportion of methyl ethyl ether adapted to produce an extract containing the fat or oil wherein the quantity of coloring matter in said fat or oil is substantially less and the character of said coloring matter is substantially more susceptible to removal in subsequent refining than in a fat or oil resulting from subjecting the material to the action of butane alone; separating the extract from the residue; and separating the solvent from the extract.

3. Process of extracting a fat or oil from an oleaginous material of nonmineral origin containing coloring matter soluble in said fat or oil which comprises subjecting the material to the action of a liquid solvent mixture consisting of a liquid saturated hydrocarbon having 3 to 4 carbon atoms and a small proportion of an ether selected from the group consisting of dimethyl ether, methyl ethyl ether and diethyl ether adapted to produce an extract containing the fat or oil wherein the quantity of coloring matter in said fat or oil is substantially less and the character of said coloring matter is substantially more susceptible to removal in subsequent refining than in a fat or oil resulting from subjecting the material to the action of the saturated hydrocarbon alone; separating the extract from the residue; and separating the solvent from the extract.

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