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THE TELEPHONE.

We have already laid before our readers accounts of the wonderful performances of Professor Bell's telephone, an instrument remarkable not merely for its phenomenal capabilities but also because of its having been brought to its present stage of development within the period which has elapsed since June last. During that month, Professor Bell exhibited the apparatus at the Centennial, working it over short distances only, and causing it to transmit sound, which reached the opposite terminus very much diminished in intensity. Without undertaking to follow the inventor through his various improvements, it will suffice here to state that the telephone has recently carried the human voice over a distance of 143 miles (from Boston to North Conway, N. H.), so that ordinary conversational tones uttered at one end were distinctly audible at the other. Further even than this, the inventor and his assistant have talked through a wire arranged to give an artificial resistance equal to 40,000 ohms, which is more resistance than the entire length of the Atlantic cable would offer. There are, however, other obstacles than the resistance, which checks the transmission of the voice over such immense distances. These the inventor is now endeavoring to overcome; and at the first favorable opportunity, a practical test of the powers of the instrument over one of the transatlantic cables will be attempted.

In the telephone which we illustrated recently in the SCIENTIFIC AMERICAN SUPPLEMENT, a battery current was directly employed. The most important improvement yet made in the apparatus is the entire abolition of the battery and electro-mag-

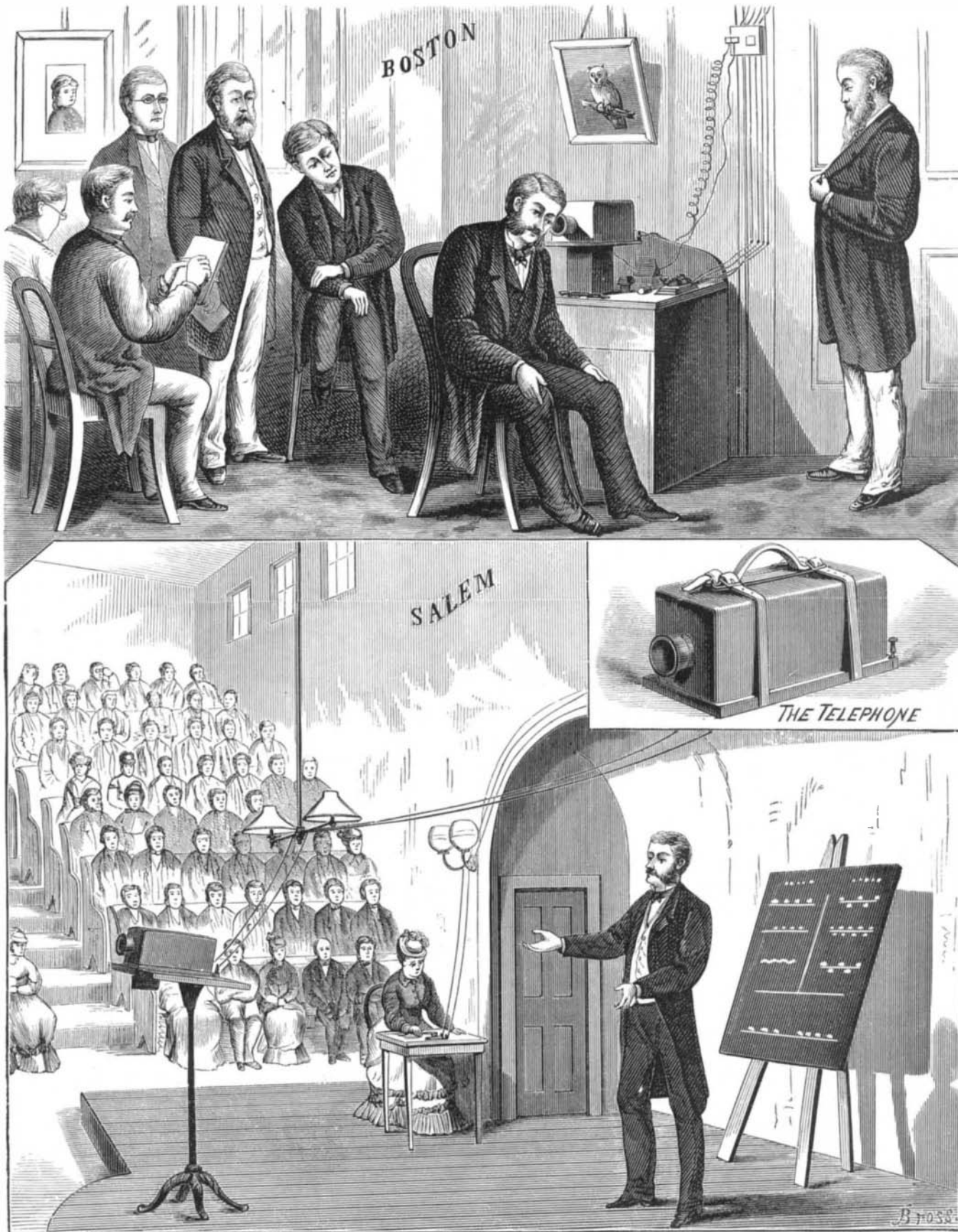
nets, and the substitution of the permanent magnet, the electric wave used in transmitting the sounds being generated by the voice itself. The construction of the instrument will be readily understood from the detailed drawings, Figs.

to or from plate, A. F is a bar of soft iron or magnet; G is a coil of insulated copper wire around the extremity, H, of said bar, and I is an adjusting screw by which the end, H, may be placed as desired in relation to plate, A. Several of these instruments are placed at different stations upon a line as represented in Fig. 3.

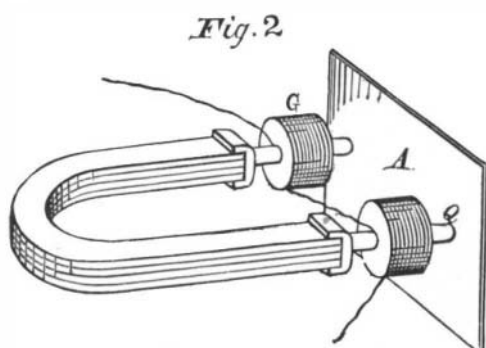
When sounds are made at the mouth-piece of the instrument, the plate, A, is set in motion before the poles of F, which may be a permanent compound magnet and arranged as shown in Fig. 2. A current of electricity is thus created in the coils, G, surrounding the poles, and the duration of the current of electricity coincides with the duration of the motion of the plate as it vibrates. When the human voice causes the diaphragm to vibrate, electrical undulations are induced, in the coils around the magnets, precisely similar to the undulations of the air produced by the voice. The coils are connected with the line wire, and the undulations induced in them travel through that wire; and passing through the coils of another instrument of similar construction, they are again resolved into air undulations by the diaphragm, A, of the second instrument. So perfectly is this resolution effected that even a whisper is audible over long distances, and soft tones are even more distinct than loud ones.

It will be evident that it is possible to send by the telephone multiple telegraphic messages or multiple verbal communications simultaneously. In Fig. 3, we have represented a number of telephones connected together, each one, for instance, at a different station, the stations being several hundred miles, perhaps, apart. To send multiple telegraphic messages, let it be supposed that a certain musical sound is uttered before the telephone No. 1: then telephones Nos. 2, 3, etc., will all repeat that sound. Now let two musical

[Continued on page 200.]

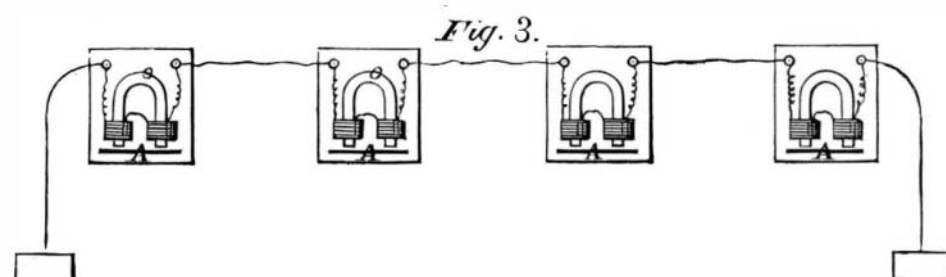


PROFESSOR A. GRAHAM BELL'S TELEPHONE.—Fig. 1.



2 and 4. A, Fig. 2, is a plate of iron or steel which is fastened to the sounding box, D, Fig. 4 (see page 200). E is the speaking tube by which sounds are conveyed

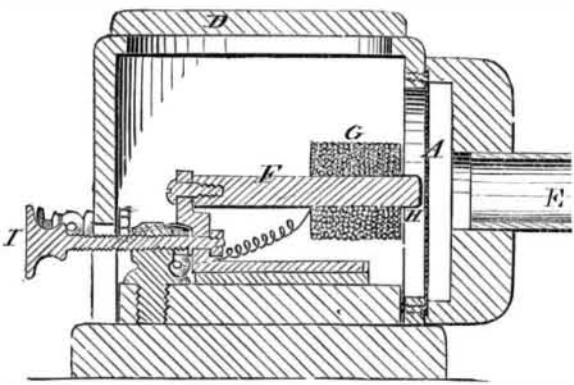
each one, for instance, at a different station, the stations being several hundred miles, perhaps, apart. To send multiple telegraphic messages, let it be supposed that a certain musical sound is uttered before the telephone No. 1: then telephones Nos. 2, 3, etc., will all repeat that sound. Now let two musical



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sounds of different degrees of the gamut be made simultaneously before No. 1. These also will be repeated by the other instruments, and the same would be true if, before the first instrument, any number of different sounds were made. Now, let it be previously understood that all messages sent to station No. 2 will be uttered in note C for instance, those to No. 3 in note D, and so on, a different note for each station; then, as the signals for each message differ in pitch from those for all the other messages, the operator has only to fix his attention upon the message sounded in the note he has learned to recognize, and he may ignore all the rest. In this way, the number of despatches which may be sent simultaneously is very large. Where, however, a large number is forwarded, rendering it the more difficult for a receiving operator to recognize his particular note, his message may be automatically received by a resonator provided with a membrane which vibrates only when the note with which the resonator is in unison is emitted by the receiving telephone. The vibrations of the membrane may be made to operate a circuit breaker, which will operate a Morse sounder or a telegraphic recording apparatus. Of course where several persons speak in the vicinity of telephone No. 1, their utterances are in a like manner simultaneously transmitted to all the telephones in the circuit. If this verbal

Fig. 4.



communication should be used for telegraphic purposes, the messages would have to be taken down by the receivers in short hand. We understand that Professor Bell has patents pending for some further improvements in his apparatus. These we shall notice at some future time.

We are indebted to a correspondent for the sketches wherewith we have prepared the engravings (Fig. 1, front page) representing Professor Bell lecturing on the telephone, at Salem, Mass., on February 12 last, and also the group in the inventor's study, in Exeter place, Boston, receiving his communications during the course of the lecture. The apparatus, an exterior view of which is also given, is all contained in an oblong box about 7 inches high and wide, and 12 inches long. This is all there is visible of the instrument, which during the lecture is placed on a desk at the front of the stage, with its mouthpiece toward the audience. Not only was the conversation and singing of the people at the Boston end distinctly audible in the Salem hall, 14 miles away, but Professor Bell's lecture was plainly heard and applause sent over the wires by the listeners in Boston.

Professor Bell was born in Edinburgh, Scotland, and came to this country about six years ago. His father, Professor A. M. Bell, who became noted as the inventor of a method for teaching deaf mutes to speak, and of a universal system of phonography, is now living in Brantford, Ontario. Professor Graham Bell, the present inventor, has also been exceptionally successful in the instruction of deaf mutes, and in one case he has enabled a girl who had never produced an articulate sound to pronounce words distinctly after having her under his tuition for the short space of two months. "If I can make a deaf mute talk," the now famous inventor is reported to have said, "I can make iron talk." We need not add that his promise has been fulfilled.

Electro-Chemical Illumination.

MM. Gauduin and Gramme have recently conducted a series of experiments in order to determine the effects of various foreign substances, combined with carbon pencils, upon the production of electric light. The materials introduced into the pencils were phosphate of lime (from bones), chloride of calcium, borate of lime, silicate of lime, pure precipitated silicic acid, magnesia, borate of magnesia, phosphate of magnesia, aluminum, and silicate of aluminum. The proportions were calculated so as to obtain 5 per cent of oxide after the baking of the pencils. The latter were submitted to the action of a current, always in the same direction, furnished by a Gramme electric machine of sufficient power to form an electric arch of from 0.4 to 0.6 inch in length. The negative pencil being placed below, the following results were observed:

1. The complete decomposition of phosphide of lime. Under the triple influence of electrolytic action, calorific action, and the reducing action of the carbon, the reduced calcium accumulated on the negative pencil, and burned (in contact with the air) with a reddish flame. The lime and phosphoric acid produced abundant smoke. The light obtained, measured by the photometer, was double that yielded by pencils of similar dimensions made from gas retort residue.

2. Chloride of calcium and borate and silicate of lime were also decomposed; but the boracic and silicic acids seemed to

be volatilized through the action of the current. Less light was obtained in this case than with the phosphate of lime.

3. Silicic acid rendered the pencils worse conductors, diminished the light, and melted and volatilized without becoming decomposed.

4. Magnesia and borate and phosphate of magnesia were decomposed. Magnesium in vapor went to the negative pencil, and burned, in contact with the air, with a white flame. Magnesia and boracic and phosphoric acids escaped in the state of smoke. The augmentation of the light was less than with the lime salts.

5. Aluminum and silicate of aluminum were decomposed only with a very strong current and large electric arch; but under these circumstances the decomposition was quite manifest, and the aluminum vapor could be seen leaving the negative pole, as from a gas jet, burning with a dull bluish flame.

The authors state that, considering that the flame and smoke which accompanied these electro-chemical lights would prove a great obstacle to their utilization, they continued their experiments no further. They point out, however, that the introduction of foreign bodies into pure carbon pencils is an excellent mode of studying the effect of electricity upon such bodies, which is susceptible of many very interesting applications.

Planing Mill Machinery.

An important point to be observed in the care of bearings for fast running journals is their lubrication. In needs no argument to demonstrate the necessity that exists for lubricating a shaft or bearing, and none to prove that the best and most economical way is to do it properly. Cylinder bearings that are supplied with oil from below, by means of wicks, valves or capillary attraction of any kind, should never be used, as they cannot be trusted for any length of time, and the result is that the operator pours on just as much oil—and wisely, too—as if they were of the ordinary pattern.

The common practice of squirting the oil from a can is another bad plan and very wasteful. Generally where one quart is really used in this manner five are wasted; and thus mill owners are often induced to buy cheap oil under the impression that it lasts just as long as the best, as it certainly does when an operator thinks he must use just so much and apply it just so often no matter what the quality may be.

For the journals of high speed machinery only the best lard or sperm oil should be used, and it should always be fed from an adjustable glass oiler placed on the top of the can in plain sight. "With this arrangement I have seen," says Mr. F. H. Morse, in the *Northwestern Lumberman*, "under my supervision, 24 inch machines with 8 inch journals run steadily for 10 hours, as a test, with only a teaspoonful of sperm oil to each journal, and at the end of that time the spindles were as cool as if they had run only half an hour. However incredible this may seem to those who are in the habit of applying more than that every 15 or 20 minutes, it is a fact, and one which I can readily substantiate. If those in charge of planing machinery would pay more attention to this part of their business and use more care and prudence than they usually do, the expense account of many mills might be sensibly reduced."

It should be the aim of every foreman and superintendent of a planing mill to keep the machines under his charge constantly at work, as no machine was ever known to make a dollar by standing idle. There may be cases where, had all the machines stood idle, or had they never been started, their owners would have been better off; but the fact still remains that, if there is any profit in running a planing mill at all (and certainly it should not be operated when there is not), it must be made by keeping all the machines steadily at work. If there are more machines in a mill than the amount of business calls for, part of them should be stopped altogether, and only those which are required for the various kinds of work, and which can be kept steadily employed, should be used. It does not pay to keep an operator standing idle over his machine one third of a day that he may work the balance of the time; for when he stops, his assistants and the machine stop, and consequently the profits stop; but his wages do not, neither does the interest upon the capital invested. There was a time, not many years since, when the profits of the planing-mill business were large enough to withstand such drawbacks; but that day has passed, and now it is only with the best management in every particular that it can be made to pay even a moderate percentage upon the investment.

A Gigantic Model Dairy.

The food supply of London has long engrossed a large share of public attention, and upon the purity of the articles supplied depends in a great measure the health and happiness of its inhabitants. Some ten years since the design was introduced of supplying the dwellers in this great city with milk and other dairy produce which, for general excellence, could not be surpassed. Like most good works, these laudable efforts were at first in a great measure abortive; but, by dint of perseverance and good management, the Aylesbury Dairy Company has assumed an importance far exceeding even the most sanguine expectations of its originators, and may fairly be designated one of the most useful and prosperous corporations now in operation. To give some idea of the gigantic nature of the business so successfully developed by this company, we may state that they daily supply some 5,000 families with milk, which is guaranteed, so far as human care and judgment can insure it, to be not only of

the purest description, but obtained from perfectly healthy sources. Upwards of 25,000 gallons of milk are dealt with every week, being the produce of nearly 50 farms in some of the best of our dairy counties. To carry on this enormous trade the company have, in addition to their town premises in St. Peterburgh place, Bayswater, a large factory at Swindon and a dairy at Bourton, where all the surplus milk is converted into cheese. With such admirable sources of supply, it is not a matter of surprise that the business has rapidly extended, and that so successful a commercial result has been achieved. The Aylesbury Dairy Company can take into their Swindon factory 3,000 gallons of milk daily, which they hold, as it were, in reserve. In the summer time, when the fashionable world is seeking recreation in garden parties, and when strawberries and cream and other suchlike seasonable delicacies are in request, then the company are in a position to meet any sudden demand. They possess every modern appliance suitable for the dairy, and have the power of setting 1,500 gallons of milk in 800 square feet of milk pans—the product from which in 10 hours' time would be a large quantity of cream. The cream is daily sent to London; and, after the orders are executed, the surplus is made into butter, the excellence of which is such that the demand exceeds the supply.—*London Court Circular.*

Wash for Fruit Trees.

At the last meeting of the Farmers' Club, a stranger inquired how he might remove the scales from the bodies and branches of his fruit trees.

The chairman stated that W. S. Carpenter used to put a pound of crude potash in two gallons of water, and after the potash is dissolved, dip a large swab in it and apply the liquid to the trees, which will kill the embryo insect in the scales.

Mr. Whitman said: That is a good remedy where one can get potash. But as this article is so unpleasant to handle, so difficult to procure except by the barrel, and so costly by the pound, I prefer to use cheap soap, with which I make a strong liquid and apply it with a swab. I have tried tobacco, soap, and carbolic soap, which are very expensive. Now I procure the Washington soap, which can be obtained in almost every city and village by the box, at only a few cents per pound. I take a cake of this soap, shave it up into thin slices and dissolve it in a pail of hot water. After it has stood a day or two the liquid will appear like mucilage, which is applied to the bodies of the trees when it is almost boiling hot. One or two applications will remove all the scales and make the bark look smooth and healthy. I procure a box of this soap every year, not only for the trees, but there is no better soap for culinary and laundry purposes.

Carbonic Acid Exhaled by Animals.

A German chemist has made a long series of careful experiments to ascertain the quantity of carbonic acid given off in respiration and perspiration by different animals. From among his most important conclusions, printed in the *Journal of the Chemical Society*, we select a few which appear worth wider notice. In proportion to their weight, the largest quantity of carbonic acid is given off by birds—mammals come next—and worms, amphibia, fishes, and snails form another group in which the excretion of carbonic acid is much smaller; of these, worms give off the most, and snails the least. Those that live in water give off more carbonic acid to the air than they do to the water; and young animals more than old ones. Experiments with colored light show that under the green and yellow more carbonic acid is excreted than in ordinary daylight; and on comparing light and darkness, it was found that much less carbonic acid is given off during the night than during the day. In colored light the milk-white and blue rays come next to the green and yellow in activity; and the red and violet are the least active.

Produce Exported in One Day.

Some idea of the vast amount of produce going from this country may be formed from the following statement: Portion of shipment from the port of New York, Saturday, March 3, taken from official sources: Corn, 99,735 bushels; apples, 2,100 barrels; bacon, 2,566 boxes; cheese, 2,400 boxes; butter, 3,827 packages; fresh beef, 90 tons, 1,488 quarters; sheep, 385; miscellaneous: 3,500 pieces maple timber, 600 barrels of oysters, 500 packages of agricultural implements, 450 tierces of lard, 24,025 cases of canned goods, and 500 barrels of shoe pegs. A single manufacturer in this city turns out 1,200 bushels shoe pegs a day. His best foreign market, he informs us, is Germany.

Pigs and Poisonous Plants.

A correspondent writes to point out that, in our recent article entitled "Absence of White Color in Animals," Mr. Darwin is quoted as to the effect of a poisonous plant on pigs in Virginia, with the comment of Dr. Ogle that there is no proof that the black pigs eat the root which poisons the white pigs; but, in fact, the white pigs are deficient in taste and smell, and not able to discriminate as to poisonous plants, etc. Our correspondent does not know what plant has such effects on pigs in Virginia, but there is a plant in Florida which may be the one referred to by Mr. Darwin. It is called paint root, and the root is a small bulb. The root and top are used as a dye by the Indians. Hogs are very fond of it, and hogs with black hoofs fatten on it; but those with white hoofs become lame and the hoof drops off. If a hog has three black hoofs and one white, the white one will fall off.

Postal Card Ink.

With the numerous useful and useless little inventions for which our country is noted, it is surprising that no one has yet placed in the market any kind of invisible ink for postal cards. Although we do not believe that such ink would prove very useful, it would probably meet with considerable sale, partially from the novelty of the thing. Many kinds of magic ink have been known for years, but most of them possess some disadvantages. A writer in the *Deutsche Industrie Zeitung*, in discussing the subject, claims that postal card ink should possess the following properties: 1. The writing must, of course, be invisible at first. 2. It must be of such a nature as to be rendered visible quickly and easily by means in the possession of every one at all times. 3. There should not be several kinds of this ink in market, one of which is developed by light, another by heat, a third by common salt solution, etc., so that, on receiving a blank card, the receiver would be at a loss to know how to develop it. This writer then goes on to recommend the use of a solution of nitrate or chloride of cobalt, mixed with a little sugar or gum to make it flow easily from the pen. Such writing is made visible by moderate heat, even a burning match being sufficient. Dr. Böttger, in a note to this article, recommends the use of ferrocyanide of potassium, or yellow prussiate of potash, which is readily developed by the sulphates of copper and iron (blue or green vitriol), the former yielding brown, the latter blue, letters.

Dr. Böttger is an exceedingly ingenious chemist, and most of his suggestions are very practical, but we beg to differ with him this time. Very few persons, except chemists, may be supposed to have solutions of either blue or green vitriol always at hand; and even a chemist, unless notified to this effect beforehand, would not think to try the effect of these solutions until he had tried several other reagents. This could be remedied by writing on the back of the card with common black ink an ambiguous or nonsensical sentence containing the name of the developer to be employed. For chemists, a convenient ink would be a solution of some lead salt, which is developed by sulphuretted hydrogen.

For ordinary use the most convenient ink is an iron salt; the common tincture of iron of the drug store will answer, if diluted. This writing is scarcely perceptible when dry, but comes out a beautiful black on pouring over it some ordinary green or black tea. The tannin in the tea unites with the iron to form a black ink precisely like that used for ordinary correspondence.

Another ink, less convenient for the writer, but more convenient for the receiver, is to write on the card with thin starch paste. When perfectly dry, the card is flowed with a solution of iodine in very strong alcohol. This imparts a reddish color to the card, but does not develop the writing, owing to the absence of water. The receiver has only to dip the card in water, when the writing will appear in blue characters. We offer this as a suggestion to manufacturers of magic inks. Of course, the operation of flowing with tincture of iodine might be left for the person who receives it, provided he were furnished with a key to the developer required. In this case dilute alcohol, or a solution of iodide of potassium, could be employed as a solvent for the iodine.

Another method, more curious than useful, consists in writing on the card with a solution of paraffin in benzol. When the solvent has evaporated the paraffin is invisible, but becomes visible on being dusted with lampblack or powdered graphite, or smoking over a candle flame. H.

Antidote for Oidium on Grape Vines.

M. Chatot, a Frenchman, recommends common table salt as an antidote for oidium, or grape vine disease. He says that his vines and grapes were covered for some years with a fungus-like substance, and that last spring he sprinkled a handful of salt about the roots of each vine. The effect was marvellous, the vines grew luxuriantly, and bore an abundance of grapes entirely free from the fungus of oidium.

NEW BOOKS AND PUBLICATIONS.

THE ELEMENTS OF MACHINE DESIGN. An Introduction to the Principles which Determine the Arrangement and Proportions of the Parts of Machines, etc. By B. Cawthorne Unwin, Professor of Mechanical Engineering at the Royal Indian College of Civil Engineers. Price 3s. 6d. (84 cents gold). London, England: Longmans, Green & Co., Paternoster row.

The designing of machinery has hitherto been principally left to the draftsman, and no attempt has been made until recently to reduce their different practices and methods to a science; and although it might be easy to form a collection of rules deduced from actual practice, no principles could be laid down on the authority of such empirical formulæ. To systematize the whole subject, and thus to simplify the practice and render it easy of acquisition by students, is the author's object, and he has succeeded in completing a work of the highest excellence. The chapters on materials and strength of materials, on riveted joints, and on shafting, are especially to be noticed for their terse and clear explanations; and throughout the book the mathematical expressions used need not deter any careful and painstaking student by their depth and abstruseness. The author has evidently put into this volume an amount of practical knowledge which must have taken many years to acquire.

THE MICROSCOPIST. A Manual of Microscopy. By J. H. Wythe, M.D. Third Edition. Illustrated. Price \$4.50. Philadelphia, Pa.: Lindsay & Blakiston, Publishers. New York city: D. Van Nostrand, 27 Warren street.

Professor Wythe offers a practically new work, since he has retained nothing but the name and perhaps the general design of his earlier elections. The present book is in all respects creditable both to the author and the publishers; and we can cordially commend it to students of microscopy. It abounds in clear, practical suggestions; its descriptions of microscopic objects and their mode of preparation are exceedingly lucid; while an abundance of admirable illustrations is provided. Beginning with a description of the various forms of microscope, the author explains all the accessories, mechanical arrangements, etc., including the micro-spectroscope and the practice of micro-photography; chapters on the use of

the instrument and how to prepare objects follow, and then the several applications of the instrument, as a means of investigation in the various sciences, are separately and fully considered.

THE LIFE HISTORY OF OUR PLANET. By William D. Gunning. Illustrated by Mary Gunning. Chicago, Ill.: W. B. Keen, Cooke & Co.

A popular and readable work on a subject which is calculated, better than any other we know of, to test an author's powers of discrimination. We can give Mr. Gunning credit for presenting his views in a new way, and can heartily commend the progressive manner in which he leads the reader from the simpler to the complex subjects. Besides, all the book has a timely value, because many recent discoveries—notably those of Professor Marsh and the deep sea expeditions—are explained in popular form, and are brought into their proper connection with the history of the world.

A PRACTICAL TREATISE ON HEAT. By Thomas Box. Price \$5. New York city: E. & F. N. Spon, 446 Broome st.

The second edition of an excellent standard work. It takes account of all the recent advances in the science, embodies a large number of the tables which enter into the daily practice of mechanical engineers, and, in brief, is a handbook, a thorough knowledge of the contents of which would be invaluable to any one in a mechanical profession. We can commend it to the many correspondents who frequently ask us what books young engineers should study.

CELESTIAL DYNAMICS. By James W. Hanna. Price 30 cts.

The author, who says he knew nothing about astronomy a year ago, now undertakes to upset the science by affirming the non-revolution of planets about the sun.

FIRES IN THEATERS. By Eyre M. Shaw, R.E., Chief of the London Fire Brigade. Price 50 cents. New York city: E. & F. N. Spon, 446 Broome street.

A very sensible treatise on an important subject, by a writer of great knowledge and experience.

On page 359, volume XXVI, we described and illustrated Mr. C. Baillarge's new system of mensuration. We are in receipt of a "Key to Baillarge's Stereometrical Tableau," relating to the same subject. Published by C. Darveau, 82 Mountain Hill, Quebec, Canada.

"Cleaning and Scouring" is the title of a handy little book of recipes for laundresses and others. Published by E. & F. N. Spon, 446 Broome-street, New York city. Price 20 cents.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

LEATHER PATENT.—NATHAN C. RUSSELL, APPELLANT, vs. SAMUEL DODGE, SR., AND SAMUEL DODGE, JR. [Appeal from the Circuit Court of the United States for the Northern District of New York.—Decided October Term, 1876.]

Where a useful result is produced in any art, manufacture, or composition of matter, by the use of certain means for which the inventor or discoverer obtains a patent, the means described must be the essential and absolutely necessary means, and not mere adjuncts, which may be used or abandoned at pleasure.

Where a reissued patent is granted upon a surrender of the original, for its alleged defective or insufficient specification, such specification cannot be substantially changed in the reissued patent, either by the addition of new matter or the omission of important particulars, so as to enlarge the scope of the invention as originally claimed. A defective specification can be rendered more definite and certain so as to embrace the claim made, or the claim can be so modified as to correspond with the specification; but, except under special circumstances, this is the extent to which the operation of the original patent can be changed by the reissue.

Where the patent was for a process of treating bark-tanned lamb or sheep skin by means of a compound, in which heated fat liquor was an essential ingredient, and a change was made in the original specification by eliminating the necessity of using the fat liquor in a heated condition, and making in the new specification its use in that condition a mere matter of convenience, and by inserting an independent claim for the use of fat liquor in the treatment of leather generally, the character and scope of the invention as originally claimed were held to be so enlarged as to constitute a different invention.

The action of the Commissioner of Patents in granting a reissue within the limits of his authority is not open to collateral impeachment, but his authority being limited to a reissue for the same invention, the two patents may be compared to determine the identity of the invention. If the reissued patent, when thus compared, appears on its face to be for a different invention, it is void, the Commissioner having exceeded his authority in issuing it.

The case of *Klein vs. Russell*, reported in the 19th of Wallace, stated and qualified.

Mr. Justice Field delivered the opinion of the court:

This is a suit for an infringement of a patent obtained by the complainant for an alleged new and useful improvement in the preparation of leather, with a prayer that the defendants be decreed to account for and pay to him the gains and profits derived by them from making, using, and vending the improvement, and be enjoined from further infringement. The patent bears date in February, 1870, and was issued upon a surrender and cancellation of a previous patent obtained by the complainant in August, 1869, upon the allegation that the original patent was inoperative and invalid by reason of an insufficient and defective specification of the improvement. The validity of the reissued patent is assailed on the ground that it describes a different invention from that claimed in the original patent, and for want of novelty in the invention. Other grounds of invalidity are also stated, but in the view we take of the case they will not require consideration.

In the schedule accompanying the patent, giving a description of the alleged invention and constituting a part of the instrument, the complainant declares that he has "invented a new and useful improvement in the preparation of leather;" that "the invention consists in a novel preparation of what is known as bark-tanned lamb or sheep skin," by which the article is rendered soft and free, and adapted, among other uses, for the manufacture of what are termed "dog-skin gloves;" and that "the principal feature of the invention consists in the employment of what is known among tanners and others as 'fat-liquor,' which is ordinarily obtained by scouring deer skin after tanning in oil," but which may be produced by the cutting of oil with a suitable alkali. The schedule then proceeds to state that in treating the leather with fat liquor "it is desirable to heat the liquor to or near the boiling point; and that it is preferred to use the same in connection with other ingredients," such as soda, common salt, and soap in specified quantities for each ten gallons of the heated liquor; and that "to effect the treatment" the skin should be well dipped in or saturated with the fat liquor or compound, of which fat liquor is the base. The schedule closes by a declaration that what the patentee claimed and desired to be secured by letters patent was:

1. The employment of fat liquor in the treatment of leather, substantially as specified.

2. The process, substantially as herein described, of treating bark-tanned lamb or sheep skin by means of a compound composed and applied essentially as specified.

It is clear from this statement that the patent is for the use of fat liquor in any condition, hot or cold, in the treatment of leather, and for a process of treating bark-tanned lamb or sheep skin by means of a compound in which fat liquor is the principal ingredient. The state of the liquor is not mentioned as essential to the treatment, or to accomplish any of the results sought. It is only stated as a thing to be desired that the liquor should be heated, and that it would be preferable that other ingredients were mixed with the heated liquor to make the compound mentioned. In other words, the specification declares that by heating the liquor the effect desired will be more readily produced—that is, more speedily or with less trouble and expense; not that the heating is in any respect essential to the treatment. Where a useful result is produced in any art, manufacture, or composition of matter by the use of certain means for which the inventor or discoverer obtains a patent, it is, as justly observed by the presiding justice of the circuit court, too plain for argument that the means described must be the essential and absolutely necessary means, and not mere adjuncts which may be used or abandoned at pleasure.

The original patent was less extensive in its claim than the reissue. That patent was for a process of treating bark-tanned lamb or sheep skin by means of a compound, in which heated fat liquor was an essential ingredient. The specification was explicit in this particular, and left no doubt on the subject. The reissued patent covers the use of the fat liquor in any condition, hot or cold, and when used alone or in a compound with other ingredients, and thus has a more extended operation, bringing under it manufactures not originally contemplated by the patentee. Is such a reissue valid?

The statute of 1836 (2 Statutes at Large, 122), under which the reissue was granted, provided that whenever any patent was inoperative or invalid by reason of a defective or insufficient description or specification, or by reason of the patentee claiming as his own invention more than he had a right to claim as new, if the error arose from inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, it should be lawful for the Commissioner, upon the surrender of such patent and the payment of a prescribed duty, to cause a new patent to be issued to the inventor for the same invention, for the residue of the period then unexpired, in accordance with the corrected description and specification.

According to these provisions a reissue could only be had where the original patent was inoperative or invalid, by reason of a defective or insufficient description or specification, or where the claim of the patentee exceeded his right, and then only in case the error committed had arisen from the causes stated. And as a reissue could only be granted for the same invention embraced by the original patent, the specification could not be substantially changed, either by the addition of new matter or the omission of important particulars, so as to enlarge the scope of the invention as originally claimed. A defective specification could be rendered more definite and certain so as to embrace the claim made, or the claim could be so modified as to correspond with the specification; but except under special circumstances, such as occurred in the case of *Lockwood & Morey* (8 Wall., 230), where the inventor was induced to limit his claim by the mistake of the Commissioner of Patents, this was the extent to which the operation of the original patent could be changed by the reissue. The object of the law was to enable patentees to remedy accidental mistakes, and the law was perverted when any other end was secured by the reissue.

Judged by that law, and the provisions of the act of 1870 on this subject are substantially the same, there can be no doubt of the invalidity of the reissue. The original patent was not inoperative nor invalid from any defective or insufficient specification. The description given of the process claimed was, as stated by the patentee, full, clear, and exact, and the claim covered the specification—the one corresponded with the other. The change made in the old specification by eliminating the necessity of using the fat liquor in a heated condition, and making in the new specification its use in that condition a mere matter of convenience, and the insertion of an independent claim for the use of fat liquor in the treatment of leather generally, operated to enlarge the character and scope of the invention. The evident object of the patentee in seeking a reissue was not to correct any defects in specification or claim, but to change both, and thus obtain, in fact, a patent for a different invention. This result the law, as we have seen, does not permit.

The decision of the Commissioner in granting the reissue is, it is true, so far conclusive as to preclude in the present suit for infringement any inquiry into its correctness outside of the patents themselves. His action in any case, within the limits of his authority, is not open to collateral impeachment. But that authority being limited to a reissue for the same invention as that embraced in the original patent, a reissue for anything more is necessarily inoperative and void. To determine the identity of the invention the two patents may be compared. Thus compared, the reissue here appears on its face to be for a different invention, and the Commissioner, therefore, exceeded his authority in issuing it. (*Seymour vs. Osborne*, 11 Wall., 544; *Wicks vs. Stevens*, 2 Wood's C. C. Reports, 312.)

In the case of *Klein vs. Russell* (19 Wall., 463), the question was not before the court whether the reissued patent was invalid because not for the same invention. The point was not made in that case in the court below, and for that reason, it was stated, the point could not be made here. It was to be presumed, said this court, until the contrary was made to appear, that the Commissioner did his duty correctly in granting the reissue. What was subsequently said of the character of the first claim, so far as it conflicts with the construction here given, does not meet our approval after the extended consideration the subject has since received.

But assuming that the reissue is not void for the reasons stated, the patent is still invalid for want of novelty in the alleged invention. The use of fat liquor in the treatment of bark-tanned skins was general with manufacturers for many years previous to the alleged invention. Testimony to this effect is given by numerous witnesses. It would subserve no useful purpose to state this testimony. It is set forth with ample fullness in the opinion of the circuit court. It is sufficient for us to say that it is entirely satisfactory to our minds.

The decree is affirmed.

United States Circuit Court—District of Connecticut.

BOLT PATENT.—WILLIAM J. CLARK vs. THE KENNEDY MANUFACTURING COMPANY AND EDWIN HILLS.

[In Equity.—Before SHIPMAN, J.—Decided January 1, 1877.]

The invention described in the patent to Wm. J. Clark, February 2, 1864, consists in the manner in which he applied lateral compression to the manufacture of an angular neck, and in the manner in which he permitted the shaping mechanism to become anvil ends, upon which the header could operate to form a head upon the bolt.

He did not discover that swaging round iron would form an angular neck, and that upsetting would form a head, and that both operations would form a bolt; but he did invent what was before unknown—the mechanical means by which swaging would form an angular neck from round iron, which mechanism could be used in connection with upsetting.

The thing invented and patented was not any mode of swaging combined with upsetting; but it was the employment of specified means, or their equivalents, for the accomplishment of a desired end.

A patentee cannot, by obtaining a reissue for a process, enlarge his right to a monopoly beyond the actual invention.

The claims for the process of forming the angular neck and protuberant head, as contained in the reissue, construed to be to the use substantially of the dies described in the specification, or their equivalents.

The patent covers dies constructed with the round and square portions of similar area, whereby the lateral swaging is effected before the header operates; and it is not infringed by the use of dies, the square portion of which is of greater area than the round, and the swaging and upsetting operations are simultaneously performed.

The claim in the reissued patent does not include any machine for making bolts from round iron, in which machine the two operations of forming the angular neck by dies which will swage, and forming the head by upsetting, are combined.

Claims should be so construed, if possible, as to embrace the invention actually made and described.

Bill dismissed.
[*Chas. E. Mitchell and Benj. F. Thurston* for plaintiff.
Chas. R. Ingersoll for defendants.]

United States Circuit Court—District of Massachusetts.

WATER WHEEL PATENT.—THE SWAIN TURBINE AND MANUFACTURING COMPANY vs. JAMES E. LADD.

[In Equity.—Before SHEPLEY, J.—Decided January 2, 1877.]

Claims which would be void as being functional should be so construed as to embrace the described means for effecting the result.

When changes of form involve functional differences, producing new or better results, they are patentable.

The claims in a reissued patent are to be construed so as not to embrace any invention broader in its scope than the invention described, or substantially suggested or indicated in the original.

ABSTRACT FROM THE OPINION OF THE COURT.

SHEPLEY, J.:

The reissued patent No. 28,314, dated November 19, 1872, has its first, second, third, and fifth claims so worded as in their broad and literal construction, without any limitation to the invention described in the specifications of the original and the reissued patent, to claim any form of "water wheel having an effective inward flow and discharge of part of the water, and an effective downward flow and discharge of part of the water simultaneously in one wheel, whereby the effective area of discharge is increased without increasing the diameter of the wheel." This is the exact language of the fifth claim, which would be void as a claim merely functional, unless this claim be construed as must also the first, second, and third claims, as including the described means of effecting the result. To uphold these claims they must not only be construed in connection with the invention described in the reissue, but so construed as not to embrace any invention broader in its scope than the invention described, or substantially suggested or indicated, in the original. However meritorious and original the invention of Swain was (and of its originality and merit as an advance in the state of the art at the date of Swain's invention, the court does not entertain any doubt), nevertheless, its great merit and utility will not justify such broad claims in a reissue as shall effectually interpose a barrier in the path of subsequent inventors, and arrest the progress of invention. The broad language of these claims, liberally construed, eliminates from the combination in the reissue the downward and inward curvature of the crown which forms an essential functional element of the combination in the original. Such a literal construction of these claims, with the scope contended for by the complainants, would render the reissue void, according to the decisions in *Wells vs. Gill*, and many other cases decided by the Supreme Court of the United States, including *Seymour vs. Osborne*. In this connection the court can only repeat the language of the opinion in *Forsyth vs. Clapp* (1 Holmes).

The court will look beyond the mere form of words in the claim of a reissued patent into the specifications in both the original and reissued patents; and, even if on the face of the reissued patent it does not embrace anything not described or suggested in the original, nevertheless the court will ascertain whether there is any substantive invention adequate to support a claim ingeniously worded, not so much for the purpose of describing what the patentee really invented as of grasping within its terms some contrivance not within the knowledge or contemplation of the patentee, and for that reason, not by inadvertence or mistake, not embraced in the claims of the original patent.

Giving to these claims the construction which we have indicated, the word crown in the first three claims will refer to and include in the combination such a crown as is described in the original patent and represented in the drawings of the original and the reissue, and the fifth claim will be limited in its scope to water wheels possessing such elements as we have hereinbefore recited as the described essential component parts of the turbine wheel described in the specifications and drawings of the original patent. Giving this construction to the claims, the defendant does not infringe, and the bill must be dismissed.

[*J. S. Abbott and H. W. Bowditch* for complainants,
Brown & Hoopes and C. E. Mitchell, for defendant.]