

long to perform its duty, for it is easy to see the great advantage to be derived from the use of an oil having every drop impregnated with solid lubricating matter.

This seemingly simple problem, however, is one that has until lately baffled engineers of experience, but it has now been found that amorphous graphite when reduced to an impalpably fine powder, when mixed with oil in the proportion of about one teaspoonful to the pint of oil, will remain in perfect suspension long enough to feed through lubricator tubes without clogging, thus causing every drop of oil to carry its mite of graphite.—The Railway and Engineering Review.

BLOOD PRESSURE AND MENTAL CONDITIONS.

In addition to those bodily movements which are called "voluntary," various bodily phenomena which are clearly involuntary accompany violent mental excitement. The blush of shame, the distinctive flushes of joy and of anger, the pallor and sweat of fear, the tears of grief, and the "creeping" of the flesh provoked by horror, are familiar examples. The respiration is quickened by joy, and retarded by anxiety, and the feeling of relief finds expression in a deep sigh. Violent emotions often disturb the digestion. The heart "bounds with joy," "is paralyzed by horror," "leaps to the throat" in terror. The connection between the heart and the emotions is so intimate that the heart was long regarded as the seat of the soul.

Most of these involuntary physical concomitants of mental excitement are brought about by a special part of the nervous system, the sympathetic nerve and its branches which ramify to every part of the body. The best known branches are those that govern the dilatation of the blood vessels, which are profoundly affected by mental states. These phenomena are susceptible of exact quantitative determination by means of a method devised by the Italian physiologist Mosso. The result is fairly accurate measurement of the variation of blood supply in the brain. The subject is laid on a board which is balanced on a fulcrum at the center of gravity in the manner illustrated in the accompanying engraving. When the subject is quiet and undisturbed the board lies horizontal. Now, if an unpleasant sensation or emotion is induced in the subject his head is involuntarily elevated, indicating diminution in the quantity of blood in the brain. An agreeable sensation or emotion produces the opposite effect.

In the course of the last twenty years, a great many experiments of this character have been made by many investigators, and have led to substantially identical results.

The method of experiment should be adapted to the character of the subject. In many cases the feeling of pleasure can be aroused by offering a coin or other gift. At the moment of presentation the head-end of the board is tilted sharply down, indicating a sudden rush of blood. Then if the gift is taken away, with the explanation that it was presented in jest, the blood vessels contract and the head-end is elevated. Similar results are obtained by giving students favorable or unfavorable reports of examinations, reading poems to persons of fine sensibilities, etc.

There are great differences in the intensity of the physical effects of various mental processes. Difficult tasks in mental arithmetic, performed in private, cause only slight contraction of the blood vessels but the same calculations made in the presence of several persons, especially persons regarded with awe, cause great contraction. In general, emotional excitement, which common experience proves to be more fatiguing than purely intellectual activity, also affects the board more strongly.

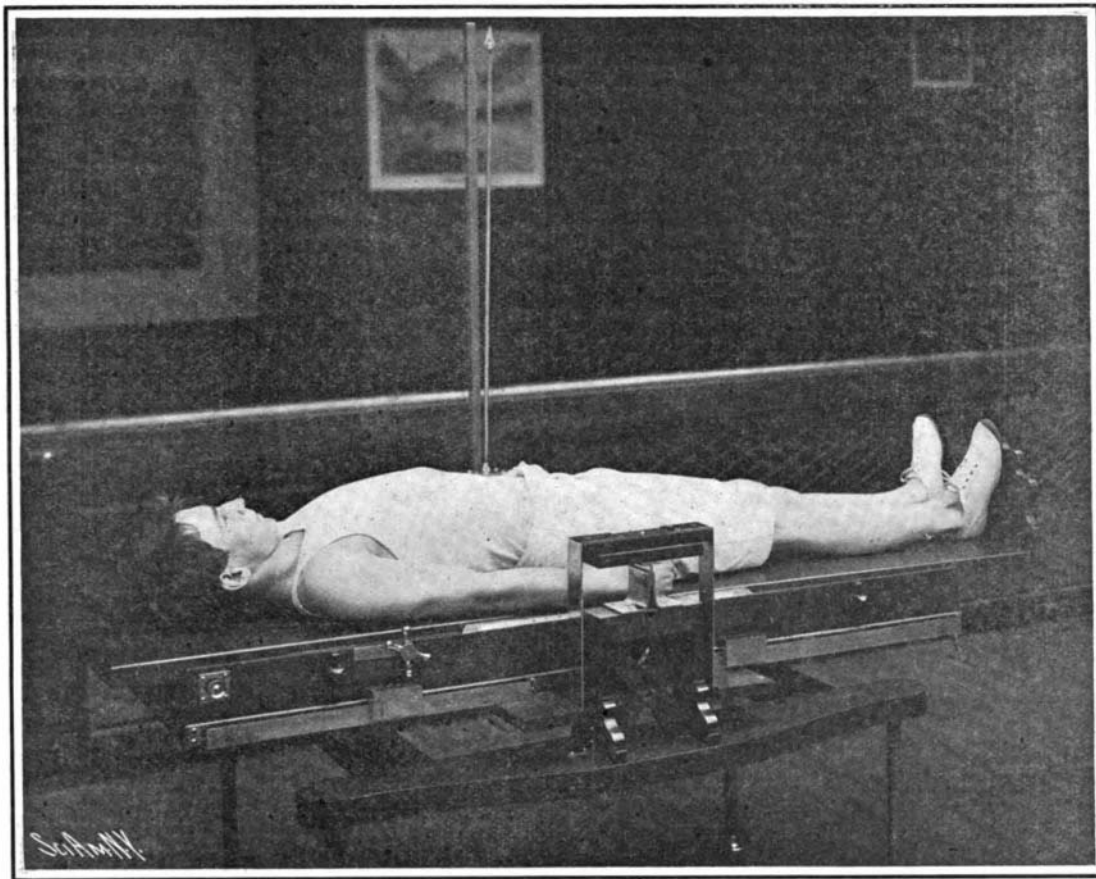
Like many other modern discoveries these revelations are not absolutely new. Variations in the pulse were regarded in antiquity as indications of mental perturbation. Nearly 2,500 years ago Erasistratus, by feeling the pulse of the son of King Antiochus in the presence and in the absence of his young and charming stepmother, successfully diagnosed the young prince's puzzling malady as an "affection of the heart."

Severe bodily pain is commonly attended by alterations in the pulse and the pupil of the eye. This method of ascertaining whether a patient's suffering is as

acute as he pretends was introduced by French physicians centuries ago.

The Lost Continent in the South Seas.

The contention that Fiji and contiguous islands are remnants of a lost continent is supported by the investigations of Dr. Woolnough, of the Sydney University. Recently he spent several weeks in Fiji, when he directed special attention to the occurrence of granite recorded by Kleinschmidt some years ago. The main difficulty in the way of reconciling existing conditions with an original great area was that depths of 2,000 fathoms occur between the islands under notice. The Solomons and other islets were undoubtedly the visible links in the chain which ended at New Guinea. But against this theory had to be placed the immense volcanic and coral areas of Fiji, which were of more recent origin than the rocks forming the basic fabric of the continental area. It was necessary, therefore, to look for land evidences of faulting or breaking to account for the submarine depths. The granite area in Viti Levu was found to be from 400 to 600 square miles in extent, underlying the modern volcanic rocks. He was, however, unable to determine the relationship between the granites and slates, although he traced the lines of junction to some extent. A range of granite mountains with precipitous cliffs on each side gave evidence of heavy faults, creating chasms of great depths. He found the rivers forming a marked rectangular network, an upraised coral reef 200 feet above sea level, conglomerate rock showing sea-shells at a height of 800 feet above



BALANCED BOARD USED TO ASCERTAIN THE RELATION BETWEEN BLOOD PRESSURE AND PSYCHICAL CONDITIONS.

the sea, certain earth tilts and tuffs which had formerly been submarine and were now at a height of 4,500 feet. All these indicated a tremendous uplift, sufficient to cause greater faulting in the original continent. The rivers of Fiji were of comparatively youthful development, and even at present passing through their cañon cycle. Many beautiful examples of hanging valleys were observed.

The Scientific American Trophy.

The SCIENTIFIC AMERICAN Trophy is now on exhibition in the window of Messrs. Reed & Barton, 32d Street and Fifth Avenue, New York. It is attracting much attention. It will be competed for at St. Louis October 22, 1907.

Change in the Time of Allowance of United States Patents.

As most inventors know, it has hitherto been the practice of the United States Patent Office to issue patents on inventions three weeks after the date of allowance on payment of the final government fee. The Commissioner of Patents has given instructions that hereafter the period between the date of allowance and the issue of the patent shall be four weeks.

Farmers have always considered that hogs should be turned loose in an orchard. By picking up the windfalls they destroy many insects, whose presence is often the cause of the fall. It is stated on good authority that they are very destructive to the larvæ and pupæ of the codling moth, and will grow fat in an infested district.

A UNIVERSAL ASTRONOMICAL CLOCK.

BY DR. ALFRED GRADENWITZ.

The astronomical clock which is illustrated herewith is a most marvelous example of horological and mechanical skill. It was designed and constructed by Christian Reithmann, astronomer and scientific mechanic, at Munich, and involved four years of work (not including two years of preparatory calculation; the mathematical rate calculations were worked out to from six to ten decimal places, in order to dispense with any future readjustment of the works). It is intended for the tower of the new Munich town-hall, and pending the completion of this building has been exhibited at the German Museum of that city.

This clock, the decorative part of which was executed by Prof. Otto Hupp, has the form of a three-tower structure, and is fitted with thirteen artistic dials. The lower part of the construction, in front of which there is a projecting balustrade, together with the planetarium, is made of stained wood, and the middle and upper parts of ornamental gilded copper. An enormous number of wheels was required to perform the manifold functions of the clock, the planetarium alone comprising no less than 400 wheels with an aggregate number of 20,000 teeth, in order to represent with astronomical accuracy the revolution round the sun of the eight main planets and their satellites.

The central dial of the clock consists of twelve parts. Two of the hands will indicate the local time of Munich, and a third the mean European time. Adjoining this central panel is a *polytopical clock*, comprising a twenty-four-hour ring, the hours of the day being marked in white, and those of the night in black figures. On another ring surrounding the whole there are marked in artistically arranged panels the names of the eighty principal cities of the world. Each of these panels is provided with a golden arrow pointing toward a given part of the ring, which bears the Roman figures, thus allowing the local time of the city in question to be read at any moment. All of the dials and hands are real masterpieces of art.

The main dial to the left of the polytopical clock is the *astrolarium*, showing the actual position of the sun and moon among the constellations, as well as the right ascension, declination, and longitude of these bodies. The dial of the astrolarium comprises several movable rings, one of which gives the nodal position of the moon's orbit, the position of perigee and the distance of the moon. Whenever the sun and moon meet in one of the nodes of the lunar orbit, there is known to occur an eclipse of the sun; if, however, the moon at the same moment

enters the earth's shadow, it will traverse the latter, producing an eclipse of the moon. The motions of the moon and sun are represented by Mr. Reithmann's mechanism with their characteristic irregularities, thus reproducing with absolute accuracy the relative positions of the two bodies, and the times of eclipses. On the inner part of the astrolarium dial there are shown the phases of the moon and seasons of the year, as well as the length of day and night for the actual date. A smaller dial on the left-hand tower will mark sidereal time, which is known to correspond to two successive passages of a fixed star through the meridian. This time is the most important to astronomers, allowing the *mean time* (according to which our clocks are adjusted and regulated) to be calculated.

The *calendarium* dial, to the right of the central dial, will indicate automatically the day of the week and the month, as well as leap days and leap years, while by means of an extensive mechanism the movable holidays are readjusted automatically, on the last day of December. The same dial further comprises two smaller dials, the apertures of which are opened more or less according as required for illustrating the duration of visibility of the sun and moon above our horizon. The rising and setting of these heavenly bodies are represented as well. The phases of the moon are likewise shown above a crowing cock (marking the hours) on the top of the middle tower. On the lateral tower of the clock, above the calendarium, there is marked *true solar time*, that is to say, the time given by sundials, and which corresponds to two successive passages of the sun through the meridian. A *movable stellar map* with the various constellations