

July 31, 1945.

M. MORRISON

2,380,667

SIGNAL MODULATION MEANS.

Filed Aug. 4, 1943

3 Sheets-Sheet 1

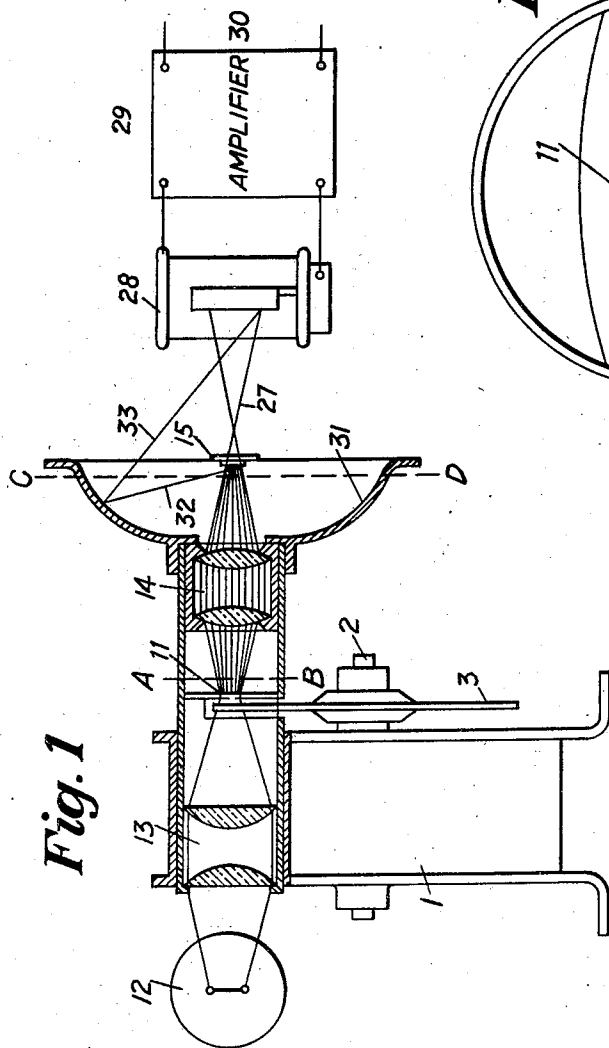


Fig. 1

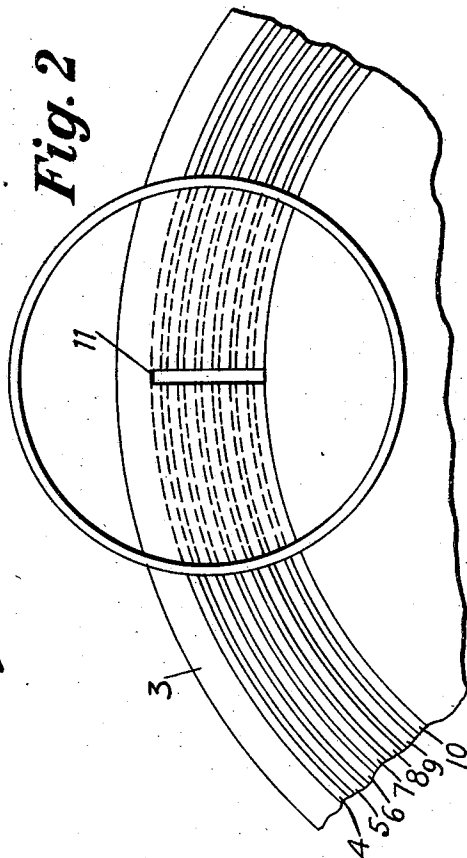


Fig. 2

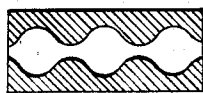


Fig. 4 Fig. 5

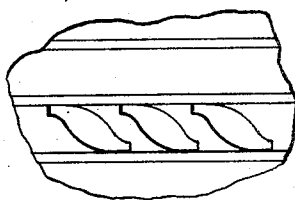


Fig. 3

INVENTOR
MONTFORD MORRISON
BY *Robert F. Beck*
ATTY.

July 31, 1945.

M. MORRISON

2,380,667

SIGNAL MODULATION MEANS

Filed Aug. 4, 1943

3 Sheets-Sheet 2

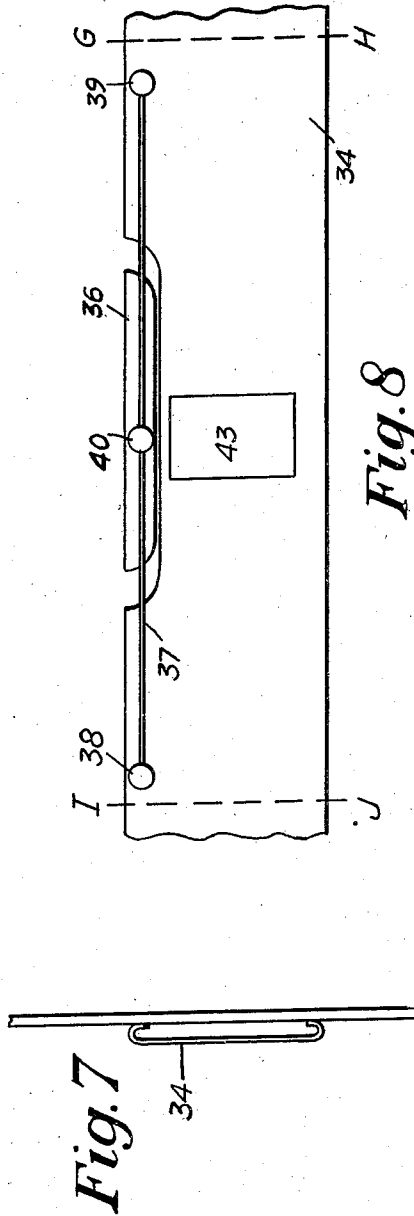
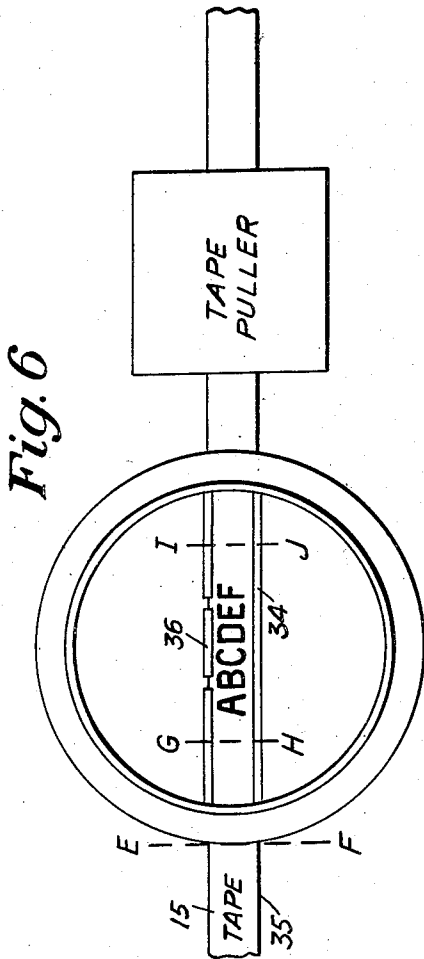


Fig. 8

INVENTOR
MONTFORD MORRISON
BY *Robert F. Beck*
ATTY.

July 31, 1945.

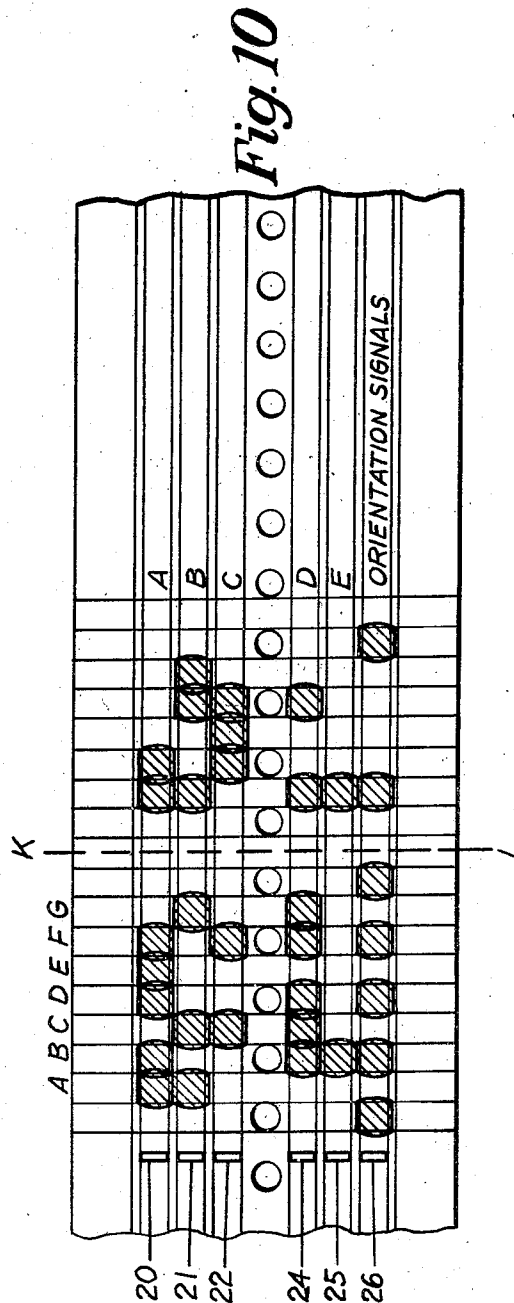
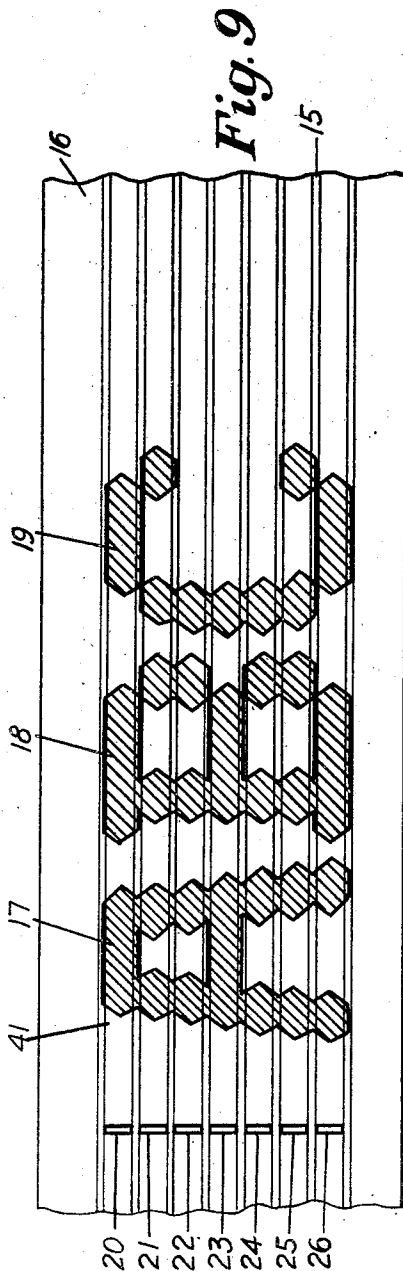
M. MORRISON

2,380,667

SIGNAL MODULATION MEANS

Filed Aug. 4, 1943

3 Sheets-Sheet 3



INVENTOR
MONTFORD MORRISON
BY *Robert F. Beck*
ATTY.

UNITED STATES PATENT OFFICE

2,380,667

SIGNAL MODULATION MEANS

Montford Morrison, Upper Montclair, N. J.

Application August 4, 1943, Serial No. 497,347

5 Claims. (Cl. 178-17)

This invention relates to systems of telegraphic transmission in which optical pick-up of the signals is used, and relates in particular to such systems employing carrier currents.

Among the objects of the invention are; to provide a simple and efficient means for generating a large number of accurately-fixed carrier frequencies; to provide a simple and effective means for modulating the light, used in the optical pick-up system, into sinusoidally varying beams before the beams are employed in the pick-up operation; to provide means for the simultaneous application of a plurality of scanning beams to a single signal copy to be transmitted; to provide means for use of both the transmitted and the reflected light from the signal copy, in the optical pick-up system; to provide means for the transmission of Baudot and other similar codes to receiving stations not equipped with synchronized apparatus; to provide means for transmission of Baudot and other codes under conditions which greatly reduce the errors of reception, due to interference; to provide a method of telegraph transmission directly from a plain letter text without requiring synchronism at the receiving station; and to provide a modification for letters, numerals and other signal characters used in telegraph transmission, which reduces the band-width of the transmission frequencies required and reduces the interchannel interference in the receiving circuit-filters.

Further and other objects will be obvious from the specifications when read in connection with the accompanying drawings, and the scope of the invention is set forth in the claims hereto.

In the drawings:

Fig. 1 is a partial section of one embodiment of the invention used as a transmitter; Fig. 2 is an enlargement of a section of Fig. 1, taken at the plane marked A—B in that figure and looking west, Figs. 3, 4, and 5 are enlargements of different modifications of the circular tracks shown in Fig. 2; Fig. 6 is a section of Fig. 1 taken at the plane C—D of that figure and looking east, and with a tape-puller added for clearness; Fig. 7 is an enlargement of a fragmentary view of Fig. 6 taken at the plane E—F and looking east, and which shows the channel form of guide for the transmission tape; Fig. 8 is a rear view of that part of the tape channel shown in Fig. 6, between the dotted lines G—H and I—J; Fig. 9 is an enlargement of the tape shown in Fig. 6; and Fig. 10 is a form of transmission tape used for Baudot and other similar codes.

In Fig. 1, 1 is a constant speed motor which

may be of any form whatever, and its function is to revolve the shaft 2 at a highly constant speed. This may be a small synchronous motor directly applied to a constant frequency alternating current system; it may be a synchronous motor driven alternating current derived by amplification from a tuning fork oscillator; or, preferably, it may be of the highly constant speed form driven directly from a direct current source, as described in my co-pending patent application filed July 28, 1943, Serial Number 496,389.

Onto shaft 2 is mounted a plate 3, which may be constructed in a variety of forms. The construction of plate 3 will be better understood from Fig. 2 which is a fragmentary enlargement thereof. Plate 3 may be constructed of a photographic film or, preferably, a photographic plate, in which latter case, there is a freedom from shrinkage. Plate 3 is provided with a series of light tracks, indicated by 4, 5, 6, 7, 8, 9 and 10. These light tracks, in the case of a photographic plate or film, are formed in the same way that light-sound tracks are formed on motion picture film, which results in either a variable width form, shown in Fig. 4, or a variable density form, shown in Fig. 5. These light tracks in reality form frequency tracks for the generation of carrier-current frequencies, in the same sense that the sound tracks on motion picture film serve for the generation of sound frequencies.

The light tracks produced on plate 3 are formed into continuous circular paths.

These light tracks, or carrier-current frequency tracks, revolve continuously behind a slit 11, Figs. 1 and 2, which slit is sufficiently narrow to provide substantially sinusoidal variation in the total light flux that is permitted to be transmitted by means of the combined action of the revolving carrier frequency track and the stationary slit, as will be appreciated by those skilled in the art to which this invention appertains. In some cases, instead of a photographic plate, I may use a thin metal relatively opaque plate provided with perforations, such as shown in Fig. 3, and which provides the same character of light flux modulation, but the pattern of the perforation is modified so as to permit more metal to be retained between perforations, thereby retaining considerable strength in the metal plate.

Returning to Fig. 1, 12 is a so-called exciter lamp, of a conventional variety, such as used in standard 35 mm. motion picture optical sound systems; 13 represents a conventional set of condensing lenses which focuses the light onto the revolving carrier frequency light tracks, in a man-

ner somewhat similar to the way in which the light is focused on sound track in a motion picture film; the difference being that in a motion picture film, the image of the slit employed is focused on the sound track, whereas in the present case the light is first focused on the carrier frequency light track, then passes through the slit in a multiplicity of beams varying in periodicity in light flux modulation representing the periods of the different frequencies of carrier-current used: This multiplicity of modulated light beams is illustrated by the lines diverging from slit 11, which pass through a projection lens system 14, which accurately focuses each beam onto a desired part of the tape 15, which is shown in its edgewise position in the figure.

An enlarged section of tape 15 is shown in Fig. 9, which comprises a translucent paper support 16, onto which specially-designed characters 17, 18 and 19 are printed. These characters are preferably printed on both sides of the translucent support 16. This double printing increases the opacity of the characters and thereby improves the quality of the optical pick-up.

The rectangles 20 to 26 represent the images of the combined slit and carrier frequency tracks, as projected upon the tape 15, Fig. 1.

These images 20 to 26, inclusive, vary in intensity sinusoidally with the period equal to that of the carrier frequency of a telegraph channel which these frequencies represent in the output circuit, as will be hereinafter more fully described. That is, each rectangle varies in light intensity in such a way, if the light represented by this image were fed directly to a photoelectric cell, unmodulated carrier current would be developed in the photocell circuit. As the tape 15 with the characters 17, 18 and 19, is pulled into the field of these light beams, modulation is produced by the absorption of light by the opaque characters, as will be understood by those skilled in the art.

Returning to Fig. 1, the seven light beams fall upon the tape 15 which is moving in the vertical direction to the plane of the paper, and as the white translucent paper passes through the light beams, some light is transmitted directly through the paper, as indicated by lines 27 and photocell 28, which forms a part of the amplifier circuit 29, having an output 30.

31 is a concave reflecting surface, and the tape 15 is so located with reference to the focus of the surface 31 that a considerable amount of the light reflected back along such lines as 32, and is also directed to the photocell 28 along lines such as 33.

By such a structure the photocell 28 receives light by direct transmission through the paper tape 15 and also, by reflection, from the surface of the paper, providing a high efficiency in the optical system.

As tape 15 moves across the paths of the various light beams, modulations in accordance with the character of relatively opaque configurations on the tape are produced in the currents of the photocell 28.

Referring to Fig. 6, which is Fig. 1 taken at the plane C—D and looking east, this shows the location of the characters facing the optical system.

Fig. 7 is a fragmentary view of Fig. 6 taken at the dotted line E—F and looking east, and shows the channel 34, Figs. 6 and 7, through which the tape is pulled, and in Fig. 6, a tape puller is indicated for clearness.

The characters ABCDEF, etc., are accurately located on tape 15 with reference to the lower side 35 of the tape 15. The channel 34, Fig. 6, is

provided with a gentle spring actuated member 36, Figs. 6 and 8.

Referring to Fig. 8, this is a fragmentary view of the part of the channel 34 which lies between the dotted lines G—H and I—J, and the member 36, Figs. 6 and 8, is a loose channelled part held by a fine spring 37, which is fixed to pins 38 and 39 on a channel part 34 and to a loose member 36 by pin 40. 43 is an opening in the channel 34 to permit the transmission of light at this location.

The function of this member 36 is to keep the tape 15 pressed against the lower side of the channel 34, keeping the characters accurately located with reference to the modulated light beams.

Referring to Fig. 9, I prefer to modify the configurations of the letters and characters in such a way as to reduce the rate-of-change in the light modulation produced by the character. As the character moves into the light image, instead of striking a parallel line, I prefer to use a graduated area such as shown in 41 which reduces the rate-of-change, as will be understood by those mathematically equipped in the art of optical light pick-ups.

Fig. 10 shows the embodiment of my invention as characterized by a tape operated in the place of the tape shown in Fig. 9, used for the purpose of transmitting Baudot code signals and signals by other similar codes. In this case, instead of transmitting a complete character in a single channel, I may employ five simultaneous channels represented by the light images 20, 21, 22, 24 and 25 providing the five units required for the code. The light image 26 provides an orientation frequency which goes out with the code signals and may be recorded simultaneously at receiving stations, and later the message decoded without the use of synchronism during reception.

In Fig. 10, to the left of the dotted line K—L, is shown such a transmission copy for the letters A—G, inclusive.

Of course, Baudot code may also be transmitted by such a system, using only one channel for a complete character, such as shown at the right of the line K—L, and at the same time employing orientation signals, such as 42, at the beginning of each character. The use of these orientation signals also obviates the necessity of using a synchronism at the receiver at the time of reception, and the message may be decoded later by the use of these orientation signals. These Baudot signal dots may be supplied with boundary lines functioning as modulation modifier, as will be understood by those skilled in the art, and as illustrated in the figure.

The use of five simultaneous channels for the transmission of Baudot code, reduces the interference effect upon the signals, since all of the interference is applied to all the signals of one character at the same time. Where only one unit is sent at a time, the interference effect is different for different units of a single character, which is conducive to errors.

The terms "print" and "paper" are used in this specification in a perfectly general sense, and are not to be construed narrowly.

What I claim is:

1. The method of optical scanning of printed signal characters which comprises creating a rectangular field of continuous sinusoidally varying light-flux, creating a series of printed signal characters having configurations adapted to reduce

the modulation rate-of-change at the boundaries of said configurations under scanning operation by said field, and causing optical scanning by moving the said series of characters in a direction orthogonal to one side of said field.

2. The method of optical scanning of printed signal characters which comprises creating a rectangular field of continuous sinusoidally varying light-flux, creating a series of printed signal characters having configurations presenting boundary lines to said field under scanning to reduce the modulation rate-of-change at the boundaries thereof and causing said field to optically scan said characters.

3. The method of reducing threshold rate-of-change in signal modulation systems employing optical pick-up, comprising creating a scanning light-flux field adapted to movement in a direction relatively identical with the precessional direction of signal characters on a printed copy, said field having an outline normally conducive to the production of high threshold rate-of-change under optical scanning of signal characters formed by lines orthogonal to said direction,

creating signal-character configurations on said copy adapted to reduce said rate-of-change, and causing said movement.

5 4. A tape for use in facsimile transmission; said tape having light transmitting characteristics and a plane surface having light reflecting characteristics; areas of said tape having light transmitting and light reflecting characteristics different from those of the main body of the tape; the boundaries of said areas along lines transverse of said tape being substantially serrate in form.

10 5. A tape for use in facsimile transmission; said tape having light transmitting characteristics and a plane surface having light reflecting characteristics; areas of said tape having light transmitting and light reflecting characteristics different from those of the main body of the tape; said areas having a plurality of extensions along the boundaries thereof transverse of said tape; said extensions extending longitudinally of said tape and diminishing in transverse width as they extend away from said areas.

MONTFORD MORRISON.