

TESTING THE MAN-ENGINE.

BY JOHN ELFRETH WATKINS.

Of the many man-engine testing plants which have been instituted within recent years, the most interesting are those which are now studying the self-directing function of the human machine. In these workshops man is continually making surprising discoveries about himself.

Perhaps the most engrossing item in their equipment is a gage for use in determining the man-engine's speed in starting, stopping, or directing its course after receiving a signal. It is a clock which records thousandths of a second, and an electric current can start and stop it within an imperceptible interval. Several complicated instruments can be connected with it in such a manner that upon the instant a sound is made, a light is flashed, or a color, a letter, or a word

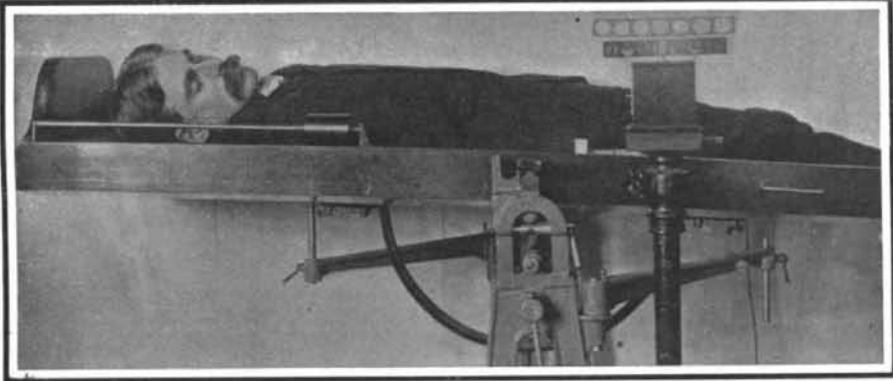
is exposed, the electrical impulse giving such a signal will start the recording hand.

The subject, with a finger pressing a telegraph key, is told that as soon as he hears, sees, or feels the signal he must release his finger from the key. The signal itself automatically closes the current and starts the clock, while the lifting of the finger from the key breaks the current and stops the clock. The number of thousandths of a second scored by the clock meanwhile measures the time required by the mind in perceiving, understanding, and obeying the signal.

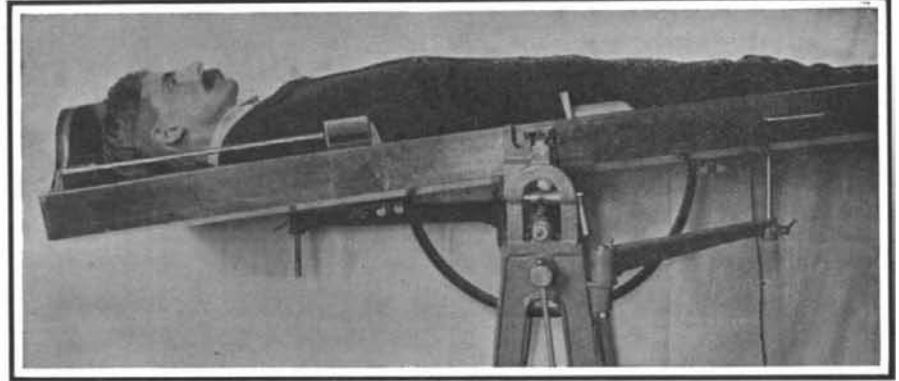
Thus, this man-engine gage will measure the time which you require to recognize or name a letter, color, or object; to read a word or sentence; to add, subtract, multiply, or divide; to remember your own name, your address, the meaning of any word in any language. Comparative tests thus far indicate that

the average mind obeys a sound signal in 125 thousandths and a light signal, in 160 thousandths of a second and that the ear therefore is quicker than the eye; also that the eye requires about the same time to read a word of five or six letters as to read a single letter; that a person remembers his own name more quickly than that of his best friend—even that of his wife; that he recollects the country in which his own city is located more promptly than that in which Paris is, for instance. According to Prof. Lightner Witmer, of the University of Pennsylvania, men hear, see, or feel signals more quickly than do women, and Indians appear to be quicker in this respect than are whites.

Of all the man-engine's working-levers the arm is the most industrious. The quickness of its movements (Continued on page 420.)



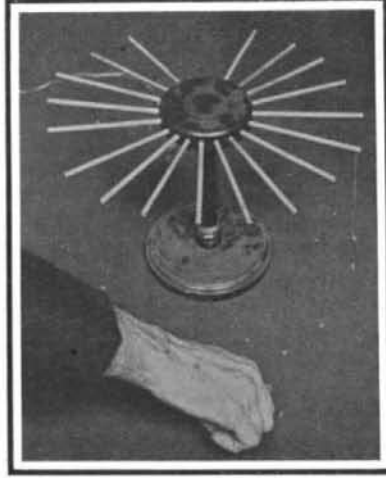
Measuring circulation in brain. Asleep, head up.



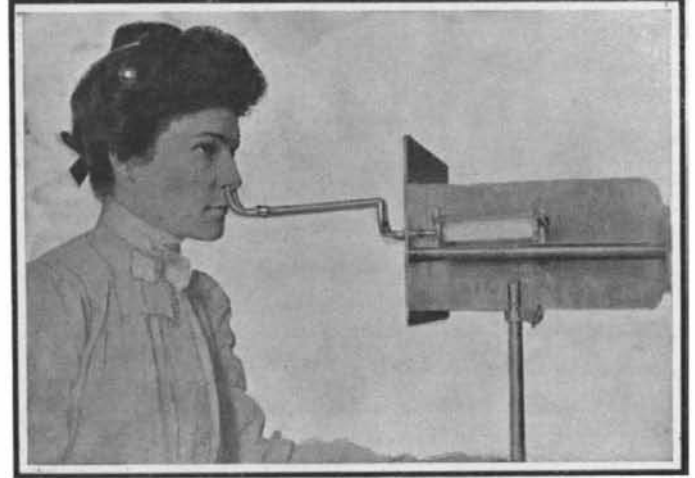
Measuring circulation in brain. Solving a problem. Head down.



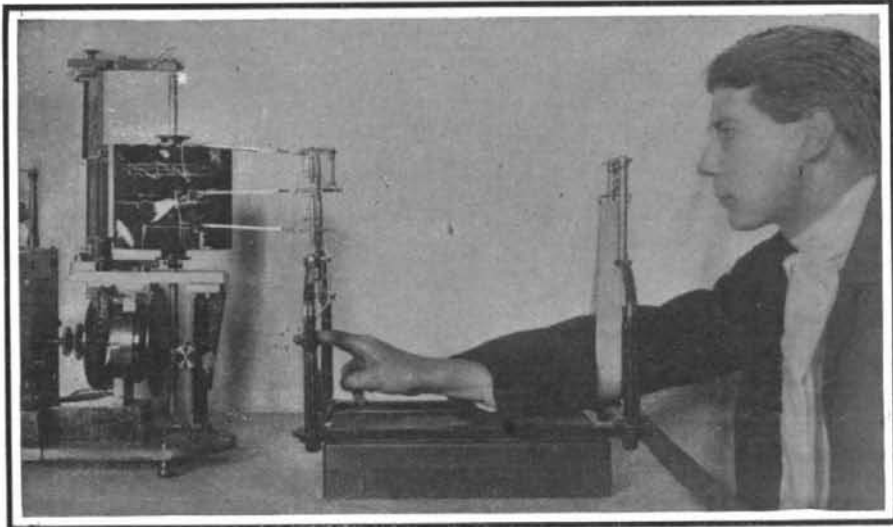
Effects of thought on muscular power.



Testing the acuteness of touch.



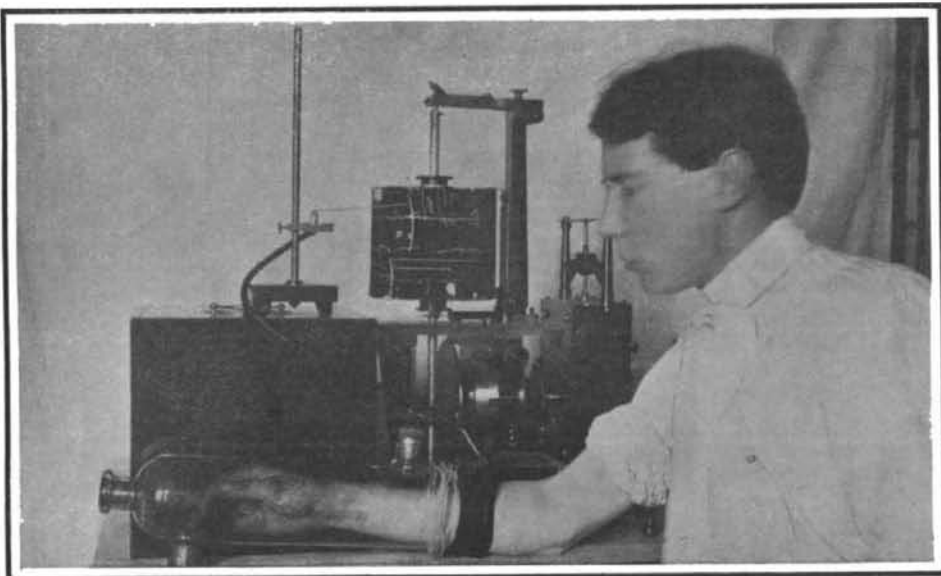
Testing the acuteness of smell.



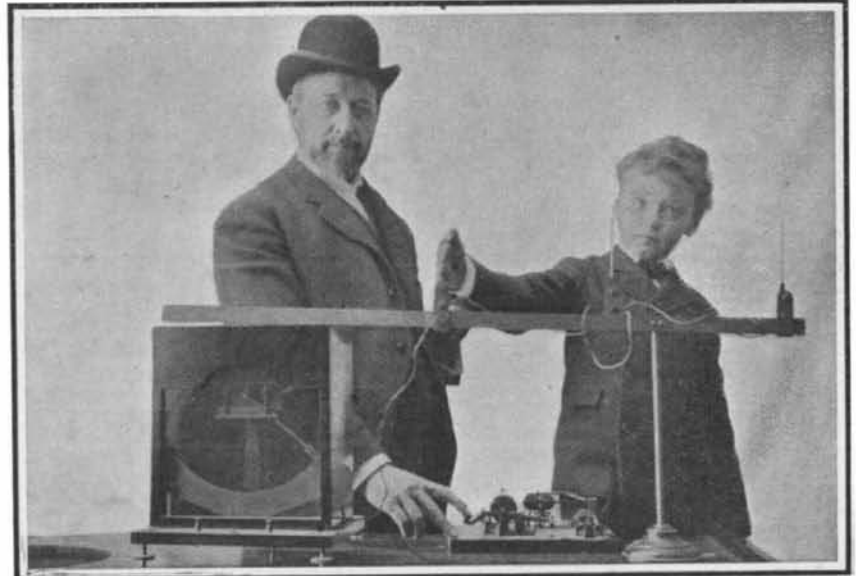
Involuntary hand movements.



Measuring lip movements.



Effects of thought on circulation of blood.



Timing the arm's speed.

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Concrete Reinforced Concrete Concrete Building Blocks

Scientific American Supplement 1543 contains an article on Concrete, by Brysson Cumulugham. The article clearly describes the proper composition and mixture of concrete and gives results of elaborate tests.

elastic belt placed about the chest is connected with the apparatus, the marking hand will record upon the paper the expansion and contraction due to breathing. Arthur MacDonald, an anthropologist of Washington, has used this instrument in studying the influence of intellectual and emotional states upon breathing and has found that, in general, concentration of thought, as in mathematical calculations or in reading, considerably decreases the breathing.

There is connected to the same recording instrument a device having two rods which press between the lips and transmit a record of their slightest movements to the paper upon the revolving cylinder. Similar gages keep score on the movements of the larynx, soft palate, and tongue, and thus are all of the physical elements of voice measured while various emotions are being experienced.

In one of these laboratories, an instrument when attached to the hand, measures its involuntary movements in three directions—forward and backward, from right to left, or upward and downward; these three elements being recorded upon one revolving cylinder by a separate marking point. Experiments with this device indicate that the hand unconsciously follows the direction taken by the mind.

These man-engine gages are revealing many other hitherto hidden truths concerning the mind's unconscious control of the body's movements and actions, and perhaps the prettiest demonstration of this is given by a device consisting of a great tray containing a man lying flat upon his back and balanced upon two knife blades at such a delicacy of poise that the least movement sets the tray to see-sawing.

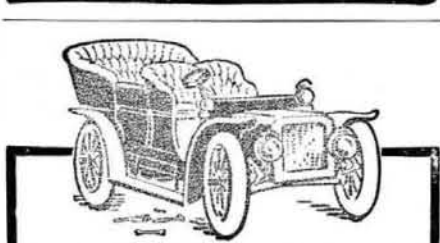


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Inquiry No. 9049.—Wanted, to buy rotary brushes suitable for a shoe shining machine.

Inquiry No. 9050.—Wanted, to buy equipment for manufacturing starch and denatured alcohol from potatoes, also manufacturers of equipments for vegetable canneries.

Inquiry No. 9051.—Wanted, to buy machinery for extraction of cotton seed oil on a small scale.

them that sleep will ensue. If so the end of the tray holding his head will rise and that holding his feet will fall, showing that in sleep the blood leaves the brain for the extremities. For a somewhat similar purpose is a large glass jar holding the arm, submerged in water. When any action of the mind causes the blood supply of the arm to increase or decrease—as the vital fluid is attracted toward or repelled by the brain—a marking point resting upon the paper of the moving cylinder above described is raised or lowered. With this has been determined that every emotional excitement speaks in the blood supply of every limb.

How our states of mind unconsciously alter, also our powers of performing muscular work, are nicely demonstrated by a machine attached to the middle finger, generally accepted by physiologists as the index to the body's muscular tone. A vise holds the forearm and hand outstretched, palm upward, upon a table, and the finger is harnessed to a cord hanging over a pulley and suspending a weight. As the finger is bent and straightened it raises and lowers the weight and at the same time a recording point worked by the cord keeps score upon a revolving cylinder. It has been discovered that if the subject concentrates his mind upon the effort of thus contracting his finger frequently and each time raises the weight with his utmost force, his finger will weaken and after a time will scarcely stir the weight. But if he continues to make this effort regardless of the results—without worrying about them—sooner or later the strength of the finger will begin to return and will move the weight almost as much as before. Thus he will continue with alternate periods of fatigue and almost complete recovery—a phenomenon akin to that of the athlete's "second wind." The experiment plainly demonstrates how fear of the results of effort will wear upon the muscles with which the effort is made.

Among the most important of the gages which measure a man-engine's comparative powers of self-direction are those which record the acuteness of the senses—of those telegraph systems over which are dispatched, from the various objects to consciousness, the subtle messages upon which our total impressions of perceived objects are based—the raw material, in fact, out of which our every thought is manufactured.

Acuteness of hearing is tested by a device in which balls of cork fall a certain distance upon a plate of glass, the ear being distant so many inches. At the outset of this test the height from which the balls fall is so slight that the ear does not perceive their impact, but the length of drop is gradually increased until the sound commences to be audible. The acuteness of each ear is measured upon a scale in units of the length of drop at which perception of the sound just barely commences. Then there is a gage measuring the ear's estimate of direction. A graduated horizontal circle surrounds the head and after the subject has been blindfolded a sound is made with a telegraphic sounder moved to the different degrees marked in the circle. The subject's estimates of the direction whence the sound issues are compared with its actual direction.

Acuteness of seeing is measured by devices too numerous for description. One of the most interesting exposes a long black surface across which extend three movable white strips. Two are placed a certain distance apart and the third, moving automatically, is stopped by the subject at the point which he estimates to be exactly between the others. A concealed scale shows his error.

When his acuteness of smell is tested the subject sits before an instrument from which protrude into his nostrils a pair of tubes connecting with a metallic case shielded from his eyes. The examiner fits to the open end of the tubes various cylinders filled with substances of different perfume, whose strength varies

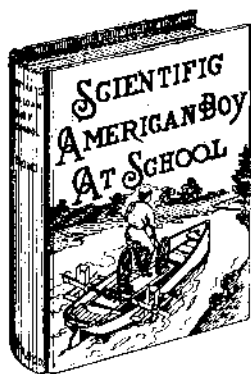
(Concluded on page 423.)

Three New Interesting Books

The Scientific American Boy at School

By A. RUSSELL BOND

12mo. 338 Pages. 314 Illustrations.
Price \$2.00 postpaid.



THIS book is a sequel to "The Scientific American Boy," many thousand copies of which have been sold, and has proven very popular with the boys. The main object of the book is to instruct how to build various devices and apparatus, particularly for outdoor use. The construction of the apparatus, which is fully within the scope of the average boy, is fully described and the instructions are interwoven in an interesting story, a feature which has assisted in making the "Scientific American Boy" so popular with the boys.

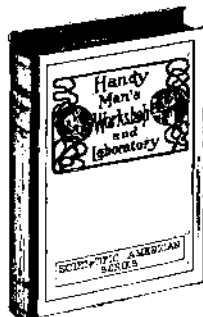
It takes up the story of "Bill" and several of his companions at boarding school. They form a mysterious Egyptian society, whose object is to emulate the resourcefulness of the ancients. Their Chief Astrologer and Priest of the Sacred Scarabeus is gifted with unusual powers, but his magic is explained so that others can copy it. Under the directions of the Chief Engineer, dams, bridges, and canal-locks are constructed. The Chief Admiral and Naval Constructor builds many types of boats, some of which are entirely new. The Chief Craftsman and the Chief Artist also have their parts in the work done by the Society, over which Pharaoh and his Grand Vizier have charge. Following is a list of the chapters:

Chapter I, Initiation; Chapter II, Building a Dam; Chapter III, The Skiff; Chapter IV, The Lake House; Chapter V, A Midnight Surprise; Chapter VI, The Modern Order of Ancient Engineers; Chapter VII, A "Pedal Paddle Boat"; Chapter VIII, Surveying; Chapter IX, Sounding the Lake; Chapter X, Signaling Systems; Chapter XI, The Howe Truss Bridge; Chapter XII, The Seismograph; Chapter XIII, The Canal Lock; Chapter XIV, Hunting with a Camera; Chapter XV, The Gliding Machine; Chapter XVI, Camping Ideas; Chapter XVII, The Haunted House; Chapter XVIII, Sun Dials and Clepsydras; Chapter XIX, The Fish-Tail Boat; Chapter XX, Kite Photography; Chapter XXI, Water-Kites and Current Sailing; Chapter XXII, The Wooden Canoe; Chapter XXIII, The Bicycle Sled; Chapter XXIV, Magic; Chapter XXV, The Sailboat; Chapter XXVI, Water Sports, and Chapter XXVII, A Geyser Fountain. Index.

Handy Man's Workshop and Laboratory

Compiled and Edited by A. RUSSELL BOND

12mo. 467 Pages. 370 Illustrations.
Price \$2.00 postpaid.



EVERY practical mechanic, whether amateur or professional, has been confronted many times with unexpected situations calling for the exercise of considerable ingenuity. The resourceful man who has met an issue of this sort successfully seldom, if ever, is averse to making public his methods of procedure. After all he has little to gain by keeping the matter to himself and, appreciating the advice of other practical men in the same line of work, he is only too glad to contribute his own suggestions to the general fund of information.

About a year ago it was decided to open a department in the Scientific American devoted to the interests of the handy man. There was an almost immediate response. Hundreds of valuable suggestions poured in from every part of this country and from abroad as well. Not only amateur mechanics, but professional men as well were eager to recount their experiences in emergencies and offer useful bits of information, ingenious ideas, wrinkles or "kinks," as they are called. Aside from these, many valuable contributions came from men in other walks of life—resourceful men, who showed their aptness at doing things about the house, in the garden, on the farm. The electrician and the man in the physics and chemical laboratory furnished another tributary to the food of ideas. Automobiles, motor cycles, motor boats and the like frequently call for a display of ingenuity among a class of men who otherwise would never touch a tool. These also contributed a large share of suggestions that poured in upon us. It was apparent from the outset that the Handy Man's Workshop Department in the Scientific American would be utterly inadequate for so large a volume of material; but rather than reject any really useful ideas for lack of space, we have collected the worthier suggestions, which we present in the present volume. They have all been classified and arranged in eight chapters, under the following headings:

I, Fitting up a Workshop; II, Shop Kinks; III, Soldering of Metals; IV, The Handy Man in the Factory; V, The Handy Man's Experimental Laboratory; VI, The Handy Man's Electrical Laboratory; VII, The Handy Man About the House; VIII, The Handy Sportsman; IX, Model Toy Flying Machines. Index.

Concrete Pottery and Garden Furniture

By RALPH C. DAVISON

Assistant Secretary Concrete Association of America

12mo. 196 Pages. 140 Illustrations.
Price \$1.50 postpaid.



THIS work should appeal strongly to all those interested in ornamental concrete, as the author has taken up and explained in detail in a most practical manner the various methods of casting concrete in ornamental shapes. The titles of the thirteen chapters which this book contains will give a general idea of the broad character of the work. They are entitled:

I, Making Wire Forms and Frames; II, Covering the Wire Forms and Modeling the Cement Mortar into Form; III, Plaster Molds for Simple Forms; IV, Plaster Molds for Objects Having Curved Outlines; V, Combination of Casting and Modeling—An Egyptian Vase; VI, Glue Molds; VII, Colored Cements and Methods Used for Producing Designs with Same; VIII, Selection of Aggregates; IX, Wooden Molds—Ornamental Flower Pots Modeled by Hand and Inlaid With Colored Tile; X, Concrete Pedestals; XI, Concrete Benches; XII, Concrete Fences; XIII, Miscellaneous, Including Tools, Waterproofing, and reinforcing.

The first two chapters explain a most unique and original method of working pottery which has been developed by the author. The chapter on color work alone is worth many times the cost of the book inasmuch as there is little known on this subject, and there is a large and growing demand for this class of work. The author has taken for granted that the reader knows nothing whatever about the material and has explained each progressive step in the various operations throughout in detail. These directions have been supplemented with half-tones and line illustrations which are so clear that no one can misunderstand them. The amateur craftsman who has been working in clay will especially appreciate the adaptability of concrete for pottery work, inasmuch as it is a cold process throughout, thus doing away with the necessity of kiln firing, which is necessary with the former material. The book is well gotten up, and is printed on heavy glazed paper and abounds in handsome illustrations throughout, which clearly show the unlimited possibilities of ornamentation in concrete.

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- Washtub cover, A. Adams 941,054
- Watches and clocks, individual hair spring stud index for, C. Teske 940,750
- Water bag, F. A. Gordon 941,245
- Water closet, etc., tank, G. H. Bailey 940,951
- Water closet, ventilating, C. H. Thompson 940,833
- Water fountain, B. Kaminsky 940,879
- Water heater, D. Hanlon 940,685
- Water heater, G. C. Madsen 940,980
- Water heater, G. H. Wade 941,215
- Water power applying apparatus, F. T. Newbery 941,090
- Water wheel, D. D. Dennis 940,677
- Web folding mechanism, E. Klein 940,933
- Wedges, manufacturing compound tapered, C. E. Sweet 940,949
- Weeder, F. M. Nevlund 941,091
- Welding tool, W. A. Sparks 940,903
- Well strainers, self-closing bottom for, J. A. Pollard 941,205
- Well tubing and means for connecting sections thereof, G. A. Pittman 941,204
- Wheel guard or fender, vehicle, J. O. Roberts 941,170
- Wheels, mudscraper for, J. O. Davidson 940,859
- Winding, doubling, gassing, and like machine, yarn or thread, Higginson & Arundel 941,319
- Winding indicator, J. C. Hawkins 941,143
- Window, J. Cooney 941,310
- Window construction, metal, G. H. Forsyth 941,018
- Wire joints, tool for forming, A. B. Probasco 940,823
- Wire stretcher, M. M. Marty 940,884
- Work support, W. C. Stewart 940,745
- Wrench, W. P. Lewis 940,977
- Yeast compound, dry, J. E. Yost 941,221

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

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- VII. The Steel Industry.**—One of the greatest steel plants in the world is that which has been built at Gary.
- VIII. The Freight Subway System of Chicago.**—Chicago can boast of a rational system of handling freight by means of subways.
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with the distance to which the cylinders are moved back beyond the tube ends. This distance is marked by a scale upon which is read the point where the subject first perceives the perfume, and thus is the acuteness of each nostril determined.

Taste is measured by solutions of sugar, quinine, tartaric acid, salt, etc., which are more and more diluted with water until the tongue—to which they are applied with a dropper—no longer perceives the flavors; and the weakness of the solution marks the acuteness of the subject's sense of taste.

When testing for acuteness of touch, the examiner holds what appears to be a rimless wheel from whose hub radiate a score of slender spokes. From the free end of each hangs a thread of slenderest cocoon fiber suspending a small disk of elder pith. All of the disks are of equal size and apparently of equal weight, but in reality are surmounted by tiny buttons of metal which give them different weights, varying from one to twenty milligrammes (1/65 to 20/65 of a grain). The subject being blindfolded, the examiner, commencing with the lightest disk, successively lowers one at a time upon the subject's skin. Several of the lighter disks are not felt, but soon there is applied one that is, and the weight of this lightest disk perceived determines the subject's sensitiveness. There are additional devices for measuring the various other elements of feeling, such as perceptions of weight, temperature, pressure, pain, etc.

INDOOR BED TENTS.

(Concluded from page 416.)

in the room, and two persons can sleep in the same bed, while only one uses the tent.

This, so far, has been a most successful device for admitting fresh air on sanitary principles to a sleeping room. It enables one to breathe the outside air without danger of being chilled or exposed to drafts and colds. Some who tried this tent felt that the fresh air was too cold in storms or wet weather, and they use an outside awning, which can be adjusted at pleasure. With these tents the body can be kept warm, while the head, which is toughened to the cold, can obtain the stimulation it needs. This last can be modified by a Canton-flannel hood, which can be made so it will come down over the shoulders, and have a face opening large enough to leave the eyes, mouth, and nose exposed. The cape of this hood covers the shoulders if by any accident the bed clothes slip off them.

Fresh air allays sweating, provides good sleep—these tents are capital for insomnia—and helps the appetite. The cold air increases resistance to disease, purifies the blood, and prevents consumption, three reasons why one should breathe it at night. The theory of keeping the head in the cold and the body warm is that the body loses eighty to ninety per cent of its heat through the skin by radiation, and cold is bracing only when it comes in contact with the respiratory organs. On this theory, no good results are obtained when the feet and lower limbs get cold. On a cold night one can move away at least twelve inches from the window and still be under the tent, get perfect circulation, and be sure of getting up in a warm room in the morning.

Not so many years ago Americans as well as foreigners were afraid of the night air, though we have no such malarial districts as around Rome. Fortunately, we are learning to know better, and workers in Little Italy and the slums where foreigners congregate in cities are pushing the fresh-air movement with all their might. Fresh air and plenty of it is the best preventive for consumption, the grip, bronchitis, common colds, and pneumonia. Some sort of inside window tent and paper napkins, tissue paper, or pieces of gauze which are now used by some people for handkerchiefs, are destined to go a long way toward keeping people well, warding off disease and the "Great White Plague."