

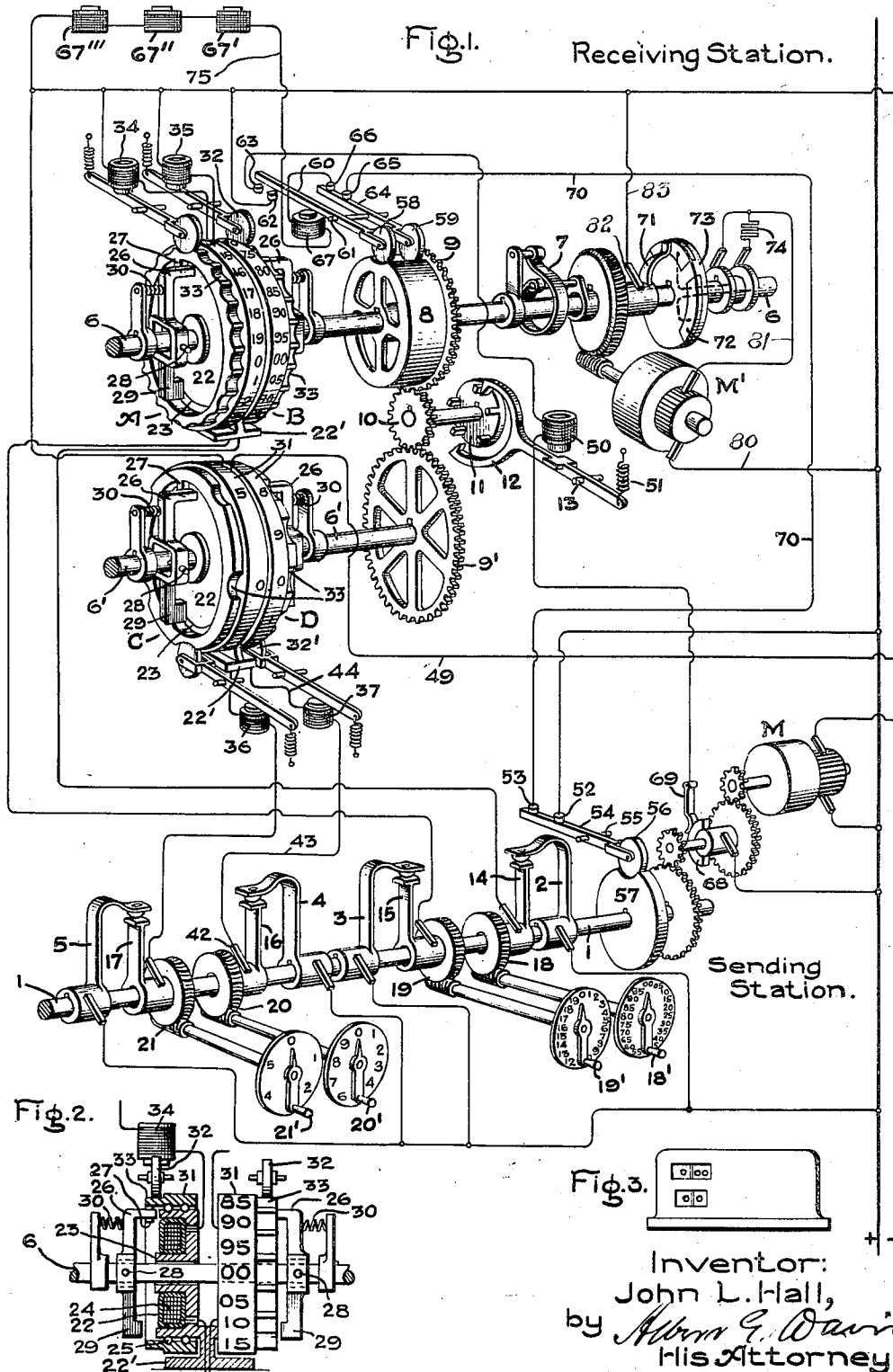
J. L. HALL.

SIGNALING SYSTEM FOR TRANSMITTING INFORMATION FROM A SENDING STATION TO ONE OR MORE RECEIVING STATIONS.

APPLICATION FILED AUG. 28, 1918.

1,306,593.

Patented June 10, 1919.



Inventor:
John L. Hall,
by *Alvin G. Davis*
His Attorney.

UNITED STATES PATENT OFFICE.

JOHN L. HALL, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SIGNALING SYSTEM FOR TRANSMITTING INFORMATION FROM A SENDING-STATION TO ONE OR MORE RECEIVING-STATIONS.

1,306,593.

Specification of Letters Patent.

Patented June 10, 1919.

Application filed August 28, 1918. Serial No. 251,854.

To all whom it may concern:

Be it known that I, JOHN L. HALL, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Signaling Systems for Transmitting Information from a Sending-Station to One or More Receiving-Stations, of which the following is a specification.

My invention relates to electric signaling and has for its object the provision of an improved signaling system for transmitting information from a sending station to one or more receiving stations. My invention is particularly adapted for transmitting ranges and deflections, or both, from a range finding or fire control station to one or more distant points as, for instance, to the gun stations. In my previous Patent No. 1,077,706, dated November 4, 1913, I have disclosed a system of this general character and my present invention is in the nature of an improvement upon the system disclosed in said patent.

My invention will best be understood from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is a diagram of the circuits, showing the mechanism of the sending station and one receiving station; Fig. 2 shows in detail two indicators, one in section and one in elevation; and Fig. 3 is an elevation for the casing of the indicating drums at a receiving station on a small scale.

Similar numerals refer to similar parts throughout the several views.

Referring to the drawings, it will be seen that I have shown one sending station and one receiving station although, as hereinafter pointed out, more than one receiving station may be employed. Located at the sending station is a shaft 1 which is continuously rotated at a substantially constant speed by an electric motor M through reduction gearing as shown, and secured to this shaft are four contact arms 2, 3, 4 and 5.

At the receiving station is located a shaft 6 driven at a substantially constant speed by an electric motor M' through reduction gearing which, in this case, as shown, is a worm gearing. The shaft is driven through a spring 7 the function of which will hereinafter appear. Secured to this shaft is a drum 8 having a gear 9 secured thereto. This shaft 6 also may drive two indicators A and B. Two more indicators C and D secured to the shaft 6' may likewise be driven from the shaft 6 through an intermediate gear 10 from the gear 9. The intermediate gear 10 is controlled by escapement mechanism consisting of a pin wheel 11 and a pawl 12 pivoted at 13.

Coöperating with the rotating contacts 2, 3, 4, 5 at the sending stations, are stationary contacts 14, 15, 16, 17 which contacts are adjustable around the shaft by any suitable means, such as gearing 18, 19, 20, 21 and handles 18', 19', 20', 21' shown. Pointers and dials therefor indicate the position of the adjustable contacts. I have shown my apparatus as adapted for transmitting ranges or deflections or both from the range finding or fire control station. Two of the indicators A and B indicate the range, while the other two indicators C and D indicate the deflections in knots. It may be stated that such a deflection relates to moving targets and is usually calculated in knots right or knots left from 1 to 25, indicating the difference in speed between the firing station and the moving target. The signals of deflection are made by designating the Nos. 1 to 25 as "knots left" and 26 to 50 as "knots right". In Fig. 2 I have shown one of the indicators in detail as consisting of an electromagnet 22 mounted on a base 22' loosely supporting shaft 6. This electromagnet is in the form of a drum 23 of magnetic material having a winding 24 inclosed therein. Surrounding the electromagnet is an indicator cylinder 31, upon which the numerals are marked. This cylinder rides upon the drum-shaped frame of the electromagnet through ball bearings 25, and is free to

either rotate with the shaft or remain stationary. The indicator cylinder is positively driven by an arm 26 which normally projects inward and engages projection 27 on the cylinder. This arm is pivoted at 28 and when the electromagnet 22 is energized, it is moved on the pivot so as to move away from the projection 27 and release the cylinder. This is accomplished by having the end 29 of the arm 26 of magnetic material so that it will be attracted by the magnetic drum when the winding is energized. The arm is normally moved into the position shown in the drawing by the spring 30. When the indicating cylinder 31 is released from engagement by the arm 26 so that it is no longer positively driven, it is held in the position in which it happens to be when released by the roller 32 which engages the notches 33 around the periphery as shown. The roller is held firmly in the notch by an electromagnet 34 which is energized at the same time as the electromagnet 22 is energized. In the drawing there are four indicators A B and C D, each constructed as above described, and also four electromagnets 34, 35, 36, 37 for holding their respective indicator cylinders in position. The indicator magnet and the holding magnet are energized when the one of the rotating contacts 2, 3, 4, 5 corresponding to this particular indicator engages its stationary contact. This obviously is once during every rotation of said rotating contacts, thus arm 26 will move out of the path of projection 27 and permit the cylinder to remain in a stationary position corresponding to the number indicated by its respective pointer and dial.

As thus far described, assuming that the shafts 1 and 6, which includes shaft 6', are operating in exact synchronism and are in proper phase relation, which operating means are more fully described hereinafter, the operation will be as follows: For purposes of illustration let it be assumed that the operator wishes to transmit a deflection of eight knots left. In order to do this, he will turn the handle 20' until the pointer comes opposite the numeral "8," thereby turning the contact 16 to a corresponding angle and turn handle 21' to "0." A circuit will then be completed through the holding magnet 37 and the magnet 22 of indicator D when the rotating arm 4 engages the stationary arm 16. Since it is assumed that the shafts are rotating in exact synchronism, this will be when the same number on the indicating cylinder is in a corresponding position. The circuit of the two magnets is as follows: From the positive side of the line through the contacts on the shaft 1, brush 42, conductor 43, electromagnet 37, conductor 44 to electromagnet 22 of indicator D and to the other side of the line

through conductor 49. The result is that the arm 26 of indicator D is withdrawn from engagement with the indicator cylinder so that the latter stops at the same time the roller 32' is forced into engagement with the notch on the cylinder corresponding to the selected number by the electromagnet 37. In a similar manner the cylinder of indicator C would stop at "0." If instead of eight knots left, it was desired to transmit a deflection of eighteen knots left, the handle 21' would likewise be turned to "1," so that the number "1" of indicator C would stop in a position corresponding to "8" of indicator D. It is understood, of course, that these numbers are read through an opening in the casing as shown in Fig. 3. In like manner, in transmitting the range, handles 18' and 19' will be operated.

It is obvious that it is practically impossible to have two shafts, operated independently by two electric motors, rotate in exact synchronism. I have, therefore, provided means for bringing the shafts into synchronism. It will be noted that the intermediate gear 10 is controlled by an escapement consisting of a pin wheel 11 and a cooperating pawl 12 pivoted at 13. This escapement is adapted to interrupt the rotation of the intermediate gearing 10, and hence will stop both gears 9, 9' and the indicators driven thereby. This pawl is moved to one position by an electromagnet 50 and moved to the opposite position by a spring 51. It will readily be understood that when the magnet is energized to release the pin wheel, the latter will turn through a distance equal to one-half the distance between the pins and will not turn further until the magnet is deenergized. This is a well-understood arrangement and requires no detail of description.

At a certain position of the shaft 1 which may be called the synchronizing position, two contacts 52 and 53 are electrically connected by a switch arm 54 pivoted at 55 provided with a roller 56 which engages a notch in the disk 57. When the shaft is not in this position, the switch arm will be held out of engagement with the contacts by reason of the fact that the roller rides on the periphery of the disk. The drum 8 which is driven by the shaft 6 is likewise provided with a notch which accommodates two rollers 58 and 59. The roller 58 is attached to a switch arm 60 pivoted at 61, which when the roller is out of the notch, electrically connects the contacts 62 and 63. The roller 59 is attached to another switch arm 64 which, as shown, is pivoted concentrically with the switch arm 58 and this switch arm electrically connects contacts 65 and 66. As shown, when two rollers are in the notch the contacts 65 and 66 are connected while

the contacts 62 and 63 are disconnected. In other words, these two switch arms are positively set. The contacts 62 and 63 control the circuit of the electromagnet 50, which in turn controls the pawl of the escapement, while the contacts 65 and 66 control the circuit of an electromagnet 67 which holds the switch lever 60 in its closed circuit position when energized. The circuit of the electromagnet 50 is also controlled by a contact segment 68 rotated by the motor M and engaged by the brush 69. This is for the purpose of energizing the magnet 50 periodically for a definite interval.

Assuming now that when the shaft 1 reaches the position in which the roller 56 engages the notch and the contacts 52 and 53 are connected, the shaft 6 is in a corresponding position so that the two rollers 58 and 59 are in their notch. In this case the magnet 50 will be energized in the following manner: From the positive side of the line through contacts 52 and 53, conductor 70, and thence through contacts 65 and 66, magnet 67 to the negative side of the line. The energization of the magnet 67 will draw the switch arm 60 down so as to electrically connect the contacts 62 and 63 thereby energizing the magnet 50 from the positive side of the line through the segment 68 and brush 69, magnet 50, and contacts 63 and 62 to the other side of the line. If more than one receiving station is used, the synchronizing magnets 67 are connected in series as shown by 67', 67'', 67'''. This will cause the pawl 12 to be attracted and release the pin-wheel, thereby allowing the indicators to advance a certain amount. As soon as this advance takes place, the roller 58 by engaging the periphery of its drum causes the contacts 62 and 63 to be connected and maintain the circuit of the magnet 50 independently of the magnet 67. This circuit will be maintained until the shaft 6 makes a complete revolution, since the contacts 62 and 63 will be kept connected during this revolution. The magnet will be intermittently energized at the segment 68 so as to permit the shaft 6 to rotate continuously. Suppose, however, that when the shaft 1 reaches the synchronizing position and the contacts 52 and 53 are connected, the shaft 6 has not yet reached that position or, for that matter, has just passed that position. In this case the magnet 67 will not be energized at the synchronizing position, but the magnet 50 will, of course, be energized so that the shaft 6 will continue to rotate. Whenever the shaft 6 reaches its synchronizing position and the rollers 58, 59 drop into their notches, the magnet 50 will be de-energized since the magnet 67 is not energized to hold the contacts 62 and 63 connected. It is of course understood that the

disk 57 is rotating continuously and alternately opening and closing the circuit of magnet 67 at contacts 52 and 53. The shaft 6 will, therefore, stop rotation until the shaft 1 reaches a synchronizing position, whereupon the magnet 67 will be energized through the contacts 52 and 53. The two shafts will, therefore, start off again in synchronism. It will be understood, of course, that while the shaft 6 is not rotating, the motor does continue to rotate but merely places the spring 7 under tension. It may be, therefore, that the tension of the spring will be continually increased, so in order to guard against trouble from this source, I provide means for slowing down the motor when the tension of the spring reaches a certain point or if the tension still continues to increase to actually stop the motor M'. This I accomplish in the following manner: by a circuit from the positive line through the conductor 80, through the motor M', conductor 81 to the slip ring 73, contact 71, brush 82 and conductor 83 to the negative line. Contact 71 is connected to the hub of the worm gear driven by the motor, which contact engages a segment 72 connected to the slip ring 73 when the relative movement between the shaft and the worm gear reaches a certain point, thereby inserting a resistance 74, and upon further rotation the circuit is opened by the contact passing off of the segment 72. The motor will then stop whereupon the spring 7 will give up its energy to the shaft to rotate the same until the circuit is again established by the contact moving forward as will be well understood.

When there is more than one receiving station, the connections to the sending station are identical with those shown, except that conductor 75 will enter each of the subsequent receiving stations as conductor 70 of the first receiving station. Therefore, it will be seen that electromagnet 67 will not be energized until shaft 6 of all receiving stations reaches a synchronizing position, whereupon the operation will proceed as above set forth.

It will also be observed that when there are several receiving stations and any one or all should be out of synchronism, a synchronous relation between all receiving stations will be established simultaneously within one revolution of the respective shafts 6, and the receiving stations and the sending stations will be in synchronism within one revolution of shaft 1 thereafter.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a signaling system a receiving station comprising a continuously rotating element, a rotatable indicator arranged to be driven by said element, electromagnetic

means for controlling the driving connection between the indicator and the element, a sending station comprising an element rotated continuously in synchronism with the element at the receiving station, and means whereby at a predetermined point in the travel of the element at the sending station the electromagnet is affected to render the driving connection inoperative and cause the indicator to be stopped at the corresponding point in the rotation of the element at the receiving station.

2. In a signaling system, a receiving station comprising a continuously rotating element, a rotatable indicator arranged to be driven by said element, electromagnetic means for controlling the driving connection between the indicator and the element, a sending station comprising an element rotated continuously in synchronism with the element at the receiving station, a contact member mounted to rotate with the element at the sending station, a stationary contact adjustable to various positions for engagement by the rotating contact and connections whereby upon the making of said contact the electromagnet is affected to render the driving connection inoperative and cause the indicator to be stopped at the corresponding point in the rotation of the element at the receiving station.

3. In a signaling system, a receiving station comprising an indicator, a continuously rotating element arranged to make a driving connection with the indicator at a point in its travel, electromagnetic means for controlling the driving connection, a sending station comprising an element rotating continuously in synchronism with the element at the receiving station and means whereby at a predetermined point in the travel of the element at the sending station the electromagnet is affected to render the driving connection inoperative.

4. In a signaling system a sending station comprising a continuously rotating element, a receiving station including an indicator and an element rotating in synchronism with the element at the receiving station arranged to make a driving connection with the indicator at a point in its travel determined at the sending station, electromagnetic means for controlling the driving connection, and means whereby at the said determined point in the travel of the element at the sending station the electromagnet is affected to render the driving connection inoperative.

5. In a signaling system, a receiving station comprising a plurality of indicators, a continuously rotating element arranged to make a driving connection with the indicators at a point in its travel, electromagnetic means for controlling the driving connection, a sending station comprising an element ro-

tating continuously in synchronism with the element at the receiving station, and means whereby at a predetermined point the electromagnetic means are affected to render the driving connection inoperative.

6. In a signaling system, a receiving station comprising a continuously rotating element, a plurality of rotatable indicators arranged to be driven by said element, electromagnetic means for controlling the driving connection between the indicators and the element, a sending station comprising an element rotated continuously in synchronism with the element at the receiving station, a plurality of contact members mounted to rotate with the element at the sending station, a plurality of stationary contacts adjustable to various positions for engagement by the rotating contacts and connections whereby upon the making of said contacts the respective electromagnetic means are affected to render the driving connection inoperative and cause the indicators to be stopped at the corresponding point in the rotation of the element at the receiving station.

7. In a signaling system, a receiving station comprising a continuously rotating element, a rotatable indicator, a member driven by said element arranged to engage said indicator to drive the same, and an electromagnet for controlling the engagement between the member and the indicator, a sending station comprising an element continuously rotating in synchronism with the element at the receiving station, and means whereby at a predetermined point in the travel of the element at the sending station the electromagnet is affected to render the driving connection inoperative and cause the indicator to be stopped at the corresponding point in the rotation of the element at the receiving station.

8. In a signaling system, a receiving station comprising a continuously rotating element, a rotatable indicator arranged to be driven by said element provided with a series of notches corresponding to the numbers indicated thereon, an electromagnetically controlled member arranged to engage in said notches to hold the indicator in a stationary position, electromagnetic means for controlling the driving connection between the indicator and the said element, a sending station comprising an element continuously rotating in synchronism with the element at the receiving station, and means whereby at a predetermined point in the travel of the element at the sending station the electromagnetic means is affected to render the driving connection inoperative and cause the indicator to be stopped at the corresponding point in the rotation of the element at the receiving station.

9. In a signaling system, a receiving sta-

tion comprising a continuously rotating element, an electromagnet, a rotatable indicator, a rotating armature for said electromagnet continuously driven by said element arranged to engage said indicator, a sending station comprising an element rotated continuously in synchronism with the element at the receiving station, and means whereby at a predetermined point in the travel of the element at the sending station the electromagnet is energized to disengage its armature from the indicator and cause the indicator to stop at the corresponding point in the rotation of the element at the receiving station.

10. In a signaling system, a receiving station comprising a continuously rotating element, a circular electromagnet, a rotatable indicator inclosing the periphery to said electromagnet, a rotating armature for said electromagnet continuously driven by said element arranged to engage said indicator, and means whereby at a predetermined point in the rotation of said armature the electromagnet is energized to disengage said armature from the indicator and cause it to stop.

11. In a signaling system, a receiving station comprising a continuously rotating element, a rotatable indicator arranged to be driven by said element, electromagnetic means for controlling the driving connection between the indicator and the element, a sending station comprising an element rotated continuously in synchronism with the element at the receiving station, and means whereby the latter element drives the indicator to a point determined at the sending station, at which the electromagnet is affected to render the driving connection inoperative to stop the indicator, and means independent of said driving means for maintaining said elements in synchronism.

12. In a signaling system, a receiving station comprising an element continuously driven through a yielding connection, a rotatable indicator arranged to be driven by said element, electromagnetic means for controlling the driving connection between the indicator and the element, a sending station comprising an element rotated continuously in synchronism with the element at the receiving station, and means whereby the latter element drives the indicator to a point determined at the sending station, at which the electromagnet is affected to render the driving connection inoperative to stop the indicator.

13. In a signaling system, a receiving station comprising an element continuously driven through a yielding connection arranged to slow down or stop the motor and subsequently to restore the motor to its normal running position, a rotatable indicator arranged to be driven by said element, elec-

tromagnetic means for controlling the driving connection between the indicator and the element, a sending station comprising an element rotated continuously in synchronism with the element at the receiving station, and means whereby the latter element drives the indicator to a point determined at the sending station, at which the electromagnet is affected to render the driving connection inoperative to stop the indicator, and means independent of said driving means for maintaining said elements in synchronism.

14. In a signaling system, a sending station comprising an element driven at a substantially constant speed, a receiving station comprising an element driven at substantially the same speed, a rotatable indicator arranged to be driven by said latter element, means whereby the latter element drives the indicator, providing the indicator is not in a corresponding position, and causes it to stop when the elements coincide in position, an electromagnet for controlling the driving connection between the indicator and its driving element, and means whereby at a predetermined point in the travel of the element at the sending station the electromagnet is affected to render the driving connection inoperative and cause the indicator to be stopped at the corresponding point in the rotation of the element at the receiving station.

15. In a signaling system, a sending station comprising an element driven at a substantially constant speed, a receiving station comprising an element driven at substantially the same speed, a rotatable indicator arranged to be driven by said latter element through a yielding connection, means whereby the latter element drives the indicator, providing the indicator is not in a corresponding position, and causes the driving connection to yield and disengage the indicator when the elements coincide in position, an electromagnet for controlling the driving connection between the indicator and its driving element, and means whereby at a predetermined point in the travel of the element at the sending station the electromagnet is affected to render the driving connection inoperative and cause the indicator to be stopped at the corresponding point in the rotation of the element at the receiving station.

16. In a signaling system, a sending station comprising an element driven at a substantially constant speed, a receiving station comprising an element driven at substantially the same speed, a rotatable indicator arranged to be driven by said latter element, means whereby the latter element drives the indicator, an escapement mechanism for controlling the movement of said driving means, an electromagnet energized

periodically in the rotation of the element at the sending station for operating the escapement, means whereby the operation of the escapement is interrupted to stop the
5 movement of said driving means unless the two elements correspond in position at a predetermined point, and means whereby at a second predetermined point in the rotation of the element at the sending station the

electromagnet is energized to release the 10 driving means and cause it to drive the indicator to a point predetermined at the sending station, whereupon said driving connection becomes inoperative and causes the indicator to stop. 15

In witness whereof, I have hereunto set my hand this 27th day of August, 1918.
JOHN L. HALL.