

of the *Oecophylla smaragdina*. This ant, one of common occurrence in Eastern Asia, forms shelters by bending the edges of the leaves of the trees upon which it lives and fastening them together. The adult ant possesses nothing with which to secure the edges of the leaves together after they have been brought into the required position; but its larva is furnished with glands that secrete an abundance of adhesive, gelatinous substance, by the aid of which it forms its cocoon, and these intelligent insects actually make animated mucilage brushes of their larvæ in order to effect their purpose. A number of the ants, seizing the edges of the leaves in their mandibles, bring them together into the . . . needed and hold them there, while other ants, each one of which bears a larva in its jaws, apply the mouths of the larvæ to such parts of the leaves as require to be cemented together, and induce their offspring to disgorge as much sticky material as they find necessary to accomplish the desired result.

Such instances as these of a knowledge of cause and effect, a seemingly conscious adaptation of means toward a desired end, and what may, perhaps, be called audacious ingenuity in devising methods of overcoming difficulties that at first sight seem insuperable, argue faculties which it is difficult to differentiate from sense and reason.

THE COOPER HEWITT LAMP.

The most recent as well as the most interesting development in electric lighting has lately been brought about by Mr. Peter Cooper Hewitt, son of Ex-Mayor Hewitt of this city, as the result of long-continued and untiring exertions on his part. This remarkable invention was recently described by Mr. Hewitt at a "Conversazione" at the Columbia University during an exhibition of recently invented electrical devices. The high-power electric lights exhibited by Mr. Hewitt were on a new principle, a gas being used as the illuminating medium instead of the usual filament. Several of these lamps are shown in the half-tone and line engravings which we publish. These lamps were all experimented with by Mr. Hewitt, and the light produced by some of them was truly remarkable, since it compared favorably with the arc light. The color of the light emitted from these

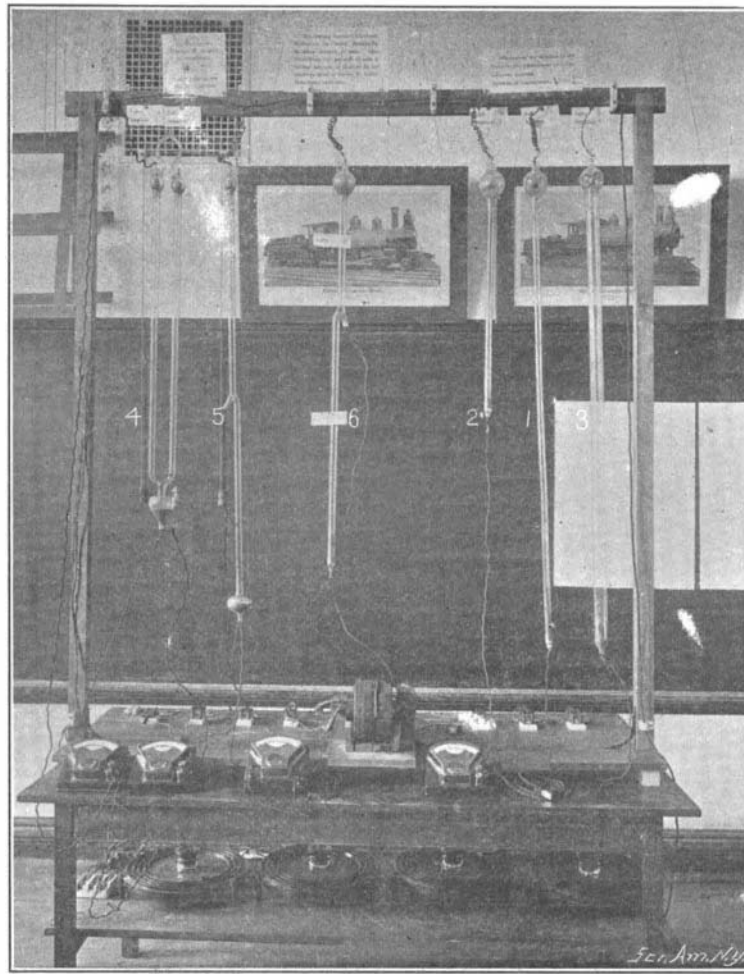


Fig. 1.—Length, 54 inches; diameter, 3/4 inch; volts, 90. Fig. 2.—Length, 27 inches; diameter, 3/4 inch; volts, 46. Fig. 3.—Length, 54 inches; diameter, 1/2 inch; volts, 54. Fig. 4.—In left-hand circuit, volts, 62; amperes, 4; ohms, 15.5. In right-hand circuit, volts, 64; amperes, 2; ohms, 32. Fig. 5.—In upper half, volts, 35; amperes, 1.75; ohms, 20. In lower half, volts, 47; amperes, 35; ohms, 13.4. Fig. 6.—In upper portion, volts, 28; amperes, 3. In lower portion, volts, 44; amperes, 2.98.

THE COOPER HEWITT ELECTRIC VAPOR LAMP EXHIBITED AT COLUMBIA UNIVERSITY.

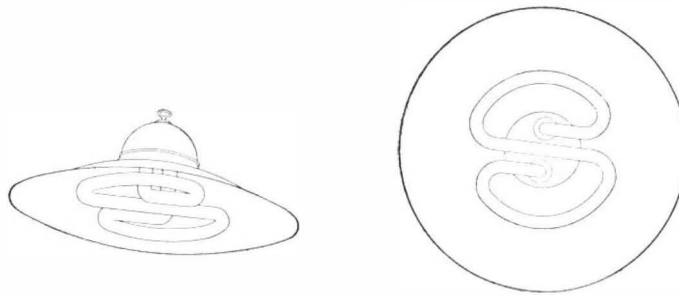


Fig. 7.

lamps depends mainly upon the gas used for the filling of the tubes. Some of the tints are objectionable, but they may be varied by changing the character of the gas. The remarkable feature of these lamps is that under the proper conditions

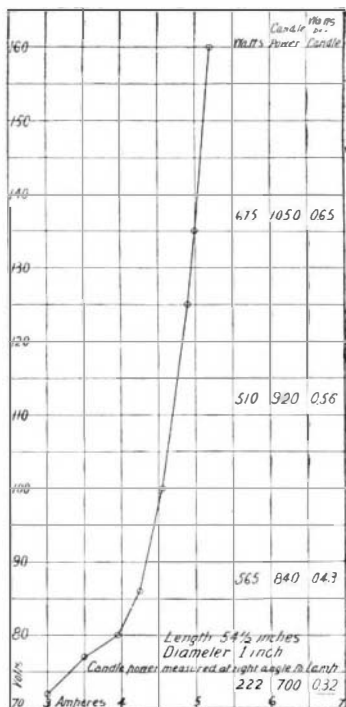


Fig. 8.

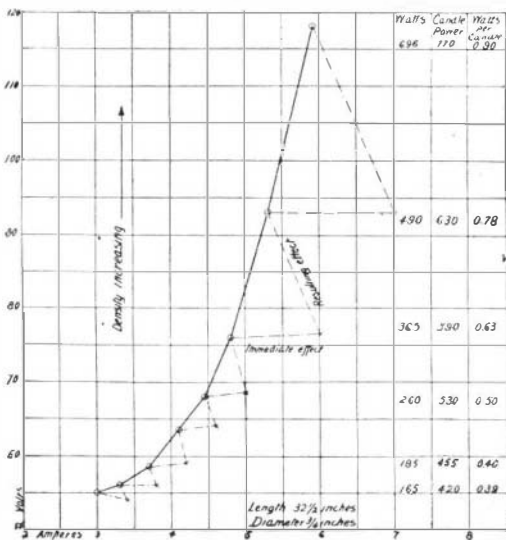


Fig. 11.

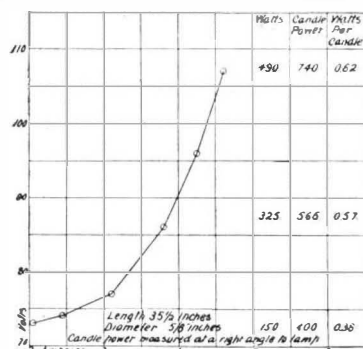


Fig. 9.

of temperature and exhaustion they may be operated by a direct current from any circuit of sufficient voltage. The light obtained has a most astonishing brilliancy and is perfectly steady. We understand that efficiencies as high as from 0.5 to 0.32 watt per

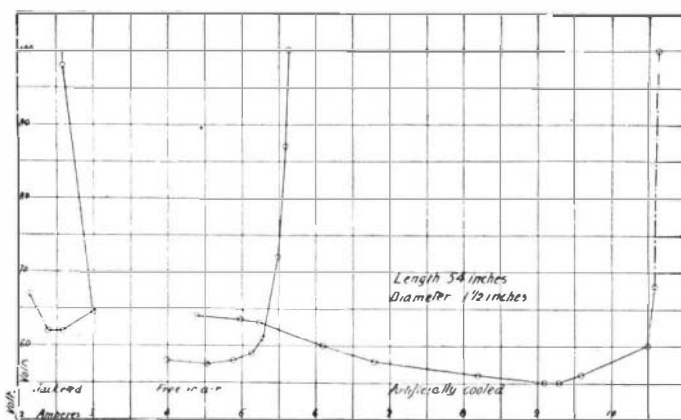


Fig. 12.

candle power have been obtained. Mr. Hewitt has made a special study of the laws of conductivity of vapors, and has ascertained many curious facts in regard to their behavior as conductors in his lamp tubes.

By reference to the half-tone engraving it will be seen that the lamps are exceedingly simple, being merely tubes with electrodes sealed in either end, in some cases surrounded by mercury, which supplies the vapor which fills the tube and becomes luminous on the passage of the current. These tubes are lighted by an ordinary direct current of from 100 to 200 volts, after being started by an impulse sent through a Wehnelt interrupter. The vapor tube acts like a conductor with a resistance which varies inversely as the current flowing through it.

The lamp is interesting on account of its great power and extreme simplicity. The many curious facts in regard to this lamp and other electrical phenomena discovered by Mr. Hewitt would make a very interesting volume.

We take pleasure in publishing herewith the following

NOTES ON THE COOPER HEWITT LAMP, BY PETER COOPER HEWITT.

The purpose of the exhibit which I had the honor to present at Columbia University, before the American Institute of Electrical Engineers, on April 13, 1901, was:

First.—To demonstrate that light can be produced from a gas or vapor in great quantity by means of the electric current and in the quantity desired.

Second.—To demonstrate that light can be produced from direct-current low-voltage circuits, by means of a gas or vapor.

Third.—To show that this light is extremely efficient.

Fourth.—To illustrate laws of conduction of the electric current by gases or vapors, and to show by experiment the effect of current on a conducting vapor or gas and the effect of variation in density of the conducting vapor on the current passed.

Fifth.—To exhibit the electrical phenomena at the joint of the negative electrode with a gas or vapor.

Sixth.—To exhibit electric vapor or gas lamps of very high efficiency.

Seventh.—To demonstrate that change in the color of the rays of light proceeding from a gas or vapor lamp of this character can be brought about by means of certain material.

Eighth.—To show, by means of curves, that the resistance of a particular vapor in a lamp can be made to vary in a predetermined manner within wide limits by varying the proportion of the vapor subjected to the current and the heat-radiating ability of the lamp.

The demonstrations actually made are illustrated by

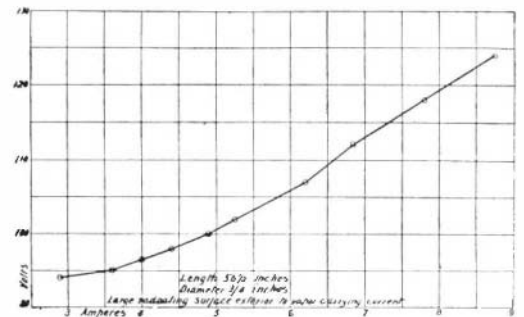


Fig. 10.

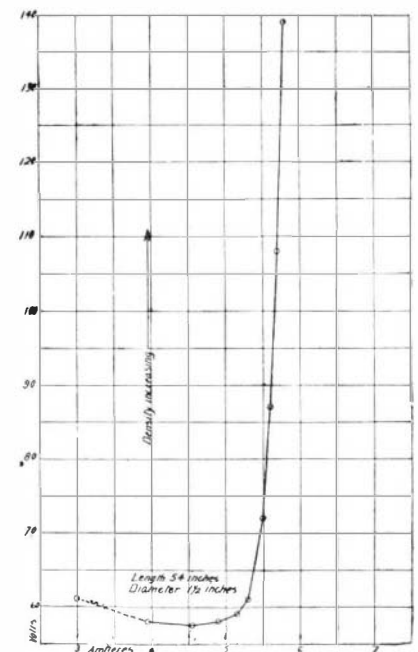


Fig. 13.

the accompanying drawings, and the measurements on the drawings were taken by Weston instruments while the lamps were in operation.

Figs. 1, 2 and 3 illustrate the relation of the volts to the dimensions of a gas-carrying current. The demonstration consisted in the operation of three lamps illustrating the tendency of the volts to vary directly as the length and inversely as the diameter, as seen by the figures of the drawing. One lamp is 54 inches long and three-quarters of an inch inside diameter, another is half the length and the same diameter, and the third is the same length as the first and twice the diameter; the drop in volts of the second and third is approximately one-half that of the first. The error in the lamp having the greater diameter, which measured 54 volts instead of 45, as should have been the case, was probably due to impurity developing in the vapor and a factor which appears on comparing tubes of widely different diameters.

Figs. 4 and 5 of the drawings illustrate the relation of current to resistance; the resistance varying inversely with the current, the volts tending to remain constant. Fig. 4 illustrates a divided vapor circuit, one leg carrying four amperes, while the other leg is carrying two amperes, the voltage over each leg being approximately the same.

The second demonstration, Fig. 5, illustrates a divided circuit consisting of a lamp with an additional electrode midway between the other two, whereby the current in the upper portion of the lamp is one-half that in the lower portion. The drop in volts over each of these portions should have been the same and the resistance of one should have been half that of the other, but for the discrepancy which was due to the greater vapor density in the lower portion, owing to the presence of the mercury forming the negative electrode.

The next demonstration illustrated negative electrode resistance or initial reluctance to allow current to pass. It also illustrated the passage of only a limited amount of current by an electrode prior to having its initial reluctance overcome. Fig. 6 was a lamp having an auxiliary electrode one-third of the distance between the positive and the negative electrode, which on being connected with the negative electrode by a conductor having a negligible resistance, allowed only 0.02 of an ampere to pass through this short circuit, although it was subjected to a measured electrical

pressure of 44 volts, while the lamp was passing about three amperes.

These demonstrations practically illustrated results obtained by me from a great number of experiments.

Fig. 7 illustrates one form of my lamp adapted to run on an Edison 110-volt circuit with an efficiency of one-half a watt per candle.

Figs. 8, 9 and 11 show actual efficiencies of my lamp at different electric pressures, while Figs. 8, 9 and 10 illustrate the control of the resistance of the lamp.

Fig. 11 illustrates the electrical variation due to variation in gas density and an immediate effect of variation in current and a result brought about by a variation in gas density.

Fig. 12 illustrates the effect on one of my lamps of varying its heat-radiating ability.

Fig. 13 is the efficiency curve for the same lamp.

The large lamp exhibited was operated by direct current. The Weston ammeter in circuit with the lamp indicated seven amperes. The drop in volts across the lamp was 100 volts measured by a Weston voltmeter and the light given by this lamp was approximately 1,500 candles. It was, I believe, the first public exhibition of a high-power vapor lamp, and it was exhibited with standard instruments attached for measuring its current consumption; in fact, all the demonstrations were made with standard instruments attached for general inspection.

"Progress of Invention."—One of the Fifty Best Books.

In January of each year the New York State Library prints a list of five hundred of the leading books of the previous year and submits it to the librarians of the State, and others who may be interested, for a vote as to which of the fifty best books should be added to a village library. Usually about two hundred persons respond. While the list is, of course, simply an expression of opinion of persons who know as to what books are most in demand, even if they are not intrinsically the best, at the same time it so closely approximates the public taste in the matter that they may be regarded with great interest. We find that Miss Mary Johnston's "To Have and to Hold" holds the first place, while Edward W. Byrn's "Progress of Invention in the Nineteenth Century" is placed thirty-seventh. Considering that this is a serious book, and entirely different from works of fiction, biography or

travel, it will be seen that the relative rank is high, especially as it leads our great American humorist, Mark Twain, by ten numbers, "The Man that Corrupted Hadleyburg" being forty-seventh. At the time this list was compiled Mr. Bryn's book had only been out some three months, which makes its inclusion with the "Fifty Best Books of 1900" most gratifying. We have received many expressions of appreciation from purchasers of this book, and the notices have been uniformly pleasing.

The Current Supplement.

The current SUPPLEMENT, No. 1321, is one of the best numbers of this edition which has appeared in some time. The leading article is devoted to the Field Columbian Museum, and it is accompanied by eight illustrations. "Searchlight Signaling at the Pan-American Exposition" is by Orrin E. Dunlap. "A Water-Softening Process" is described in detail. "The Glasgow International Exhibition of 1901" is accompanied by a map. "Animal Diseases and Animal Food" is by D. E. Salmon, Department of Agriculture. "A General Survey of Foreign Trade" is by Frederic Emory. The first installment is published in this issue, and our next issue will present a large and elaborate map showing all the countries of the world to which we export goods.

Evelyn B. Baldwin, who is to lead the Baldwin-Ziegler Arctic expedition, sailed for Hamburg April 18. He will confer with members of the German and British Antarctic expeditions, and will then go to Dundee, where his ship, the "America," is fitting out.

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RECENTLY PATENTED INVENTIONS.

Engineering Improvements.

REVERSING AND CUT-OFF MECHANISM FOR ENGINES.—WILLIAM A. MILLIGAN, Strasburg, Ill. It is the object of the invention to provide a mechanism for use on various types of engines, notably locomotive and traction engines. The mechanism is easily manipulated to shift the engine valves for cut-off or reversing purposes, and is completely under the control of the engineer.

Mechanical Devices.

SPOKE-DRIVING MACHINE.—FERDINAND UNCKRICH, Galion, Ohio. This invention relates to an apparatus for holding wheel-hubs and for driving spokes. By means of this apparatus the hub is held and turned as each spoke is driven therein; and the spokes are placed in position with mechanical uniformity, at the same time, permitting the work to be done more rapidly and effectively than by hand.

CHANGE-GEARING.—KIRK G. JOHNSTON, Piqua, Ohio. This change-gearing is particularly adapted for automobiles and comprises but two gear-wheels so arranged that adjustment of different speeds can be quickly made. The change-gearing is of very simple construction, and is not liable to be easily injured.

MOP-WRINGER.—THOMAS F. CONDON, Dorset, Vt. The wringer can be used on any ordinary pail, and squeezes the mop to any desired degree. The construction comprises a supporting frame, provided with an upwardly-projecting member. Bell-crank levers are pivoted to the frame; and squeezing rollers are mounted in the bell-crank levers. A slide is vertically movable on an upwardly-projecting member of the frame and extends inwardly above the rollers. A link connects each of the bell-crank levers with the slide.

LATHE.—WILLIAM ROBINSON, Aurora, Ill. The invention is a watchmaker's lathe which is especially designed for automatically turning articles having more than one diameter, such as balance-staffs, barrel-arbors, center-staffs, cannon-pinions, third and fourth escape-type pinions, pallet arbors, type-bar pins for typewriting-machines, and the like. The novel features of the invention are a carriage supported by a spindle, mounted both to turn and to slide. On the spindle is a yoke. A revolvable-cam mechanism is employed to impart a sliding motion to the spindle and a swinging motion to the yoke, the cams being rotated to give the desired motion to the carriage so as to turn the article according to a predetermined design.

DRIVING-GEAR.—WILLIAM H. YOUNG and WILLIAM R. DANLEY, Rockyford, Col. The

patent shows a means of employing a bicycle frame and gearing as a convenient means for effectively driving small machinery by foot-power. In the present instance the bicycle sprocket-wheel is geared by a chain with the central shaft of a coffee-mill.

Railway Contrivances.

SWITCH.—JOSEPH T. EVANS, Rushville, Neb. This railway-switch is arranged to be opened and closed by a mechanism under the control of the engineer of a train, so that the train can be run on the main track or on a side track. An engineer can close a switch which has carelessly been left open, and thereby prevent accidents. The arrangement comprises a switch-shifter having a three-armed lever adapted to be actuated by a device under the control of the engineer. Notched bars are connected with the lever. A shifting-lever has connection with the switch points, and is adapted to be alternately engaged by the notched bars.

Vehicle Accessories.

MEANS FOR SECURING ELASTIC TIRES TO WHEELS.—WILLIAM F. WILLIAMS, 17 and 18 Great Pulteney Street, Golden Square, London England. The means of attachment comprise inwardly-projecting flanges or wire edges on the tire or its cover, which are received in the groove of the rim; a metal strip or strips adapted to engage the flanges and to encircle the wheel-rim, so that when drawn tightly they hold the tire securely in position in the groove of the rim; and by means of which the tension may be applied to the band or bands and maintained after the tire has been put on the wheel, so as to insure a close butt-joint of the ends of the tire and prevent creeping.

Miscellaneous Inventions.

FALL-BOARD AND MUSIC-DESK.—CHARLES F. REEPS, Albany, N. Y. The invention provides a new fall-board and music-desk for pianos and organs. The construction is such that the board is noiseless in operation, and is adapted to fold very compactly to permit the music-desk or rack to come close to the keys. The music-desk is automatically moved into an active position upon opening the fall-board.

COMBINED UNDERVEST AND CORSET-COVER.—CORINNE DUFOR, Savannah, Ga. The combined undervest and corset cover comprises a body having a front and rear flap secured to its upper end, these flaps being provided with means for securing their outer corners together. Thus the combined garment can be used for the protection of the chest and back with an ordinary dress, or employed as a corset-cover with a low-necked dress.

GARMENT-FASTENER.—WILLIAM F. SCHMIDT, Bianco, Cal. The inventor has devised an improved garment-fastener, which is designed for use on skirt-bands for properly fastening the end of the skirt-band together and for connecting the skirt-band with the waist to hold the skirt in position and give it the proper hang.

CHICKEN-COOP.—CHARLES H. CANFIELD, Bath, N. Y. The coop has two compartments in which fowl may be placed, and from which they may be independently removed. The various arrangements of parts provide proper ventilation for the fowl, and also enables them to be readily seen and inspected. The coop, when not in use, may be folded and transported from place to place, thus occupying very little space.

HORSE-BOOT.—ARTHUR COLE, Oak Lodge, Telford Park, Streatham Hill, London, S. W., England. This invention relates to improvements for boots for horses when employed on grass lands for the purpose of drawing rollers, mowing-machines, carts and the like, chiefly used in keeping golf-links, cricket-grounds, parks and lawns in proper condition. Such boots are used to prevent, as far as possible, the marking and cutting up of the grass by the animals' feet, especially in wet weather, when the ground is soft.

WEATHER-STRIP.—MRS. ALICE HAZELTON, Lamoni, Iowa, Administratrix of Norman N. Hazelton. The threshold is formed with a longitudinal recess in its upper face, such recess being in advance of the recess formed in a lower plane than the corresponding face in the rear of the recess. A retaining-plate is secured upon the threshold in the rear of the recess, and is projected at its front edge over the recess. The weather-strip is formed with a guard-plate, and with curved ribs above and below the plane of the guard-plate. The weather-strip operates when the door is open as a wear-plate for the sill, and is adjusted by the door, in position, to serve as a weather-strip when the door is closed.

TRIPPING ATTACHMENT FOR CANSLINGS.—LOUIS H. AVET, Plaquemine, La. Slings for lifting sugar-cane, hay, corn, and the like, are commonly provided with pivoted hooks, which can be tripped to release the sling to discharge the load. Such hooks must be restored to their normal position by hand and re-engaged with the releasing device. Mr. Avet has devised a construction and arrangement of sling-hooks which restores them to their original position automatically, thus saving time and labor.

BOLT-HOLDER.—HERMAN STADE, Flandreau, S. Dak. The bolt-holder is provided with a lever having a chisel-shaped fulcrum made to clutch the bolt-head, while the outer end of the lever is anchored to some solid part to permit pressure to be brought on the chisel-

shaped fulcrum to clutch the bolt-head and thereby hold the bolt against the turning strain, both in turning up nuts and in twisting them off. The device is practical and cheap, and holds bolts of all sizes very firmly in almost any position.

ATTACHMENT FOR REED OR PIPE ORGANS.—EDGERLY R. BAILEY, Clarinda, Ia. By the use of this attachment, chords or tones once struck continue in duration as desired by the performer, thereby permitting further execution, the tones thus produced intermingling with the sustained ones. In other words, certain keys may be struck and held depressed indefinitely without requiring continued pressure of the player's hand, so that the corresponding notes will sound as long as desired, or until the depressed keys are mechanically released at the will of the player.

PROJECTILE.—DR. WILLIAM F. COLE, Provident Building, Waco, Texas. The projectile is to be used only in a gun having an elliptical bore, since this form has merits which are of much importance. The projectile is elliptical in cross section throughout the length of its body, and is also twisted to conform with the bore of the gun. The front portion of the body is likewise tapered toward the point, which is constructed with a thin edge having a twist or reverse curve. With this form of projectile the rapidity of rotation is maintained and the flight even increased, while the resistance and friction of the air are said to be reduced.

NON-REFILLABLE BOTTLES.—ALEXANDER BRIELMAYER, South Nyack, N. Y. The non-refillable bottle comprises a casing fixed in the neck of the bottle. In this casing a conical stopper having an outlet-channel is mounted to slide. An outlet-tube is fixed in the casing and opens at one end into the bottle, the other end of the tube opening into the stopper-outlet when the stopper has moved into an outermost position upon tilting the bottle. After the contents have been poured out of the bottle, and the bottle is placed upright, then the stopper by its own weight glides back to close the outlet-channel.

DISTANCE AND ALTITUDE MEASURING INSTRUMENT.—LEWIS N. HORNBECK, Minco, Ind. Ty. The instrument is an improved combination distance and altitude measuring instrument designed for use by mariners and by surveyors and engineers. The instrument is particularly noteworthy for the rapidity with which results are obtained.

POLYPHONE ATTACHMENT.—NEWMAN JENSEN, Eureka, Cal. This invention provides an attachment for phonographs which is designed to reproduce the recorded sound with double the usual volume. The arrangement consists of two styli and diaphragms fitted to two tubes opening into a common horn. Not only is the volume of sound increased, but its