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RECEIVING APPARATUS.

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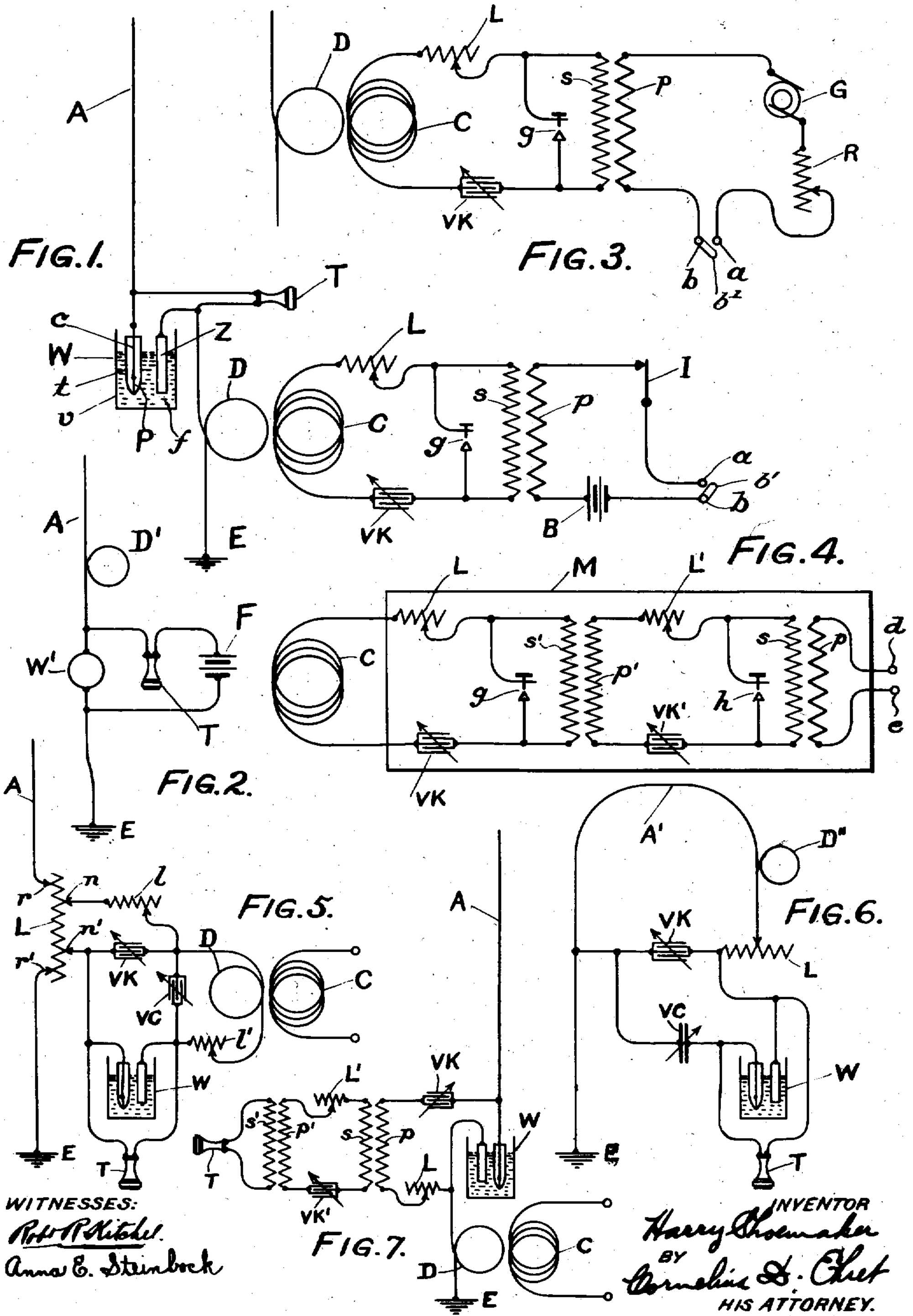
974,927. Patented Nov. 8, 1910.



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974,927. Specification of Letters Patent. Patented Nov. 8, 1910.

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To all whom it may concern:

Be it known that I, HARRY SHOEMAKER, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented a new and useful Receiving Apparatus, of which the following is a specification.

My invention relates to electrical signaling systems and more particularly to a system for transmitting signals or messages through space by means of electro-radiant energy.

More particularly my invention relates to the receiving apparatus in such a system, and has for its object the rendering of the receiving apparatus more sensitive or more responsive to weak signals coming from great distances. To this end I generate at the receiving apparatus high frequency energy of suitable strength having the same or different characteristics of the weak electro-radiant energy arriving from distant stations.

I have found that when employing receiving apparatus, especially when involving a self-restoring wave-responsive device, that signals so weak as to be incapable of sufficiently influencing the wave-responsive device, or even when so weak as not to be heard at all, become very easily readable or manifest if the wave-responsive device be acted upon by other electro-radiant or high frequency energy even though of much greater power than the extremely weak signals. What the true theory of the action is, I am now unable to state, but it is my belief that the electro-radiant energy of the very weak signals is insufficient to call the wave-responsive device into action and that other electro-radiant or high frequency energy brings the wave-responsive device into more sensitive or responsive condition; and then the very weak signals are able to produce an effect. In any event, the very weak signals are readable through whatever effects the other electro-radiant or high frequency energy may cause. I have found that signals otherwise unreadable become immediately readable and manifest when a transmitting apparatus, even when located in the same room with the receiving apparatus, is set into operation. And though the energy produced by the local transmitter produced signals in the receiver, yet the wave-responsive device seemed to have gained in sensitiveness and the weak signals from a great distance were easily readable in spite of the transmitter operating in the vicinity of the receiver. Thus, if properly controlled or adjusted as to strength, electro-radiant or high frequency energy from a source other than the transmitter of a distant station, becomes useful instead of detrimental, and aids in the reception of signals from that distant station.

For an illustration of several of the forms my invention may take reference is to be had to the accompanying drawing, in which:

Figure 1 represents in diagram a simple receiving apparatus with which there is caused to coöperate a local producer of high frequency energy, the wave-responsive device being in this case a primary cell detector. Fig. 2 is a diagrammatic view similar to Fig. 1, except that the wave-responsive device is of any other suitable type, such, for example, as requires a local battery. Fig. 3 is a fragmentary diagrammatic view illustrating a modified form of local transmitter or producer of high frequency energy. Fig. 4 is a diagrammatic view illustrating a further modification of a local producer of high frequency energy. Fig. 5 is a diagrammatic view illustrating a tuned or selective receiving apparatus in conjunction with a local producer of high frequency energy, the circuit arrangements being such as to select the electro-radiant energy coming from a distance without, however, losing the advantageous effect of the local producer of high frequency energy. Fig. 6 is a diagrammatic view illustrating my invention as applied to a looped aerial conductor along with selective apparatus. Fig. 7 illustrates diagrammatically my invention as employing a circuit selective of wave train or spark frequency, the local producer of high frequency energy having a wave train or spark frequency different from that of the distant station.

Referring to Fig. 1, A represents an aerial conductor between which and the earth connection E is connected a primary cell wave-responsive device or detector W, consisting of the vessel v, preferably of insulating material, containing the cell excitant f in liquid or other suitable form. Z is a zinc or other suitable cell element. The other cell element is a small conductor, of platinum or other suitable material, sealed in the lower end of the glass tube t, the conductor P and the glass tube t being ground off so that the end section only of the conductor P is exposed to the cell excitant f. A copper or other suitable wire c forms an external connection for the conductor P. A signal translating instrument T, such as a telephone receiver, either magneto or condenser, a relay, galvanometer, siphon recorder, or other suitable device, is connected directly to the elements of the primary cell detector.

As thus far described, the apparatus forms normally sensitive receiving apparatus for wireless telegraphy and is capable of indicating in the instrument T signals coming from great distances.

To render the apparatus, and especially the wave-responsive device, over-sensitive, so as to respond to very weak signals and ordinarily not manifested in the instrument T, I combine with the receiving apparatus thus far described a local producer of high frequency energy. Such producer comprises the usual induction coil or transformer having the primary winding p and the secondary winding s. Included in the circuit of the primary p is the usual interrupter I (which may be a Wehnelt interrupter) and the source of energy B. At a and b are shown terminals of this primary circuit which are adapted to be bridged to set the apparatus in operation whenever it is desired to receive messages. These contacts a and b may preferably be bridged by a contact b' actuated by the arm of a switch which disconnects the transmitter and throws the receiving apparatus into action, as well understood in the art. Across the terminals of the secondary s is connected the adjustable spark gap g, capable of adjustment to very short length.

VK is a variable condenser connected in series with the coil C and the variable inductance L. While a coil C is shown, it is to be understood that any suitable conductor disposed in any suitable manner may be employed. The adjustable inductance L is provided in case the conductor or coil C does not give the circuit sufficient inductance.

D represents a loop of one or more turns in the aerial conductor. The coil or conductor C is placed at suitable distance from the loop D and the coil C and the loop D are both or either one of them pivoted so that the plane of the coil C may be made parallel with the plane of the loop D or may be made to assume any other angular position. This adjustment serves, with a given state of affairs, to increase or diminish the amount of high frequency energy locally impressed upon the wave-responsive device W. Furthermore, the distance between the coil C and the loop D may be adjustable within wide limits to secure proper strength of energy locally impressed upon the wave-responsive device.

When the receiver switch is closed, the contacts a, b, are bridged by b' and the interrupter in the primary circuit begins its action in the well known manner. The secondary energy is then supplied to the oscillating circuit including the condenser VK, coil C, inductance L, and spark gap g. The natural period of the circuit may be adjusted to any desired value by varying either L or VK, or both, in a manner well understood in the art. The natural period of the high frequency energy locally impressed upon the wave-responsive device W may, therefore, be made equal to, greater than, or less than the frequency of the weak energy coming from the distant station. And by choosing a suitable interrupter I, or suitably adjusting it, the wave train or spark frequency may be made equal to, less than, or greater than the spark frequency or wave train frequency of the distant station.

It is to be understood that a loop D is not absolutely essential, for it may be dispensed with entirely and the local producer simply placed near the receiving apparatus, in which case the exposed connecting wires or connections may be sufficient to impress a requisite amount of locally generated energy upon the wave-responsive device. The loop D may be placed, if desired, in conductor A above the wave-responsive device W.

In Fig. 2 the parts are the same as in Fig. 1, the local producer being omitted, it being understood that any of the local producers herein described or any of the improvements thereof, may be used in connection with the circuits shown in this figure, except that a wave-responsive device W' of any other type than a primary cell may be employed, as, for example, such as requires a local battery F.

It is to be understood that my invention is not limited to the employment of a primary cell detector, as any other form of wave-responsive device, preferably the self-restoring types, may be employed. Thus a Ferrie detector, magnetic hysteresis detector, carbon, or carbon and metal, etc., may be employed.

Referring to Fig. 3, there is shown a local producer similar to that shown in Fig. 1, except that in the circuit of the primary p of the transformer a generator G of alternating or fluctuating currents is used in place of a source and an interrupter and there is included, if desired, an adjustable resistance or inductance R as means for properly graduating the strength of the energy developed. The frequency of the generator G may be chosen so that the spark gap frequency or wave train frequency shall be equal to, greater than, or less than the wave train or spark gap frequency of the distant station whose signals are to be received. Indeed, the frequency of the generator G may be chosen so high that it will be above the point of audition in the telephone receiver T, as for example, 10,000 cycles per second, more or less. On the whole, it is of advantage, though not imperative, that the wave train or spark frequency of the local producer be high as compared with the wave train or spark gap frequency of the distant station, so that the wave-responsive device will be ever sensitive or more nearly constantly sensitive for the reception of the wave trains of slower frequency coming from the distant station. And simultaneously with this dissimilarity or spark gap or wave train frequency the wave frequency may be chosen equal to, greater than, or less than the wave frequency of the distant station. It is of advantage, though not imperative, that the wave frequency of the local producer be much lower than that radiated from the distant station. That is, the length of the wave produced by the local producer is preferably longer than the length of the wave produced at the distant station.

Referring to Fig. 4, a local producer is shown in which high spark gap or wave train frequency is obtained by the use of an additional oscillation circuit. At *d* and *e* are represented terminals of the primary *p* of the transformer whose secondary is *s*. By means of these terminals, the primary *p* may be connected in a circuit such as shown in Fig. 1 and Fig. 3, that is with a source of energy and suitable interrupter such as a Wehnelt interrupter or with a generator as G. A spark gap *h* is connected across the terminals of the secondary *s* and with the variable condenser VK′, primary *p′* and adjustable inductance L′, forms an oscillation circuit whose natural period determines the spark gap or wave train frequency of the succeeding circuit. By adjusting VK′ or L′, or both of them, this frequency may be determined within wide limits and in general may be very high, such as 10,000 cycles per second, more or less. The secondary *s′* is bridged by the spark gap *g*, and such gap with the variable condenser VK, the coil C, and the adjustable inductance L forms an oscillation circuit whose natural period determines the natural period of the waves produced, and the period may be chosen as heretofore described. Inclosing all of this apparatus, except the coil C, there is preferably a metallic box or casing M which will then prevent any complicated influences upon the wave-responsive device as, for example, from the spark gap *h* and its circuits and connections.

In Fig. 5 there is included between the aerial conductor and earth connection E, an inductance L variable by the riders *r*, *r′* as to amount included in the aerial circuit and by the riders *n*, *n′* as to amount included in the local circuit. An adjustable inductance *l* with the variable condenser *vk* and a portion of the inductance L, forms a closed circuit. By adjusting the riders named and by adjusting *l*, and *vk*, the circuit is made highly selective of the received electro-radiant energy. A wave-responsive device W, here again shown as a primary cell, though not necessarily so, is connected in shunt to the condenser *vk*, through the preferably smaller variable condenser *vc*, and the signal translating instrument T is connected in shunt to the wave-responsive device W. Connected in shunt to the smaller variable condenser *vc*, is a circuit including the loop D and the variable inductance *l′*. The local producer is represented merely by the coil C. By suitably adjusting the inductance *l′*, and by making the adjustments heretofore mentioned, the wave-responsive device is kept sensitive by the local producer producing waves of preferably a widely different length from the waves of the received energy, the disposition being such that while the wave-responsive device is acted upon by the locally produced energy, it is so disposed as to be selectively acted upon by the received electro-radiant energy.

Referring to Fig. 6, A′ represents a looped aerial conductor. L is a variable inductance and VK is a variable condenser. VC is also a variable condenser of preferably smaller capacity than VK. The wave-responsive device W is connected to the terminals of VK through VC. And the loop D″ is connected in looped aerial A′. While the loop D″ has been shown so connected it may also be placed in any other suitable position in the aerial conductor or in the associated circuits or conductors.

In Fig. 7, the wave-responsive device is shown connected between the aerial conductor and earth with the loop at D or above detector W. C represents the coil of the local producer. In shunt to the wave-responsive device W is a circuit including a variable condenser VK, the adjustable inductance L and the primary *p* of a transformer. The secondary *s* includes in its circuit a variable condenser VK′, adjustable inductance L′ and the primary *p′* of a second transformer whose secondary *s′* is connected to the signal translating instrument T. By properly adjusting the condensers and inductances the signal translating instrument has selected to it very sharply only impulses equal to or corresponding with the wave train or spark gap frequency of the distant transmitter or received energy. The local producer in such case preferably produces energy whose wave train or spark gap frequency is widely different from that of the distant station, so that, while the wave-responsive device W is made sensitive by the locally produced energy the response of the wave-responsive device to such locally produced energy is not manifested in the signal translating instrument.

While I have here shown a few of the dispositions that may be employed, it is to be understood that the wave-responsive device may be of any suitable character and may be either connected conductively or inductively with the receiving aerial circuit or conductor, and that in place of a producer having closed oscillation circuit, the local producer may be of the open circuit type.

While a local producer or transmitter is here shown, it is to be understood that the energy which it emits for use in this invention is very slight only and very small indeed in comparison with the power or energy used to transmit energy to a distant station.

While the loops, as D, D′, D″, are shown in certain positions in the drawings, it is to be understood that such loop may be disposed either above or below the detector in the aerial conductor, or at any point in a looped aerial conductor, or at any point in the conductors or circuits associated with an open or looped or other aerial conductor.

What I claim is:

1. In a signaling system, receiving apparatus comprising a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with a local producer of high frequency impulses for rendering said wave-responsive device over-sensitive.

2. In a signaling system, receiving apparatus comprising a self-restoring wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with a local producer of high frequency oscillations for rendering said wave-responsive device over-sensitive.

3. In a signaling system, receiving apparatus comprising a receiving conductor or circuit, a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, and means for producing locally high frequency oscillations to render said wave-responsive device over-sensitive.

4. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, and means for impressing upon said wave-responsive device locally generated high frequency oscillations for rendering said wave-responsive device over-sensitive.

5. In a signaling system, receiving apparatus comprising a receiving conductor or circuit, an electro-chemical wave-responsive device associated therewith, a signal translating instrument, and means for impressing upon said wave-responsive device locally generated high frequency oscillations.

6. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, and means for impressing upon said wave-responsive device for rendering the same over-sensitive locally produced high frequency oscillations, the group frequency of said oscillations being different from the group frequency of the received energy.

7. In a signaling system, receiving apparatus comprising a receiving conductor or circuit, a wave-responsive device associated with means for reproducing a signal and means for impressing upon said wave-responsive device locally produced high frequency oscillations, the group frequency of said locally produced oscillations being high as compared with the wave train frequency of the received energy.

8. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device of normal sensitiveness associated with means for reproducing a signal and means for impressing upon said wave-responsive device for rendering the same over-sensitive locally produced high frequency oscillations of a frequency different from the frequency of the received energy.

9. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device of normal sensitiveness associated with means for reproducing a signal and means for impressing upon said wave-responsive device for rendering the same over-sensitive locally generated high frequency oscillations of a frequency less than the frequency of the received energy.

10. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device associated with means for reproducing a signal and means for impressing upon said wave-responsive device locally generated high frequency oscillations having a group frequency and frequency different from the wave train frequency and frequency of the received energy.

11. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device associated with means for reproducing a signal and means for impressing upon said wave-responsive device locally generated high frequency oscillations of a group frequency greater than the wave train frequency of the received energy and of a frequency less than the frequency of the received energy.

12. In a signaling system, receiving apparatus comprising a receiving circuit or con-

ductor, a wave-responsive device of normal sensitiveness associated with means for reproducing a signal and capable of simultaneous response to effects caused by a plurality of sources of energy, and means for impressing upon said wave-responsive device locally generated high frequency oscillations for rendering the same over-sensitive.

13. In a signaling system, receiving apparatus comprising a receiving conductor or circuit, a wave-responsive device of normal sensitiveness associated therewith, a signal translating instrument, means for selecting to said signal translating instrument the signals produced at a distant station, and means for impressing upon said wave-responsive device locally generated high frequency oscillations for rendering the same over-sensitive.

14. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device associated therewith, a signal translating instrument, said signal translating instrument being associated with a circuit or circuits selective of impulses having a frequency equal to or corresponding with the wave train frequency of the received energy, and means for impressing upon the wave-responsive device high frequency oscillations locally generated and having a group frequency different from that of the received electro-radiant energy.

15. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, and means for subjecting said wave-responsive device to locally produced high frequency impulses, whereby said wave-responsive device is rendered over-sensitive.

16. In a signaling system, receiving apparatus comprising a receiving circuit or conductor, a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, and means for subjecting said wave-responsive device, for rendering the same over-sensitive, to the effects of high frequency impulses other than the effects of the energy representing the signals transmitted.

17. In a signaling system, receiving apparatus comprising a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with means for subjecting said wave-responsive device, for rendering the same over-sensitive, to the effects of high frequency impulses other than effects caused by received energy.

18. In a signaling system, receiving apparatus comprising a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with means for subjecting said wave-responsive device, for rendering the same over-sensitive, to high frequency energy other than and of a frequency different from that of the received energy.

19. In a signaling system, receiving apparatus comprising a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with means for continuously subjecting said wave-responsive device, for rendering the same over-sensitive, to fluctuating energy other than received energy.

20. In a signaling system, receiving apparatus comprising a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with means for continuously subjecting said wave-responsive device, for rendering the same over-sensitive, to high frequency energy other than received energy.

21. In a signaling system, receiving apparatus comprising a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with means for subjecting said wave-responsive device, for rendering the same over-sensitive, to the effects of high frequency oscillations produced at the same station.

22. In a signaling system, receiving apparatus comprising a wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with means for continuously subjecting said wave-responsive device, for rendering the same over-sensitive, to the effects of fluctuating energy generated at the same station.

23. In a signaling system, receiving apparatus comprising a wave-responsive device consisting of an electro-chemical source of energy, in combination with means for subjecting said wave-responsive device to high frequency energy other than received energy.

24. In a signaling system, receiving apparatus comprising a wave-responsive device consisting of a primary cell, in combination with means for subjecting said cell to the effects of high frequency energy locally produced.

25. In a signaling system, receiving apparatus comprising an electro-chemical cell wave-responsive device of normal sensitiveness associated with means for reproducing a signal, in combination with means for subjecting said wave-responsive device, for rendering the same over-sensitive, to the effects of locally generated high frequency energy.

26. In a signaling system, receiving apparatus comprising a wave-responsive device of normal sensitiveness, in combination with means for subjecting said wave-responsive device, for rendering the same over-sensitive, to the effects of high frequency energy

other than received energy and different in character from said received energy.

27. In a signaling system, receiving apparatus comprising a wave-responsive device, and a producer of high frequency impulses at the same station for rendering said device oversensitive.

28. In a signaling system, receiving apparatus comprising a wave-responsive device and means at the same station with said device continuously producing high frequency impulses for rendering said device oversensitive.

29. In a signaling system, receiving apparatus comprising an electro-chemical cell as a wave-responsive device, in combination with means for subjecting said cell to the effects of high frequency impulses other than the received energy.

30. In a signaling system, receiving apparatus comprising an electro-chemical cell as a wave-responsive device, in combination with means for subjecting said cell to the effects of high frequency oscillations other than the received energy.

In testimony whereof I have hereunto affixed my signature in the presence of the two subscribing witnesses.

HARRY SHOEMAKER.

Witnesses:

JAMES M. SAWYER,

A. D. KNEUPER.