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RETOUCHING DEVICE

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2,495,146

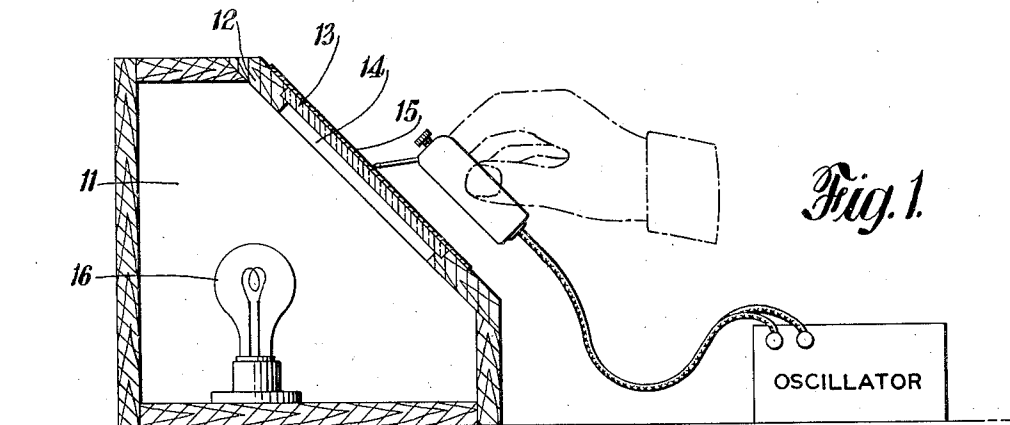


Fig. 1.

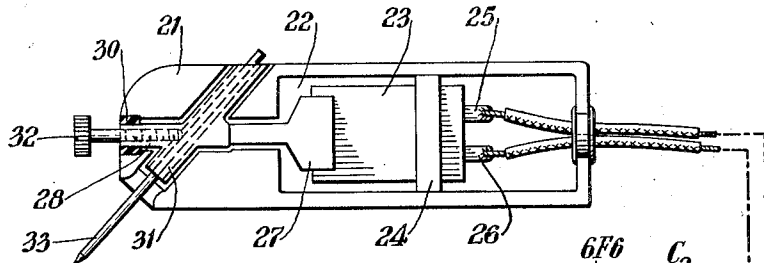


Fig. 2.

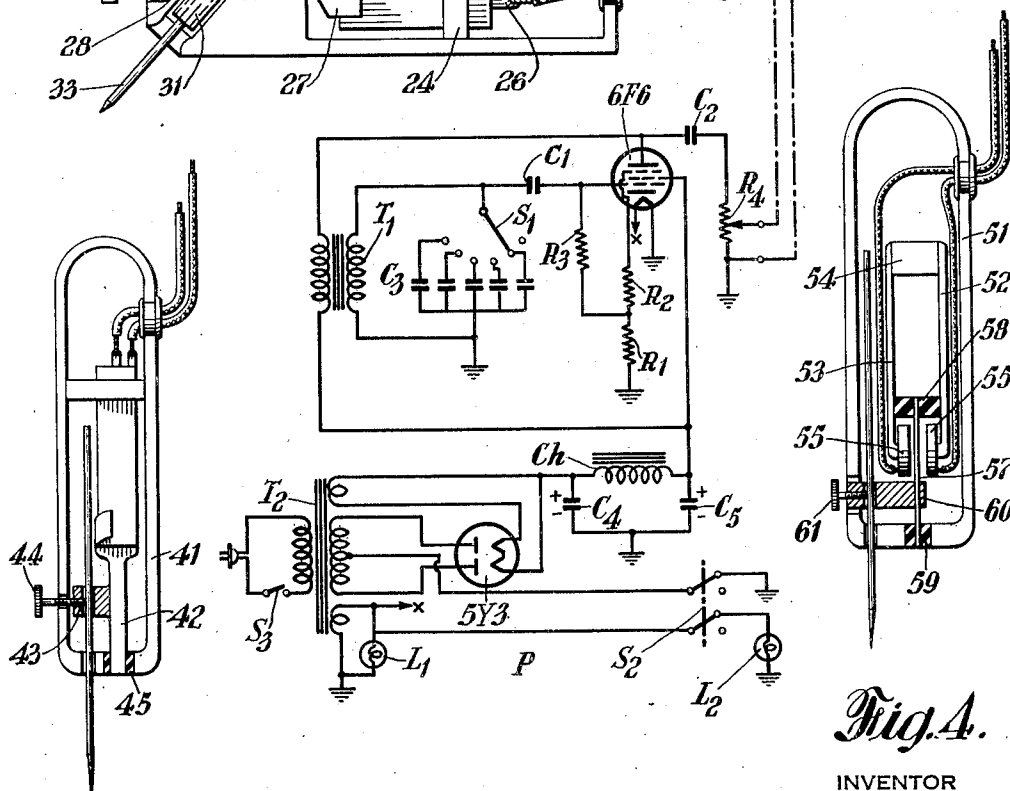


Fig. 3.

Fig. 4.

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RETOUCHING DEVICE

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3 Claims. (Cl. 95—101)

1

This invention relates to vibrating devices and particularly such devices that are intended for the retouching of photographic negatives. In the retouching art it has long been recognized that the vibrating of a black lead or pencil (or a vibrating stand for holding the negative) is desirable. In the retouching other problems also arise in that the lead cannot be heavily or indiscriminately applied, for a heavy touch causes streaks and above a limited amount seems to glaze the negative so that the graphite does not take hold; on the other hand, the density of application must be such as to give the correct contrast or to conform to that of the negative. To accomplish these ends a wide variety of mechanically vibrating devices, including armatures operated by make-and-break magnetic means, have been proposed in order to reduce the time and labor involved. But they have not come into general or any extensive use, because the vibrations secured through mechanical means have been transmitted to or have taken place in the manually held devices; not only is the weight necessary in such constructions tiring, but the continuous jarring is apt to have a numbing effect and the constant shaking of the hand makes it difficult to apply the lead accurately to a small point or area. To overcome or lessen these objections, vibrating stands for negatives have been proposed, but they in turn import other difficulties, such as the heavy construction necessary and the practical impossibility of turning the negative as desired, which a retoucher must frequently do to obtain good results; moreover, the mechanical vibrations of stands is likely to be accompanied by distressing sound effects.

It has now been discovered that for overcoming the foregoing objections attending the vibrations of retouching tools or stands, the vibrations should have a simple harmonic motion, i. e., they should have a frequency and amplitude that can be represented by a harmonic (sine or cosine) curve. Vibrations of this character are found to be free from any jarring effects, and they afford a smoothness of operation that promotes both efficiency and speed; when other waves are superposed, or if the wave departs materially from the pure sine wave, there is a corresponding roughness in the result. Even though the frequencies selected are in the audible range, the sounds produced are not annoying or distracting.

For accomplishing the object of harmonic mechanical motion, it has been found that an electronic oscillator generating harmonic driving power is surprisingly effective when properly

2

utilized. It has been further found practical to translate this power into mechanical vibrations for operating a retouching device by various means, preferably vibrating-reed electromagnetic devices and particularly piezo-crystal elements suitably constrained to give the harmonic mechanical motion when subjected to electrostatic fields; the vibrating-reed electromagnetic and the piezo-electric elements have in common that of being a vibrator responding mechanically to and in consonance with the wave character of the electrical energy changes imposed on an electric field. With these types of energy converters, the simple harmonic motion is faithfully conveyed to the retouching lead, there are no relatively heavy mechanical elements to be vibrated, a very light construction is possible, and the vibrations created have no jarring or tiring effect.

It has been further found, however, that for retouching efficiently and speedily with satisfactory effects, these devices should be operated within a selected range of frequencies. Actual demonstrations appear to indicate a limitation upon the frequency range to be used to one of about 200 to 800 cycles per second; below that range the results are apt to be streaked or lined, and above that range there is a tendency to lift a graphite layer previously applied. Within that range the amplitude is open to variation by the power input to regulate the density of the applied coating; but for smoothness there seems to be an optimum relationship between the amplitude and frequency selected that can be determined by trial. Since the range covers audio frequencies, audible hums are created when the lead touches the negative; but as they are simple tones, they are not disagreeable or annoying, and in fact they serve a useful purpose in giving warning concerning the heaviness of the touch.

The combination of a sine-wave oscillator with an energy converter is attended with additional advantages. For retouching one grade of black lead is not generally sufficient due to the variations in densities of negatives or of different portions of the same negative requiring retouching, and with only one converter this means a changing of the black lead; again with different grades of black lead and also with different operators, changes in frequency may be required or desirable for best results. An oscillator, however, can be made to readily provide a range of frequencies, either continuous or in increments by merely changing the tuning, and moreover a plurality of converters can be operated simultaneously by a single oscillator. Or by tuning the

tuning control to obtain the most suitable frequency for a particular grade of black lead or for an individual operator, a converter carrying that particular grade of black lead can then be switched or plugged in. It is further possible to connect to an oscillator a plurality of converters for different frequencies by means of gang switches, so that by turning the frequency control a converter operating at the selected frequency is simultaneously connected into the circuit.

While the preferred embodiments of the invention thus constitute an electronic oscillator combined with an energy converter, it is possible to generate the simple harmonic waves by other means. For instance, a generator of alternating energy in the desired frequency range, and operated from a 60 cycle power line, can be used as a source of power for driving the electromagnetic or crystal devices; or a tone wheel of the type used in an electronic organ (described in "Sales Instructions Bulletin No. 4" issued by Hammond Clock Co., Chicago, Ill., as a disc with high points on its periphery that rotates in front of a pole of a permanent magnet with a coil about the pole in order to create alternating energy in the coil) can be substituted for the purpose. Essential to the invention is the generation of alternating energy of substantially pure simple harmonic wave character in the useful frequencies and means for transforming the currents into harmonic mechanical motion.

For adequately disclosing the invention but not limited thereto, embodiments are illustrated in the accompanying drawing in which

Fig. 1 shows in vertical section a retouching stand in assembly with an electronic oscillator and a crystal type retouching head;

Fig. 2 is an enlarged vertical cross-section of the head shown in Fig. 1 and also shows diagrammatically a suitable oscillator circuit;

Fig. 3 shows in cross-section a modified form of crystal-operated head; and

Fig. 4 is a view similar to Fig. 3 illustrating an electromagnetic head or converter.

The retouching stand is of the usual type comprising a box 11 with a panel top 12 having a ground glass 13 fitted over an opening 14. The negative 15 rests on the ground glass and a lamp 16 furnishes the illumination.

The crystal type of head or converter, shown in cross-section in Fig. 2, consists of a casing 21, in the cavity 22 of which is mounted a piezo-crystal 23 of known construction. Such a crystal commonly consists of one or more flat Rochelle salt prisms with sheets of metal foil on the outer flat surfaces; when alternating energy is applied the crystal bends or twists in correspondence to the frequency. One end of the crystal is clamped in the casing by bars 24 and leads 25, 26 are connected to the metal foils on the crystal. The other end carries a coupling member 27 that at its free extremity 28 is bedded in a rubber bushing 30. As part of the coupling member is a chuck 31 with a set screw 32 for securing the retouching black lead 33.

A simple oscillator circuit is selected for illustration, and this comprises resistors R_1 (4,000 ohms), R_2 (400 ohms), R_3 (50,000 ohms), condenser C_1 (.01 microfarad), and a tube of the 6F6 type in circuit with the secondary of a feedback transformer T_1 ; the energy is supplied to the tube by a power pack generally indicated by P. The secondary circuit is shunted by a plurality of condensers C_3 of different capacities and a step switch S_1 connects in any one of the con-

densers C_3 for varying the tuning and so the frequency of the oscillator wave. In the power output line from the tube is a condenser C_2 and variable resistance (10,000 ohms) for controlling the intensity or volume. The power supply is taken from a power line by closing switch S_3 through transformer T_2 , tube 5Y3, choke and condensers C_4 , C_5 ; stand-by switch S_2 open the negative side of the power supply and controls pilot lamp L_1 .

Fig. 3 illustrates a modified crystal head to conform more nearly in shape to a pencil. In this the crystal, clamped in the casing 41, carries the coupling member 42 bedded in the rubber bushing 45, and on the member 42 is an extension 43 with set screw 44 for receiving the black lead. Evidently with this construction the black lead traces tiny menisci when the crystal twists under the influence of the electric energy to rotate the member 42 about its axis.

In Fig. 4 the crystal is substituted by an electromagnet comprising within the casing the arms 52, 53 of soft iron secured at one end to a block 54 of ferrolloy. A coil 55 surrounds the free ends of the arms, and between the opposing poles a reed armature 57 mounted at each end in rubber cushions 58 and 59; under the influence of the electric energy through the coil 55, the reed armature vibrates between the poles with a mechanical wave motion corresponding to that of the imposed electric energy. The armature carries a chuck 60 with set screw 61 for securing the black lead to transmit to the latter the vibrations of the armature.

In operation the oscillator is set to the frequency selected by connecting in the condenser C_3 for that frequency. The intensity of the output is controlled through the potentiometer R_4 ; for simplicity the potentiometer is shown as part of the oscillator, but it can be separated and mounted in a box or plate on the retouching stand. When the oscillator is operating, a gentle hum can be heard in the retouching head, since the frequencies operable for retouching lie in the audio range. The hum means that the black lead is vibrating at the frequency of the oscillator wave, and the translation into mechanical vibration is caused by the crystal in Figs. 2 and 3 and by the electromagnet and vibrating reed armature in Fig. 4. The vibrating black lead is touched to the negative, and the desired density or blotting out of defects is speedily accomplished. If the amplitude or intensity is too much or too little the potentiometer is varied to give the correct energy output.

What is claimed is:

1. Retouching device comprising in combination with a source of electric energy of substantially simple harmonic wave character, a head having means connected by leads to the source for converting the electric energy into mechanical vibrations of like wave character, said means including a piezo-crystal element, and means for retouching carried by the head and connected to the crystal element for vibration thereby.

2. Retoucher comprising in combination a piezo-crystal element for converting electrical energy of harmonic wave character into mechanical vibrations of like wave character, means for retouching connected with the element for vibration therewith, and leads extending from the element for connection to a source of the electrical energy.

3. Retoucher comprising in combination a piezo-crystal element for converting electrical

5

energy of harmonic wave character into mechanical vibrations of like wave character, means for maintaining one end of the element in fixed position, a coupling member secured to the other end of the element for vibration therewith, means for retouching carried by the coupling member, and leads extending from the element for connection to a source of the electrical energy.

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6

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