June 18, 1935. J. W. DALTON 2,005,130

ELECTRICAL CIRCUIT AND APPARATUS

Filed July 19, 1932 2 Sheets-Sheet 1

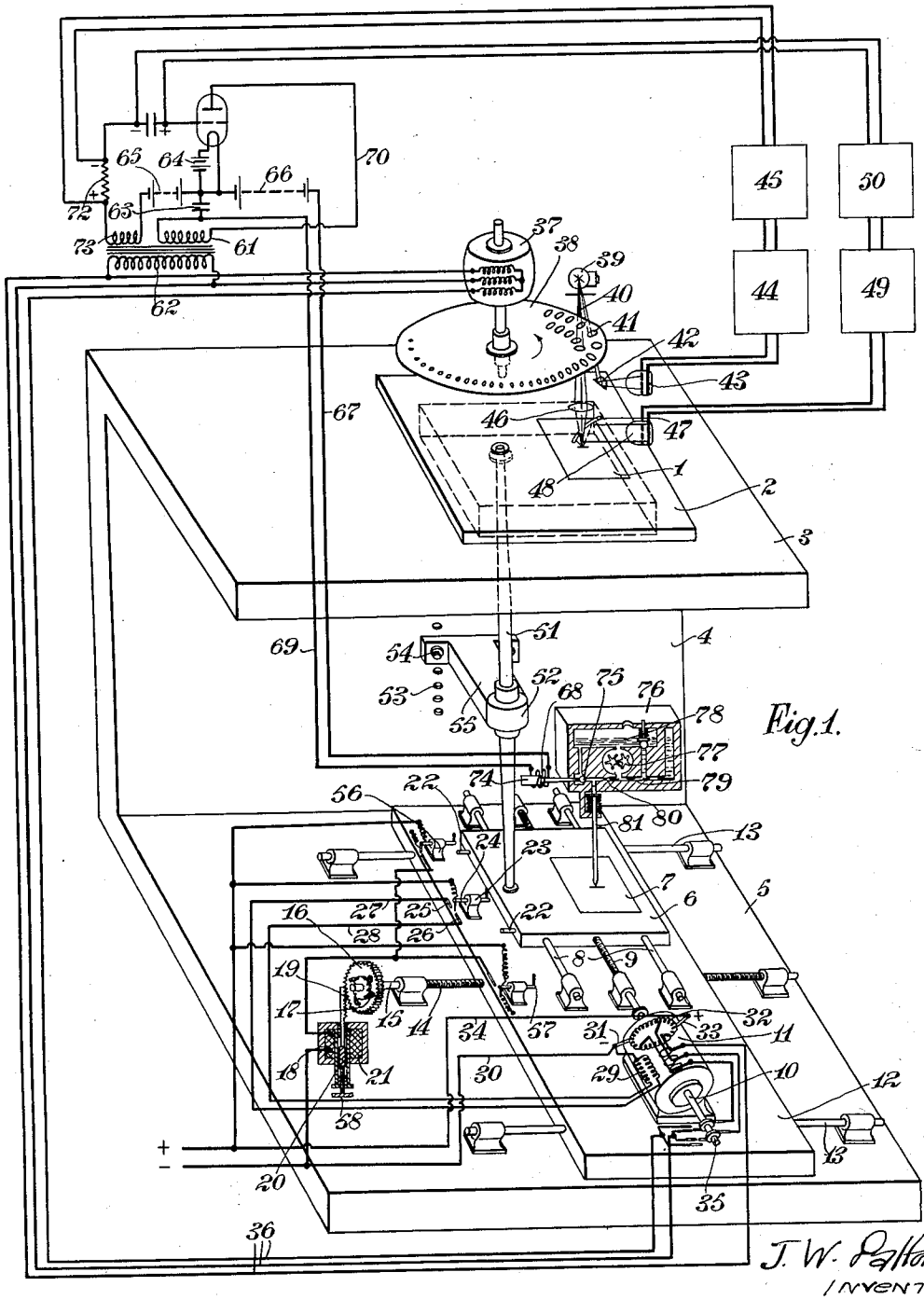


Fig. 1.

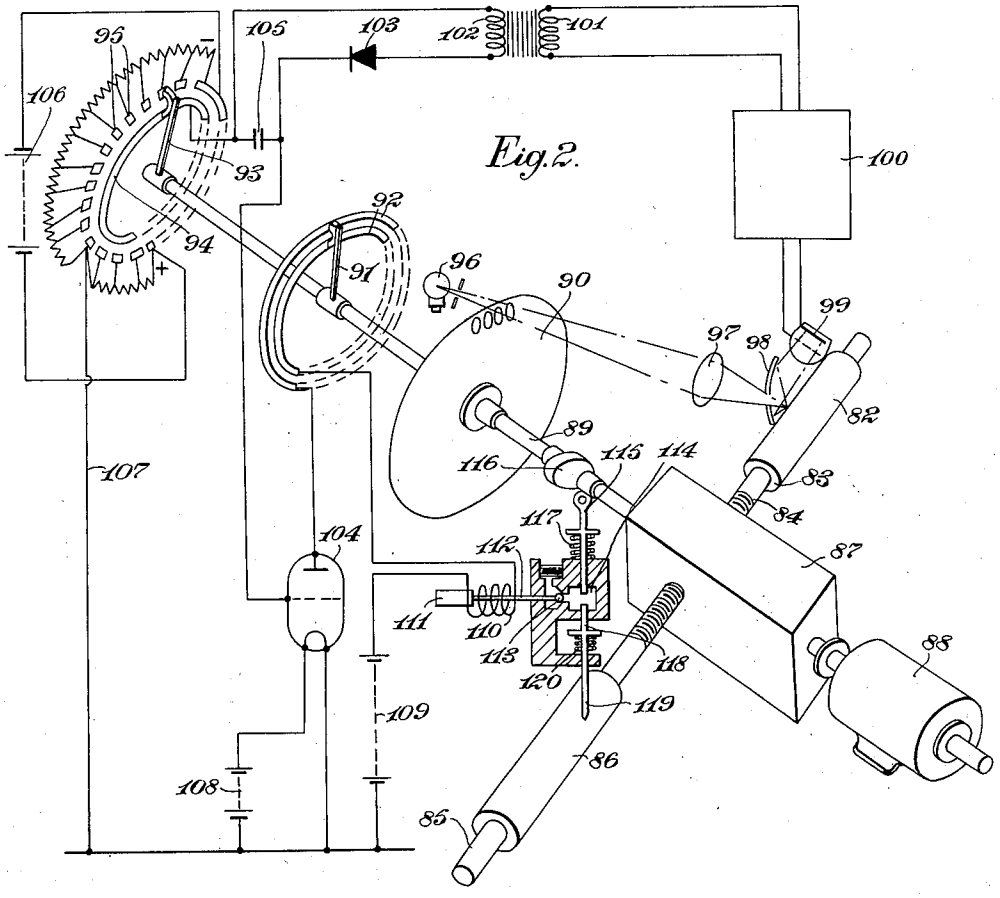
J. W. Dalton
INVENTOR

By: Marks & Clerk
Attys.

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ELECTRICAL CIRCUIT AND APPARATUS

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J. W. Dalton INVENTOR

By: Marko & Clerk Attys.

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ELECTRICAL CIRCUIT AND APPARATUS

John Willey Dalton, Wimbledon, London, England

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In Great Britain July 28, 1931

1 Claim. (Cl. 178—5)

This invention relates to the production of representations of original subjects, for instance printing plates or like surfaces, by electrically controlled means and extends to the production of such visual representations at a station distant from that at which the original subject is located, or in other words, by methods falling within the scope of the term "photo-telegraphy".

The invention relates, inter alia, to the production of engraved surfaces adapted for use, for instance, in substitution for photo-mechanically produced surfaces or blocks, the original and the surface to be engraved, for example, being operated upon at the same station or, in other words, in conditions which do not correspond with those obtaining in photo-telegraphy.

The invention consists in a method of producing a representation of an original subject which comprises applying a gradually decreasing negative voltage to the grid of a gaseous discharge tube during regularly spaced predetermined intervals of time, projecting light on to successive small areas of the original subject in a scanning operation during a fraction of each such interval, causing the light reflected from or transmitted through each such small area of the original subject to set up a voltage on the grid of the tube proportionate with the tone values of the successive small areas into which the original subject is scanned, applying a plate voltage to the tube which is interrupted at the end of each such interval, and causing reproducing means, for instance a cutting tool, to be actuated by the plate current flowing through the tube from the instant at which the grid voltage reaches a predetermined value permitting the flow of plate current to the end of each such predetermined interval.

Conveniently the gaseous discharge tube may be a "Thyratron" tube (the name "Thyratron" being a registered trade-mark), one of the properties of which is to preclude the flow of current from the cathode to the anode until the grid of tube has been given a certain minimum negative bias and thereafter to permit the flow of current irrespective of variation in the bias until the operation of the tube is interrupted by change in the voltage applied to the anode.

The interruption of the flow of current in the anode circuit may be effected by the employment of a mechanical interrupter, or alternatively by applying an alternating or otherwise varying voltage to the anode circuit of the tube from some convenient source of current of the desired character.

The invention will be described further in detail with reference to the accompanying drawings in which are illustrated diagrammatically and by way of example certain forms of apparatus in accordance with the invention:—

Figure 1 being a view partly in perspective and partly diagrammatic of one construction,

Figure 2 being a corresponding view of a second construction.

In Figure 1, 1 indicates the original of which an engraved reproduction is to be formed mounted upon a support 2 freely movable upon the upper platform 3 which is connected by the vertically arranged portion 4 with the lower platform 5 upon which a table 6 adapted to form a support for the surface 7 to be engraved is arranged in association with guides 8 permitting the table 6 and with it the surface 7 to be engraved to be moved in one direction through the intermediary of the lead screw 9. This lead screw is connected with the spindle 10 of the motor 11 also acting as a convertor which, with the guides and lead screws, is mounted upon a table 12 in association with guides 13 secured to the platform 5. This table, in turn, is adapted to be moved in a stepwise manner in a direction at right angles to the direction in which the table 6 is moved on its guides 8, such motion being secured by the lead screw 14 which is provided with an extension 15 rigidly connected with a ratchet wheel 16 co-operating with pawls 17 on the toothed wheel 18 rotatably mounted upon the aforesaid extension of the lead screw.

With the toothed wheel in question is engaged a rack 19 connected with a core 20 arranged within a solenoid 21 the energization of which, in a manner subsequently to be described, will cause stepwise motion to be imparted to the lead screw at determined intervals of time.

The operation of the motor 10 will cause the table 6, in consequence of the action of the lead screw 9, to travel in a direction parallel with the axes of the guides 8 in one or other of two senses until one or other of the pins 22 is brought into position to actuate a switch 23 comprising a movable contact 24 and two fixed contacts 25 and 26, thus causing the movable contact to complete the circuit through one or other of the fixed contacts and thus through the leads 27 and 28 with the winding 29 of the motor 11, the mid-point of which is connected with a lead 30, supplying direct current to the motor, and the brush 31 associated with the commutator 32, the other brush 33 being connected with the lead 34 of the supply of direct current. The alteration of the position

of this switch will change the direction of rotation of the motor 11 on the shaft of which is also provided a friction-operated double pole phase reversing switch 35 connected by the leads 36 with the three-phase self-synchronizing motor 37 in such manner that the reversal of the direction of rotation of the motor 11 will not result in a similar reversal of the direction of rotation of the motor 37.

On the spindle of the motor 37 there is mounted a light-interrupter disc 38 through which is projected light from a source 39.

In the interrupter disc there are provided two sets of apertures 40 and 41, the latter being in the path of the rays directed on to a prism 42 from which they are directed in turn on to the light-sensitive surface 43 in circuit with a valve amplifier 44 and rectifier 45. The other set of apertures 40 is arranged in the path of the light rays passing to the lens 46 by which they are directed on to the original 1, the light reflected from the original being, in turn, reflected by the mirror 47 on to the light-sensitive cell 48 connected with the valve amplifier 49 and rectifier 50.

For the purpose of ensuring that to the original 1 motion is imparted corresponding with that imparted to the engraved surface, a pantograph device is employed. In the construction illustrated, the pantograph comprises a rod 51 mounted in a ball-and-socket joint 52 on the bracket 53, the height of which can be varied by engaging bolts 54 in one or other of the rows of holes 55.

It will be appreciated that at intervals motion must be imparted to the table 6 to secure its movement in a direction at right angles to the axes of the guides 8 as has in fact been already stated. This motion is secured as the result of one or other of the pins 22 being caused to operate one or other of the switches 56, 57 in circuit with the solenoid 21, the solenoid being thus energized at intervals whereby the core of the solenoid will be caused to move to a degree limited by the set screw 58 to advance the table in the direction in question a predetermined distance.

The output from the rectifier 50 is applied across the condenser 59 arranged in the grid lead of a Thyratron tube or other form of gas-filled relay 60, the anode of which is connected with the secondary 61 of a transformer, the primary 62 of which is connected by two leads to the three-phase synchronous motor 37. The secondary in question is connected through the condenser 63 with the filament battery 64 of the Thyratron tube, a form of gas-filled relay tube, with a grid biasing battery 65 and also with a source of direct current 66, one terminal of which is connected by the lead 67 with one end of the winding 68, the other end of which is connected by the lead 69 with one end of the secondary 61 which is also connected by the lead 70 with the anode of the Thyratron tube.

The rectifier 45 is connected by the leads 71 across the resistance 72 connected to one electrode of the condenser 59, and with the secondary 73 of the transformer of which the primary is indicated by the reefrence 62.

The current supplied to the Thyratron tube will be controlled by the outputs of the light-sensitive cells and in accordance with the current flowing in the anode circuit. The core 74 arranged in the winding 68 will be moved for a greater or less length of time into the position in which it closes the ball valve 75 provided in the casing 76 in which a rotary pump 77 is arranged, this rotary pump functioning to draw liquid from the reservoir 78 and deliver it into the duct 79 through a restricted aperture 80 in which the liquid will be delivered into the chamber in which the stem of the engraving tool 81 projects forming a piston therein, so that according to the time during which the valve is closed, and this time will be determined by the tone value of the original operated upon, the liquid will be forced by the pump on to the stem of the engraving tool 81 and thus operate to advance the point of the engraving tool 81 for a greater or less length of time or less distance into the surface of the plate to be engraved. The depressions formed in the engraved surface will thus be controlled in depth or otherwise in magnitude in relation to the tone value of the corresponding area of the original.

In the construction illustrated in Figure 2, the original is indicated by the reference 82 and it is mounted upon a mandrel 83 secured on a lead screw 84 on which also a mandrel 85 is secured carrying the surface 86 to be engraved, the lead screw being driven through gearing arranged in the casing 87 by the motor 88 which also drives the shaft 89 on which the interrupter disc 90 is mounted. On this shaft there is also mounted a movable contact 91 co-operating with contact segments 92 and a further contact member 93 co-operating with a contact 94 and a plurality of studs 95.

Light is projected on to the original from the source of illumination 96 through apertures in the interrupter disc 90, the light passing therethrough being concentrated by the lens 97 and projected on to the original 82, the light reflected from which is, in turn, reflected by the lens 98 on to the light-sensitive cell 99, the current flowing through which is amplified by the valve-amplifier 100 in the output of which is arranged the primary 101 of the transformer, one end of the secondary 102 of which is connected through the rectifier 103 with the grid of the Thyratron tube 104 and also with the condenser 105, the other end of the secondary being connected with the opposite terminal of the condenser and with the contact segment 94, the studs 95 associated with the segments being connected together through resistances and with a source of direct current indicated by the negative terminal of the battery 106, the positive terminal of which is connected through the whole of the resistance with one of the studs, the lead 107 being taken from another of the studs to the filament heating battery 108 connected across the filament of the Thyratron tube and also to one terminal of a second battery 109, the other end of which is connected with one end of the solenoid 110, the other end of the solenoid being connected with one of the segments 92, the other segment being connected, in turn, with the anode of the Thyratron tube.

Within the solenoid 110 there is arranged a core 111 provided with an extension 112 adapted, by the movement of the solenoid, to actuate a ball valve 113 associated with the chamber 114 in which there is contained a liquid and into the chamber containing the liquid extends a piston element 115, the end of which contacts with a cam 116 on the shaft 89.

Rotation of the shaft will cause the piston element to be forced into the chamber in opposition to the spring 117 and depending upon the time during which the valve is closed the forcing of this piston into the chamber will cause the liquid

therein to move the stem 118 of the engraving tool 119 in opposition to the spring 120, thus causing the engraving tool to make an impression of greater or less depth in the surface to be engraved proportionate with the amount of light reflected from the corresponding surface of the original.

The mandrel 82 on which the original is mounted, and the mandrel 85 with which the surface to be engraved is associated, may be moved continuously or in a stepwise manner.

While above the invention has been described mainly in its application to the production of engraved surfaces, the invention as stated extends to the production of visual representations of an original generally and by for instance methods falling within the scope of the term "photo-telegraphy".

In conclusion it is to be observed that the foregoing description is furnished for the purpose of illustrating certain suitable manners of carrying the invention into effect and various changes may be made in the details of construction and arrangement above referred to without exceeding the scope of the present application. For instance, while particular circuit arrangements and modes of operation have been described in some detail it is to be understood that the individual features of such circuits or modes of operation may be employed in combination or association with features herein referred to other than such as are specified in their immediate context, without departing from the invention.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

The method of producing a representation of an original subject which comprises moving the original subject relative to scanning means, moving a surface upon which the representation of the original subject is to be formed at a corresponding rate relative to reproducing means, and during such movement effecting in each of a plurality of successively recurring regularly spaced intervals of time the following operations:—applying to the grid of a gaseous discharge tube for a period of time which is constant for each of the intervals a decreasing negative voltage the rate of decrease of which is the same for each of the intervals, projecting light on to a small area of the original subject in a scanning operation during a fraction only of the said period, applying to the grid of the tube during the said fraction of the period a further voltage which is stored on the grid and is proportionate with the tone value of the light transmitted through or reflected from the small area as a result of the scanning operation, thereby causing the voltage on the grid to reach a value permitting the flow of plate current only after the lapse of a fraction of the time interval which is proportionate with the tone value of the small area, causing the reproducing means to operate upon the surface upon which the representation is to be formed by current flowing from the plate of the tube from the instant at which the grid voltage reaches the said predetermined value to the end of the interval, and at the end of the interval interrupting the flow of current from the plate of the tube, thereby interrupting the operation of the reproducing means.

JOHN WILLEY DALTON.