

Aug. 30, 1949.

M. C. POYLO

2,480,160

SIGNALING SYSTEM

Filed June 27, 1945

2 Sheets-Sheet 1

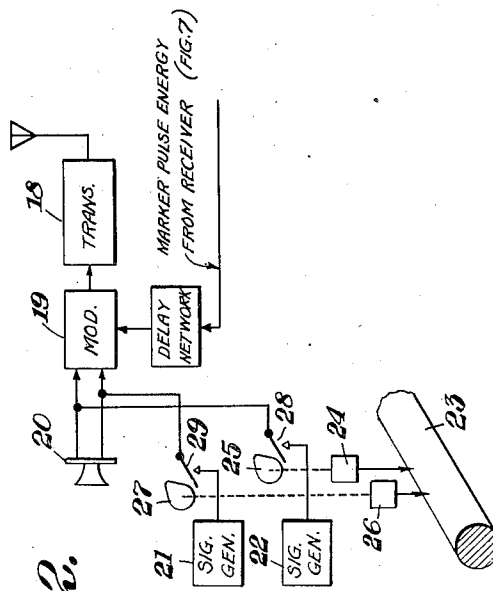
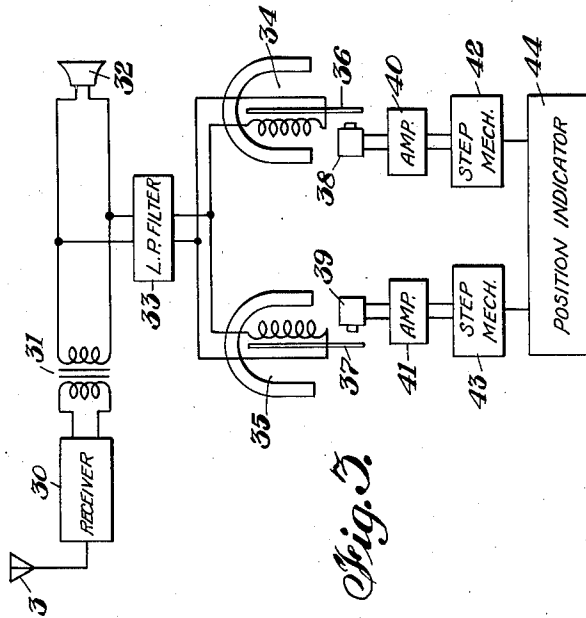
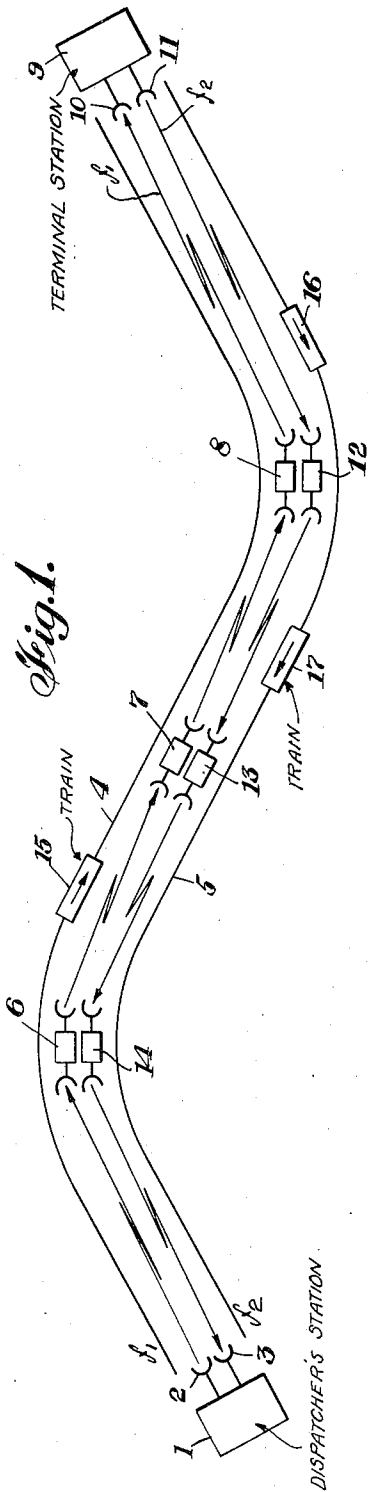


Fig. 2.

Fig. 3.

INVENTOR.  
MICHEL C. POYLO

BY *Percy P. Lantry*  
ATTORNEY

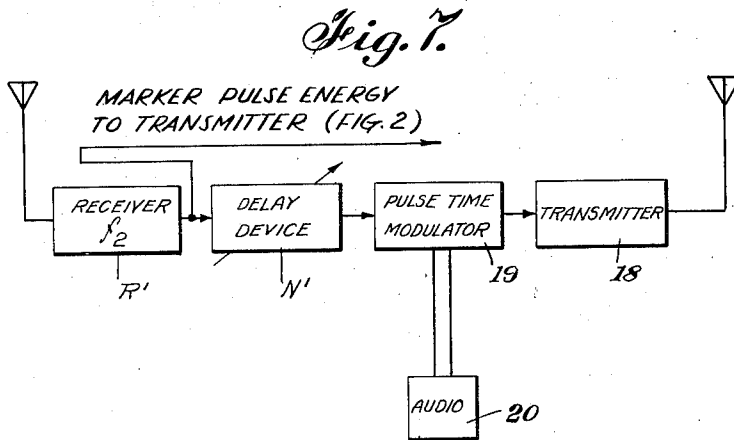
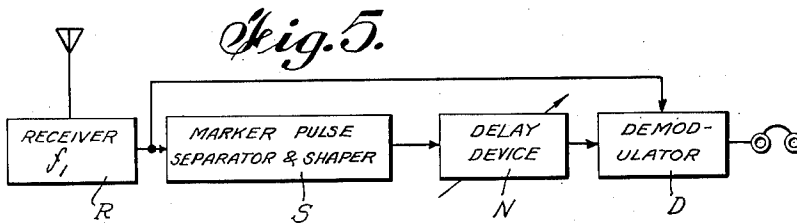
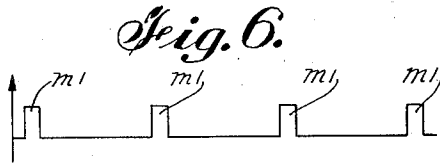
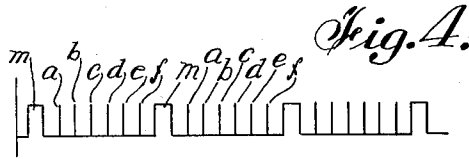
Aug. 30, 1949.

M. C. POYLO  
SIGNALING SYSTEM

2,480,160

Filed June 27, 1945

2 Sheets-Sheet 2



INVENTOR.  
MICHEL C. POYLO  
BY  
*Percy P. Lantz*  
ATTORNEY

# UNITED STATES PATENT OFFICE

2,480,160

## SIGNALING SYSTEM

Michel C. Poylo, New York, N. Y., assignor to Federal Telephone and Radio Corporation, New York, N. Y., a corporation of Delaware

Application June 27, 1945, Serial No. 601,799

4 Claims. (Cl. 177-353)

1

This invention relates to new and useful improvements in train dispatching systems, and more particularly to a system adapted for combination with a railroad communication system such, for example, as disclosed in the copending application of E. M. Deloraine (37), Serial No. 531,851, filed April 20, 1944.

It is the object of the present invention to devise an arrangement for providing at all times at a dispatcher's station and/or on board any train a record of the position and/or speed of one or more trains.

Another object of the invention is to provide means on a moving vehicle, such as a railroad train, to provide a source of signals whereby substantially the instantaneous location of the vehicle along a given path may be readily determined or indicated.

The nature of the invention will more clearly appear from the following description of an embodiment thereof, the specific means here disclosed being subject to many variations as will be obvious to those skilled in the art.

In the drawings, Fig. 1 illustrates the general scheme of a railroad communication system with which the dispatcher's signaling station is combined;

Fig. 2 illustrates as much of a train radio transmitter as is necessary for an understanding of the invention;

Fig. 3 diagrammatically illustrates a portion of the receiver at the dispatcher's station arranged to receive signals from the train transmitters to record the position of the train;

Fig. 4 is a graph of the pulses transmitted from the dispatcher's station;

Fig. 5 is a block diagram of the receiver provided on each train to receive signals from the dispatcher's station;

Fig. 6 is a curve of the synchronizing or marker pulses sent out from the synchronizing station; and

Fig. 7 is a block diagram of the receiver and transmitter on each train adapted to receive from the synchronizing station and send to the dispatcher's station.

In Fig. 1 is shown a dispatcher's station 1 from which radio signals may be sent out on carrier frequency  $f_1$  via directional antenna 2 and at which radio signals may be received on carrier frequency  $f_2$  via directional antenna 3. Preferably the system utilizes an ultra-high frequency or microwave carrier on which intelligence can be transmitted in a plurality of channels by means of time-modulated pulses. As is well known and

2

shown, for example, in British Patent No. 587,941, filed May 26, 1944 and United States Patent No. 2,445,775, the pulses belonging to each channel of intelligence follow one another, and a group or series of such pulses representing the different successive channels is separated from the next series by a synchronizing or marker pulse having a distinguishing characteristic, e. g., greater width than the width of the intelligence pulses.

Fig. 4 shows a graph of the emission from the dispatcher's transmitting station 1. In this graph,  $m$  designates the marker pulses and  $a, b, c, d, e, f$ , the relatively narrow channel pulses. The positions of the channel pulses  $a-f$  will be varied with respect to the marker pulse in accordance with the modulation impressed thereon.

The modulated carrier can be relayed along the railroad tracks 4, 5 which it is desired to supervise by means of relay stations 6, 7 and 8.

At the other end of the system is a synchronizing station 9 where synchronizing signals may be sent through directional antenna 11 superimposed on carrier frequency  $f_2$ . These serve to segregate the series of channel pulses which may be sent on  $f_2$  from station 9 and any one of the trains 15, 16 and 17 and relayed by means of relay stations 12, 13 and 14 to the dispatcher's station 1.

The means on each train for receiving and demodulating the signals sent to it from the dispatcher's station 1 may be of any well known design. As indicated in Fig. 5 they may consist of a receiver R adapted to receive signals on frequency  $f_1$ . This receiver controls a pulse width separator and shaper S of known character for example, of the type disclosed in United States Patent Number 2,440,278 which is adapted to be operated by the marker pulses  $m$  only. A delay network N of well known type connected with the separator-shaper S introduces a sufficient time delay between the marker pulse timing and a particular channel timing like channel C, for example, so that the demodulator D, of the type shown in British Patent No. 587,941 or in United States Patent Number 2,199,634 will be conditioned only for action on the desired channel signals, e. g.,  $c$  which is meant for the particular train on which the receiver is located.

Each of the moving trains, e. g., 15, 16 and 17, is adapted to receive signals belonging to a particular channel on frequencies  $f_1$  and  $f_2$  and to transmit signals to the dispatcher's station on a predetermined channel at frequency  $f_2$ . The sending is accomplished on a train by means of a transmitter 18 modulated by means of a modula-

3

tor 19 which may be controlled by a microphone 20.

As shown in Fig. 7 each train is equipped with a receiver  $R_1$  of well known type adapted to receive on  $f_2$ , the marker or synchronizing pulses  $m_1$  (Fig. 6) which are sent out from synchronizing station 9. By means of a delay network  $N_1$  of well known type which is adjustable so as to insure the insertion of channel pulses at the right point, the marker pulses  $m_1$  are conveyed to the modulator 19 shown in Fig. 2 where the signaling pulse is superimposed on the carrier  $f_2$  in its proper phase relation to the marker pulses  $m_1$ . This signal pulse is modulated from an audio source in a manner to be presently described and shown in greater detail in Fig. 2 and the modulated signal pulse together with the marker pulse  $m_1$  are transmitted by the transmitter 18 from the train on carrier frequency  $f_2$  towards the dispatcher's station 1.

In addition to modulation by a microphone 20 the transmitter 18 on a train may be modulated also by a generator 21 adapted to generate a 150-cycle signal or a generator 22 adapted to generate a 100-cycle signal. Both generated signals being below the range of audibility, they will not interfere with speech transmission on the channel assigned to the train.

Number 23 illustrates a rotatable means e. g., the axle on which a special wheel or a non-driving wheel of the locomotive or other car is mounted. Through suitable coupling 24 the clockwise rotation of the axle 23 is transmitted to a cam 25 at a certain ratio, and through a suitable coupling 26 the counterclockwise rotation of the axle 23 is transmitted to the cam 27. Depending; therefore, whether the train goes forward or backward, the cam 25 will be rotated in a clockwise direction periodically to close a contact 28, or the cam 27 will be rotated in a counterclockwise direction periodically to close a contact 29. Whenever the contact 28 is closed the carrier is modulated by a 100-cycle and whenever contact 29 is closed by a 150-cycle signal and transmitted from the train. Thus, for each unit of length the train travels forward, a 100-cycle signal is sent, and for each unit of length the train travels backward, a 150-cycle signal is sent. Assuming that the circumference of a wheel mounted on axle 23 is ten feet and assuming a top speed of 120 miles per hour, or 166 feet per second, one might provide a gear ratio of 8 to 1 to produce two impulses for every sixteen revolutions that the wheel may perform per second, or one impulse every 83 feet. Thus, the position of the train may be indicated within 100 feet for a speed of 120 miles per hour, although impulses will be sent only at the rate of two per second.

Each train will retransmit on frequency  $f_2$  the pulses  $m_1$  together with the signal pulse properly spaced therefrom. The signals will be received at the dispatcher's station 1, on antenna 3 in the usual interlaced channel pattern as shown for instance in Fig. 4 for the signals that are transmitted from the dispatcher's station on frequency  $f_1$ . Of course, if no signal is sent from a train to which a channel is assigned then there will be no pulse in its place. The antenna is connected with the known receiver means 30 adapted to receive and demodulate the time-modulated pulses received.

Number 31 is an audio frequency output transformer on receiver 30 conveying the intelligence received to a loudspeaker 32. The 100 and 150-

4

cycle pulses will pass through a low-pass filter 33 to two reeds 34 and 35 connected in parallel with the filter, the reed 34 being tuned to 100 and the reed 35 to 150 cycles. One or the other reed will be caused to vibrate its armature 36 and 37, respectively, to alter the magnetic field of permanent magnets 38 or 39 provided adjacent thereto. The impulses so generated are rectified and amplified at 40 and 41, respectively, to operate stepping mechanisms 42 or 43, as the case may be and are thus accumulatively registered on the corresponding stepping mechanisms. Any suitable arrangement may be provided at 42 and 43, e. g., a pawl and ratchet arrangement of any well known type as for example that shown in Fig. 7 of U. S. Patent to Lambot No. 1,072,474, granted September 9, 1913, to cause an indicator or recorder 44 which even may be desired, to move in one direction or the other in response to each step conveyed thereto from 42 or 43 thus indicating at any moment the position of the train. It will be seen therefore that the stepping mechanism will take one step each time contact 28 or 29 is closed; the mechanism as in other well known systems not being responsive to each cycle of the 100 or 150 cycle modulation but being responsive to each period of such modulation.

The recorder may take any one of a number of forms. It may be a counter which displays numerals indicating the distance traveled by the train (83 feet for each impulse received in the above-assumed case), or it may consist of a bank of lamps each of which is allotted to a certain point of the track and which lamps successively light, or of a stylus which draws a graph on a strip of paper, etc., and may include some form of speed indicator. There will be one such location recorder and speed indicator at the dispatcher's station for each train indicating at all times its exact position and speed and it should be understood that, of course, each channel individually allotted to a train, is separated from the other channels already in the receiver.

In my reference to "train," it should be understood that this term is used in a broad sense as covering any vehicle that is guided along a given track. It will also be clear that since instantaneous positioning of several trains are indicated substantially simultaneously by the signals transmitted along the track, such provide a good anti-collision signaling system between trains.

While I have referred to station 9 as the source of synchronizing signals, it will be clear that the synchronizing signals may originate at the dispatcher's station 1 if desired. It will be clear that many other variations such as the details of the transmitting and receiving equipment of Figs. 2 and 3, and their combination with other apparatus may be made without departing from the scope of the invention. For example, each train could be equipped with a receiver for receiving signals transmitted from another train and with an indicator responsive to the received signals.

I claim:

1. In a signaling system, a dispatcher's station provided with a receiver to receive on a carrier frequency signals forming a plurality of communication channels, a plurality of trains movable with respect to said dispatcher's station each provided with a transmitter to send on said carrier signals belonging to a predetermined channel, two different signal generators on each train, means on each train for connecting one of the

5

associated generators to modulate the transmitter on the train once for each unit of distance travelled in one direction, means on each train for connecting the other generator there-at to modulate the transmitter on the train once for each unit of distance travelled in the opposite direction, means at the dispatcher's station selectively responsive to the signals transmitted by said generators, and indicator means at said station controlled by the last mentioned means in one sense in response to accumulated signals of one generator and in the opposite sense in response to accumulated signals from the other generator.

2. The signaling system according to claim 1, means for sending from a common point channel synchronizing signals on said carrier, and means on each train to receive and to send out by the associated transmitter said synchronizing signals together with the other signals generated on the train.

3. In a signaling system, a dispatcher's station provided with a receiver to receive on a carrier frequency signals forming a plurality of communication channels, a plurality of trains movable with respect to said dispatcher's station each provided with a transmitter to send on said carrier audio signals belonging to a predetermined channel, two different generators of sub-audible frequency signals on each train, means on each train for connecting one of the associated generators to modulate the transmitter on the train once for each unit of distance traveled in one direction, means on each train for connecting the other generator there-at to modulate the transmitter on the train once for each unit of distance traveled in the opposite direction, a low-pass filter connected with the receiver at the dispatcher's station, two frequency responsive means connected with the low-pass filter, one tuned to the frequency of one and the other to the frequency of the other of said generators, and a recorder con-

6

trolled by one responsive means in one sense and the other responsive means in the opposite sense.

4. In a signaling system, a dispatcher's station provided with a receiver to receive on a carrier frequency time-modulated pulses belonging to a plurality of communication channels, a plurality of trains movable with respect to said dispatcher's station each provided with a transmitter to send on said carrier pulses belonging to a predetermined channel two different generators of pulses of a frequency outside of the audible range on each train, means on each train for connecting one of the associated generators to modulate the transmitter on the train once for each unit of distance traveled in one direction, means on each train for connecting the other generator there-at to modulate the transmitter on the train once for each unit of distance traveled in the opposite direction, means at the dispatcher's station selectively responsive to the signals transmitted by said generators, and an indicator means at said station, the last mentioned means operating in one sense in response to signals from one generator, and in the opposite sense in response to signals from the other generator.

MICHEL C. POYLO.

## REFERENCES CITED

The following references are of record in the file of this patent:

## UNITED STATES PATENTS

Number	Name	Date
253,442	Starr	Feb. 7, 1882
1,072,474	Lambot	Sept. 9, 1913
1,747,011	Alexanderson	Feb. 11, 1930
1,993,497	Wells	Mar. 5, 1935
2,089,639	Bedford	Aug. 10, 1937
2,311,021	Blumlein	Feb. 16, 1943
2,363,416	Henroteau	Nov. 21, 1944