

to which the eccentric is attached, and passing up the whole length of the valve chambers to the end or ends, as the case may be, and attached to the valve rods, thereby giving motion to the valves. I claim this arrangement, as set forth by drawings, or their mechanical equivalents."

59. For an *Improvement in Life Boats*; Yelland Foreman, City of New York.

Claim.—"What I claim is, constructing the body of my life boat wholly of metallic tubes, brazed, or similarly united throughout, thus affording a water tight and solid metallic connexion, and mutual bracing of every part, as shown, whereby are attained the objects explained, in a compact and generally advantageous manner. I further claim, in combination with such boat, the detachable tubular seat, as described."

60. For an *Improved Valve Motion of Oscillating Engines*; William Stephens, Pittston, Pennsylvania.

Claim.—"What I claim is, 1st, The combined arrangement of the slide valve and guide, which assists the oscillation of the engine in producing, and directs the motion of the said valve, substantially as described, to wit: the valve being arranged to work transversely to the cylinder, and the guide being in the form of part of a helix or screw, concentric to the axis of the cylinder's oscillation, and receiving an arm or cross-head attached directly to the rod or stem of the valve, whereby the intermediate mechanism usually employed is dispensed with. 2d, Giving the valve the necessary or desired lead, by means of the adjustable sliding lining pieces which line the sides of the guide, and are furnished with projecting or rising parts, which will give the necessary lead in working the engine in either direction, as set forth."

61. For a *Machine for Cutting Binders' Boards*; John A. Elder, Westbrook, Assignor to John E. Coffin, Portland, Maine.

Claim.—"What I claim is, 1st, The arrangement of machinery for cutting pasteboard into strips, and those strips a given length, at the same time. 2d, The arrangement of the rocker shaft, rolls, and shears, for the purpose above described. 3d, I also claim the series of shears, or its equivalent, for the purpose described."

62. For an *Improvement in Cultivating Ploughs*; L. M. Whitman, Assignor to Samuel G. Wise, Weedsport, New York.

Claim.—"What I claim is, the employment of the long inclined spring wings, secured at their front ends to the share and main standard, and turning upon the pin, in combination with the mechanical contrivance shown and described, for expanding and contracting the wings, or setting them more perpendicular and nearer together, for the purpose of throwing more pulverized soil against or up to the hills, or setting them less inclined to the horizontal plane, and further apart, for the purpose of allowing the pulverized soil, weeds, &c., to pass over them into the broad open spaces in the centre; the said wings in either case cutting up the weeds and pulverizing the soil, the same as fully set forth."

MECHANICS, PHYSICS, AND CHEMISTRY.

Experimental Investigation of Table-Moving. By M. FARADAY.*

The object which I had in view in this inquiry was not to satisfy myself, for my conclusion had been formed already on the evidence of those who had turned tables,—but that I might be enabled to give a strong opinion founded on facts, to the many who applied to me for it. Yet, the proof which I sought for, and the method followed in the inquiry, were precisely of the same nature as those which I should adopt in any other physical investigation. The parties with whom I have worked were very honorable, very clear in their intentions, successful table movers, very desirous of succeeding in establishing the existence of a peculiar power, thoroughly candid, and very effectual. It is with me a clear point that the

* From the London Athenæum, July, 1853.

table moves when the parties, though they strongly wish it, do not intend, and do not believe that they move it by ordinary mechanical power. They say, the table draws their hands; that it moves first, and they have to follow it,—that sometimes it even moves from under their hands. With some the table will move to the right or left according as they wish or will it,—with others the direction of the first motion is uncertain:—but all agree that the table moves the hands, and not the hands the table. Though I believe the parties do not intend to move the table, but obtain the result by a *quasi* involuntary action,—still I had no doubt of the influence of expectation upon their minds, and through that upon the success or failure of their efforts. The first point, therefore, was, to remove all objections due to expectation, having relation to the substances which I might desire to use:—so, plates of the most different bodies, electrically speaking,—namely, sand-paper, millboard, glue, glass, moist clay, tinfoil, cardboard, gutta percha, vulcanized rubber, wood, &c.,—were made into a bundle and placed on a table under the hands of a turner. The table turned. Other bundles of other plates were submitted to different persons at other times,—and the tables turned. Henceforth, therefore, these substances may be used in the construction of apparatus. Neither during their use nor at other times could the slightest trace of electrical or magnetic effects be obtained. At the same trials it was readily ascertained that one person could produce the effect; and that the motion was not necessarily circular, but might be in a straight line. No form of experiment or mode of observation that I could devise gave me the slightest indication of any peculiar natural force. No attractions, or repulsions, or signs of tangential power, appeared,—nor any thing which could be referred to other than the mere mechanical pressure exerted inadvertently by the turner. I therefore proceeded to analyze this pressure, or that part of it exerted in the horizontal direction:—doing so, in the first instance, unawares to the party. A soft cement, consisting of wax and turpentine, or wax and pomatum, was prepared. Four or five pieces of smooth slippery cardboard were attached one over the other by little pellets of the cement, and the lower of these to a piece of sand-paper resting on the table; the edges of these sheets overlapped slightly, and on the under surface a pencil line was drawn over the laps so as to indicate position. The upper cardboard was larger than the rest, so as to cover the whole from sight. Then, the table turner placed the hands upon the upper card,—and we waited for the result. Now, the cement was strong enough to offer considerable resistance to mechanical motion, and also to retain the cards in any new position which they might acquire,—and yet weak enough to give way slowly to a continued force. When at last the tables, cards, and hands all moved to the left together, and so a true result was obtained, I took up the pack. On examination, it was easy to see by the displacement of the parts of the line, that the hand had moved further than the table, and that the latter had lagged behind; that the hand, in fact, had pushed the upper card to the left, and that the under cards and the table had followed and been dragged by it. In other similar cases when the table had not moved, still the upper card was found to have moved, showing that the hand had carried it in the expected direction. It was evident, therefore, that the table had not drawn the hand and person

round, nor had it moved simultaneously with the hand. The hand had left all things under it behind, and the table evidently tended continually to keep the hand back.

The next step was, to arrange an index, which should show whether the table moved first, or the hand moved before the table, or both moved or remained at rest together. At first this was done by placing an upright pin fixed on a leaden foot upon the table, and using that as the fulcrum of a light lever. The latter was made of a slip of foolscap paper, and the short arm, about $\frac{1}{2}$ of an inch in length, was attached to a pin proceeding from the edge of a slipping card placed on the table, and prepared to receive the hands of the table turner. The other arm, of $11\frac{1}{2}$ inches long, served for the index of motion. A coin laid on the table marked the normal position of the card and index. At first the slipping card was attached to the table by the soft cement, and the index was either screened from the turner, or the latter looked away: then, before the table moved, the index showed that the hand was giving a resultant pressure in the expected direction. The effect was never carried far enough to move the table, for the motion of the index corrected the judgment of the experimenter, who became aware that, inadvertently, a side force had been exerted. The card was now set free from the table, *i. e.*, the cement now removed. This, of course, could not interfere with any of the results expected by the table turner,—for both the bundle of plates spoken of and single cards had been freely moved on the table before; but now that the index was there, witnessing to the eye, and through it to the mind, of the table turner, not the slightest tendency to motion either of the card or of the table occurred. Indeed, whether the card was left free or attached to the table, all motion or tendency to motion was gone. In one particular case there was relative motion between the table and the hands: I believe that the hands moved in one direction; the table turner was persuaded that the table moved from under the hand in the other direction:—a gauge, standing upon the floor, and pointing to the table, was therefore set up on that and some future occasions,—and then, neither motion of the hand nor of the table occurred.

A more perfect level apparatus was then constructed in the following manner:—Two thin boards, $9\frac{1}{2}$ inches by 7 inches, were provided; a board, 9 by 5 inches, was glued to the middle of the underside of one of these, (to be called the table-board,) so as to raise the edges free from the table; being placed on the table, near and parallel to its side, an upright pin was fixed close to the further edge of the board, at the middle, to serve as the fulcrum for the indicating lever. Then, four glass rods, 7 inches long and $\frac{1}{4}$ in diameter, were placed as rollers on different parts of this table-board, and the upper board placed on them; the rods permitted any required amount of pressure on the boards, with a free motion of the upper on the lower to the right and left. At the part corresponding to the pin in the lower board, a piece was cut out of the upper board, and a pin attached there, which, being bent downwards, entered the hole in the end of the short arm of the index lever: this part of the lever was of cardboard; the indicating prolongation was a straight hay-stalk 15 inches long. In order to restrain the motion of the upper board on the lower, two vulcanized rubber rings were passed round both, at the parts

not resting on the table: these, whilst they tied the boards together, acted also as springs,—and whilst they allowed the first feeblest tendency to motion to be seen by the index, exerted before the upper board had moved a quarter of an inch sufficient power in pulling the upper board back from either side, to resist a long lateral action of the hand. All being thus arranged, except that the lever was away,—the two boards were tied together with string, running parallel to the vulcanized rubber springs, so as to be immovable in relation to each other. They were then placed on the table, and a table turner sat down to them;—the table very shortly moved in due order, showing that the apparatus offered no impediment to the action. A like apparatus, with metal rollers, produced the same result under the hands of another person. The index was now put into its place and the string loosened, so that the springs should come into play. It was soon seen, with the party that could will the motion in either direction, (from whom the index was purposely hidden,) that the hands were gradually creeping up in the direction before agreed upon, though the party certainly thought they were pressing downwards only. When shown that it was so, they were truly surprised; but when they lifted up their hands, and immediately saw the index return to its normal position, they were convinced. When they looked at the index, and could see for themselves whether they were pressing truly downwards, or obliquely so as to produce a resultant in the right or left handed direction, then such an effect never took place. Several tried, for a long while together, and with the best will in the world; but no motion, right or left, of the table, or hand, or anything else, occurred.—[A passage from the letter in the *Times* is worth reproducing here,—as illustrating in other words the value of this method of self-conviction.—“The result,” says Prof. Faraday, “was, that when the parties saw the index it remained very steady; when it was hidden from them, or they looked away from it, it wavered about, though they believed that they always pressed directly downwards; and, when the table did not move, there was still a resultant of hand force in the direction in which it was wished the table should move, which, however, was exercised quite unwittingly by the party operating. This resultant it is which, in the course of the waiting time, while the fingers and hands become stiff, numb, and insensible by continued pressure, grows up to an amount sufficient to move the table or the substances pressed upon. But the most valuable effect of this test-apparatus (which was afterwards made more perfect and independent of the table) is the corrective power it possesses over the mind of the table turner. As soon as the index is placed before the most earnest, and they perceive—as in my presence they have always done—that it tells truly whether they are pressing downwards only or obliquely, then all effects of table turning cease, even though the parties persevere, earnestly desiring motion, till they become weary and worn out. No prompting or checking of the hands is needed—the power is gone; and this only because the parties are made conscious of what they are really doing mechanically, and so are unable unwittingly to deceive themselves. I know that some may say that it is the cardboard next the fingers which moves first, and that it both drags the table and also the table turner with it. All I have to reply is, that the cardboard may in practice be reduced to a thin sheet

of paper weighing only a few grains, or to a piece of goldbeaters' skin, or even the end of the lever, and (in principle) to the very cuticle of the fingers itself. Then the results that follow are too absurd to be admitted: the table becomes an incumbrance, and a person holding out the fingers in the air, either naked or tipped with goldbeaters' skin or cardboard, ought to be drawn about the room, &c.; but I refrain from considering imaginary yet consequent results which have nothing philosophical or real in them."']

Another form of index was applied thus :—a circular hole was cut in the middle of the upper board, and a piece of cartridge paper pasted under it on the lower surface of the board; a thin slice of cork was fixed on the upper surface of the lower board corresponding to the cartridge paper; the interval between them might be a quarter of an inch or less. A needle was fixed into the end of one of the index hay-stalks, and when all was in place the needle point was passed through the cartridge paper and pressed slightly into the cork beneath, so as to stand upright: then any motion of the hand or hand-board was instantly rendered evident by the deflexion of the perpendicular hay-stalk to the right or left.

I think the apparatus I have described may be useful to many who really wish to know the truth of nature, and would prefer that truth to a mistaken conclusion: desired, perhaps, only because it seems to be new or strange. Persons do not know how difficult it is to press directly downward, or in any given direction against a fixed obstacle: or even to *know only* whether they are doing so or not; unless they have some indicator, which, by visible motion or otherwise, shall instruct them: and this is more especially the case when the muscles of the fingers and hand have been cramped and rendered either tingling, or insensible, or cold, by long continued pressure. If a finger be pressed constantly into the corner of a window frame for ten minutes or more, and then, continuing the pressure, the mind be directed to judge whether the force at a given moment is all horizontal, or all downward, or how much is in one direction and how much in the other, it will find great difficulty in deciding; and will at last become altogether uncertain: at least such is my case. I know that a similar result occurs with others; for I have had two boards arranged, separated, not by rollers, but by plugs of vulcanized rubber, and with the vertical index: when a person with his hands on the upper board is requested to press only downwards, and the index is hidden from his sight, it moves to the right, to the left, to him and from him, and in all horizontal directions; so utterly unable is he strictly to fulfil his intention without a visible and correcting indicator. Now, such is the use of the instrument with the horizontal index and rollers: the mind is instructed, and the involuntary or *quasi* involuntary motion is checked in the commencement, and therefore never rises up to the degree needful to move the table, or even permanently the index itself. No one can suppose that looking at the index can in any way interfere with the transfer of electricity or any other power from the hand to the board under it or to the table. If the board tends to move, it may do so, the index does not confine it; and if the table tends to move, there is no reason why it should not. If both were influenced by any power to move together, they may do so,—as

they did indeed when the apparatus was tied, and the mind and muscles left unwatched and unchecked.

I must bring this long description to a close. I am a little ashamed of it, for I think, in the present age, and in this part of the world, it ought not to have been required. Nevertheless, I hope it may be useful. There are many whom I do not expect to convince; but I may be allowed to say that I cannot undertake to answer such objections as may be made. I state my own convictions as an experimental philosopher, and find it no more necessary to enter into controversy on this point than on any other in science, as the nature of matter, or inertia, or the magnetization of light, on which I may differ from others. The world will decide sooner or later in all such cases, and I have no doubt very soon and correctly in the present instance. Those who may wish to see the particular construction of the test apparatus which I have employed, may have the opportunity at Mr. Newman's, 122, Regent Street. Further I may say, I have sought earnestly for cases of lifting by attraction, and indications of attraction in any form, but have gained no traces of effects. Finally, I beg to direct attention to the discourse delivered by Dr. Carpenter at the Royal Institution on the 12th of March, 1852, entitled 'On the influence of Suggestion in modifying and directing Muscular Movement, independently of Volition':—which, especially in the latter part, should be considered in reference to table moving by all who are interested in the subject.

Royal Institution, June 27.

*Art-Manufacture.**

(Continued from page 278.)

The study of the productions of a past age and of the beautiful forms of nature has certainly done much for Art of late,—and has laid the foundation from which much more will arise; but the servile imitation which has been unfortunately far more prevalent has filled our shops and houses with productions which call up a smile on the face of the man of taste, whether Englishman or foreigner. In one place we find a row of sphinxes supported by something between an obelisk and a milestone, guarding the entrances of a row of houses in the simplest modern English style. In another we are condemned to clean our shoes upon a scraper composed of two anomalous looking figures, whose wings clasp each other and supply the edge by means of which the mud is to be removed from the sole. On one table we see octagonal jugs which look as though they had been made out of a number of spare pieces, and call up the idea rather of carpentry than of pottery;—on another—probably devised to hold that very unromantic liquid with which we temper the crudity of our tea and coffee—the chivalric temperament of the designer comes forth in great force; around the top edge is an elegant Gothic fret-work, which might have been borrowed from the screen of one of our most beautiful cathedrals. Below, the same ornament is reproduced in an inverted position. Between these two specimens of happy adaptation we find a knight armed *cap-à-pie*,

* From the London Athenæum, May, 1853.