

April 6, 1926.

1,579,263

E. F. WATSON

ELECTRICAL TRANSMISSION OF PICTURES

Filed March 26, 1924

2 Sheets-Sheet 1

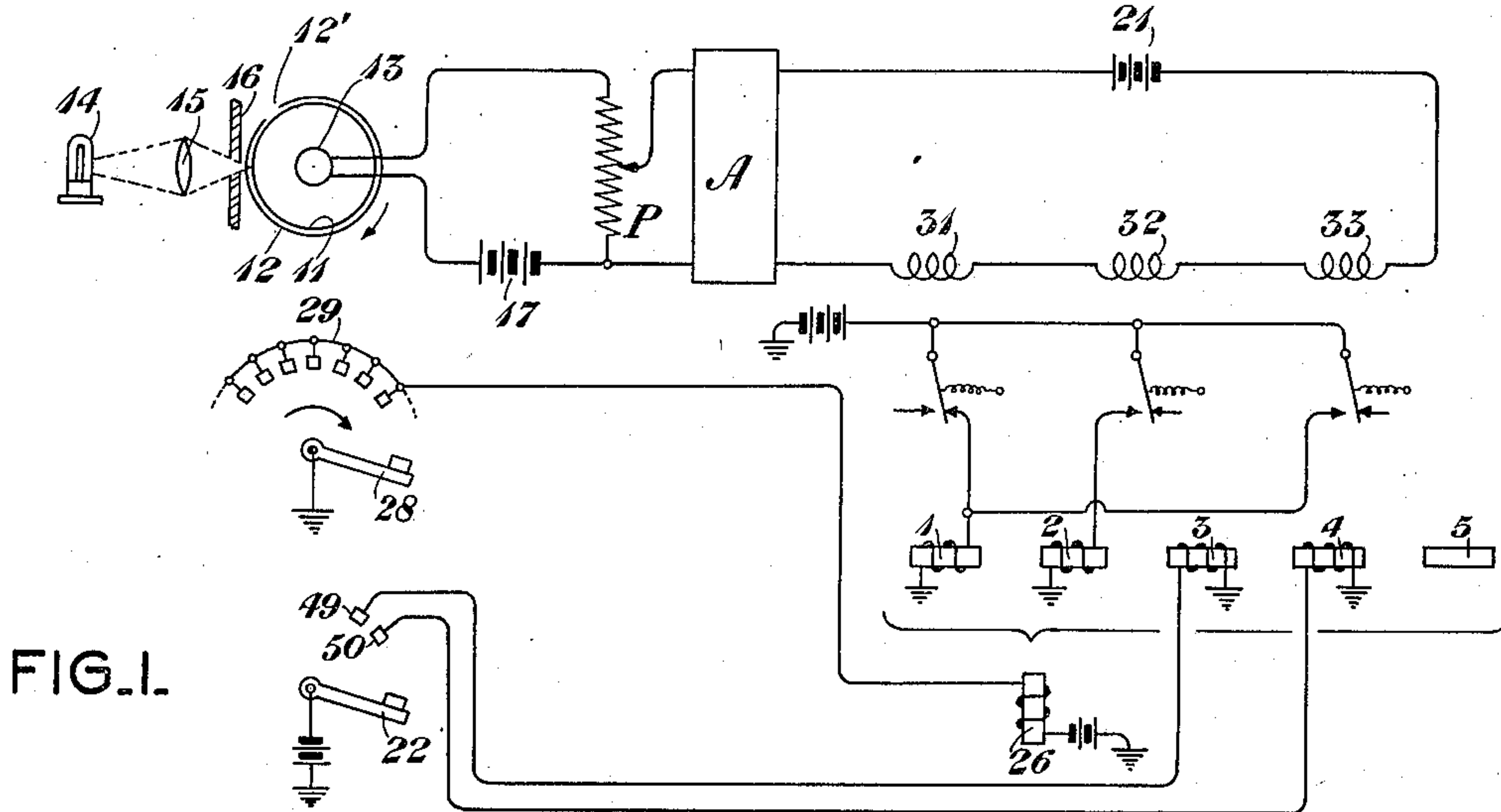
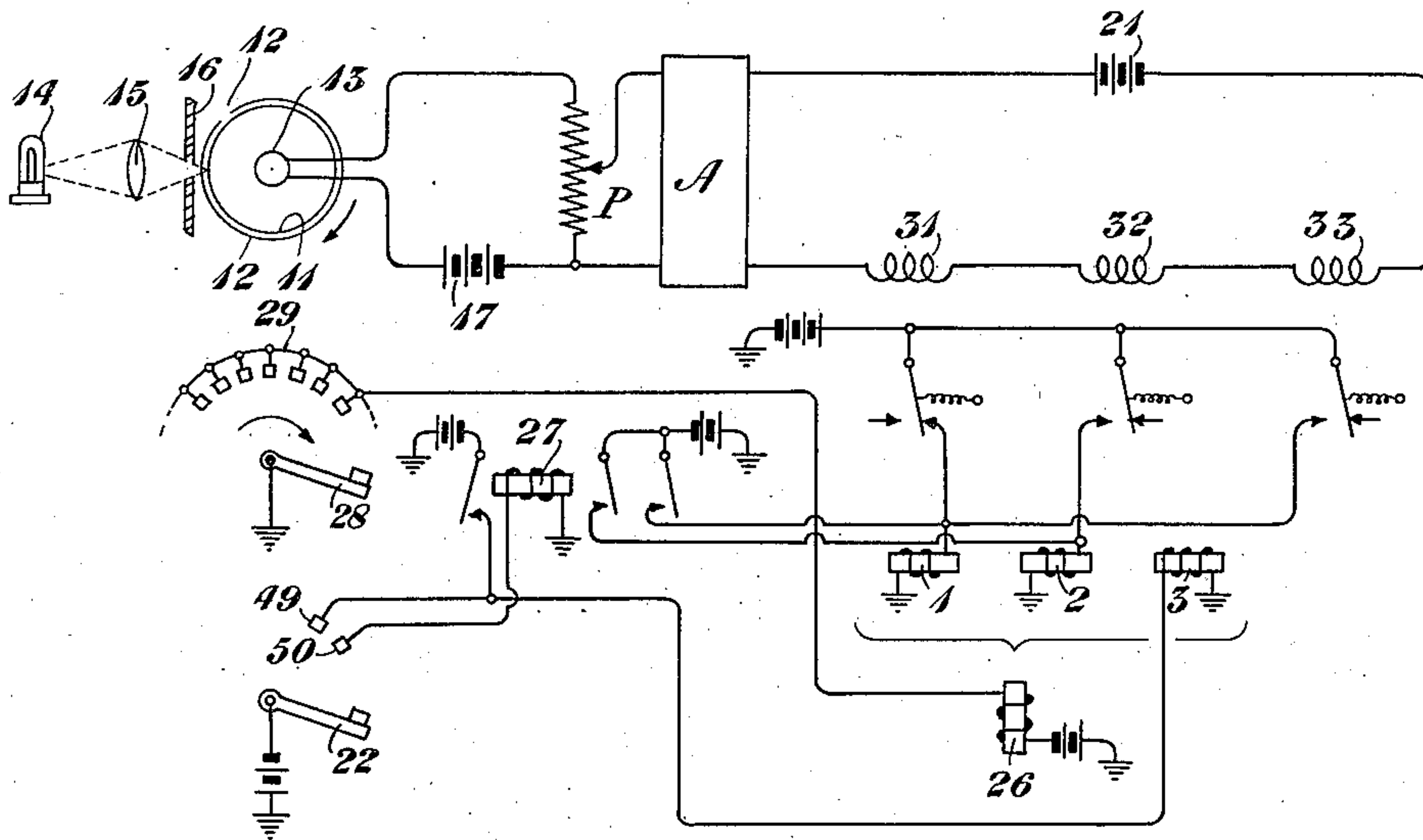


FIG. 2.



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2 Sheets-Sheet 2

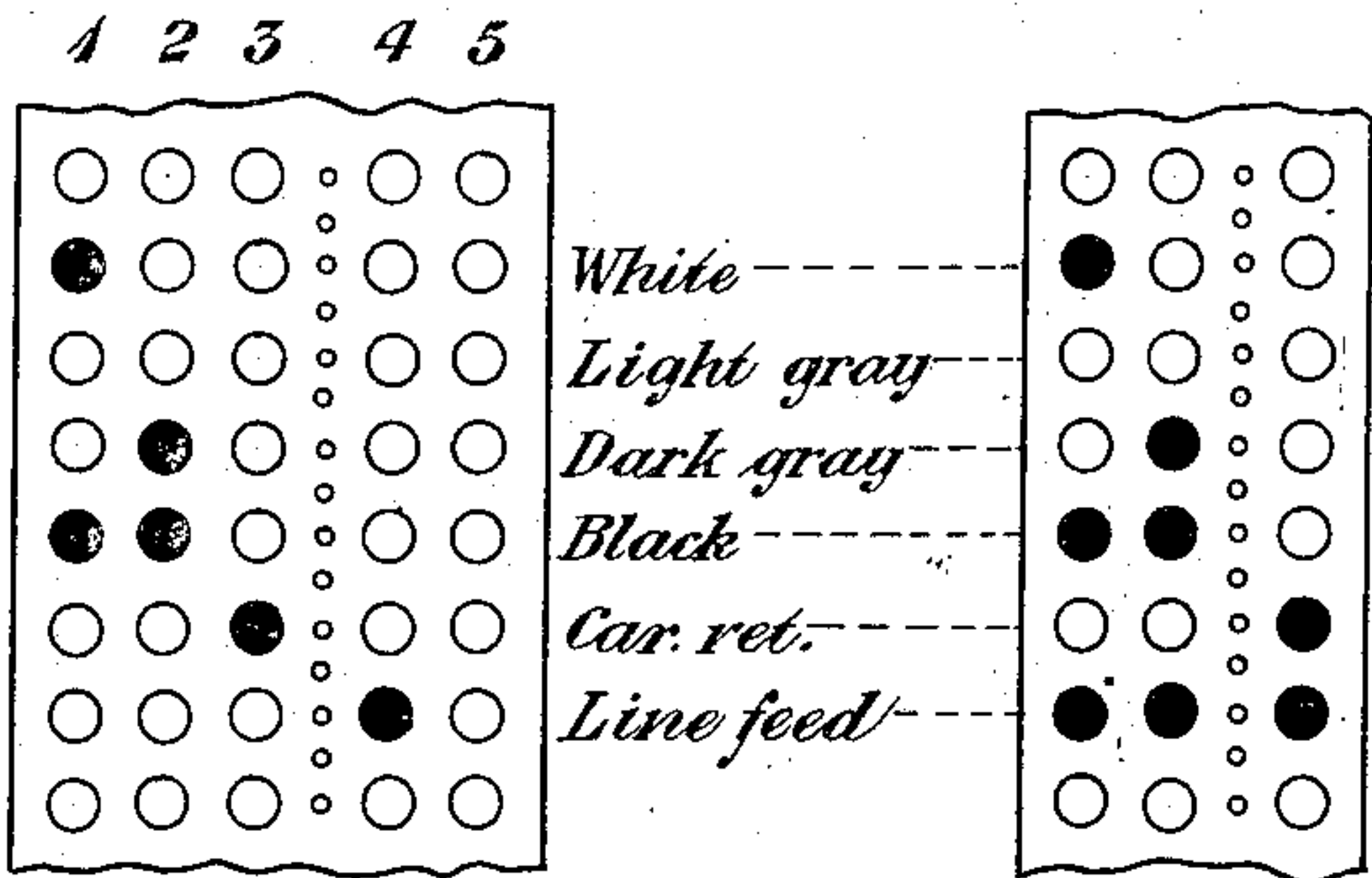


Fig. 3

Fig. 4

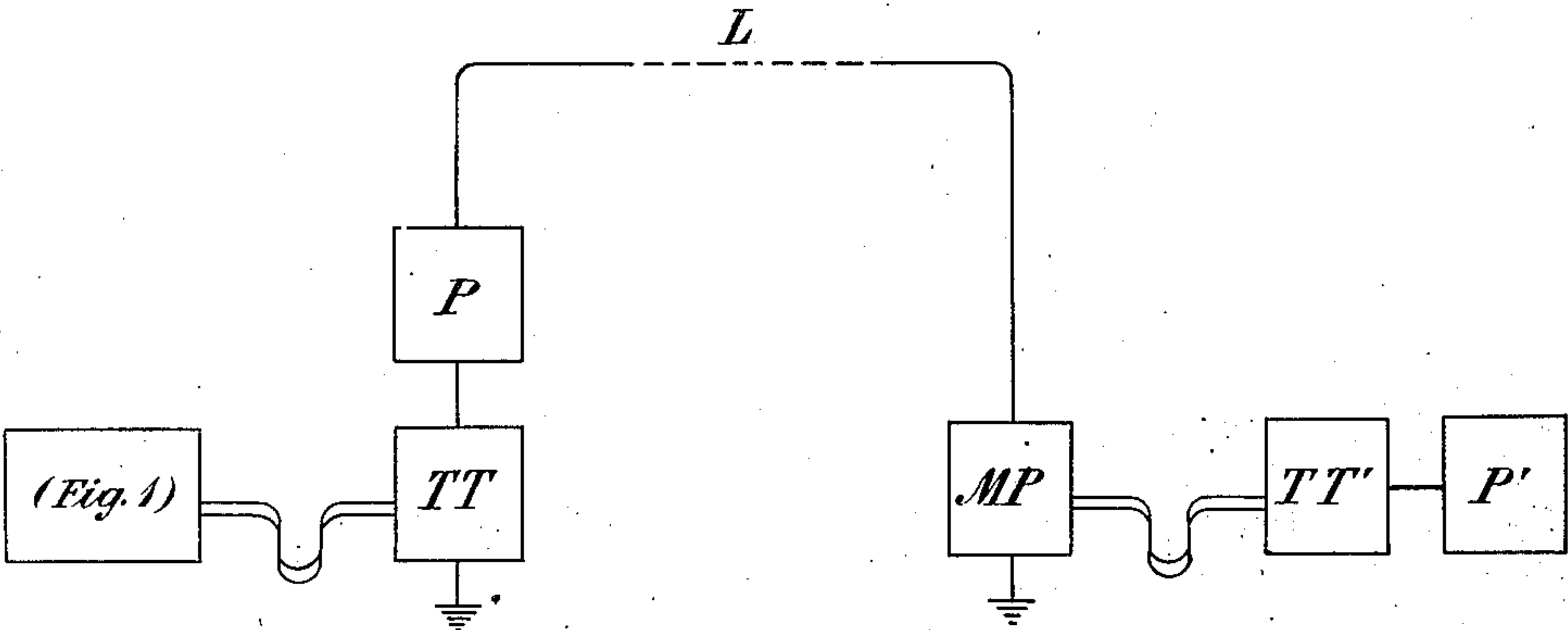


Fig. 5

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Patented Apr. 6, 1926.

UNITED STATES PATENT OFFICE.

EDWARD F. WATSON, OF LARCHMONT, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

ELECTRICAL TRANSMISSION OF PICTURES.

Application filed March 26, 1924. Serial No. 702,115.

To all whom it may concern:

Be it known that I, EDWARD F. WATSON, a citizen of the United States, residing at Larchmont, in the county of Westchester and State of New York, have invented certain Improvements in Electrical Transmission of Pictures, of which the following is a specification.

The principal object of my invention is to provide a new and improved system for transmitting pictures to a distance. Another object of my invention is to provide a practical system for punching code combinations in a tape to correspond to the light and shade of successive elements of a picture. Another object of my invention is to provide for punching such code combinations in a tape along with other code combinations to take care of the transition from one line of picture elements to the next, and to provide against any accidental production in the tape of a code combination of the latter kind among those of the other kind. These and various other objects of my invention will become apparent on consideration of a limited number of specific embodiments of the invention which I have chosen to illustrate in the accompanying drawings and which I will now proceed to describe in the following specification. It will be understood that the following disclosure relates to these examples of the practice of the invention and that the invention is defined in the appended claims.

Referring to the drawings, Figure 1 is a diagram of apparatus embodying my invention; Fig. 2 is a diagram of a modification; Figs. 3 and 4 are diagrams showing the code combinations punched in tapes for Figs. 1 and 2, respectively; and Fig. 5 is a symbolic diagram of the entire system.

Referring to Fig. 1, the glass drum 11 has wrapped around it a picture representation in the form of a semi-transparent film 12. The drum 11 is rotated and at the same time traversed slowly along its axis so that the spot on the film 12 lying under the opening in the screen 16 describes a helical course on the film 12. Light from the lamp 14 is focused by the lens 15 on the opening of the screen 16 and shines through the underlying spot of the film 12 on the photo-electric cell 13 which is in circuit with the battery 17 and the resistance of the potentiometer P. The input of the amplifier A takes an ad-

justed part of the voltage drop in the potentiometer P and the output of the amplifier A comprises the battery 21 and the windings of the three marginal relays 31, 32 and 33.

The arrangement is such that with a dark spot in the film under the opening in the screen 16 very little current will flow in the circuit of the photoelectric cell 13 and very little current will flow in the output circuit comprising the windings of the marginal relays 31, 32 and 33, but with a light spot in the film 14, considerable current will flow in the circuit of the cell 13 and considerable current will flow through the windings of the relays 31, 32 and 33.

The armatures and contacts of the relays 31, 32 and 33 control circuits for the selector magnets 1 and 2 in accordance with the table given below:

Shade in picture	Shade in film 12	Marginal relays energized	Selector magnets energized	Code punched in tape	Symbols printed in printer
White.....	Black.....	None.	1	o -	Blank.
Light gray.	Dark gray.	31	None.	- -	Small dot.
Dark gray.	Light gray.	31 and 32	2	- o	Medium dot.
Black.....	White.....	All.	1 and 2	o o	Large dot.

For each picture element of the film 12 a contact is made momentarily between the wiper 28 and one of the terminals 29, thus closing a circuit through the tape punching magnet 26, which punches the code combination set up at that time in the selector magnets 1 and 2. Accordingly, the shades of the successive elements of the picture will have their corresponding code combinations punched in the first and second positions of the tape as shown in Fig. 3. In Figs. 3 and 4 a solid black circle means a hole punched in the tape, and an unfilled circle merely indicates a position at which a hole might have been punched.

It will be seen that there are five selector magnets in Fig. 1 and five positions are shown on the tape of Fig. 3. This is in accordance with the use of ordinary text message page printing telegraph apparatus which has five selector magnets and five positions on the tape. Only the first and second positions are here used for the shade combinations. A hole in the third position is for carriage return and in the fourth position for line feed. The wiper 22 carried by

the drum 11 engages two contacts 49 and 50 just after the edge 12' of the film 12 passes the opening in the screen 16. The closure with the contact 49 energizes the selector magnet 3 and punches the code combination for "carriage return" as shown in Fig. 3; and the closure of the wiper 22 with the contact 50 energizes the selector magnet 4 and causes the code combination for "line feed" to be punched in the tape as shown in Fig. 3.

The tape prepared in the manner that has been described passes from the apparatus of Fig. 1 to the tape transmitter TT of Fig. 5. This and the other elements of apparatus to be mentioned in connection with Fig. 5 are well-known devices commonly used in regular text message printing telegraphy; hence they are shown only symbolically in Fig. 5 and will not be described in detail here. The tape transmitter TT sends code impulse currents over the line L as determined by the tape and these current impulses in the machine perforator MP at the receiving station cause it to perforate a tape like that at the sending station. This tape at the receiving station goes from the machine perforator MP to the tape transmitter TT' which determines the operation of the printer P' in accordance with the last column of the foregoing table. Thus a half-tone reproduction of the picture represented in the film 12 at the sending station will be formed on the printed sheet of the printer P' at the receiving station.

The code combinations for carriage return and line feed in the tape will effect those operations in the page printer the same as for printing text messages, so that a new line of shade symbols will be begun in the received picture corresponding to each passage of the edge of the film 12 across the opening in the screen 16.

It will be appreciated that the shade in the film 12 will sometimes be so close to a marginal value that it will be a matter of some uncertainty how many of the marginal relays 31, 32 and 33 will pick up, and sometimes the combinations set up by the selector magnets 1 and 2 will differ for only a very slight difference of shade in the picture. But any combination in the magnets 1 and 2 represents a shade for a single picture element, and even if it is wrong, the error affects only one picture element.

A combination to effect carriage return or line feed can only be set up by means of a selector magnet outside the pair, 1 and 2, that are employed for shade combinations. Hence any erroneous actuation of the selector magnets 1 and 2 cannot effect a carriage return or line feed, which would be a somewhat serious error in the reproduction of the picture.

As already explained, Fig. 1 shows the

adaptation of a 5-unit code for picture sending. Actually, the functions that have been described can be effected with a less number of units and suitable apparatus for this purpose is shown in Fig. 2 and the corresponding tape and its code are shown in Fig. 4. Here the two selector magnets 1 and 2 in all their possible combinations give the code combinations for the picture shades just as for Fig. 1. Also as for Fig. 1, energization of the selector magnet 3 gives the code combination for carriage return. But unlike Fig. 1, the code combination for line feed is obtained by energizing all three of the selector magnets 1, 2 and 3. It will be seen that the wiper 22 closes at 50 a circuit for the relay 27, which in turn closes circuits for all three selector magnets 1, 2 and 3.

In Fig. 2 as in Fig. 1, any possible code combination set up by selector magnets 1 and 2 will give a shade for a single picture element only and the functions of carriage return and line feed can be effected only by energizing the selector magnet outside the pair 1 and 2, that is, the selector magnet 3.

I claim:

1. Means to set up successive code combinations in a set of relays corresponding to the shade of successive elements of a picture, means to set up a code combination in relays at least one of which is not comprised in said set, this last mentioned combination corresponding to the completion of a cycle of elements in the picture, and means to record and effect the said combinations respectively.

2. In combination, a set of selector magnets and an additional selector magnet, means to set up code combinations in said set corresponding to the shade of successive elements of a picture, means to set up a code combination in certain of the selector magnets comprising said additional one, said last mentioned combination corresponding to the completion of a cycle of elements of the picture, and means to record and effect the combinations set up in the said selector magnets.

3. The combination in a picture transmission system of means for testing the shade of elemental areas of the picture, a device for reproducing said picture, a series of combination elements, means for employing certain of said elements to record the shades of said elemental areas, means for employing different ones of said elements for recording other information, means for operating said reproducing device in accordance with the shades recorded by said first mentioned elements, and means for controlling certain functions of said device in accordance with the information recorded by said second mentioned combination elements.

4. The combination in a picture transmission system of a sending station, a receiving

station, a transmission line interconnecting said stations, means at the sending station for testing the shade of the elemental areas of the picture, a printer at the receiving station for reproducing said picture, a series of combination magnets, means for employing certain of said magnets to effect in a tape perforations representing shades of said elemental areas, means for employing different ones of said magnets to effect in the tape perforations representing functions of said printer, means for transmitting over the line an electric current varying in accordance with the perforations in said tape, and means responsive to said current at the receiving station for operating said printer. 15

In testimony whereof, I have signed my name to this specification this 24th day of March, 1924.

EDWARD F. WATSON.

DISCLAIMER

1,579,263.—*Edward F. Watson*, Larchmont, N. Y. ELECTRICAL TRANSMISSION OF PICTURES. Patent dated April 6, 1926. Disclaimer filed September 12, 1934, by the assignee, *American Telephone and Telegraph Company*.

Hereby enters this disclaimer to the said claim of said Letters Patent which is in the following words to wit:

"1. Means to set up successive code combinations in a set of relays corresponding to the shade of successive elements of a picture, means to set up a code combination in relays at least one of which is not comprised in said set, this last mentioned combination corresponding to the completion of a cycle of elements in the picture, and means to record and effect the said combinations respectively."

[*Official Gazette* October 9, 1934.]