[For the Scientific American.]

THE NATURE OF THE NEWLY DISCOVERED FORCE.

BY GEORGE M. BEARD, M. D.

In my letters to the *Tribune* and in my lecture before the Polytechnic Club, I advanced a theory of the force recently discovered by Mr. Edison, that might perhaps ally it to electricity, though not to any known form, and account for its non-polarity and other phenomena exhibited by it. This theory I suggested and used merely as a temporary working hypothesis. At the present time, the weight of evidence in my mind is in favor of the theory that this is a radiant force, somewhere between light and heat on the one hand and magnetism and electricity on the other, with some of the features of all these forces. Experiments of the following kind are of themselves powerful arguments in favor of this theory:

When the wire conducting the force from the battery to the dark box is divided in the air, and the ends are separated even a sixteenth of an inch, no spark appears in the dark box. Lay these ends of the wire on a semi-conductor, as wood, and the force will pass when they are separated a moderate distance. Place small pieces of tinfoil about these ends as they are suspended in the air, and the force now passes one inch or perhaps several inches through the air. Place pieces of tinfoil of larger surface about these ends, and separate them a wider distance, and the force will yet pass. Make the surfaces of tinfoil larger still, until they are a foot square or more, and the force will travel several feet through the air. Prepare three large pieces of tinfoil, place one piece on each end of the divided wire suspended as before, and the other piece about equidistant between them; and still the spark may be seen (though faintly and irregularly) in the dark box. The force must jump from the piece of tinfoil at one end of the wire to the middle piece, which acts as a kind of resting place, and thence to the piece at the other end of the wire. The spark has been obtained (though with difficulty, and only after very nice adjustment of the pencil points in the dark box) after having passed through four pieces of tinfoil, the distance from the first piece to the last being eight feet. The highest tension statical electricity, as generated by Holtz' machine, could not do this; and electricity prefers to pass by points. Through experiments of this kind we have learnt one important law of this force, namely, that it prefers to pass through surfaces; and the larger the surface, the better it passes through any bad conductor, at least within certain limits.

Phenomena of the kind here described suggest magnetism more than induction or dynamical electricity: but this force does not respond to the test of magnetism, the power to attract iron; and moreover it exhibits phenomena that do not belong to magnetism. It is attracted by iron and other metals, as conductors, but it does not itself attract iron.

The points which favor the radiant theory of this force may be thus recapitulated:

1. It does not respond to any of the physical tests of electricity, except the spark.

2. It produces no perceptible or demonstrable physiological effects, like electricity.

3. It is not resisted by non-conductors as air, water, glass, rubber, and paraffin, to the same degree as electricity.

4. It gives no evidence, in any of its phenomena, of polarity.

5. It passes through non-conductors, as air, rubber, glass, etc, most readily by large surfaces at the terminals, while electricity prefers to pass by points.

6. It diminishes in strength with the distance from the battery, possibly in some definite ratio, although that is not yet demonstrated.

Any form of electricity giving a spark like the spark of this force would respond to some of the physical tests of electricity, would produce readily perceptible physiological effects, would be powerfully resisted by the air, and would in all its phenomena suggest polarity, even if rapidly reversed.

Again, the four facts regarded by me as favoring the theory that this force is allied to electricity, are, when severely analyzed, not so convincing as they might at first appear. The spark of this force resembles the spark of dynamical electricity; but so also does the spark produced by combustion. The velocity of this force is great, but so also is that of light. This force is best conducted by metals; but so also is heat. This force is resisted somewhat by non-conductors, but so also is heat, and both to a less degree than electricity.

If it be, as I have suggested, a kind of electricity which, after the manner of the shuttle, returns to its source by rapid forward and backward movements, it would yet be electricity under very different conditions from those under which we are wont to consider it, and would be practically a new force. The more I experiment in this department, and the more closely I reflect on the results of experiments, the farther I seem to be driven from the electrical toward the radiant theory of this force; and there would appear to be no ready escape from the conclusion that we have here something radically different from what has before been observed by Science. The relation of this force to the other forces may be thus represented:

Light, Heat . . . New Force . . . . . Magnetism, Electricity.

The above would represent Mr. Edison's theory of a radiant force, nearer to light and heat than to magnetism or electricity.

The theory I have suggested would bring the force nearer to magnetism and electricity than to light or heat, as follows:

Light, Heat . . . . . New Force . . . Magnetism, Electricity.

The discovery that broad surfaces at the terminals are necessary to conduct this force through non-conducting solid bodies, as glass, rubber, paraffin, etc, was made but a few nights ago. That the force passed through air when large surfaces were at the terminals had been proved previously by Mr. Edison's experiments and by my own. A large surface of tinfoil (6x6 or 12x12 inches) was connected with one end of the divided wire, and laid on a table. Over this were placed broad pieces of hard rubber, glass, or paraffin, and on the top of these was placed a similar piece of tinfoil connected with the other end of the divided wire, through which the force was to be conducted to the dark box. In this way, it was proved that the force could pass through 2½ inches of dry wood, 2 plates of glass, each ¼ of an inch in thickness, ¼ of an inch of hard rubber, ¼ of an inch of solid paraffin, and 5 layers of paraffin paper. When the surfaces at the ends of the wire were reduced in size, or when the tinfoil at one end was removed, the force passed less easily. When the tinfoil at both ends was removed, and only a few inches of fine wire constituted the surface, the force passed, but through thinner resistance. When only the terminals of the wires were applied to the resisting body, the force would not pass at all, or but a very short distance. The force passed through 8 inches of water, and was apparently but little diminished even when the surface at the terminals was but an inch of fine wire.

Useful Recipes for the Shop, the Household, and the Farm.

A new compound for polishing and cleaning metals is composed of 1 oz. carbonate of ammonia dissolved in 4 ozs. water; with this is mixed 16 ozs. Paris white. A moistened sponge is dipped in the powder, and rubbed lightly over the surface of the metal, after which the powder is dusted off, leaving a fine brilliant luster.

A new alloy for bell metal is proposed, which does not tarnish, is less liable to crack, gives a better sound, and is much lighter in weight than the alloy usually employed for the purpose. It is prepared as follows: Nickel 1 lb. and copper 6 lbs. are melted and cooled. Add zinc 2 lbs., aluminum ½ oz. Melt and cool. Melt again, and finally add ½ oz. quicksilver and 6 lbs. melted copper.

A very beautiful application of electro-metallurgy is to apply a coat of silver by electro deposition on natural leaves and flowers. By this means very delicate ornaments are produced, since the precise form and texture of the natural leaf are produced under the thin silver film.

Lemons can be preserved by varnishing them with a solution of shellac in alcohol. The skin of shellac formed is easily removed by rubbing the fruit in the hands.

J. Q. R. B. says; Varnish made with alcohol will get dull and spongy by the evaporation of the alcohol, which leaves water in the varnish, as all commercial alcohol contains water. Take thin sheet gelatin, cut it in strips, and put it in the varnish; it will absorb most of the water, and the varnish can be used clear and bright till the last drop. The gelatin will get quite soft; it can then be taken and dried, and used again. "I have used this plan for the last two years in photographic varnish, and have never had to throw away one drop."

There is no simpler remedy for preventing cider growing sour than mustard seed. After the cider has fermented and reached the desired palatable condition, put 1 pint mustard seed to a barrel of cider, and bung tight.

DECISIONS OF THE COURTS.

United States Circuit Court--- District of New Jersey.

PATENT SKATES.—GEORGE B. TURRELL *vs.* EDWARD SPAETH AND CHARLES GUELICKER.

[In equity—Before Nixon, J.]

NIXON, J.:

This suit is for the infringement of reissued letters patent, dated April 6, 1875, for "Improvement in Skates," of which the complainant became the owner by assignment on the 13th of April, 1875. The bill was filed July 6, 1875, charging the defendants with infringement, and praying for an injunction, and for an account of the gains and profits made by the defendants, and of all the damages sustained by the complainant from the said infringement.

The complainant is taking testimony to prove his *prima facie* case, and has issued a subpœna *duces tecum* to one of the defendants, Edward Spaeth, requiring him to produce before the Examiner all "books, papers, and documents whatsoever, that will show the number of skates made or delivered by the defendants, or their employees, since the 6th day of April, 1875."

The defendants complain that this is not an honest inquiry into their acts to sustain the charge of infringement, but an attempt, by an abuse of the process of the court, to ascertain the nature, extent, and direction of their business affairs. While they express themselves willing to make a full exhibit of all their manufacture and sale of skates from the date of the last reissue of the patent to the commencement of this suit, they protest that the complainant is not entitled at this stage of the proceedings, and before a decree against them for infringement, to compel an exposure of their business matters since the last-named date. They have accordingly applied for, and obtained, a rule upon the complainant to show cause before the court (1) "why the subpœna *duces tecum* should not be modified by inserting the clause 'and until the commencement of this suit' after the words and figures '6th day of April, 1875,'" and (2) "why the defendants should not be excused from disclosing to the complainant, in the complainant's *prima facie* case, what defendants have or have not done since the commencement of this action."

The counsel for the complainant justifies the questions propounded, and the call for the books, exhibiting the amount and character of the business of the defendants since the filing of the bill, on the ground that the complainant's patent is for a combination; that it already appears in evidence that the defendants have a contract to manufacture the skates, which are sworn to be an infringement of the complainant's patent, and to deliver them to persons who are not licensees of the patentee; that a number of such skates are yet to be made and delivered under said contract; that it further appears that the defendants are accustomed to make large quantities of the parts of skates interchangeable, and to put them together afterward; that it is admitted in their testimony that some of these parts were manufactured before the commencement of the suit; and the object of the present inquiry is to ascertain whether the other parts of the skates have not been manufactured since, and whether the parts made before filing the bill have not since been united to form skates, so that what was done after the reissue and before the suit has been contradictory to the infringement.

The reissued patent owned by the complainant, and for the infringement of which the suit is brought, is undoubtedly for a combination in the specifications. The inventor states that the nature of his invention consists in the combination, with a skate and the lateral-acting clamps, of mechanism that operates to move the clamps toward each other with sufficient force to cause them to grasp the sole, and hold the skate to the boot or shoe.

The first claim of the reissue is for—

The combination, in a skate, of clamps for grasping the sole, a plate or rest for the foot, and mechanism for moving and holding the clamps.

The second is for—

The clamps for grasping the heel and the clamps for grasping the sole, combined with mechanism operating and holding both sets of clamps, substantially as specified.

And the law is well settled that such a patent is not infringed by the use of some of the parts which make up the combination, the other parts being omitted, unless the place of the discarded constituents is supplied by something substantially equivalent.

As was remarked by Mr. Justice Nelson in delivering the opinion of the Supreme Court in Vance *vs.* Campbell (1 Black, 429):

Unless the combination is maintained, the whole of the invention fails. The combination is an entirety; if one of the elements is given up, the thing claimed disappears.

Hence, also, it was held in Gould *vs.* Rees (15 Wall, 194), that "where the defendant, in constructing a machine, omits entirely one of the ingredients of the plaintiff's combination, without substituting any other, he does not infringe; and if he substitutes another in the place of the one omitted, which is new or which performs a substantially different function, or if it is old, but was not known at the date of the plaintiff's invention as a proper substitute for the omitted ingredient, then he does not infringe."

The complainant seeks to establish his *prima facie* case of infringement by putting one of the defendants on the stand as a witness, and proving by him what the defendants have done. He calls his attention to Exhibit No. 1, and asks whether he has made skates substantially like that. The witness admits that he has, and that the defendants have a contract to furnish such skates to the firm of Peck & Snyder. He is then requested to produce the contract, which he properly declines to do, alleging as a reason that he does not wish to disclose to rivals the price which they were to receive, nor the number to be manufactured; but he again admits that it was a contract to deliver skates very nearly like Exhibit No. 1 of complainant. The sole pertinent inquiry now is the fact of the infringement, and that fact will not be made any more evident by producing the contract than it has been by the admissions of the defendants. The extent of the infringement is a different question, and will only arise, if at all, upon a reference for an account after a decree for the complainant.

He then continues the defendants' examination as follows:

Q. 23. Do you keep books of account which show how many skates like Exhibit 1 you make, the deliveries of such skates, and the dates of such delivery?

A. Yes.

Q. 24. Will you produce those books of account at the next adjournment?

(Objected to, because complainant has no right to compel the witness to produce his books at this stage of the suit, and because he has not served any subpœna *duces tecum* upon him, and he has no right to such subpœna.)

A. I decline throwing our books open to the complainant.

Q. 25. In manufacturing skates under your contract, has it been your practice to make considerable numbers of each of the different parts of the skates, and keep them until such time as you may desire to put them together?

A. We always have made those parts at the commencement of the year, as that is work we keep boys on to fill up time when we are doing nothing else.

Q. 26. During the period of time between the reissue of the patent and the filing of the bill, did you have on hand a considerable number of each of the parts constituting the clamping mechanism like that in Exhibit No. 1?

A. Yes; we always do have such parts in the factory.

Q. 27. Since that time, have you used any of the parts that you then had in store in the construction of skates substantially like complainant's Exhibit No. 1?

(Objected to as immaterial and irrelevant to any issue in this suit; and because the question ought to be limited to the time of the commencement of this suit, and counsel instructs witness not to state what he has done since that time.)

The design of these questions is apparent. They are put on the theory that, in a patent for a combination, he is an infringer who makes or sells only one or two of the parts of which the combination is composed, if done with the intent that the purchaser shall unite them with the other parts, procured either from the same or other sources, and at the same or at different times.

That seems to be the principle decided in Wallace *vs.* Holmes, (9 Blatch., 65,) on which the counsel for the complainant relies in support of his right to ask the question, and to call for the books of the defendants, exhibiting their business since the commencement of this suit.

In that case, where there was a patent for a new and useful improvement in lamps, which consisted of an improved burner in combination with a chimney, and the proof was that the defendants had manufactured and sold the burner alone, leaving the purchaser to supply the chimney—without which the burner was useless—the late Judge Woodruff held that the manufacture and sale of the burner by the defendants without the chimney was an infringement of the patent.

It cannot be (he says) that, where a useful machine is patented as a combination or parts, two or more can engage in its construction and sale, and protect themselves by showing that, though united in an effort to produce the same machine and sell it, and bring it into extensive use, each makes and sells one part only, which is useless without the other, and still another person, in precise conformity with the purpose in view, puts them together for use. If it were so, such patents would indeed be of little value. In such case all are tort-feasors, engaged in a common purpose to infringe the patent, and actually by their concerted action producing that result. * * * * Each is liable for all the damages.

Without thereby intending to intimate an ultimate opinion in regard to its relevancy to the pending one, I propose to adopt its spirit in the order which I shall make on the present motion.

Let the subpœna *duces tecum* be modified as the defendant requests, by inserting the clause "and until the commencement of this suit" after the words and figures "6th day of April, 1875;" but at the same time let the defendant, and any other witnesses, answer question 27, and all other questions tending to show the subsequent use of any of the parts of skates like Exhibit No. 1, which defendants had on hand when the suit was commenced.

This order is made upon the supposition that the answer to question 27 will serve the purpose of complainant as to present proof. If the evidence as to the fact of what the defendants have done since the commencement of the suit in the matter of uniting the constituents of the combination should not be satisfactory to the complainant, and it is supposed that the book of the defendants will shed more light on the subject, the court will hear an application hereafter, on notice to defendants, in regard to exhibition of the books of account.

[*Charles F. Blake* for complainant.
J. Van Santvoord, for defendants.]

NEW BOOKS AND PUBLICATIONS.

TINNITUS AURIUM, OR NOISES IN THE EARS. By Laurence Turnbull, Ph. G., M.D., Physician to the Eye and Ear Department of the Howard Hospital, Philadelphia, Pa., etc. Second Edition, with Cases. Philadelphia, Pa.: J. B. Lippincott & Co.

Dr. Turnbull sends us a very readable and interesting pamphlet on a very common and little understood malady. He shows that noises in the ears are the effects of causes widely different, and that sometimes the sounds are merely hallucinations, produced by abnormal action of the cerebral organs. Many remarkable instances of tinnitus are cited, and serve to render the book of value to the medical profession.

BRIDGES AND TUNNEL CENTERS. By John B. McMaster. Price 50 cents. New York city: D. Van Nostrand, 23 Murray street.

SAFETY VALVES. By R. H. Buel, C. E. Price 50 cents. New York city: D. Van Nostrand, 23 Murray street.

These two excellent volumes are Nos. 20 and 21 of Mr. Van Nostrand's Science Series. The work on safety valves is especially commendable for its clearness and accuracy, and such a work, judging from our multitudinous correspondence, has long been needed in our workshops and factories.

ADVENTURES OF A DEAF MUTE. By W. B. Swett. Marblehead, Mass.: Published by the Author.

An interesting and well written account of some journeys and adventures in the White Mountains, the profits from the sale of which are devoted by the author to the benefit of his brethren in affliction.

THE ORIGIN OF LIFE AND SPECIES, a New Theory. By J. B. Pool. Price 10 cents. Pittsfield, Mass.: W. H. Phillips.

The author of this pamphlet deserves credit for courage in attacking a very large subject, and for the clearness with which he states his views.

THE GROCER. Volume I, No. 1. Published Weekly. Subscription $2 a year. New York city: The Grocer Publishing Company, 163 Chambers street.

A valuable and well edited trade journal, replete with accurate information and original articles.

THE ILLUSTRATED ANNUAL REGISTER OF RURAL AFFAIRS FOR 1876. With 170 Engravings. Price 30 cents. Albany, N. Y.: Luther Tucker and Son.

An excellent handbook of agricultural and gardening matters, accompanied by a calendar and much useful information.

AURORA BRAZILEIRA is the name of a new monthly scientific and mechanical periodical, published in the Portuguese language by Mr. J. C. Alves Lima, at Syracuse, N. Y. The journal is intended principally for Brazilian circulation, and as a medium for trade between the United States and the Portuguese-speaking population of South America. The first number before us is well illustrated, and contains an interesting variety of articles. The subscription price, 10,000 reis, is somewhat startling unless one appreciates the minute unit of Brazilian money, and translates the total into $5.45 United States currency.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 3 to December 16, 1875, inclusive

ARTIFICIAL LEATHER.—A. W. Pope (of Boston, Mass.), London, Eng.
BOOT SEWING MACHINE.—D. Mills (of Brooklyn, N. Y.), Aston, Eng.
BUILDING SHIPS.—T. H. Buckler, Baltimore, Md.
CHECK FOR FIRE ARMS.—W. D. Miller, Pittsburgh, Pa.
CLOTHES HORSE, ETC.—C. T. Rowe, Brooklyn, N. Y.
GRINDING BARK.—S. R. Thompson *et al.*, Portsmouth, N. H.
LOCK NUT, ETC.—P. M. F. Cazin, Colorado.
METAL CAR FRAME, ETC.—B. J. La Mothe, New York city.
ORE-ROASTING FURNACE.—R. M. Fryer, New York city.
PREPARING PAPER FOR PRINTING.—R. M. Hoe, New York city.
REPEATING FIRE ARM.—B. B. Hotchkiss, Paris, France.
SHIP'S TABLE.—E. P. S. Andrews, Havilah, Cal.