

to become more or less luminous. In this manner an exact copy of the photograph at the transmitting station is reproduced upon the printing-off paper.

This process can also be used for the transmission of handwriting. In this case the matter is written with non-conductive ink upon tin-foil, which is then drawn through a contact device. Closing of the current then takes place upon the surface of the metal, whereas, owing to the nature of the ink, the current is broken at the written characters; in this way the above described photographic currents are produced, which are then used at the receiving station as stated above. At present from 500 to 600 words can be transmitted per hour, giving an exact replica of the original; or a stenographed message of 3,000 words can also be telegraphed in the same time.

Terms Employed by Foresters and Loggers.

"Terms Used in Forestry and Logging," just published as Bulletin No. 61 of the Bureau of Forestry, affords the lay reader an insight into a strange vernacular.

The first half of the pamphlet is devoted to forestry. There we may read all the technical terms in good use, from "absolute forest land" to "yield table." Many terms explain themselves, but where they are not so readily understood the short definition makes plain at once the idea conveyed and the need of a special word or phrase to convey it. Perspicuity, precision, and common sense seem to have been the objects sought by the compilers.

On turning to the logging terms, which are listed in the last half of the bulletin, we come across some truly remarkable expressions—terms which, though evidently derived from slang, are now in good use among woodsmen either throughout the country or in the region denoted in each case. There the uninitiated may learn the distinction between a "ball-hooter" and a "boom rat," between a "bull cook" and a "cattyman," and find that none of them refers to any lesser animal than the logger himself. Among other creatures of the logging camp may be numbered also the "alligator," the "dolphin," the "dog," the "pig," and the "road donkey," all names of objects endowed with life by the vernacular of the logger. The "alligator" proves to be "a boat used in handling logs;" the "dog" a "short, heavy piece of steel;" the "pig" a "rigging sled;" and the "road donkey" a donkey engine mounted on a heavy sled, etc. Birds are represented by the "blue jay" and the "rooster" (also called "goose-neck"), reptiles by the "snake," and insects by the "katydid." A tenderfoot intending a visit among the brawny loggers in the North Woods, the Appalachian Forest, or elsewhere, should find it decidedly in order to take along this bulletin.

As the only reliable handbook of the kind in the language, Bulletin No. 61 will be in wide request among those interested in forestry and lumbering. It may be secured by application to the Forester, Department of Agriculture, Washington, D. C.

The Gases Given Off by Actinium.

Solutions of radium salts are known to give off continually an explosive mixture, $H_2 + O$, resulting from the decomposition of the water under the influence of radium. Ramsay and Soddy have shown this mixture to contain also small amounts of helium, which, as is generally presumed, is due to the disaggregation of the radium atom.

Mr. A. Debierne, as pointed out in a recent memoir to the French Academy of Sciences, has performed a large number of experiments on a solution of radium bromide and on actinium salts both in solution and in the solid state, when a formation of helium was stated with both kinds of salts. The experimental outfit used was similar to the one employed by Ramsay and Soddy, the gaseous mixture being introduced into a glass tube containing different substances to absorb any gases susceptible of chemical reactions. Such gases as were not absorbed in one of these tubes, viz., those of the argon group, were compressed by means of mercury in a small capillary tube, about 2 cubic millimeters in capacity, and carrying two platinum electrodes. The spectrum of the gas was observed in a direct vision spectroscopy of fairly great dispersive power, giving the wave length with an error of 1 or 2 units in the fourth figure. Photographs of the same spectrum were obtained by means of a quartz spectrograph, allowing the wave length to be measured with an error of one unit in the fifth figure.

The helium gas obtained in the author's experiments was found to be due to the presence of radio-active bodies as borne out by numerous checking experiments made under similar conditions.

In a previous paper, the author has shown that outside of the large amount of rapidly evolved emanation from actinium, there is a rather small amount of emanation which is evolved much more slowly. This latter emanation is found to be identical with the one given off by radium, though the amount evolved be extremely small.

It may be mentioned that Prof. Debierne has found in the spectra of the gases given off by actinium a number of lines which he has not been able as yet to ascribe to any one of the known gases.

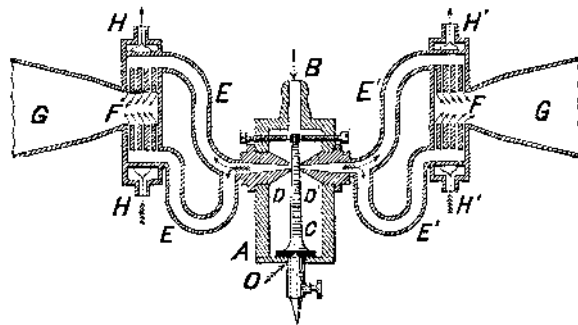
A NEW MEGAPHONE.

BY DR. ALFRED GRADENWITZ.

A novel apparatus for increasing the intensity of sounds has been invented by Messrs. G. Laudet and L. Gaumont. The principle underlying the construction of this apparatus, which was recently presented to the French Academy of Sciences, consists in transmitting the sound vibrations concerned to and from a convenient flame. After the first experiments made in this connection, utilizing the human voice, had given satisfactory results, the voice assuming a remarkable intensity, the experimenters continued their investigations, employing sources of sounds of mechanically determined intensity, with continued success.

The megaphone (shown in the accompanying engraving) consists of an equilibrated distributor to regulate the amount of the burning gas mixture, and a burner wherewith the gases are consumed in an ignition chamber. The apparatus submitted to the Academy was arranged for registering the reinforcement of sounds of any kind on ordinary phonograms. Air and acetylene were employed as burning gases.

The distributing mechanism consists of a chamber, *A*, into which the combustible mixture is introduced under pressure through a conduit, *B*. A vane, *C*, supported on knife edges at *O*, is mounted at the bottom of the chamber, *A*, an elastic ring being provided to insure airtightness in *O*. Any motion given to the pencil is transmitted to the vane, *C*, inside of the distributor. On either side of *C* openings, *D* and *D'*, are provided through which the gaseous mixtures are allowed to issue in respectively equal amounts as long as the vane is immovable. Any displacement of *C* will, however, result in an increase of the amount of gas issuing on one side, while the amount issuing on the other side is reduced. The total amount of utilized mixture remains constant, and the pressure in the interior of the chamber is also unaltered.



A NEW MEGAPHONE.

The gases are collected and conveyed to the burners through a series of conduits, *E, E, E', E'*. The burners consist of a series of disks cooled by an air current, *H H'*, the gases being expanded and reduced to a temperature such that combustion always occurs in the chamber, *F F'*, just at the point where the gases escape from the openings of the burner. The apparatus further comprises two funnels, *G G'*. The power of the sounds obtained, which is truly remarkable, depends on the amount of gas mixture used and on the energy expended during its combustion.

The Current Supplement.

The current SUPPLEMENT, No. 1560, opens with a description of a 50-ton electric crane having a radius of eighty-seven feet. In a number of papers recently contributed to various scientific publications, Prof. Rutherford and others have made valuable contributions to our knowledge of the properties and life history of radium. These are reviewed in an excellent article bearing the title "Recent Study of Radium." Platinum and its alloys are briefly discussed. Prof. John J. Montgomery writes authoritatively on new principles of aerial flight. Walter J. May contributes an account of metal foundry patterns. Curious optical illusions are described by Arthur K. Bartlett, the chief being the halo of the moon. Mr. J. H. Morrison's excellent series of papers on the iron and steel hull steam vessels of the United States is brought to a conclusion. The last installment of A. Dastre's article on the stature of man at various epochs is presented. R. Kissling contributes the result of his recent investigations in the chemistry of tobacco. There are few more familiar sights than rain, and yet the method of its formation is but little understood by the ordinary reader. For his benefit the current SUPPLEMENT contains a most instructive article, in which the phenomena of rainfall are simply discussed. Prof. Dr. Hans Molisch, whose investigations on the phosphorescent light of plants have made him a leading authority on the subject, read a paper on "The Radiation of Light by Plants" before the Congress of German Naturalists and Physicians. This paper is published in full.

Engineering Notes.

In considering the proper material for a lagging, the principal elements are nonconductivity, noninflammability, efficiency, economy, ease of application, structural strength to withstand frequent removals and re-application, freedom from corrosive agents, ability to withstand indefinitely the disintegrating effect of the action of heat, and the vibrations and concussions incident to locomotive action. In addition, the covering should be only of material which is of a porous or spongy nature, with numerous cells or spaces, which will retain air between the particles of the substance.

As an instance of the rapidly-increasing use of steam turbines in Europe, we may mention the following electric plants, which are either in construction or already running. The plants in question are all under the control of a Franco-Belgian syndicate. The first of these, and the largest, is the new electric station which is to supply an extensive section of Paris with current for lighting and motors. It is now in construction at St. Denis. The power of this station will reach nearly 30,000 horse-power, and an overload of 20 per cent can be kept on for two hours. Next comes the large electric plant of Sclessin, near Liège, which has steam turbines to the amount of 15,000 horse-power. The new electric plant of Charleroi, also in Belgium, can furnish 3,500 horse-power, while the new plants which are erecting at Brussels, Ostend, Maubeuge, and at Cairo represent in all about 15,000 horse-power. Thus we find that steam turbines to the extent of 65,000 horse-power have been installed within three years by the same company.

The question is sometimes asked whether it pays to reduce the pressure when the load is light. It hardly pays to reduce the pressure on the boiler, except in very extreme cases, but if it can be done by throttling before the steam reaches the cylinder of the engine, it would be an advantage, because this retains the heat units due to the higher pressure in the steam and the throttling has a slight superheating effect. As a matter of fact, tests made by Willans & Robinson, of England, go to show that for light loads and high pressure, a throttling engine may do even better than automatic cut-off. The ideal arrangement is to throttle the steam for light loads up to say near quarter cut-off, and after that, for heavier loads, allow the variable cut-off to come into play. This practice has been carried into effect by the design of Mr. E. J. Armstrong, in which he arranges the shaft governor so that there is negative lead up to nearly one-quarter cut-off, after which the lead becomes positive, and this has the effect of throttling the steam for the earlier loads and undoubtedly gives better economy, in addition to making the engine run more quietly.

The first tunnel which is to pass underneath the Seine near Notre Dame for one of the new sections of the Paris subway has now been commenced. The Metropolitan had been taken across hitherto upon two bridges. These latter sections have not as yet been completed, however. As to the tunnel under the Seine, the first of the caissons was sunk not long ago. It has the peculiarity that it not only serves in carrying out the work, like an ordinary caisson, but the superstructure forms the walls and vault of the tunnel itself, having straight sides and an elliptical arched top. So that it will be sunk on the spot where it is to remain and then will be covered on the inside by an envelope of cast iron and masonry. Each of the caissons thus forming a section of the tunnel is 130 feet long by 33 wide and 29 high. At this point the Seine has 16 feet depth. The lower side of the caisson will be sunk to a depth of 33 feet below the river bed and the upper part will thus lie about four feet below the ground. There will be three of these sections to form the tunnel which passes obliquely across the Seine.

In Switzerland, the number of electric and cable inclined railways for ascending the mountain slopes has greatly increased within the last few years, and when working in connection with the railroads, the system has proved very useful both for tourists and also for the inhabitants of the health-resorts which are placed at elevated points. Among the new inclines which are now in construction we may mention the one which is to be used for mounting the Wetterhorn. It is designed upon the Feldmann system, by the constructor of the well-known Barmen-Elberfeld-Vohwinkel suspended road. The peculiar feature of the new Wetterhorn incline is that the cars are suspended above the tracks upon cables. The overhead cable is made double and there are two cables, one above the other, so as to provide for breakage. The two tracks lie 25 feet apart and the cars are drawn as usual by cable. The descending car helps to draw up the ascending one. The sustaining cables are anchored separately at the upper part and at the lower are stretched by a counterweight. This makes the tension of the cables independent of the value and the position of the traveling weight due to the cars. Steel cables of about 2-inch diameter are used. The cars are very light, and the system takes less power than usual.