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HAULING A FRENCH OBSERVATION BALLOON TO A NEW SIGNALLING POST

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Voice-controlled Writing Machine

A New Phonetic Alphabet Based on Speech Characteristics of Sound

A NEW alphabet has been discovered For years thousands of styluses have been tracing the strange characters right here in our very midst but the writing has been so fine and so complicated that hitherto the letters have not been deciphered We refer of course to the writing of the phonograph needle which spells out its record phonetically in cursive characters that are not arbitrary symbols, like those of man made alphabets but are definite forms fixed by laws of nature

Three years ago the SCIENTIFIC AMERICAN published a description of a voice-operated typewriter which was then in a purely experimental stage although it gave some promise of success The inventor Mr John B Flowers had devised a system of reeds tuned to respond to various characteristics of speech These by means of electrical connections were adapted to operate corresponding keys of a typewriter If a simple word were spoken into the receiver of the apparatus the keys would automatically respond and write the word

While the vowel sounds were easily detected by the instrument it was exceedingly difficult to distinguish the consonants, and when continued experiment failed to solve this knotty problem the inventor came to the conclusion that he needed a more complete knowledge of the characteristics of human speech Evidently, the difference between two speech sounds such as B" and ' D" for instance, was not one of wave frequency Variation in the number of sound waves would merely raise or lower the pitch, but the characteristic ' B ' and "D" sounds are distinguishable whether uttered by the highest soprano or the basso profundo What then are the peculiar characteristics that enable us to distinguish the various letter sounds? This was the problem that Mr Flowers set out to solve

He realized early in his experiments that speech is not dependent upon the vocal chords, for words may readily be distinguished if whispered Hitherto, speech records have always been spoken aloud or sung, with the result that the curves traced have been complicated by fundamental tones and over tones of the vocal chords as well as the mouth tones In order to get a pure curve Mr Flowers decided to make records of whispered speech This he succeeded in doing by the use of an acousticon transmitter coupled to an Einthoven string galvanometer in the manner shown in Fig 6. A cross-section of the acousticon is also shown in this engraving, which shows how the sound waves are gathered by reflecting surfaces and projected with magnified intensity upon the diaphragm The operation of the acousticon transmitter produces electrical vibrations corresponding to those of the voice. These vibrations are conducted through a fine silver plated quartz thread one ten thousandth of an inch thick. This passes between the poles of an electromagnet, and in response to the electrical variations the wire is compelled to vibrate A beam of light shines upon the wire and its shadow is cast upon a revolving drum fitted with a highly sensitive photographic film By a system of lenses the slightest motion of the string is magnified nine hundred times on the film The telephone receiver shown in the diagram was used as a check on the articulation of the words In order to produce a time record, the light of the arc lamp was interrupted five hundred times per second, thus producing vertical lines on the film at intervals of 0 002 sec.

With this apparatus it was proved conclusively that it is the variation of intensity in sound waves that produces speech. For instance, the waves recorded by the sound "B" would vary in intensity according to the pattern shown in Fig 1 If ' B ' were pronounced on a lower pitch, this pattern would be the same, but it would contain fewer waves, as in Fig 2. The pattern usually lasts at least 0 001 second, when, if the sound continues, it repeats itself

Hundreds of records were made, all of which showed practically the same sound pattern regardless of the age or the sex of the various speakers. Thus a complete phonetic alphabet has been worked out by Mr Flowers, which we have shown in part, in Fig 3, leaving out certain of the vowel sounds.

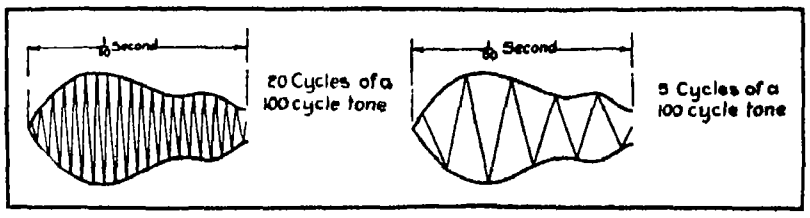

Fig 1 Characteristic intensity curve of the "B" sound

Fig 2. Intensity curve of sound "B" when uttered at a lower pitch

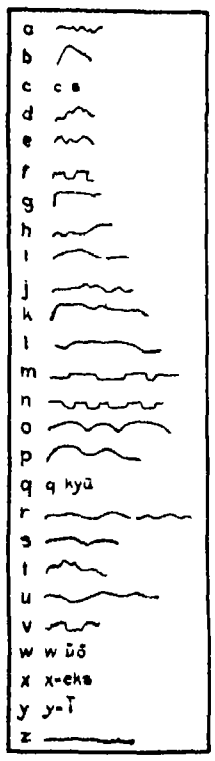

Fig 3 The new phonetic alphabet

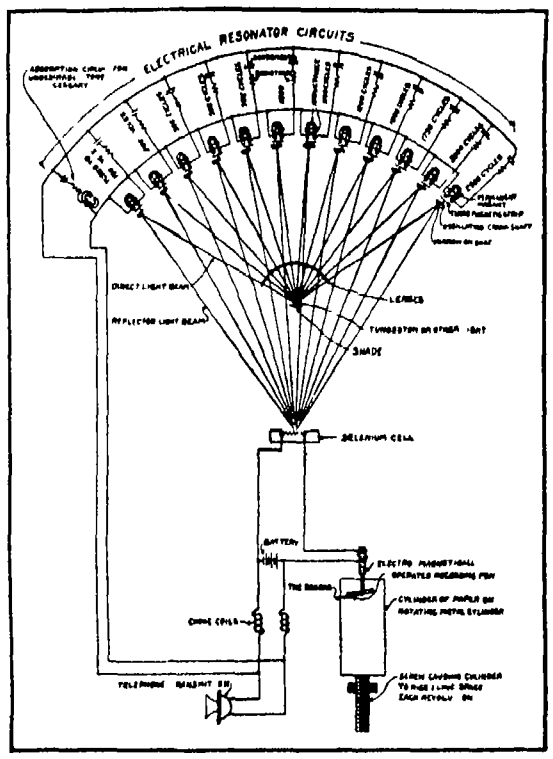

Fig. 4. Diagram of a voice-operated machine for recording speech in the new phonetic characters

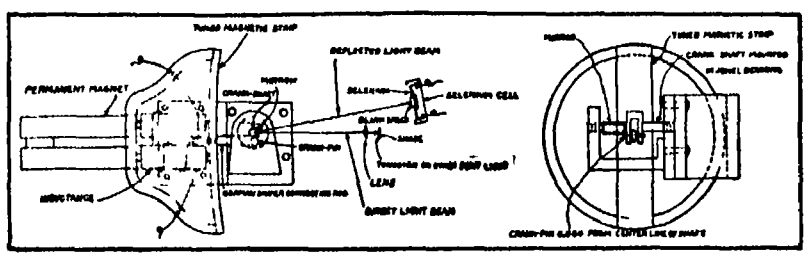

Fig 5. Mechanical arrangement of the mirror-moving mechanism of the voice-operated writing machine

On talking into the transmitter, speech-controlled currents pass into the resonator circuits, and the resonator that is tuned to the main tone of the speech at that instant will respond, and the tuned magnetic strip of that resonator will vibrate powerfully As shown in Fig 5, this oscillates a tiny mirror, which throws a beam of light upon a selenium cell, normally the beam falls upon a blank part of the cell, but as the beam vibrates it illuminates more or less of the selenium on each side of this blank zone, producing a variation in the electrical resistance of the cell An electrically-operated pencil bearing upon a cylinder of paper is controlled by the variations of resistance of the selenium cell and thus a wavy line is drawn that records the speech in the new phonetic characters

The reason for having a large number of electrical resonator circuits is to allow for variations of pitch An average man's voice has a pitch lying between 85 and 160 vibrations per second, while a woman's voice will vary between 150 and 320 vibrations. The machine illustrated has not yet been built for all the various pitch cycles shown in the drawing, but it has been constructed to operate on a single pitch

In use, a machine such as this, would produce a record that would have to be transcribed by a typist into Latin characters and English spelling The record made by the machine is fully as easy to decipher as that of a siphon recorder used in cable telegraphy Should such an instrument come into common use, the dictator would soon learn to read the natural phonetic writing, and it is conceivable that in time it might become unnecessary to transcribe the writing into Latin characters. The public would learn a new phonetic alphabet, and the problem of simplified spelling would be solved

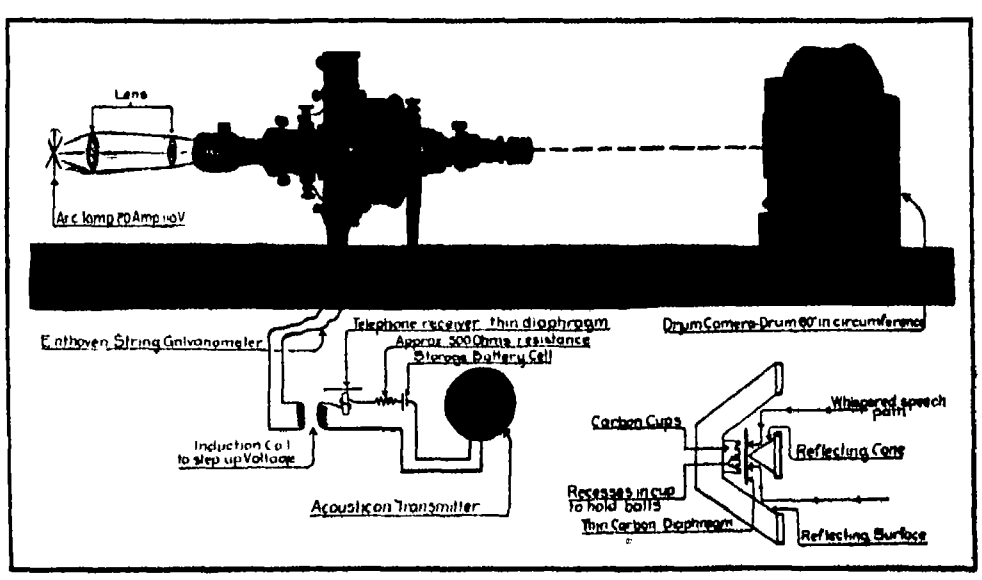

Fig. 6. Apparatus with which the characteristics of speech were studied. The insert shows a section of an acousticon

Radio Direction Finder Invented by Young American

IT is announced by the Department of Commerce that the Bureau of Standards has met with success in the developing of a satisfactory radio direction finder Much interest centers about this device, since the possibility of locating accurately the source of wireless signals is of utmost importance not only to naval and military men, but also to the mercantile marine as a means of avoiding collisions. Furthermore, the direction finder apparatus is invaluable to the radio inspectors of the Bureau of Navigation for the locating of amateur and other stations that are not observing the radio regulations or are otherwise interfering with radio transmission of the Government and legitimate business.

The wireless experts of the Bureau of Standards, under the direction of Frederick Kolster, who, it will be recalled, has contributed materially to the progress of radio telegraphy, have been investigating the subject of wireless direction finding for some time past. The instrument, which they have developed as a result, is said to be simple and practical, and at the same time very efficient in operation. It indicates the direction of the source at the instant the signals are being received, and while it is very sensitive to radiations in a given direction, it is less affected by atmospheric disturbances and interfering radiations from other directions than an ordinary receiving apparatus It is stated that messages have been received by one or another of the three sizes of instruments that have been built, from Philadelphia, Boston Glace Bay Newcastle (N B), New York, Norfolk, New Orleans, Panama, Key West, San Diego, and Hanover, Germany When atmospheric disturbances have been very pronounced on the large antenna at the West Laboratory, they have been very slight on the direction finder apparatus, which is entirely indoors, having no antenna or earth or outside connection

The new direction finder apparatus appears to be well adapted to use on merchant and naval ships to obtain the direction from any light houses or light ships that may be equipped with radio fog signaling apparatus to obtain the direction of one ship from another at sea, to communicate between ships or ship and shore stations irrespective of direction by reducing interference and atmospherics, to use by the War Department in field service as the receiving apparatus is portable and requires no ground or antenna, and can be carried readily in a light vehicle or even by a single observer, and to use by the Bureau of Navigation to locate amateur or other stations that are not operating their transmitting apparatus in compliance with the radio regulations

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Frederick Kolster of the Bureau of Standards, and the new radio direction finder apparatus

Railroad Wheels That Are Practically Silent

DESPITE the number of attempts made in the past to produce a really silent wheel for railroads and trolley cars, no successful wheel of this type has been generally adopted by the railroad companies In the course of long-continued tests there always cropped out disadvantages which the inventor had overlooked in the design of his wheel

At the present time however, Eastern railroad officials are greatly interested in the performances of a new type of wheel which has been undergoing the most strenuous tests and subjected to nearly a year of actual service

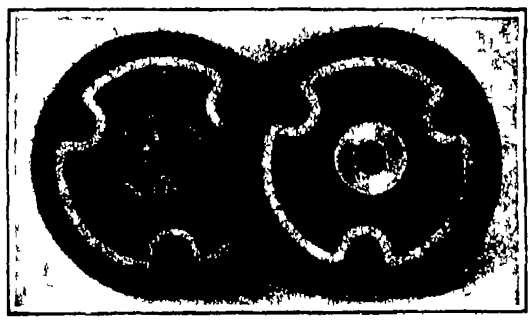
The tests to which the new wheel has been subjected have been carried on without undue publicity, in fact without even the formality of advising the technical press of their purpose It has been the intention of the inventor as well as the railroad officials, to keep the matter private until the full year trial is over At the end of this time provided the wheel has shown its many advantages to the satisfaction of the railroads, it is to be manufactured in quantities.

The writer was informed of the object of these tests in October, 1915 and after some difficulty succeeded in obtaining a short technical description of the wheel and some photographs of the first two sets made Since April 8th, these wheels have been in continuous use on one of the trolley cars in Portland Me, and a complete daily record is kept of the performance During the first six months of the strenuous test the wheel proved so satisfactory that a large order is now being arranged for, while a plant is to be erected for the manufacture of the wheel in large quantities.

The new wheel, as will be seen in the accompanying illustrations, consists of two distinct wheels—a wheel within a wheel—separated from each other by an irregular cushion of rubber The shape of this cushion represents the results of innumerable tests with shock absorbing devices. It absolutely prevents both forward and backward creeping. It is claimed, without the use of lugs or bolts. In actual use, of course, the sides of the wheel are protected against dirt, dust, and damage by steel plates, while the rubber cushion is prevented from moving laterally by the same disks.

Among the advantages claimed by the inventor, and so far borne out by the tests made in Portland, are the following First, several times the tire service of an ordinary cast iron wheel, second, tires are easily removed and renewed, third, wear of the cushion proper is estimated at four years on average trolley service fourth, steam railroad tests indicate its good influence on the rolling stock rails and switches which are subjected to much smaller shocks, fifth, on city and interurban trolley lines the question of excessive noise is solved to the satisfaction of residents along the routes, sixth greatly improved riding qualities of the cars and greater comfort for the passengers

In order to forestall the incorporation of any possible defects in the wheels when these are to be placed on the market the inventor has resolutely refused to accept definite orders until the tests in Portland are completed In the meantime residents along the line



Interior view of the silent wheel with both cover disks removed, showing the shock-absorbing cushion

on which the silent car is operating are highly pleased and interested while the railroad officials look on with increasing approval They estimate the life of one of these silent wheels at 300,000 miles of actual travel Tires and inner cushions are renewed at small expense whenever new ones become necessary

Edwin C Madden, the inventor of this wheel, was Assistant Postmaster General under the McKinley Administration, and is the originator of the little stamp booklets now sold throughout the United States to the public, incidently making a profit of about $150,000 a year for the Post Office Department.

Outside view of a group of Madden silent railroad wheels, with the steel side disks in place

The Solar Constant of Radiation

THE June issue of the *Proceedings* of the National Academy of Sciences contains a note on the solar constant of radiation by C G Abbot F E Fowle, and L B Aldrich, who made nearly one thousand determinations of the solar constant between the years 1908 and 1914 The observations were made at Washington (at sea level) Bassour in Algeria (1 160 meters above sea level), Mount Wilson, California (1 780 meters) and Mount Whitney, California (4 420 meters)

Langley's spectrobolometric method was employed at the atmospheric absorption being computed from measurements of the distribution of energy in the solar spectrum at different zenith distances The bolometric measurements were reduced to calories by daily comparisons with standardized pyrheliometers The mean value found is 1 93 calories per square centimeter per minute

The close agreement of the values found at different times and places although both the direct measurements and the computed atmospheric absorption were greatly affected by differences in temperature barometric pressure humidity and haziness seems to be strong evidence of the soundness of the method

Furthermore the atmospheric transmission coefficients obtained at Mount Wilson agree well with Rayleigh's theory of atmospheric scattering. From these coefficients Fowle has computed the number of molecules per cubic centimeter of air as 2 70 × 10¹⁹ which is very close to Millikan's value (2 705 × 10¹⁹), obtained by absolutely independent methods

Another evidence of the soundness of the work is the fact that simultaneous observations at Mount Wilson and Bassour agree in showing an irregular variability in solar radiation which has recently been confirmed by measurements of the distribution of brightness along the sun's diameter

Nevertheless it has been objected that 1 93 is much too low a value for the solar constant that higher values have been obtained for the uncorrected solar radiation on mountains and from free balloons and that the correction made for atmospheric absorption was too small because no observations were made within 15 deg of the horizon

In order to meet these objections observations were made at Mount Wilson from sunrise until 10 o'clock, on September 20th and 21st 1914 On both days the atmospheric transparency remained sensibly unaltered The values found for the solar constant fall between 1 90 and 1 95

In July 1914 a recording pyrheliometer was raised by sounding balloons to an altitude of about fifteen miles where the barometric pressure was one-twenty fifth of the pressure at sea level The mean value of the best records of solar radiation thus obtained at highest altitudes is 1 84 calories per square centimeter per minute The highest reliable direct observations of solar radiation range from this value downward to 1 58, made at the sea level at Washington

Germany's Substitute for Cotton

GERMANY'S supply of cotton, so necessary for the manufacture of modern high explosives is low enough that a diligent search is being made for adequate substitutes England has cut off the foreign supply and thousands of tons are demanded for comparatively short campaigns

So far the hope has been that cellulose from some special wood might be nitrated successfully into gun-cotton but that success has not yet been reported A measure of success in getting a substitute has been obtained however in using certain forms of paper pulp lignin etc as a dressing for wounds thus saving some of their precious cotton for explosives One firm in Berlin is selling "lignin" as an absorbant for blood at a price of about eight cents per pound in hundred pound lots It is put up in sheets about fourteen by twenty four inches and in packages of eight pounds or rolls of two pounds

One of the most effective wound dressings among these substitutes is sphagnum moss which to some extent had been used in both England and Germany before the war The moss is so full of minute tubes that in its ordinary state it holds nine times its own weight of water and is therefore a powerful absorbent when dry It is very soft and light Gathered from the swamps, it is dried on rocks or bushes until bleached white, then cleaned and sterilized