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S. D. FIELD.

METHOD OF RECEIVING TELEGRAPHIC SIGNALS.

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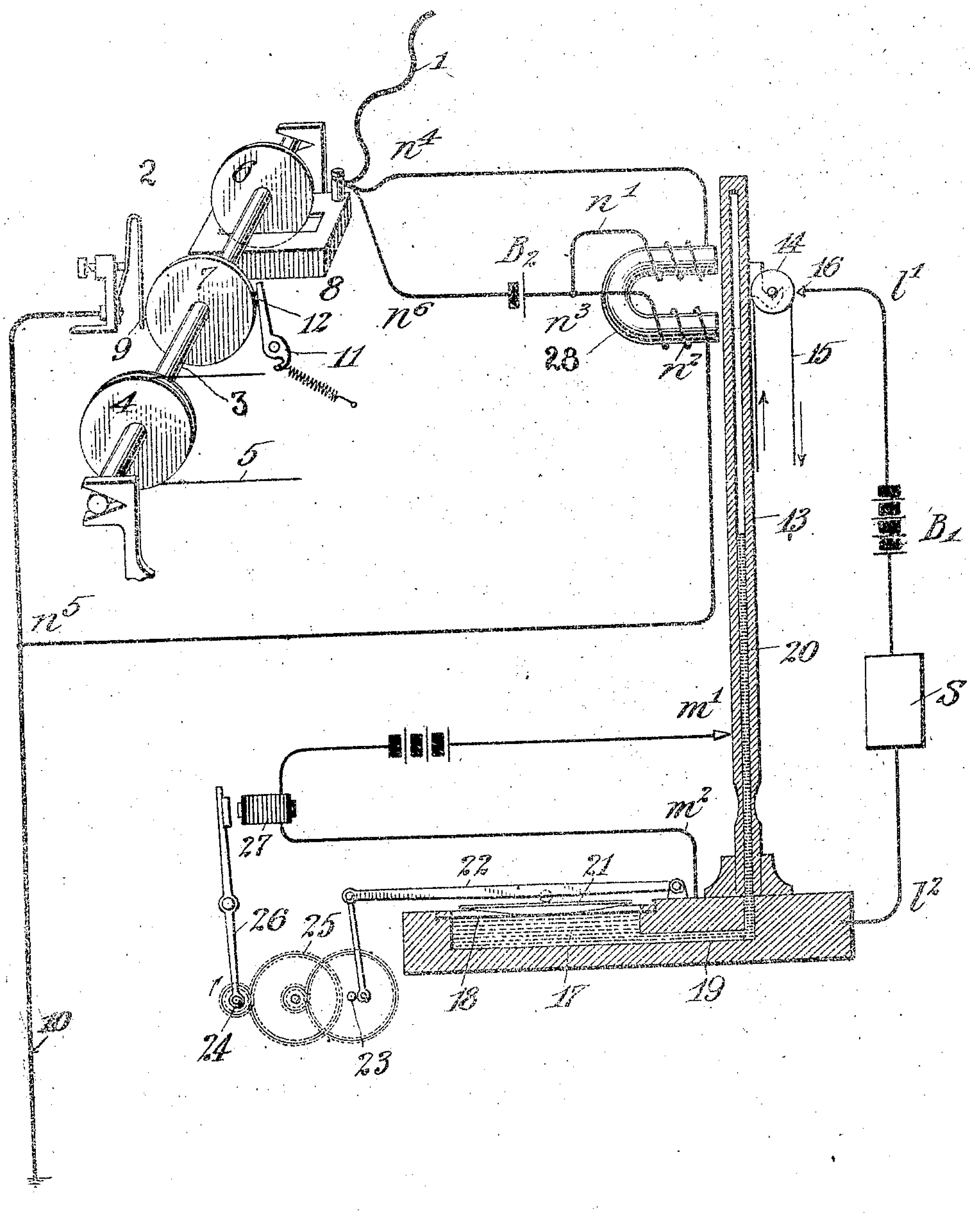

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METHOD OF RECEIVING TELEGRAPHIC SIGNALS.

No. 812,557. Specification of Letters Patent. Patented Feb. 13, 1906.

Application filed June 10, 1905. Serial No. 264,676.

To all whom it may concern:

Be it known that I, STEPHEN DUDLEY FIELD, a citizen of the United States, residing at Stockbridge, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Methods of Receiving Telegraphic Signals, of which the following is a full, clear, and exact description.

My invention relates to receiving apparatus for electric signaling systems.

In transmitting electric signals, and particularly in connection with wireless telegraphy, an apparatus is often employed in which impulses are sent out of certain predetermined frequency or periodicity, and in order to properly receive these signals the receiving apparatus must be attuned or synchronized to correspond with the periodicity of the impulses transmitted.

The object of transmitting and receiving the signals in periodic impulses is twofold. In the first place on account of the strengthening effect of resonance, the receiving apparatus can be made to respond to much feebler impulses than would otherwise be possible, and secondly by the use of apparatus of different periodicity in the different stations, the receivers can be selective and respond to only particular messages.

The object of my present invention is to provide a method for receiving signals of any sort, having a periodic character, and to further provide a method by which the periodicity can be varied, so that any receiver can be readily attuned to any kind of messages transmitted. In this way communication may be had with any one of a plurality of transmitting-stations, sending messages simultaneously, by merely attuning the receivers to respond to similar impulses of any particular transmitting-station.

A further object of my invention is to provide a method by which the periodicity of the receiving-station is made continuously varying in its normal receptive condition so that it is in condition to receive a signal of any periodicity whatever for the brief interval while its varying resonance accords with such periodicity. In this way the apparatus may be signaled by any station whatever and then subsequently put into communication with that station exclusively.

A further object of the invention is to devise a method which shall be economical and efficient for securing the above-named features and purposes, and one of which is adapted to be embodied in apparatus of simple character, and occupying a minimum of space.

My invention consists substantially in the order and sequence of steps and manipulations as will be more fully hereinafter set forth, and finally particularly pointed out in the appended claims.

Referring to the accompanying drawing I have shown a diagrammatic view of the circuits and the appliances which may be used to carry out an embodiment of the present invention.

It is to be clearly understood that this invention in its preferred aspect, is wholly distinct from the phenomenon of electric resonance proper, which relates to the surging of currents backward and forward in a conductor or circuit with enormously high frequency. This phenomenon forms the basis of all wireless transmission and attempts have been made to adapt it to selective signaling by attuning the resonance of the receiving and transmitting circuits to correspond with one another. But inasmuch as the electric resonance of circuits and conductors is of very uncertain and variable character, due to what is known as "multiple resonance," such electric resonance cannot be relied upon for selective signaling, any particular receiver being likely to respond to the signals of transmitting-stations of widely different periodicity from that which it is attuned to receive. The method of the present application, however, does not rely upon the phenomenon of electric resonance proper for its selective signaling properties, but depends upon synchronizing mechanically-produced vibrations of any sort whose periodicity can be absolutely controlled and maintained at any fixed rate. Under these circumstances the present method is not only adapted to wireless-telegraph transmission, where each of the impulses received is itself composed of alternating vibrations or waves, but is also applicable to impulse-currents through wire circuits, or wireless transmission of messages by mere single electrostatic or electromagnetic waves in accordance with the methods practiced before the advent of the so-called "wireless telegraphy" proper, as the term is now used.

Referring now to the drawing and the various views and reference-signs thereon in which like parts are indicated by the same

reference-signs wherever they occur: 1 denotes a wire or connection through which the impulses are received from any source whatever, as for example the aerial conductor or antenna of a wireless-telegraph system, or it may be the line-wire of a usual telegraph installation through which impulse-currents are transmitted. In any case the currents are led from the wire 1 into a coherer of any suitable form which I have broadly designated on the drawing as 2. In order to make the method which constitutes my present invention perfectly understood, I will describe the general features of the coherer and other apparatus which I have employed in practice for utilizing my method. Upon a shaft or spindle 3 continuously rotated by the pulley 4, and the band 5, I arrange a pair of metallic contact-disks 6, 7, both of which are grounded on the shaft so as to form a continuous electrical connection between their peripheries. The periphery of disk 6 dips in a mercury-cup 8 which forms the terminal of the line-wire 1. An electrical contact 9 is spring-pressed against the periphery of the disk 7 and constitutes the ground terminal 10 of the wireless or othe telegraph system.

11 denotes a spring-pressed arm carrying a pad 12 which bears upon the periphery of the disk 7 and acts to maintain the same in a clean and proper condition. This constitutes the coherer and its operation will be later described.

13 denotes a mechanical vibrator of any suitable or desired form. I have shown this vibrator as comprising one arm of a tuning-fork, but it is obvious that a reed or any form of rotary, or other mechanical vibrator may be employed. The vibrator has mounted upon it an electrical contact which is adapted to make and break an electrical circuit when the vibrator is operated.

I have shown a convenient form of contact comprising a wheel 14 continuously rotated by a band 15 and disposed adjacent to a contact 16 of the local circuit l', l^2, which also includes a battery B', and a sounder or telephone-receiver S. As the fork 13 vibrates, contact is successively made at points 14, 16, and the sounder or telephone-receiver S is operated.

For the purposes of my invention I provide means to change the periodicity of the mechanical vibrator 13 and in the drawing I have illustrated a convenient construction, diagrammatically shown in section, comprising a mercury-reservoir 17, closed by a diaphragm 18 and having an outlet-pipe 19 which leads up into a cavity 20 within the fork 13. 21 indicates a presser-plate supported on connections 22 and driven from a continuously-rotating shaft 23 which is driven by a second continuously-rotating shaft 24, through any suitable gearing 25 whereby the mercury-column slowly rises and falls within the fork 13. The shaft 24 is adapted to be operatively disengaged from the shaft 23 for the purpose of discontinuing the rotation of the latter, and for this purpose I have diagrammatically shown the shaft 24 upon an arm 26 moved by a magnet 27, so that when the magnet is energized, the shaft 24 will be operatively disconnected from the part 23, thereby fixing the mercury-column within the fork 13. The magnet 27 is included in a local circuit m', m^2, which is adapted to be closed to energize the magnet by the vibrations of the fork 13 which closes the contact m'. It is to be understood that the apparatus here diagrammatically shown is merely taken for the purposes of illustration to show a practical way in which the method of my invention can be embodied.

28 designates a magnet differentially wound with opposed windings n', n^2, which are joined at n^3 to one terminal of a battery B^2, and whose other ends are connected respectively at n^4 to the line connection 1, and at n^5 to the ground connection 10. The second terminal n^6 of the battery B^2 is also joined to the line-terminal 1, whereby there is formed a continuously-closed circuit through the winding n' of the differential magnet 28. The circuit through the other winding n^2 can only be completed through the coherer 2. This coherer, of whatever form, interposes a normally high resistance, as will be understood by those skilled in the art, while the battery B^2 is of low voltage, one volt or less, so that no current normally passes winding n^2.

I will now describe the steps, and sequence of operations, which constitute my invention, and in the performance of which the above apparatus operates. I do not wish to confine myself to the specific apparatus shown or to any of the details or features thereof, since these are not essential to carry out my invention, but merely a convenient and practical construction. Any form of coherer could be substituted for the one here shown, various forms of mechanical vibrator can be employed, and the magnet 28 may have a single core if desired which carries both windings n' and n^2.

The electrical impulses induced in the antenna of a wireless-telegraph receiving-station pass downward through the connection 1 into the mercury-cup 8 and into the disks 6 and 7. The disk 7 carries on its surface by reason of its rotation, a very thin film of air and across this air-gap the periodic current leaps to the contact 9 and to the ground 10 to complete the circuit in the usual way. The action of the current in leaping across the gap establishes a local battery-circuit as follows: B^2, n^3, n^2, n^5, contacts 9, 7, cup 8, back to the battery B^2. The effect of energizing the coil n^2 is to neutralize the effect of the winding n' which is continually excited by the battery, so that as the two windings now oppose each

other, the magnet 28 loses its attractive force upon the mechanical vibrator 13. Under these circumstances the vibrator 13 begins to sway backward and forward, with a certain periodicity, dependent on the mercury-column or other means which regulates said periodicity. In the meantime the connection 22 is slowly oscillating, so that the mercury slowly rises and falls in the cavity 20 of the fork 13. I have found that a complete cycle of movement of the mercury in about a minute or a minute and a half gives good results in practice.

If the periodic currents in the connection 1 are coming in the form of impulses regularly and successively entering the apparatus at defined and properly-spaced intervals of time, the magnet 28 will be energized to correspond with such impulses and transmit them to the mechanical vibrator 13. If this vibrator happens to be attuned to the impulses, it will resonate to them and take up a noticeable vibration which will close the local circuit 14, 16, and make a signal in the sounder or receiver S. Should the mechanical vibrator not be attuned to the impulses, nothing will happen until the mercury 13 has had time to change the periodicity of the mechanical vibrator so that it is in tune, whereupon the signal S will be actuated.

At the instant such signal is given, the operator knows that his instrument is attuned to impulses from some station, and he promptly operatively disconnects shafts 24 and 23, or allows the magnet 27 to do so automatically, so that thereafter the periodicity of the mechanical vibrator 13 is fixed, and attuned to the transmitted impulses. Thereafter the impulses are sent in groups to correspond with the dots and dashes of the Morse code, and the message is received in the sounder or telephone-receiver S from the transmitting-station. In the meantime the apparatus is not affected by messages from other stations to which the mechanical vibrator is not at that moment attuned.

When the conversation is completed, the periodicity-varying means 24 is again started into operation and the apparatus is in condition to catch the attention-signal of any transmitting-station. In order therefore to establish communication between a sending-station and a receiving-station, it is only necessary for the former to send out a steady stream of impulses at its own rate until a response comes from some receiving-station.

What I claim is—

1. The method of detecting vibratory currents of a constant periodicity which consists in subjecting a vibratory body to the influence of said currents and simultaneously gradually altering the periodicity of said body until it is in tune with that of said currents.

2. The method of signaling which consists in subjecting a vibratory body to successive impulses, and simultaneously gradually changing the periodicity of the vibratory body until its periodicity corresponds to that of the impulses.

3. The method of bringing a vibratory body into synchronism with impulses of a constant periodicity, which consists in subjecting it to the influence of said impulses, and simultaneously continuously changing the periodicity of said body from minimum to a maximum or vice versa, until its periodicity corresponds to that of the vibratory impulses, and finally automatically stopping said changes when such correspondence is obtained.

4. The method of signaling which consists in transmitting electric impulses of a fixed periodicity, receiving such impulses in a coherer which forms part of a local circuit including a magnet, and subjecting a vibratory body to the influence of said magnet and gradually changing the periodicity of said body.

5. The method of signaling which consists in receiving impulses in a coherer which forms part of a local circuit including a battery and a magnet, subjecting a vibratory body to the influence of said magnet, gradually changing the periodicity of said body and finally closing a local circuit by means of said body.

6. The method of signaling which consists of receiving impulses in a coherer, each impulse being composed of periodic currents of high frequency, establishing a local circuit through the coherer by means of said periodic currents whereby the periodic currents are transformed into simple impulses in the local circuit, and subjecting a mechanical vibrator having a continuously-changing periodicity to said local impulses.

7. The method of signaling which consists in initially transmitting high frequency waves, divided into separate impulses to a coherer, establishing a circuit including a local battery through the coherer by means of said periodic currents whereby the periodic currents are transformed into single impulses in the local circuit, subjecting a mechanical vibrator having a gradually-changing periodicity to said impulses and finally fixing the periodicity of said vibrator.

8. The method of detecting vibratory currents which consists in subjecting a vibratory body to the influence of said currents and continuously changing the periodicity of the body until it is attuned to said vibratory currents and then finally fixing the periodicity of said vibratory body.

9. The method of signaling which consists in transmitting high-frequency waves divided into impulses, transforming said waves into simple impulse-currents, transforming said currents into pulsating magnetic force of corresponding periodicity, subjecting a

mechanical vibrator having a gradually-changing periodicity to said magnetic force, and finally transforming the vibrations of said mechanical vibrator into sound.

10. The method of signaling which consists in transforming electric emanations or waves separated into groups of a certain periodicity into simple impulse-currents, transforming said impulse-currents into pulsating magnetic force, subjecting a mechanical vibrator having a changing periodicity to said pulsating magnetic force, and finally fixing the periodicity of the mechanical vibrator when it is attuned to said magnetic force.

11. The method of signaling which consists in transforming electric emanations or waves into simple impulse-currents, transforming said impulse-currents into pulsating magnetic force, subjecting a mechanical vibrator having a changing periodicity to said magnetic force and finally automatically fixing the periodicity of said vibrator when it is attuned to the magnetic impulses.

In witness whereof I subscribe my signature in the presence of two witnesses.

STEPHEN DUDLEY FIELD.

Witnesses:
DANIEL B. FENN,
LOUIS H. FENN