

Jan. 5, 1943.

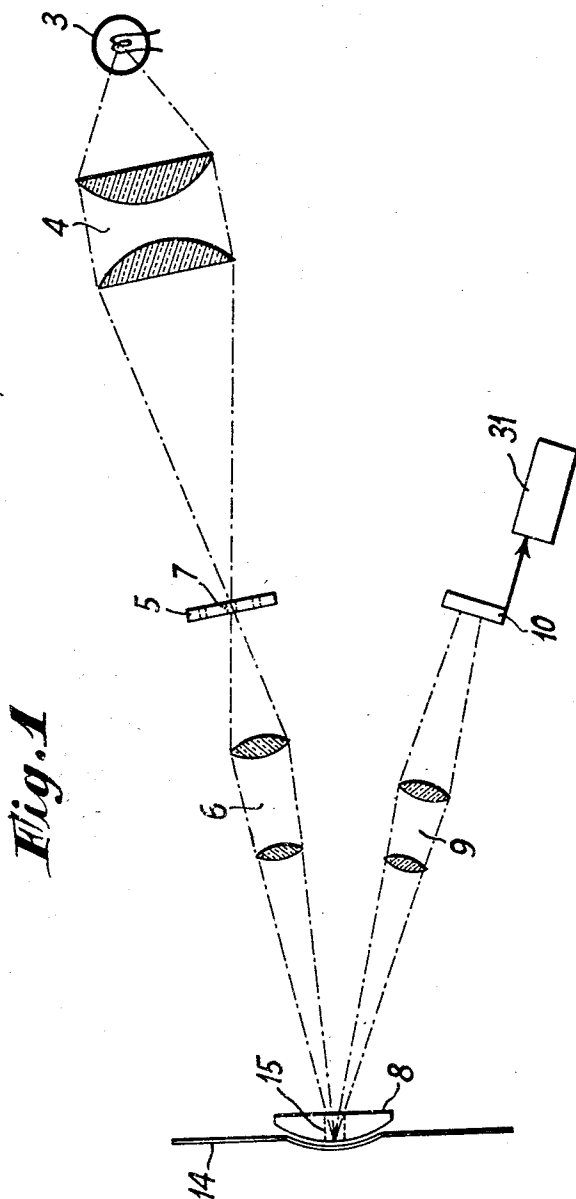
G. APPERLEY

2,307,099

HIGH SPEED TELEGRAPH SYSTEM

Filed Sept. 27, 1939

2 Sheets-Sheet 1



INVENTOR
GEORGE APPERLEY
BY *H. S. Snow*
ATTORNEY

Jan. 5, 1943.

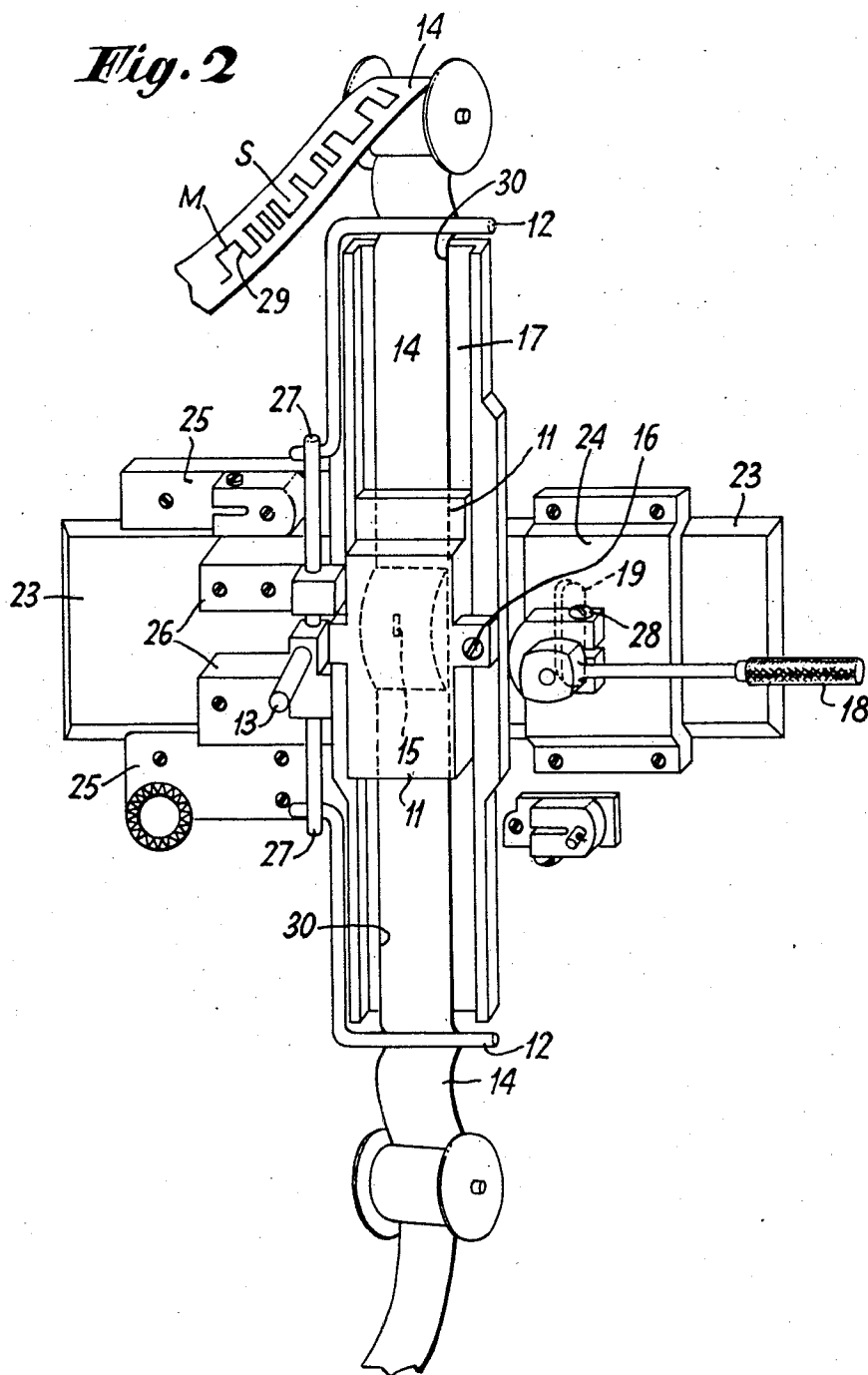
G. APPERLEY

2,307,099

HIGH SPEED TELEGRAPH SYSTEM

Filed Sept. 27, 1939

2 Sheets-Sheet 2



INVENTOR
GEORGE APPERLEY
BY *H.S. Simon*
ATTORNEY

UNITED STATES PATENT OFFICE

2,307,099

HIGH SPEED TELEGRAPH SYSTEM

George Apperley, Melbourne, Victoria, Australia,
 assignor, by mesne assignments, to Radio Cor-
 poration of America, New York, N. Y.

Application September 27, 1939, Serial No. 296,758
 In Australia September 27, 1938

4 Claims. (Cl. 178-17)

This invention relates to high speed telegraph systems and more particularly to means for materially increasing the effective speed of their operation.

In one known automatic telegraph system, received signals are caused to actuate a re-perforating machine which records the signals in the form of perforations in a moving tape which is then caused to actuate a printing machine to convert the signals to Roman characters, or alternatively, to actuate a second transmitter where it is desired to relay the message over a second channel.

In such known system the working speed is limited to that at which any one function in the sequence of operations can be performed. In practice the maximum speed of operation is governed by that of the re-perforating and/or printing machine.

If the main signalling channel comprises a radio link, speeds greatly in excess of the maximum speed of such printing systems are possible over that portion of the system. It is in fact common practice to transmit and receive signals on radio circuits at speeds up to 300 words per minute, and such signals are usually recorded in the form of ink markings representing Morse characters or otherwise, on a paper tape, by means of an undulator.

The speed of signalling over a radio channel is usually governed by atmospheric conditions, prevailing at any given time, and as such conditions may vary considerably over a given period, it is evident that if delays are to be avoided, advantage should be taken of those periods when conditions are favourable to operate the circuit at maximum speed. This means that during periods of good reception when the signalling speed exceeds the maximum at which automatic re-perforating, printing or re-transmission is possible, it becomes expedient to transcribe manually the message from the undulator tape; or, if the message is to be re-transmitted over a second channel, to prepare manually a perforated tape.

It is an object of the present invention to provide means for overcoming the above difficulties and limitations, and to enable a telegraph system to operate automatically at the speed of the fastest link in the signalling channel.

More specifically it is an object of this invention to provide means for converting graphical representations of Morse or other code characters to corresponding electrical impulses and

to cause said impulses to control a transmitter or automatic printing apparatus.

The invention comprises means for receiving and recording telegraph signals in the form of ink markings or otherwise on a paper tape, means including a light source and photoelectric cell for converting the said markings to corresponding electric impulses, and means for utilising the said impulses to actuate or control one or more automatic printing instruments or further transmitters.

In cases where it is desired to convert automatically the received signals to Roman characters at the receiving station, the signals are received and recorded as ordinarily on an undulator tape at the maximum speed of the signalling channel and undulator. In accordance with this invention the undulator tape is then divided into suitable lengths and these are fed separately to individual scanning devices whereby the recording on the tape is converted at a suitable speed to electrical impulses which are replicas of the received signal impulses, and used to actuate a plurality of automatic printers.

In cases where it is desired to re-transmit or relay the message over a further circuit the converted signal impulses may be caused to actuate re-transmitting apparatus.

In order to convert the recorded signals on the undulator tape to electrical impulses the said tape is caused to pass in close proximity to a suitable source of illumination, the light from which is directed onto the markings on the tape and is then reflected to control a photo-electric cell, the output from the latter being amplified to a strength suitable to operate a reperforator, automatic printer or transmitter.

For a more complete understanding of the invention and the manner in which it is to be carried into effect, attention is now directed to the accompanying drawings, in which:

Fig. 1 is a diagrammatic representation of a light system arranged in accordance with a preferred application of this invention, and

Fig. 2 is an isometric view serving to show the construction and operation of one type of scanning head suitable for use in conjunction with the light system of Fig. 1.

Referring to Fig. 1, light rays from a light source 3 are concentrated by means of a condenser 4 onto a diaphragm 5 having an aperture 7. The image of the aperture 7 is focussed by means of a lens or optical system 6 onto a tape 14 bearing the signal markings 29 (Fig. 2) which are to be converted into electrical impulses

and which, as they pass the aperture 15, are exposed to the light rays from the source 3. The signal markings 29 on the tape 14 are such as will cause a variation in the intensity of the light reflected therefrom. The light rays which are reflected from the signal tape 14 are focussed by means of a further lens or optical system 9 onto a light sensitive cell 10. The current variations in the output of the light sensitive cell 10, brought about by variations in the intensity of the light reflected from the signal tape 14, may be amplified and utilised in any desired manner. Thus, for example, a utilization device 31 may comprise a re-perforating or printing machine (as hereinbefore mentioned) and may be rendered operable under control of electrical impulses from the photo-electric cell 10, with which it is in circuit.

In the present example the use of an aperture 7 between the light source 3 and the aperture 15 is described. Whilst this is the preferred arrangement it is to be clearly understood that the aperture 7 may be dispensed with and light rays from the light source 3 focussed onto the aperture 15 direct if desired.

In practice, it is preferred that the light source 3, condenser 4, aperture 7 and lens 6 of the light source (also the light sensitive cell 10 and its associated lens 9) should be adjustable with respect to the tape 14 in the aperture 15.

The aperture 15 is itself, in the present example, arranged for independent adjustment, such that its position with respect to the tape 14 may be varied in a direction coincident with the movement of the tape 14 and also in a direction at right angles to the movement and in the plane of the tape 14. This independent adjustment of the aperture 15 compensates for any mis-alignment of the components employed for directing the light rays onto the aperture 15. Further, it enables the aperture 15 to be adjusted to that section of the incident light beam which contains the greatest concentration of light rays, and so ensures that optimum amount of light is reflected to the light sensitive cell 10.

The components forming the light system of Fig. 1 may be mounted in any convenient and well-known manner such as will enable them to fulfil their individual functions in directing a concentrated beam of light onto the aperture 15, from the light source 3, and producing the desired response by the light sensitive cell 10 to light rays which are reflected from the signal tape 14 in the aperture 15.

The light system of Fig. 1 is preferably enclosed so as to protect the light-sensitive cell 10 from the influence of extraneous light. Those parts of the system which are exposed to the light rays are preferably blackened or otherwise treated to prevent undesirable reflections on the light sensitive cell 10.

The aperture 15 and associated lighting system, is located behind the scanning head of Fig. 2 in such a manner that the tape 14, carrying the signal markings 29 which are to be converted, passes over the aperture 15, and in the course of its progress the signal markings 29 on the tape 14 produce a corresponding variation in the intensity of the light rays reflected from the aperture 15 onto the light sensitive cell 10.

Referring now to Fig. 2, the tape 14, carrying the signal markings 29 which are to be converted, is passed over the aperture 15 through a tape carrier 17 in a manner such that the said signal

markings are on that side of the tape 14 which is adjacent to the aperture 15.

The tape 14 runs in a groove 30 which is provided in the tape carrier 17 in order to prevent undesirable lateral movement of the tape 14. The said tape is tensioned in the running groove of the carrier 17 by means of tensioning devices 12 and the gate 11. This gate and the tensioning device 12 are preferably ganged for simultaneous operation by the lever 13.

The gate 11 and the associated tensioning means 12 in the present example are mounted in fixed relationship to one another on a member 27 (which is supported for angular rotation in a direction at right angles to the movement of the tape 14) by means of supports 26 which are attached to or form an integral part of a sliding base member 23. The mounting of the gate 11 and tensioning springs 12 is such that in the effective position of the lever 13, as shown in Fig. 2, the inner surface of the gate 11 as well as the tensioning devices 12 contact with the surface of the tape 14. The pressure of the gate 11 and the tensioning devices 12 on the tape 14 is adjustable by means of the adjusting screw 16, which passes through the gate 11 and projecting beyond the inner surface thereof presses against the carrier plate 17. The pressure of the gate 11 and tensioning means 12 on the tape 14 should be such as will substantially eliminate undesirable movement of the tape 14 in front of the aperture 15 without placing too great a load on the motive means propelling the tape through the carrier 17, or imparting such tension as would retard the free movement of the tape and result in breakage thereof.

The carrier 17, as well as the gate supports 26, is fixedly mounted on the sliding base 23, which is supported in guides 24, 25 for movement in a direction at right angles to the movement of the tape 14.

Depending upon the nature of the graphical signal representations on the tape 14 it may be necessary to adjust the position of the latter with respect to the scanning aperture 15 to permit scanning of any portion of the tape between its two side edges. For example, the signal markings indicated on the tape 14 are those produced by an undulator. The side of the marking indicated by M is the marker signal, whilst that shown as S is the space signal. If it is desired to scan either one of these sides for the purpose of producing corresponding electrical impulses, the tape 14 must be moved to one side or the other to bring the relative portion thereof over the aperture 15. This involves the bodily movement in a lateral direction of the tape carrier 17 and its associated apparatus. This adjustment is provided for in the present example by the lever 13. This lever is pivotally mounted on the fixed member 24 for angular rotation in a horizontal plane and carries on its under side a cam (not shown), which projects into an elongated slot 18 in the slide member 23 supporting the carrier 17 and gate 11.

When the lever 13 is in the position shown in Fig. 1, the central portion of the tape 14 is located over the aperture 15. Rotational movement of the lever 13 in a clock-wise or anti-clock-wise direction will shift the carrier 17 laterally with respect to the aperture 15, and to one side or the other depending upon the direction of movement of 13. The lever 13 may be locked in any of its effective positions by means of the

screw 28, which tightens the bearing wherein the lever 18 pivots.

The aperture 15 is a longitudinal slit in a rectangular receptacle 8 (Fig. 1) which is dimensioned to fit into an aperture in the member 23 and a slot in the carrier 17 in a manner such as will bring the aperture 15 in contact with the tape 14. In the present example the external surface of the receptacle 8, which contacts with the signal tape 14 and in which also the aperture 15 is located, is convex and protrudes through apertures in the slide member 23 and the carrier 17 into a concavity in the gate 11.

To facilitate lateral movement of the carrier 17, the aperture in the slide 23 and carrier 17 is extended in a lateral direction to an extent necessary to provide for the full lateral movement of the carrier 17 as previously described.

The operation of the arrangement is as follows:

Signal markings 29 representative of the intelligence to be conveyed are imprinted on a tape 14, either manually or electrically. The marking 29 may be straight Morse characters or undulating as for example those produced by signal responsive instruments normally employed in high speed telegraph systems and commonly known as undulators.

The lever 13 is operated to lift the gate 11 and associated tape tensioning devices 12.

The tape 14 is passed through the groove 30 in the carrier plate 17 in a manner such that the signal markings 29 on the tape 14 are on that side which is adjacent to the aperture 15. The end of the tape 14 is attached to some form of motive means (not shown) generally employed for pulling the tape through the carrier. The lever 13 is operated to line up the aperture 15 with that portion of the signal marking 29 which is to be scanned. The gate 11 and tensioning means 12 are now closed on the tape 14 and are held in position by a spring catch or other suitable means (not shown). The tension of the gate 11 is adjusted by means of the screw 16 to suit the thickness of the tape employed.

As previously stated, the light rays from the light source 3 are focussed onto the aperture 15 and the rays reflected from any matter appearing therein are focussed onto a light sensitive cell 10, which is connected in the input of a suitable amplifier 31.

As the signal markings 29 on the tape 14 pass over the aperture 15, the intensity of light reflected therefrom varies in dependence upon the variations of the signal markings on the tape. This variation in intensity of the reflected rays impinging on the light sensitive cell 10 produces corresponding current variations in its output circuit, which are amplified in the associated amplifier 31 and utilised to actuate or control a printing instrument, re-perforator or further transmitter.

Where signal marked tape, which is produced by a signal operated undulator, is employed, that portion M of the markings 29 on the undulator tape 14, which lies closely adjacent to a line drawn through the upper horizontal section of the markings, represents a graphical replica of the signals received, whilst that portion S of the markings which lies adjacent to a line drawn through the lower horizontal section of the marking represents the spacing periods between the signal characters of the received signals.

In carrying out the invention the aperture 15 may be arranged to scan either the upper or lower horizontal sections.

It is further possible by the use of two apertures each having its own light system as described in Fig. 1, to scan simultaneously both the upper and lower horizontal portions of the tapes and to utilise the converted electrical impulses in the output of each unit to carry out individual functions or to act as a check one against the other.

As an example of the operation of a system embodying the present improvements, it will be assumed that the speed of the signalling channel is 300 words per minute, and that of the printer or re-transmitter 100 words per minute. In these circumstances three scanning units would be employed. The tape from the undulator produced at 300 words per minute would be divided into suitable lengths and individual lengths fed to individual scanning devices so that the speed of the whole system would then be 300 words per minute and the system would be completely automatic in operation and there would be no necessity to transcribe manually.

I claim:

1. A scanning device for tape which has signal markings thereon, comprising a tape guide member, an apertured gate, means for moving the tape longitudinally past the gate aperture, means for positioning the gate in either of two alternative fixed lateral positions with respect to the guide member, means for directing light through the aperture of the gate thereby to scan a portion of the tape to one side only of its longitudinal center line, and photo-electric sensing means responsive to variations in the intensity of light reflected by said tape and outwardly through said aperture.

2. A device according to claim 1 in combination with a tape bearing a graphic representation of marking and spacing signals, said gate-moving means being adjustable to scan either the marking or the spacing elements of said signals.

3. A telegraph tape scanner having a tape guide member and an apertured gate, an optical system including a light source arranged to illuminate the tape area which is framed by the aperture in said gate, a photo-electric device disposed in the path of light rays reflected by the tape through said aperture, said tape being marked with telegraph signals, and means for laterally shifting the position of said gate into one or the other of two fixed positions, thereby to sense a predetermined longitudinal track on said tape.

4. A telegraph tape scanner having an apertured gate, a light source to which the gate aperture is exposed, a photo-electric sensing device distinctively responsive to reflections of light through the aperture of said gate, a tape bearing marking and spacing indicia which are disposed thereon in two separate longitudinal tracks, said indicia being selectively exposable to light from said source through said aperture in dependence upon the lateral position of said tape with respect to said aperture, and means for moving said tape longitudinally past said aperture.

GEORGE APPERLEY.