May 23, 1933. M. L. D. McFARLANE ET AL 1,910,556

MECHANISM FOR PRODUCING A PERFORATED TAPE FOR REPRODUCING PICTURES OR THE LIKE

Filed Sept. 11, 1929 3 Sheets-Sheet 1

Fig: 1.

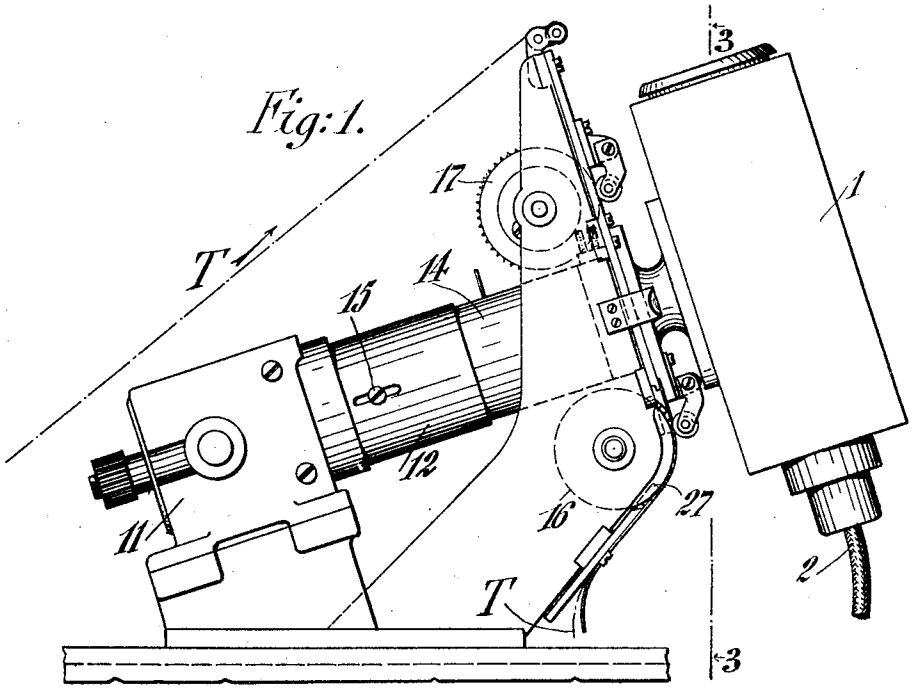
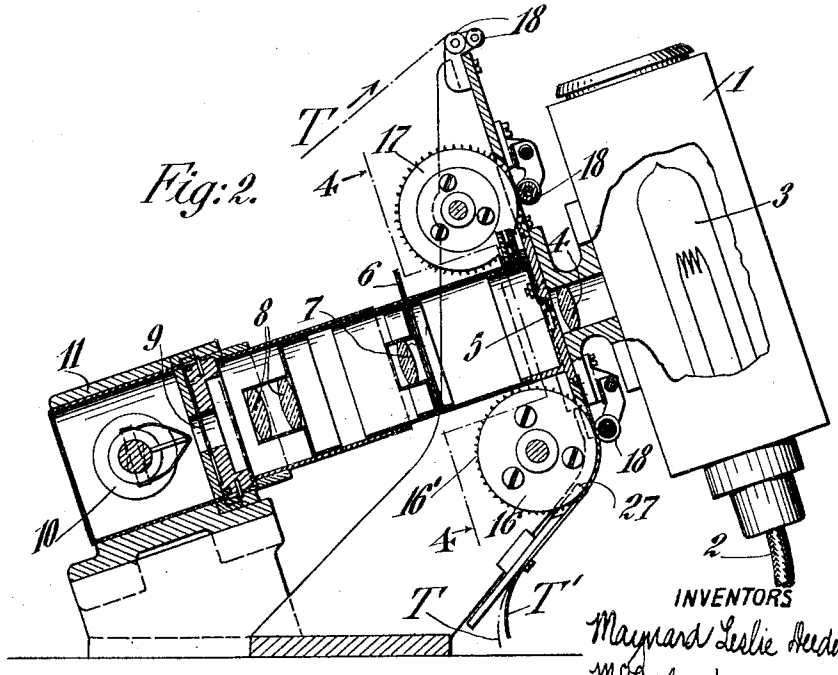


Fig: 2.



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Fig:3.

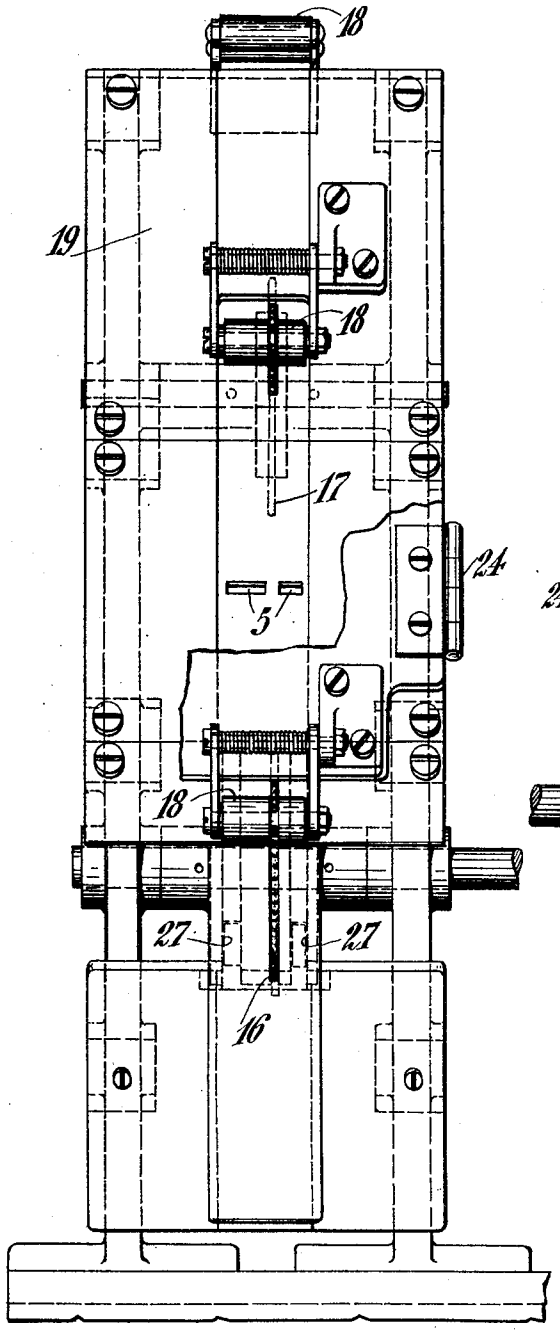
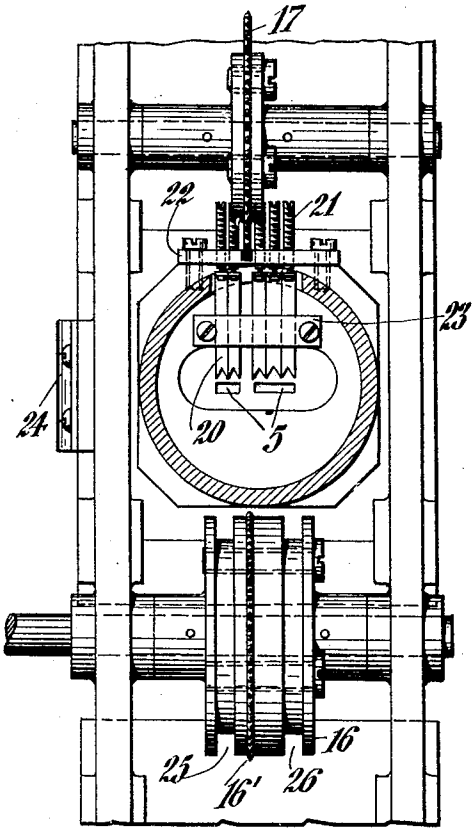


Fig:4.



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MECHANISM FOR PRODUCING A PERFORATED TAPE FOR REPRODUCING PICTURES OR THE LIKE

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Fig:5.

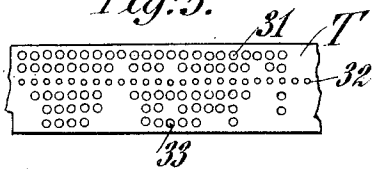


Fig:6.

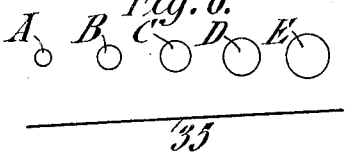


Fig:7.



Fig:8.

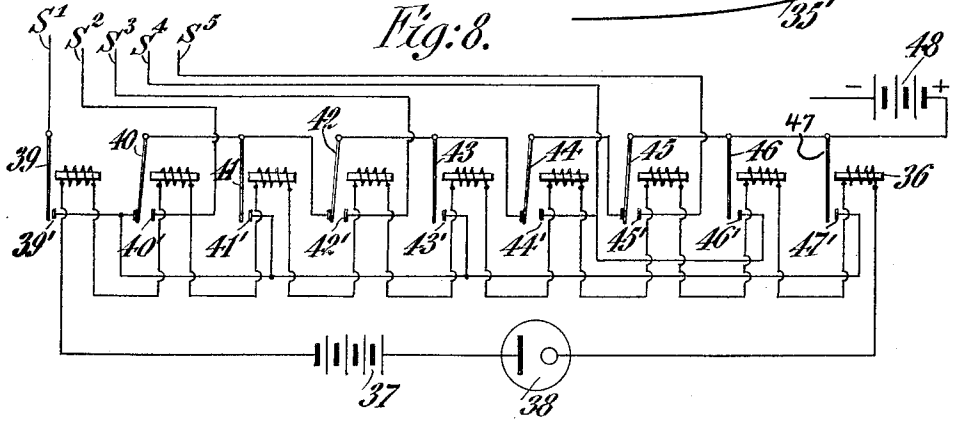


Fig:9.

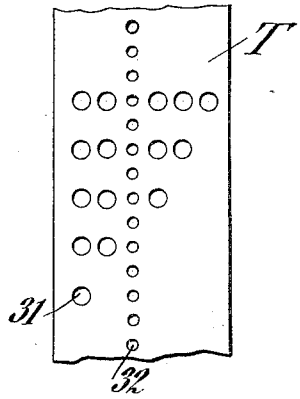
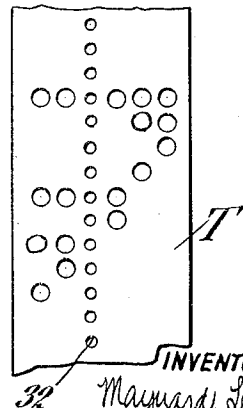


Fig:10.



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Patented May 23, 1933 1,910,556

UNITED STATES PATENT OFFICE

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MECHANISM FOR PRODUCING A PERFORATED TAPE FOR REPRODUCING PICTURES OR THE LIKE

Application filed September 11, 1929. Serial No. 391,820.

This invention relates to a new and improved mechanism for producing a perforated tape for reproducing pictures or the like.

One of the objects of this invention is to devise improvements in a mechanism for reproducing pictures, which produces a perforated tape having a series of rows of perforations, each of said rows corresponding to the tone value of a small area of the picture or the like which is to be reproduced. Such systems are described in the following British Patents:—

No. 195,577 to Bartholomew and McFarlane;

No. 197,402 to Bartholomew and McFarlane;

No. 209,816 to Bartholomew and McFarlane.

Another object of this invention is to devise a mechanism for producing said tape so that the perforations in said tape may be permitted to control the passage of light through apertures which vary in size according to a suitable formula for causing the reproduced picture to have substantially the same tone values as the original picture.

Another object of this invention is to devise a mechanism for reproducing pictures whereby the numerical magnitude of a tone value will depend not merely upon the number of perforations in a given row on a tape, but also upon the relative locations of the said perforations. It is thereby rendered possible to reproduce a number of tone values or gradations which exceeds the maximum number of perforations in each row.

Other objects of this invention will be set forth in the following description and drawings which illustrate preferred embodiments thereof, it being understood that the above general statement of the objects of this invention is intended merely to generally explain the same and not to limit it in any manner.

Fig. 1 is a side elevation of an apparatus which may be used for carrying out the invention.

Fig. 2 is a vertical central section.

Fig. 3 is a view on the line 3—3 of Fig. 1.

Fig. 4 is a section on the line 4—4 of Fig. 2.

Fig. 5 shows the record tape.

Fig. 6 shows the variation in the size of the light apertures and a graph illustrating the relationship between the diameters of the light apertures in one embodiment of this invention.

Fig. 7 is a view similar to Fig. 6 and illustrating the same relationship in another embodiment of this invention.

Fig. 8 is a diagrammatic view showing the connections between the relay magnets for locating perforations on the record tape in accordance with the magnitude of the tone value of each area of the picture which is being reproduced.

Fig. 9 diagrammatically illustrates a record tape in which the magnitude of the tone values is represented solely by the number of perforations in a given row.

Fig. 10 diagrammatically shows a record tape according to the second embodiment of this invention, in which the magnitude of a tone value is also recorded by the location of the perforation or perforations in a given row, with respect to the central line of the tape.

This is a continuation in part of our application Ser. No. 140,049 filed October 7th, 1926, now Patent No. 1,731,345, Oct. 15, 1928.

In the previously issued patents above mentioned, mechanism has been described whereby a plurality of reader points pass over the suitably prepared picture to be reproduced, said picture consisting of an image formed by an insulating layer or coating located on a conducting metal plate, so that said reader points open and close separate circuits, dependent upon their contact either with the said conducting plate or the said insulating layer or coating. The circuits which are opened and closed by said reader points include electromagnets which actuate selectors in a punch mechanism whereby the number of perforations formed in a given row, in a tape which is passed adjacent the punch mechanism, is dependent upon the number of contacts of the respective reader points with the metal base of the picture to

be reproduced. In these previously issued patents, apparatus was also described whereby the perforated tape was led between a source of light and a suitable lens system which concentrated the light shining through the perforations in a point upon a light-sensitive film, so that the tone value of each point or small area of the image formed upon the light-sensitive film was in proportion to the number of perforations in the respective row on the tape.

In making reproduced pictures with the apparatus set forth in the previously issued patents, it has been found impossible to accurately reproduce very dark tones, because if the record tape only had a single perforation in a given transverse line thereof, which corresponded to a very dark tone of the picture to be reproduced, the reproducing apparatus allowed too much light to shine through this single perforation. Likewise, the number of tones which could be reproduced could not exceed the number of perforations on a transverse line of the tape, and it would require the use of a very wide tape to represent a large number of tone values or gradations. Since the width of the tape must be standard in order to utilize existing apparatus for forming a reproduction of a perforated tape over a telegraph line or the like, this made it practically impossible to properly represent the requisite number of tone gradations for producing a good reproduction.

According to the present invention, and in the first embodiment thereof, a tape T is formed, as shown in Figs. 5 and 9. This tape T has a row of feeding perforations 32 by means of which the tape is fed through the reproducing apparatus. It is also provided with transverse rows of message perforations 31, the maximum number of such perforations on a given transverse line of the tape being five. The tape is also provided with what may be termed "end of the row" perforations 33, there being three such perforations in the embodiment shown in Fig. 5, and these end of the row perforations designate the end of a series of message perforations corresponding to a single lateral strip of the picture which is being reproduced.

The apparatus shown in Figs. 1 and 2 has a lamp-house 1 provided with a lamp 3 of any suitable type, to which current is supplied by means of the cable 2. The optical apparatus comprises a condenser lens 4, apertures 5, a movable stop diaphragm 6, a concentrating lens 7, focusing lenses 8, a movable safety shutter 9, and a film drum 10 which is mounted in a light-tight casing 11. The various lenses before mentioned are mounted in tubes 12 and 14 which are held in adjustable fixed position by means of the set screw 15. The tape is fed transversely between the lenses 4 and 7 by means of the drum 16 which has a row of teeth 16′, which engage with the feeding perforations 32. A guide drum 17 is provided for the tape and this is provided with a similar circumferential row of teeth. The tape T is fed through the apparatus from top to bottom, as indicated by the arrow in Fig. 2. Guide rollers 18 mounted on pivoted arms are also provided, and a guide T′ is provided at the bottom of the apparatus.

As shown in Fig. 4, the lamp-house is mounted upon a hinge 24 so that it can be readily swung away from the rest of the apparatus. Also, and as shown in Fig. 4, the drum 16 is provided with grooves or recesses 25 and 26. As shown in Figs. 2 and 3, stripping fingers 27 are provided, these stripping fingers being adapted to enter the grooves 25 and 26 so as to strip the film from the drum 16, as indicated in Fig. 2. The width and location of the stripping fingers are such that they bear on the film intermediate the message perforations 31, so that the action of the stripping fingers do not enlarge the message perforations 31 and thereby injure the tape.

In order to control the amount of light passing to the light-sensitive film, five separate shutters 20 are provided, as shown in Fig. 4. Likewise, two apertures 5 are provided through which the light passes from the condensing lens 4, to then pass through the message perforations in the tape. As shown in Fig. 4, one of these apertures 5 has a width equivalent to two of the message perforations 31, and the other aperture 5 has a width equivalent to three of the message perforations 31. The shutters 20 are separately adjustable by means of the screws 21, which pass through a clamping plate 22 having five openings provided with suitable internal threadings, so that the turning of each screw 21 moves the respective shutter 20 up and down with respect to its adjacent aperture 5. A guide plate 23 is provided.

As shown in Fig. 4, the bottoms of the shutters 20 are of angular shape so as to permit a more flexible adjustment of the said apertures. It likewise will be noted in Fig. 4 that the plate having the apertures 5 therein, is solid at the point corresponding to the feeding perforations 32.

As shown in Fig. 6, the shutters 20 are adjusted so that the five separate apertures in the openings 5 formed thereby have the area relationship indicated by the circles A, B, C, D and E in Fig. 6. As shown by the graph 35, the relationship between the respective areas of the said five perforations A–E inclusive, is substantially linear. Hence, if a certain area of the picture to be reproduced is very dark, almost a pure black, and only a single perforation is

formed in the record tape, the location of this perforation corresponds to the opening A, so that when the tape or a duplicate thereof is passed through the apparatus shown herein, only a small amount of light passes to the light-sensitive film. Likewise, when the picture has the next gradation or tone value at a given area thereof, so that two perforations are formed in the record tape, these two perforations will control the apertures A and B. Experience has shown that by thus regulating the light which falls upon the light-sensitive film, that a much more accurate reproduction can be formed.

Fig. 9 shows five lateral lines of perforations, the bottom perforation corresponding to a very dark tone value, and the other rows of perforations corresponding respectively to lighter tone values.

According to this method, only five tone values or gradations can be reproduced, and this is frequently insufficient to secure an accurate reproduction.

In order to permit a record tape having no more than five perforations in a given lateral line to record ten tone values, the record tape shown in Fig. 10 is utilized. In this tape, the bottom perforation represents the darkest tone value of the picture which is being reproduced, it being noted, however, that if the picture which is being reproduced is a negative, that this darkest tone value of course corresponds to the lightest tone value of the object which has been photographed. The single perforation in the next row corresponds to the next tone value, which would correspond to the first row of message perforations from the bottom depicted in Fig. 9. In other words, in the embodiment shown in Fig. 10, the magnitude of a tone value is not merely represented by the number of perforations in a given transverse line of the tape, but it is also represented by the lateral location of said perforation or perforations.

In the embodiment shown in Fig. 10, the two perforations shown in the third transverse line represents the third tone value, the single perforation shown in the fourth row represents the fourth tone value, and so on, until nine tone values are represented, the tenth tone value which is an absolute black, being indicated by the total absence of all perforations. By suitably choosing the permutations of the five message perforations, a maximum of thirty-two tone values can be recorded, but the recording of ten tone values has been found sufficient for practical purposes.

In order to form the message perforations as indicated in Fig. 10, the apparatus diagrammatically illustrated in Fig. 8 is utilized. This shows nine relay magnets 36 having armatures 39, 40, 41, 42, 43, 44, 45, 46 and 47 respectively, these armatures serving as switch levers which may be moved from their normal positions shown in Fig. 8, so that the armatures 39, 41, 43, 46 and 47 can contact with the switch terminals 39′, 41′, 43′, 46′ and 47′. Likewise, when these magnets are energized, they cause the armatures 40, 42, 44 and 45 to separate from the switch terminals with which they are in contact, and to respectively contact with the terminals 40′, 42′, 44′ and 45′. The nine relay magnets 36 are connected in series to a source of electric current 37, and the circuit includes a photo-electric cell 38.

A second source of current 48 has one terminal thereof connected to the armatures, as shown in Fig. 8. The other terminal of the source of current 48 is connected to each of the coils of the five selector magnets which are not illustrated, as selective punch mechanism of this type is described in the patents previously mentioned, and has also been known for a great many years in connection with telegraph systems. The other ends of the five coils of the five selector magnets are respectively connected to the conductors S^1, S^2, S^3, S^4 and S^5.

The picture to be reproduced is formed upon a substance such as celluloid or the like which is permeable to light, and a beam of light is allowed to shine through the successive areas of the picture and to then fall upon the photo-electric cell. The resistance of the photo-electric cell therefore varies in accordance with the tone value of each small area of the picture which is being reproduced, and the amount of current flowing through the coils of the nine relay magnets also varies accordingly. The nine relay magnets are of uniformly graduated sensitiveness, so that the left-hand magnet 36 responds to the smallest current to actuate its armature 39, the second magnet 36 (as well as the first magnet) actuate their respective armatures when the current has reached its second stage of intensity, etc., so that all nine magnets respond when the picture which is being reproduced has its lighest tone value, it being understood that the picture which is being reproduced is preferably a negative.

When the armature 39 contacts with the switch terminal 39′, the current from the battery 48 passes through the armatures 45, 44, 42 and 40 to the switch terminal 39′, through the intermediate connections shown in Fig. 8, so that the selector magnet corresponding to the left conductor S′ has its coil energized, thereby actuating the selector which causes the formation of a perforation corresponding to the bottom row in Fig. 10.

When a current of the second degree of intensity passes through the relay magnets, this causes the armature 39 to touch the switch terminal 39′ and the armature 40 is also moved to contact with the terminal 40′.

The current now passes from the plus terminal of the battery 48 through the armatures 45, 44 and 42 as before, but the current does not pass to the switch terminal 39' because of the change in position of the armature 40. Hence, the current from battery 48 only passes to the conductor S^2, thus causing the energizing of a single selector magnet and the formation of the single perforation shown in the second row in Fig. 10.

When a current of the third degree of intensity passes through the relay magnets, the armatures 39, 40, and 41 are actuated to respectively contact with the switch terminals 39', 40' and 41'. The current now passes through the armature 41 to the terminal 41', and thence to the switch terminal 39' by the connection shown. The current also passes through the armature 40 to the switch terminal 40'. However, the third relay magnet 36 is not energized, thus causing the formation of only two perforations as shown in the third row of Fig. 10.

When a current of the fourth degree of intensity passes through the relay magnets, the armatures 39, 40, 41 and 42 are moved to the right to respectively contact with the terminals 39', 40', 41' and 42'. This causes the current to pass only to the conductor S^3, because the movement of the armature 42 to the right throws the conductors S' and S^2 out of the circuit. Hence, the single perforation shown in the fourth row of Fig. 10 will be formed.

When a current of the fifth degree of intensity is passed through the relay magnets, the armatures 39, 40, 41, 42 and 43 are moved to respectively contact with the switch terminals 39', 40', 41', 42' and 43'. The current therefore passes to the three conductors S', S^2 and S^3 by the connections shown.

When the current passing through the relay magnets has the sixth degree of intensity, then the armatures 39, 40, 41, 42, 43 and 44 are actuated to respectively contact with the switch terminals 39', 40', 41', 42', 43' and 44'. Since the armature 44 is moved to the right of the position shown in Fig. 8, this throws the conductors S', S^2, and S^3 out of the circuit, and only the conductor S^4 is in the circuit of the battery 48, thus producing the single perforation indicated in the sixth row of Fig. 10.

When the current is of the seventh degree of intensity, the armatures 39, 40, 41, 42, 43, 44 and 45 are actuated to respectively contact with the switch terminals 39', 40', 41', 42', 43', 44' and 45'. Since the armature 45 is moved to the right of the position shown in Fig. 8, this position cuts out of the circuit the conductors S', S^2, S^3 and S^4, so that only the conductor S^5 is maintained in the circuit, thus producing the single perforation shown in the seventh row of Fig. 10.

When the circuit has the eighth degree of intensity, the armatures 39, 40, 41, 42, 43, 44, 45 and 46 are moved to respectively contact with the switch terminals 39', 40', 41', 42', 43', 44', 45' and 46'. The conductor S^5 is thereby maintained in the circuit of the battery 48 and the cross-connection between the conductor S^4 and the switch terminal 46' also places this in the circuit, thus producing the two perforations shown in the eighth row of Fig. 10.

When the circuit has the ninth degree of intensity, all the armatures are moved to respectively contact with the switch terminals 39'–47' inclusive, and the five selectors are thrown into the circuit of the battery 48 because of the cross-connections between the switch terminals 39'–47' inclusive which are shown in Fig. 8. For example, there is a direct connection between terminal 47' and terminal 41' so that current will pass through the armature 41, to the armature 40 and the terminal 40', to conductor S^2.

As shown by graph 35' in Fig. 7, the relationship between the apertures A', B', C', D' and E' is expressed by a graph having different inclinations at the ends thereof with respect to a horizontal axis.

It can be seen from Fig. 7 that the location of a perforation or perforations shown in Fig. 7 substantially affects the amount of light shining upon the reproducing film.

Hence, according to the improved method shown in the second embodiment, the lateral location of a message perforation or perforations is associated with light apertures of suitable size to reproduce the required tone value.

It will be noted that the improved mechanism disclosed herein comprises a series of marking circuits identified as S', S^2, S^3, S^4, S^5, and that the relay or control magnets for said marking circuits exceed the number of said marking circuits.

It will also be noted that the number of values which can be recorded upon a tape or other record is not less than twice the number of marking circuits, if we assume that the total absence of perforations or markings constitutes one of the records marked on the tape or other record-bearing device.

Whenever we refer to a photo-electric cell in the description or claims, it is to be understood that we generally include all devices whereby a change in light value produces a change in the value of the current passing through the relay magnets. For convenience, the current pulses passing through the relay magnets may be designated as a series composed of successive pulse members, the first of said pulse members having the value of zero, and the last of said pulse members being sufficient to cause all the relay magnets to be operated.

While we have shown a complete apparatus, it is clear that said apparatus includes valuable sub-combinations which could be utilized in other mechanisms differing from the complete device disclosed herein.

For example, it is a valuable feature of our invention that a pair of successive tone values are recorded by merely shifting the position of a perforation or marking, without increasing the number of markings. For this purpose, the marking circuits identified by S′ and S² may be considered as forming a pair of marking circuits, and the electro-magnets associated with the switch armatures 39 and 40, together with the terminals 39′ and 40′ and their associated connections, may be considered as forming a pair of electro-magnetic circuit-closing devices. The circuits S′ and S² may then be considered as forming a first marking circuit and a second marking circuit, individually controlled and operated. The same principle is utilized when the marking circuits S⁴ and S⁵ are individually operated. For convenience, the position of each switch armature shown in Fig. 8 may be designated as its "inoperative" position.

Preferred embodiments of our invention have been shown, but it is clear that numerous changes and omissions could be made without departing from the spirit of this invention.

We claim:

1. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of a plurality of marking circuits and a plurality of electrical control devices for said marking circuits for the production of a non-pictorial record in accordance with the degrees of light and shade of a picture, the number of said electrical control devices exceeding the number of said marking circuits.

2. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of a plurality of marking circuits, electro-magnetic circuit-closing devices for said marking circuits, the circuit of said electro-magnetic devices including means to automatically transmit electrical current according to the degrees of light and shade in a succession of picture elements so that a series of electrical pulses of varying intensity can be sent through said devices, a pair of said devices being adapted to be individually operated by electrical pulses of different intensity, the operation of either of said pair of devices being adapted to only close a single marking circuit.

3. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of a first marking circuit and a second marking circuit, a first electro-magnet having a first switch armature adapted to control the first marking circuit, a second electro-magnet having a second switch armature adapted to control the second marking circuit, said electro-magnets being connected to a circuit which includes means to automatically transmit electrical current according to the degrees of light and shade in a succession of picture elements so that successive current pulses of varying value can be sent therethrough, the first electro-magnet being sufficiently sensitive to operate the first switch armature upon receiving a current pulse of relatively low value, the second electro-magnet being less sensitive so that it is operated to actuate its switch armature only when it receives a current pulse of relatively greater value, each of said switch armatures having a terminal associated therewith, the first switch armature being spaced from its terminal when it is in inoperative position, the second switch armature being connected to the terminal of the first switch armature by conducting means independent of the first switch armature when it is in inoperative position.

4. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of a plurality of marking circuits adapted to produce identical markings when closed, said markings being formed in different relative positions on the non-pictorial record-bearer, and electro-magnetic devices of varying sensitiveness adapted to selectively close said marking circuits in accordance with the value of the current pulse passing through said electro-magnetic devices.

5. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of three marking circuits having four electro-magnets associated therewith, each of said electro-magnets having a switch armature associated therewith, each said switch-armature having a switch terminal associated therewith, said electro-magnets having a circuit provided with means to automatically transmit electrical current according to the degrees of light and shade in a succession of picture elements so that current pulses of varying magnitude can be sent through said electro-magnets, the first marking circuit being directly connected to the first armature associated with the first electro-magnet, said armature being spaced from its terminal when it is in inoperative position, the second marking circuit being connected to the terminal of the second switch armature, said second switch armature being connected to the first switch terminal when it is in inoperative position, the third marking circuit being connected to the switch terminal of the fourth switch armature, said fourth switch armature being connected to the third switch armature and to the second switch armature when it is in inoperative position, the third

switch terminal and the first switch terminal being connected to each other, said electro-magnets having successively decreasing sensitiveness.

6. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of a pair of marking circuits having three electro-magnets associated therewith, each of said electro-magnets having a switch-armature associated therewith, each said switch-armature having a terminal associated therewith, said electro-magnets having a circuit provided with means to automatically transmit electrical current according to the degrees of light and shade in a succession of picture elements so that current pulses of varying magnitude can be sent through said electro-magnets, the first marking circuit being directly connected to the first armature associated with said first electro-magnet, said armature being spaced from its terminal when it is in inoperative position, the second marking circuit being connected to the terminal of the second switch-armature, said second switch-armature being connected to the first switch terminal when it is in inoperative position, the third switch-armature being spaced from its terminal when it is in inoperative position, the third switch terminal being connected to the first switch terminal, said electro-magnets having successively decreasing sensitiveness

7. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of three marking circuits having five electro-magnets associated therewith, each of said electro-magnets having a switch-armature associated therewith, each said switch-armature having a switch terminal associated therewith, said electro-magnets having a circuit provided with means to automatically transmit electrical current according to the degrees of light and shade in a succession of picture elements so that current pulses of varying magnitude can be sent through said electro-magnets, the first marking circuit being directly connected to the first armature associated with the first electro-magnet, said first armature being spaced from its terminal when it is in inoperative position, the second marking circuit being connected to the terminal of the second switch armature, said second switch armature being connected to the first switch terminal when it is in inoperative position, the third switch armature being spaced from its terminal when it is in inoperative position, the third switch terminal being connected to the first switch terminal, the third marking circuit being connected to the switch terminal of the fourth switch armature, said fourth switch armature being connected to the third switch armature and to the second switch armature when it is in inoperative position, said electro-magnets being of successively decreasing sensitiveness, the fifth switch terminal being connected to the first switch terminal and to the third switch terminal.

8. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of four marking circuits having six electro-magnets associated therewith, each of said electro-magnets having a switch armature associated therewith, each said switch armature having a switch terminal associated therewith, said electro-magnets having a circuit provided with means to automatically transmit electrical current according to the degrees of light and shade in a succession of picture elements so that current pulses of varying magnitude can be sent through said electro-magnets, the first marking circuit being directly connected to the first armature associated with the first electro-magnet, the second marking circuit being connected to the second switch terminal, said second switch armature being connected to the first switch terminal when it is in inoperative position, the third switch armature being spaced from its terminal when it is in inoperative position, the third switch terminal being connected to the first switch terminal, the third marking circuit being connected to the fourth switch terminal, the fourth switch armature being connected to the second switch armature and to the third switch armature when it is in the inoperative position, the fifth switch armature being spaced from its switch terminal when it is in the inoperative position, the fifth switch terminal being connected to the first switch terminal and to the third switch terminal, the fourth marking circuit being connected to the sixth switch terminal, the sixth switch armature being connected to the fourth switch armature and to the fifth switch armature when it is in the inoperative position, the said electro-magnets having successively decreasing sensitiveness.

9. A device according to claim 8 and including a fifth marking circuit and a seventh electro-magnet, said seventh electro-magnet having a switch terminal to which the fifth marking circuit is connected, said seventh electro-magnet having a switch armature which is connected to the sixth switch armature when it is inoperative position.

10. A device according to claim 8 and including a fifth marking circuit, a seventh electro-magnet and an eighth electro-magnet, said seventh electro-magnet having a switch terminal to which the fifth marking circuit is connected, said seventh electro-magnet having a switch armature which is connected to the sixth switch armature when it is in inoperative position, the

eighth electro-magnet having a switch armature and a switch terminal which is spaced from said eighth switch armature when said eighth switch armature is in operative position, said eighth switch terminal being connected to the fourth marking circuit and being also connected to the switch terminal of the sixth electro-magnet.

11. A device according to claim 8 and comprising a fifth marking circuit, a seventh electro-magnet, an eighth electro-magnet, a ninth electro-magnet, said seventh electro-magnet having a seventh switch terminal to which the fifth marking circuit is connected, said seventh electro-magnet having a seventh switch armature which is connected to the sixth switch armature when it is in inoperative position, the eighth electro-magnet having an eighth switch armature associated with an eighth switch terminal from which it is spaced when said eighth switch armature is in the inoperative position, said eighth switch terminal being connected to the fourth marking circuit and to the switch terminal of the sixth electro-magnet, the ninth electro-magnet having a ninth switch terminal from which it is spaced when said ninth switch terminal is in inoperative position, said ninth switch terminal being connected to the first, third, and fifth switch terminals.

12. A mechanism for producing a non-pictorial record of a picture, comprising the sub-combination of a succession of marking circuits for the production of a non-pictorial record, a succession of electro-magnets of greater number than said marking circuits and of varying sensitiveness, said electro-magnets having switch armatures respectively associated therewith and adapted to be actuated when said electro-magnets are energized, said marking circuits being connected to some of said switch terminals, said marking circuits including a source of electric power which is connected to a number of said switch armatures which is less than the total number thereof, some of the switch armatures which are directly connected to their associated source of electric power being connected to the preceding switch armatures only when said succeeding switch armatures are in the inoperative position.

In testimony whereof we affix our signatures.

MAYNARD LESLIE DEEDES McFARLANE.
HARRY GUY BARTHOLOMEW.

DISCLAIMER

1,910,556.—*Maynard Leslie Deedes McFarlane*, New York, N. Y., and *Harry Guy Bartholomew*, London, England. MECHANISM FOR PRODUCING A PERFORATED TAPE FOR REPRODUCING PICTURES OR THE LIKE. Patent dated May 23, 1933. Disclaimer filed April 5, 1938, by the patentees.

Hereby enter this disclaimer as to claims 1, 2, 3, 4, and 6 of said patent.

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