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INVESTIGATING SPIRITUALISM.

After an extended and painstaking investigation, a commission appointed by the University of Pennsylvania, to see what there was in "modern spiritualism," have concluded their labors. They find that it is made up of equal parts of humbug and jugglery, calculated to deceive only the credulous or feeble minded. The appointment of this commission, it will be remembered, is the result of a codicil to the will of the late Henry Seybert, of Philadelphia, whereby the sum of \$60,000 was left to found a chair of philosophy in the university, on the condition that it should lend its name to the inquiry. In his later years, Mr. Seybert fell a prey to the wiles of a coterie of slate writers, spirit-form projectors, and banjo players, and he believed that such an investigation would prove spiritualism to belong to the sciences, rather than, as now, to the arts.

The committee appointed by the university was composed as follows: Dr. Joseph Leidy, professor of anatomy and a well known naturalist; George A. Koenig, professor of chemistry; the Rev. George S. Fullerton, professor of moral and intellectual philosophy; Coleman Sellers, civil engineer; Dr. S. Weir Mitchell, the neurologist; Dr. William Pepper, provost of the university; Prof. Robert E. Thompson; Dr. Horace Howard Furness, one of the trustees of the university.

In their summing up they say they did not, in all their investigations, discover a single novel fact, and are "forced to the conclusion that spiritualism, as far, at least, as it has been shown before them, presents the melancholy spectacle of gross fraud, perpetrated upon an uncritical portion of the community."

This is a broad and sweeping statement, and to the minds of many who do not believe in supernatural manifestation, but, nevertheless, have been mystified by certain phenomena, oft recurring, and more or less related to the subject, it is not likely to prove altogether satisfactory. Even if Slade and the other "mediums" examined were unable, as the commission say, to do anything that could not be equally well done by an acknowledged and skillful juggler, like Heller, whom they were so fortunate as to have with them, it remains that there are certain phenomena that, from the time of Emanuel Swedenborg down to the present, have never been satisfactorily explained; and it would seem, since so many have been and are puzzled to account for them, not beneath the dignity of science to separate them from the mass of humbug by which they are surrounded, and enter upon their explanation.

Among these phenomena may be classed "table tipping and walking," the curious and well authenticated "knocking," and, above all, what is known as "clairvoyance." Is the Seybert commission prepared to say that these manifestations are necessarily fraudulent?

If so, they should have their attention called to the findings of an equally reliable commission, formed some years ago, of Heidelberg professors, who, after the same careful investigation, recorded the contrary opinion; one of their number, Herr Heinemann, professor of physics in Heidelberg University, writing an interesting and instructive little treatise on the result of his investigations, where, under the title of "The Fourth Dimension of Space," he attempts to formulate a theory to account for their existence. He does not find in them any supernatural attributes; but, on the contrary, regards them as the expression of a natural force, the characteristics of which he attempts to explain, while admitting ignorance as to its origin.

Wholly outside the circle of professional spiritualists and jugglers, there are those who possess, unconsciously, strange powers. Witnesses testify that tables follow them about a room, and other phenomena, unasked, as they are uncanny, come at unexpected moments. Intelligent and incredulous persons have been astounded by the revelations made them by certain so-called "clairvoyants" as to circumstances and happenings in their earlier lives; things of little consequence, of which even their intimate friends were never apprised, and of which it seems incredible that these "clairvoyants" could have any means of informing themselves in advance.

In his "Transcendental Philosophy," that eminent physicist, Baron Karl von Reichenbach, attempts an explanation of similar phenomena, which he attributes to a force which he calls "odic," or the force of "od." "Od," says an expounder of his theory, "pervades all nature, and is akin to the great physical forces of electricity, magnetism, chemical affinity, heat, light, etc., and always accompanies them, so that wherever they are in action, od is developed, and the strength of its most active development is often in proportion to the energy of their action. As in electricity and magnetism there is a polar dualism, so also there is in od. It has two poles, the positive and negative, which keep company respectively with the electric and magnetic positive and negative poles. The human body is od-positive on the left side and od-negative on the right. This gradation of amorphous bodies from od-negative to od-positive is called the od-chemical order, and is found to correspond with the electro-chemical order established by Berzelius. The odic radiation can be felt and seen by certain persons called 'sensitives,' who have a peculiar nervous susceptibility; while the

majority of mankind, called 'non-sensitives,' are entirely insensible to the odic influences and impressions. Odic sensitiveness has many symptoms, among which are liability to somnambulism, capability of being magnetized, inability to sleep on the left side, in the northern hemisphere, dislike of strong yellow colors, fondness for blue as opposed to yellow, dislike of crowds and close rooms and dislike of fatty and fondness for sourish victuals. The causes of many singular phenomena not hitherto understood are explained by the odic theory."

Immanuel Kant, the great metaphysician, recognized the existence of physical manifestations, and so classified them that they might be completely separated from the knowable; and, though he was unwilling to admit the conclusions of Fichte as expressed in the latter's "Revelations," he virtually admitted that he was not altogether prepared to deny the truth of what related to the phenomena. The spirit of the age tends toward investigation. Supposing "spiritualism" is a fraud, as this committee says it is, and innumerable other investigations have shown it to be, may there not be something in the so-called "second sight" and other physical phenomena? May they not be the expression of a natural force, not any more related to the supernatural than are electricity and magnetism?

TO MAKE CHLORIDE OF GOLD.—According to the following, by J. B. Heyl, in the *National Druggist*, this salt can be easily prepared by druggists: "Put a half sovereign or a \$2.50 piece in a small evaporating dish, using one, two, or three sizes larger as a water bath, and pour on it $\frac{1}{2}$ a drachm of nitric acid mixed with $2\frac{1}{2}$ drachms of hydrochloric acid and 3 drachms of water; digest at a gentle heat, but do not boil the acid, or much of the chlorine will be driven off in the form of gas. At the expiration of a few hours add fresh nitro-hydrochloric acid in quantity the same as at first, which may be sufficient; if not, repeat the process a third time. Observe that if any silver be present in the gold coin it will produce a flocculent deposit of chloride of silver, thus preventing the solution from being complete. I have found coins with platinum in them, which remains at the bottom, and is easily separated by pouring off the chloride of gold after it is dissolved. Next dilute largely with distilled water, and add a filtered aqueous solution of common sulphate of iron (6 parts to 1 of gold); collect the precipitated gold, which is now free from copper; redissolve in aqua regia as at first, and evaporate to dryness. The weight of a half sovereign is about 61 grains, of which 56 grains are pure gold. This is equivalent to 86 grains of chloride of gold, which will be about the quantity contained in the solution. The most convenient mode of keeping the chloride is in aqueous solution—1 grain to the drachm of water. I have used the above for years."

Impurities of Ice.

Dr. T. Mitchell Prudden, of New York, has been making some important experiments with a view to determining the effect of freezing on bacteria. In the case of the *Bacillus prodigiosus*, there were 6,300 bacteria in a cubic centimeter of water before freezing; after being frozen 4 days, 2,970; after 37 days, 22; and none after 51 days. Of the *Staphylococcus pyogenes aureus*, there were a countless number before freezing; after 18 days of freezing, 224,598; after 54 days, 34,320; and after 66 days, 49,280. Of the typhoid fever bacillus, innumerable before freezing, 1,019,403 after being frozen 11 days; 336,457 after 27 days; 89,796 after 42 days; and 7,348 after 103 days. These facts show that certain bacteria have a remarkable power of resisting the temperature at which ice forms. Dr. Prudden, therefore, recommends that the New York State Board of Health, or other authority, should have power to determine which, if any, of the sources of ice supply are so situated as to imperil the health of consumers of ice.

Liquid Paraffine as a Reagent.

This substance dissolves in all proportions in alcohol and ether, if perfectly anhydrous, forming a clear liquid, which is rendered turbid by the smallest quantity of water or aqueous alcohol. Absolute alcohol takes up only a certain quantity of paraffine oil, and if brought in contact with a larger quantity of paraffine, two clear liquids separate out—pure paraffine oil and a saturated solution of it in the alcohol. If a small quantity of aqueous alcohol is brought in contact with the latter, an immediate turbidity is produced. If 20 c. c. of chloroform or absolute alcohol are mixed with 0.04 c. c. of a 50 per cent alcohol, and a few drops of paraffine oil are added, a distinct turbidity appears. The author finds further that paraffine oil freely dissolves chlorine, iodine, and bromine.—*L. Crismer*.

To Make Paper Adhere to Metals.

M. Eliel gives the following formula for a mixture which can be used for metal, glass, or wood: Gum tragacanth, 30 grammes; acacia gum, 120 grammes; water, 500 c. c. Dissolve, filter, and add $2\frac{1}{2}$ grammes of thymol suspended in 120 c. c. of glycerine; then add enough water to make up the bulk to 1 liter. This bath will keep a long time.—*Revue Photographique*.

A British Torpedo Fleet.

A flotilla of torpedo boats recently assembled off Portland for full speed trials and general maneuvering at sea. The little squadron consisted of twenty-four of these vessels, of which sixteen were built by Messrs. Thornycroft, four by Messrs. Yarrow, and four by Mr. White. At an early part of the proceedings the fleet became reduced to twenty-two, owing to the Thornycroft boat No. 43 and the Yarrow boat No. 66 coming into collision and having to be withdrawn. The Thornycroft boat was considerably damaged in the bows, but the Yarrow boat would seem to have sustained but little injury, owing doubtless to its greater structural strength. This happened on Monday, May 9, and on the following Thursday the race for speed took place, the course being from Portland round the Ore Stone and back, a run of about ninety miles. The flotilla was formed in six divisions, and soon after the second division had started, the Thornycroft boat No. 27 had to put back with hot bearings. After a while the Thornycroft boats Nos. 41 and 50 were disabled, and drew out of the line. Then occurred the painful catastrophe on board the Thornycroft boat No. 47, which is attributed to the crown of the furnace coming down, owing either to lowness of water in the boiler, or to the circumstance that the crown became uncovered while the boat was rolling, or to want of strength of construction.

A similar accident is reported to have nearly occurred on board the Thornycroft boat No. 57, where the men were hurriedly driven from the stokehold on to the deck by a sudden rush of steam. Three more Thornycroft boats were put out of action, namely, Nos. 42, 45, and 55, the first by reason of defects in her engines, and the second by the loss of a screw blade. We thus have no fewer than seven of one builder's boats disabled out of the twenty-two that started. The race was finished by the remaining boats, the first three coming in in the following order: No. 31, Yarrow; No. 35, White; and No. 46, Thornycroft. The race was thus won by a Yarrow boat, the crew gaining the £15 prize.

The evolutions and the race were carried out under Captain Long, the director of the torpedo school, and who commanded the flotilla. There was some spirited work done both by day and night, which proved the ability of the officers and men to handle their boats. Among other operations, we may mention one which took place at night in order to simulate the attack on a blockading ship at anchor. The Rattlesnake went out after dark, and anchored somewhere between the White Nose and St. Alban's Head. A division of torpedo boats followed at 11:50 P. M. in search of her. The night was dark as pitch, a pelting rain poured down, and it was blowing hard from the W.S.W. As may be imagined, the difficulty of preserving the requisite relative positions of the boats was enormously increased. No light of any description was allowed to be shown, and perfect silence was also maintained. The division went along comfortably for about ten miles at a speed of eight knots, when suddenly No. 44 (Thornycroft) broke down, and although No. 41 went on ahead immediately, she failed to find the rest of the flotilla. The now scattered boats searched about till 1 A. M., when three blue lights burning about two miles ahead revealed the Rattlesnake. The experiment clearly showed how the breaking down of one boat may easily upset a well planned enterprise. No. 44 was third of a string of seven boats, and, breaking down through no fault of her crew, utterly capsized the arrangement. And here we cannot but record the calm heroism of George Platt, one of the victims of the catastrophe on board No. 47. Platt was an engine room artificer, and was in the stokehold at the time of the accident, and made his escape through the water tight door into the engine room, and thence on deck. Almost blinded and frightfully burned and sealded, his first thought was for others. "Turn fire extinguisher cock," he gasped to the deck hands, who were assisting him up the ladder. This cock can be worked from the deck, and his motive was to save the boat. When the surgeon arrived, he first turned his attention to Platt, who nobly asked to be left until his groaning companions were attended to. The maneuvers of the torpedo boats having terminated, they returned to Portsmouth to refit and prepare for the forthcoming review.

The results of the trials cannot be viewed with satisfaction when we see that, during the full speed run, out of the twenty-two boats, the machinery of seven, all Thornycroft's build, broke down. It was not unreasonable to expect that, in experimenting with more or less novel craft, such as these are, some hitches might occur. But such a high percentage of failures could hardly have been anticipated, much less the tragic occurrence which has cost three lives. What remains is the consolation that the officers and men, under the strange and harassing circumstances in which they found themselves suddenly placed, did their duty nobly and manfully, and with an alacrity that indicated the possession of a goodly heritage from their ancestors in the shape of British pluck. The failures must awaken some anxiety when it is remem-

bered that they are confined to the boats of one builder, who has constructed the greater proportion of the torpedo boats in the Royal Navy. Not only does the question affect the country from a financial point of view, and as regards the desire to possess efficient torpedo boats, but with respect to the safety of those who are appointed to navigate them. The outside risks of torpedo work are in themselves considerable, and those who expose their lives to dangers from without should certainly be protected from dangers within by all the means that science has placed at our disposal. It is, so far, fortunate that the failure of these boats, particularly that of No. 47, whatever the cause, should have taken place now, when there is time and opportunity to investigate the matter fully, and to put right what may be found to be wrong. Had the disasters occurred for the first time during an engagement, and had our men found an enemy within as well as without the boats, it might have resulted in national disgrace. We may observe that the boats constituting this torpedo flotilla were ordered by the late administration at Whitehall, and, therefore, if there be any blame, it is not participated in by the present authorities. All the boats which have been contracted for of late are being built by Yarrow, the wisdom of which course these trials clearly demonstrate. It is, however, to be hoped that the Admiralty will direct a complete investigation into the causes of the recent failures, and we trust it will then be found that matters are not quite so serious as at first sight appears, but that small alterations will suffice to render our torpedo fleet efficient.—*Iron*.

The Conservation of Energy.

At a recent meeting of the Manchester Association of Engineers, a paper with the above title was read by Mr. S. Dixon, of Manchester. After referring to a previous paper on the same subject which he had contributed to the Association's proceedings, and briefly stating the principle of the conservation of energy, he went on to trace the amount of power available from the combustion of coal under given conditions. Beginning with boiler making, he said that an exhaustive series of experiments made by Mr. Michael Longridge in 1884 demonstrated that the average efficiency of ordinary Lancashire boilers amounted to about 54 per cent. Comparing this with the effect obtained from the marine boiler, as shown by the paper recently communicated to the Institution of Mechanical Engineers, it was found to be a very inferior result, the efficiency of marine boilers having been there shown to be 80 per cent, the consumption of coal per horse power per hour being $1\frac{1}{2}$ lb.

The difficulty of ascertaining accurately what the engine was doing was one which pressed hardly upon anyone investigating the subject, as the data commonly related to the engine and boilers combined. In the report of Mr. Longridge just referred to, however, an experiment made on a pair of compound engines indicating 900 h.p. showed that out of the total heat there was utilized about 12 per cent. The author then referred to the law of Carnot, and said that denoting the absolute temperature of the source of heat by T , and the absolute temperature of the condenser by t , the absolute efficiency is given by the well known formula $T-t$.

Taking the case of the Corliss engines above referred to, the temperature of the steam entering was 309° F., and that of the ejection water 106° F., from which, by applying the above formula, it is deduced that the efficiency of the engines is 26 per cent. The conversion of the whole of the heat into mechanical energy is only possible with a perfect engine, where the temperature of the condenser is absolute zero; but as this is impracticable, all that can be done is to approach this point. Recurring to the case of the Corliss engines named, and comparing their efficiency with that of a perfect engine working between the same temperatures, the result is an efficiency of 41 per cent.

These engines were using 2 lb. of coal per h.p. per hour, but the averages over a number of engines, as given by one of the boiler associations, are as follows:

Compound engines, condensing, 3.66 lb.; single cylinder, condensing, 5.88 lb.; single cylinder, non-condensing, 7.95 lb. Now, comparing these results with those of triple expansion marine engines, as recorded in the paper spoken of, they will be found to be very inferior. The author next referred to gas engines, and took the Otto as an example, observing that, up to the present, the economical results of this engine had not been surpassed. Taking an average of 20 cub. ft. of ordinary gas per hour as used by this engine, and calculating that each foot produces 620 units of heat, the total heat supplied to the engine would be 12,400, and as the units theoretically required for 1 h.p. are 2,564, it shows an efficiency of 20.6 per cent. Applying Carnot's principle, and calculating the efficiency of this engine as compared with a perfect engine working between the temperatures of combustion in the cylinder, viz., $3,000^{\circ}$ F. and $1,250^{\circ}$ F.—the assumed temperature of the discharged gases—the maximum efficiency would be 58 per cent, and it will be seen that an Otto works with

an efficiency of 38 per cent of that of the perfect engine.

An actual experiment established that 29 per cent of the total heat was effective, the remaining portion being represented by 69 per cent absorbed by the water jacket, and 2 per cent from direct radiation. The amount of coal used per h.p. per hour by the Otto when Dowson gas is used is 1.3 lb.; but it has been found that when the Dowson gas is produced from coke, 1.4 lb. are needed per h.p. Turning now to the useful energy finally left after distribution, Mr. Dixon commented on the paucity of information at the command of investigators, saying that in the records of the insurance companies there must be a mass of information of a valuable kind as to the relative efficiency of various modes of communicating power. A gentleman of considerable experience, to whom the author had appealed, had, however, given him some details, which showed that in mills using 800 to 1,000 h.p., it is found that the total energy absorbed by the friction of engines, shafting, etc., was from 20 to 30 per cent of the whole power, sometimes reaching 35 per cent. Of the three main plans for driving, strap driving absorbs 5 per cent, and rope driving 10 per cent, more energy than spur gearing. Referring now to electricity, Mr. Dixon said that Sir William Thomson had asserted that power could be transmitted three hundred miles with a loss of but 20 per cent.

An actual experiment made in Paris during last year established the fact that in transmitting 200 h.p. thirty-five miles, 50 per cent was found to be lost. Even when we thus got the power into the factory or workshop, it would be found that an enormous waste of power was taking place in the operations of all machines, and that this required constant attention. The time lost in the use of machine tools was chiefly that required for setting, which was more than that occupied in cutting. The use of long chimneys was then referred to as a clumsy means of obtaining draught, and forced hot blast was advocated. Mr. Dixon then referred to some diagrams, stating graphically the results obtainable in a perfect engine, and those actually obtained, and showed that with an engine working with steam at a pressure of 200 lb., and the heat in it finally reduced to a temperature of, say, 50° F., the realizable efficiency is only 40 per cent. Against this, Corliss engines are utilizing 14 per cent, and triple expansion engines 15.9 per cent. The diagrams, which were constructed to scale, starting at absolute zero of temperature, showed that the possible efficiency of gas engines was about 83 per cent. The use of a dynamometer in a convenient form was then recommended, in order to test the amount of power actually transmitted through a shaft or machine. The failure of the coal supplies of the country was then referred to, and it was pointed out that a great responsibility rested upon engineers to see that no power was wasted.

The Wonderful Delicacy of the Sense of Smell.

A curious series of experiments has just been completed by Drs. Emil Fischer and Penzoldt (*Liebig's Annalen*, B. 239, i., 131) upon the sensitiveness of the sense of smell. These chemists used mercaptan and chlorphenol as their odoriferous substances, and experimented in a room of 230 cubic meters capacity. A gramme of the substance was dissolved in a liter of alcohol; 5 c. c. of the solution were again diluted to a known volume, and 1-3 c. c. of the latter solution measured out into a flask from which a fine jet could be directed by the experimenter to all parts of the room, the air of which was subsequently agitated by the waving of a flag. At a given signal a second experimenter stepped into the room, and took his olfactory observation, which was checked by the independent observation of a third person. The astonishing result was arrived at that our olfactory nerves are capable of detecting the 1-4,600,000 part of a milligramme of chlorphenol and the 1-460,000,000 part of a milligramme of mercaptan. The quantity of mercaptan present in the air of the room was 250 times less than the amount of sodium present in the air of the room in which Bunsen and Kirchhoff made their experiments upon the sensitiveness of the spectroscope, when the sodium lines were just perceptible.

Monument to Galileo.

On the 21st of April, on the occasion of the anniversary of the founding of Rome, the municipality of the Eternal City inaugurated a monument in honor of Galileo, consisting of a column erected opposite the palace of the French embassy, wherein the illustrious astronomer was imprisoned in 1632.

The column bears the following inscription in Italian: "In the neighboring palace, belonging at the time to the Medici, was imprisoned Galileo, who was guilty of having seen the earth revolve around the sun. S. P. Q. R., MDCCCLXXXVII."

The Syndic of Rome was represented by Assessor Tommassini, who delivered an oration. The University of Rome was represented by Professor Ferri, and the Academy of the Lycei by Mr. Valentine Cerruti.—*La Nature*.