

horizontal cylinder with conical ends, the slant height of the cones being equal to the diameters of their bases. The resistance to motion of a plane surface has been given in the preceding table; and it is found by experiment that, if three bodies having the same cross section are moved through the air at the same velocity, having the forms respectively of a circular plane, a sphere, a cone with slant height equal to diameter of bases, the resistances to motion in the two latter cases will be (calling the resistance of the plane R) for the sphere  $\frac{R}{2}$  and for the cone  $\frac{R}{3}$ .

The most favorable form of aerial machine, according to M. Bruignac, is a combination of a balloon with a sustaining plane. By his calculations, it appears that the most advantageous design, for a speed of 20 miles an hour in a calm, must not weigh, with engines, navigators, fuel, stores, etc., more than 2,200 pounds, and must have the following dimensions: There must be a balloon, filled with hydrogen, 22 feet in diameter and 94 feet long, together with a sustaining plane 94 feet long and 16 feet wide; and an engine capable of exerting from 6 to 7 horse power. This is equivalent to saying that the problem is impossible with our present means of construction, and would seem to settle the matter conclusively, unless it can be shown that a more favorable plan than the best one discussed by M. Bruignac can be designed. It is pretty evident that, if a machine is not practicable even in theory, there is little hope of its actual success.

Dr. Barnard concludes his paper with an exceedingly practical suggestion, which we commend to all our readers who are endeavoring to work out this problem. If it is possible to lift a given weight into the air, and make it move in any desired direction, it is certainly easier to do the same with a part of that weight. Let the inventor, then, attach his lifting apparatus to some vehicle on land, as, for instance, a railroad train, and, by sustaining some of the weight, make it move more easily; let him remove the locomotive, and put in its place his aerial propeller. If this works well, there is some hope of actually getting into the air; but should it fail, it would seem advisable for him to abandon his experiments.

#### THE "SCIENCE" OF SPIRITUALISM.

Resuming the subject from page 80: Gordon's materialization was a startling novelty and too good a trick to be lost. Its successful revival, however, necessitated a patience of waiting till the little drawback of the exposure should blow over, and a shifting of the scene of action to a safe distance from the unfriendly climate of New York. The conditions were complied with; there was a waiting of a year, and the performance was repeated in the city of London under the mediumship of Miss Florence Cook. But Gordon's invention was expanded and improved, for Miss Cook substituted living persons for the masks; she constructed the celebrated and original Katie King, whose genuineness as a veritable spirit was certified to by witnesses whose testimony on matters of this world would be unimpeachable. The precise *modus operandi* was not found out. Katie appeared only a few times and London knew her no more. The medium explained that she had over-exerted herself, and thus had impaired her power of materializing, which, we take it, implies that a wholesome caution or forewarning had come upon her. The original Katie has probably made her last appearance in public.

But a duplicate or imitation Katie made her *debut* in Philadelphia in May, 1874, and was a greater success there than the original. The proprietors were practised mediums, Mr. and Mrs. Nelson Holmes. They had just returned from London; and it is pretty certain that they were acquainted with Florence Cook, and that they brought her secret with them. The theory that the London and Philadelphia tricks are substantially the same is tenable till something more plausible is proposed.

The new Katie was welcomed with enthusiasm by the leading spiritualists, and her desertion of England for America stimulated their patriotism; to them she was the final and overwhelming demonstration of practical spiritualism. The weak in faith were strengthened, and new converts were added to the fold in droves. For months, the Katie King mystery was the most prominent sensation for newspapers and magazines. But great success made the Holmeses too bold in continuing the show; and they came to a grief in November last, which early in January became wholly inconsolable. The trick was found out and fairly exposed; but the Holmeses and the devotees persisted, denied, and sophisticated, and thus kept Katie King alive as a spirit for more than a month.

The credit of the exposure is almost wholly due to the *Philadelphia Inquirer*. The facts of evidence against the Holmeses, as they were developed, were published in the *Inquirer*. But the evidence so appearing in disconnected fragments, although convincing to most sensible people, was misunderstood, perverted, and sophisticated by the spiritual partisans. A methodical statement which should end all doubt and controversy was therefore prepared and published, in an article occupying about fifteen columns of the *Inquirer* of January 9 and 13, 1875. The statement is in the form of an autobiography of the lady who personated Katie King; it was verified by her affidavit sworn to in the presence of several prominent citizens of Philadelphia. It was further confirmed by the lady having in her possession the robes and ornaments worn at the show, and the presents which she had received from her admirers in the character of Katie; she was fully identified by respectable people who had seen her at the show. Also Dr. Henry T. Childs, Hon. Robert Dale Owen, and others, who had been zealous and admiring pa-

trons of Katie King, are witnesses to the truth of many of the essential facts. The *Inquirer* promises that the autobiography will be published in book form; we commend the book in advance as an antidote to the spiritual delusion, which will be effective as well as pleasant to take.

The lady objects to the use of her real name in connection with the spiritual fraud, and we will continue to call her Katie King. She was born in Massachusetts, January 1, 1851, was married at 15, and has a child eight years old. Her husband died two years ago, leaving her penniless, and her child and an aged mother depending on her exertions for their support. Last spring she set up the enterprise of keeping boarders in Philadelphia; the Holmeses boarded with her and got their living by the practice of spiritualism. But Katie fell among Philistines, and her enterprise lasted only a few weeks. In her extremity she entered the service of the Holmeses and was by degrees taught to tolerate and to practice deception, and at last to exhibit herself as a spirit.

The grand secret of the Holmeses was the device for getting Katie on and off the stage of exhibition without being discovered by the spectators. The device was a dummy board in a partition which constituted the rear of the cabinet, the partition separating the exhibition room from a private apartment or other hiding place; the dummy board was a board neatly cut in half, the lower half serving as a door for Katie's exclusive use. At one house in Philadelphia, the cabinet was erected against a doorway leading to a bed room, the back of the cabinet being the partition with its cut board substituted for the door. At another, the cabinet was erected against a window, the embrasure of which, by means of the partition, was made into a secure but narrow hiding place for Katie. The partition with its dummy board was an essential part of the stock in business, and was carried by the mediums in the various journeyings.

The exhibition had two acts or parts: first, a dark *séance* wherein a guitar was thumped, bells rung, and things stirred up promiscuously, being the ordinary and silliest of spiritual performances; next came what the mediums designated as the light *séance*, wherein darkness was made visible by a single and shaded kerosene lamp, placed as far as possible from the cabinet. For the light *séance*, Holmes locked himself in the cabinet, and Mrs. Holmes kept guard, seated at the door of the cabinet. The performance begins by the display of masks at the window of the cabinet, *à la* Gordon Katie King says these false faces were generally recognized by persons in the audience as the veritable spirits of their deceased friends. At last Katie herself appears at the window or in the doorway of the cabinet, and talks and walks precisely like a human being.

Katie's first appearance was on the evening of May 12; we quote her account of it:

"I entered it the first time, after the dark *séance* was over, from the bell room. Mr. Holmes was in the cabinet. After one or two false faces had been exhibited, I gently drew aside the curtain hanging over one of the apertures, showing the audience my face, and in a very low whisper, scarcely audible, said: 'Good evening, friends,' then drew back my head and drew down the curtain. The sensation in the audience was great.

Although somewhat excited, I was amused to hear the different remarks: 'Did you hear it speak?' 'I wonder who it is?' 'How beautiful it was.' 'I do wish it would appear again.' The lady medium, who was on the outside of the cabinet, among the audience, appeared very much pleased indeed at the reception I had received, and remarked that "she thought something unusual would occur, for the spirits had been drawing from her so hard all evening, to enable them to materialize, that she had scarce any vitality left." After the excitement had subsided a little and various requests had been made that I should appear again, I pulled the curtain to one side, showed my face at the aperture, and three or four voices at the same time said: 'Who are you?—Please tell us your name.' I answered in a low whisper, as before: 'I am Katie King, you stupid.'

These cant phrases, 'you stupid,' 'I shan't,' 'be sure I am,' etc., were used by Florence Cook (so I was informed by Mr. and Mrs. Holmes,) when personating Katie King, and it was very important that I should use them, so that the people would think I was the same Katie who had appeared in London. The sensation among the audience was greater than at first, and often was the question asked: 'Can this possibly be the Katie King who appeared through the mediumship of Florence Cook in London?' After a few moments I again showed my face and said: 'Of course it is, you stupid.' The sensation was even greater than before. I again withdrew. The lady medium remarked that 'spirits could not remain materialized but a few moments at a time; they had to retire into the cabinet to gather strength.' On my appearance again at the aperture, Dr. Childs asked me 'when I had been in London.' I replied: 'I attended a *séance* there to-day, you stupid,' and again retired.

Mr. H. suggested that I had said enough for the first time, and I left the cabinet, passed through the bed room, upstairs to my own room on the third floor."

Katie by degrees became accustomed to her part, and overcame much of the timidity of her first appearance; she found that the credulity of the average man was her safe protection; she at last permitted the faithful, especially Dr. Child and Mr. Owen, to touch her and to converse with her. She received many tokens of regard in the form of bouquets, letters, jewelry, and other things appropriate for a young lady, and in return she gave letters, locks of hair from her wig, and pretended pieces of her dress; to supply the great demand for the latter, she carried in her pocket a roll of muslin from which she cut the pieces as they were called for. Those who were so fortunate as to possess these bits of muslin

were generally willing to certify that they saw them cut from the dress, and that they saw the holes in the dress close up before their eyes; the dress had a reproducing power like that of the widow's cruise. As the show advanced in interest and popularity, the admission fee was raised from \$1 to \$5.

The risk of discovery of the fraud was always a subject of anxiety with the mediums and Katie; with the mediums it was only a question of business, but Katie's conscience was constantly in trouble. Various precautions against detection, besides those mentioned above, were resorted to. Care was taken that the inner circle, the visitors seated nearest the cabinet, should be composed of devotees. They knew that suspicion would be likely to be centered on the bogus partition, and they forearmed themselves. One morning they put a sound board in the place of the dummy and had a committee of ten, including several experts, to make a thorough examination. This committee took down the cabinet, including the partition, piece by piece, and then conscientiously reported that the structure was of a substantial character and that there was nothing deceptive about it, and especially that the partition concealed no fraud and could not be used for Katie's entrances and exits. The report was printed and was made into a very effective advertising circular. Katie's autobiography, as may be inferred perhaps from our brief account of it, furnishes very rich amusement as well as instruction; it is a kind of truth stranger and more readable than a first class fiction; we regret that our limited space does not allow us to say much more about it.

But there is one extraordinary fact that has been developed in this matter, which justice to a leading spiritualist requires us to publish. Dr. Henry T. Child, more than any other spiritualist, with perhaps the exception of the Hon. Robert Dale Owen, has given the most unqualified, enthusiastic, and public endorsement of the Holmes' pretensions. On the discovery of the fraud, and this is what is extraordinary, he publicly and unreservedly makes reparation for his error, a course of conduct which is a novelty among spiritualists.

On January 8, 1875, Katie King, accompanied by Dr. Child and other friends, presented herself before the Hon. William B. Hanna, Judge of the Orphans' Court, Philadelphia, and signed and made affidavit to the truth of her written confessions as prepared for the *Inquirer*. Dr. Child then took the pen and wrote upon the document, below the affidavit of Katie and the certificate of Judge Hanna, the following:

I hereby certify that I witnessed the signing of the above paper, the confession of Katie King, and that it was signed, declared, and affirmed to be true by the person who appeared at the *séances* of Mr. and Mrs. Nelson Holmes, No. 50 North 9th street and No. 82½ North 10th street, as the materialized spirit of Katie King.

Henry T. Child, M. D., No 634 Race street.

#### NOT THE BEST WAY TO SELL A PATENT.

As soon as an invention is patented, the fact is published throughout the length and breadth of the land; and then the patentee begins to receive circulars and letters from agents of all kinds, suggesting to the inventor that they possess unequalled facilities for selling his patent. In some cases these persons state that they have a customer willing to pay several hundred dollars for the patent, and warning the patentee not to negotiate with others till he hears from them again; this conveys the impression that they have a *bona fide* offer, and, more even than this, that a greater sum may be realized from the *anxious* purchaser. But before the letter closes, it states that a power of attorney and a fee of from \$5 to \$25 must be sent by early mail to pay for this preliminary negotiation, and that the balance of their commission will be taken out of the purchase money. By this mode, a number of persons in different parts of the country live on the credulity of patentees, without rendering them the least equivalent for their money. They get from the inventor a power of attorney, and a small fee, and that is the last he hears from his agent. Tired of waiting for the mail to bring him the money he so confidently expects, he, after a while, writes to know how the sale is progressing. He receives no reply—he waits—then writes again; still no answer. Then he writes to us; and states what he has done, incloses the correspondence, and wishes us to investigate the matter, and tell him if he has been swindled; he asks if we know the parties, if they are reliable, etc. Sometimes a circular is inclosed, in which our names are used as references, etc.

Now we do not pronounce all dealers in patents to be swindlers; but when such parties refer to us, it is without our authority, and they should be looked upon with suspicion. We advise every patentee to be on his guard against granting a power of attorney to sell his patent to any one whom he does not know, and under no circumstances to pay in advance any sum of money, however small, under the idea that this preliminary payment is necessary to the negotiation of the sale. When patentees receive letters or circulars exacting such conditions, they will be wise in paying no attention to them; but if they do reply, we would suggest that they tell their correspondent that it will be time for them to deduct the small fee required in advance when the sale is consummated.

TREES ON BOUNDARY LINES.—The New York Court of Appeals not long since decided that a man has no right to the fruit growing upon branches of a tree overhanging his land where the trunk of the tree stands wholly upon the land of his neighbor. But the law regards the overhanging branches as a nuisance, and they may be removed as such; or the owner of the land shaded may remove them if he is careful not to commit any wanton or unnecessary destruction in so doing. Where the trunk of a tree stands on the line, the owners of the adjoining land have a joint ownership in the tree and fruit, and neither one has the right to remove it without the consent of the other.

### Curiosities of Ocular Spectra.

Spectra are not only the concomitant sequences of color sensations, says W. Cave Thomas in *Art*, but of the sensations of black and white. A black spot will be succeeded by a white spectrum, a white spot by a black spectrum. Ocular spectra appear to change their places with relation to our bodies with every movement of the eyes, and, for an evident reason, are still seen in whatever direction we turn the retina.

The natural sequence of the ocular spectra after a momentary glance at any object would appear to be this: The original sensation persists as a spectrum for 0.32 to 0.35 of a second, as may be illustrated by the whirling of a light or other object. Then, if the original impression be not renewed, the reaction sets in; this first spectrum is doubtless followed by feebler librations or oscillations, which, although too delicate to be perceived by the open and excited eye, may, sometimes with closed eyes, be followed for a greater length of time.

If we view for a long time a black square on a white ground, and then divert our eyes slightly to the right or left of the square object, or rather look more directly at its margin, a portion of the spectrum which it has produced will appear free as a bright margin on a white ground; the remainder of the spectrum will overlap the true image and appear as a gray space, while a portion of the true image will be free and intensely black. We have then a free portion of the spectrum very bright, a middle portion, where the true image and the spectrum are coincident, gray, as if the two conditions of black and white were there balancing each other, and a free portion of the true image intensely black. The usual explanation of the phenomenon is this: The sensation of white in the part of the retina which was previously the seat of the black image is more intense, because that part of the seat of the retina was unexcited, hence the bright margin. The part of the image where the true image and spectrum are coincident remains unchanged, while the portion of the true image which is left free appears darker than before, because it now falls upon a part of the retina which had previously received rays from the white ground, and has consequently lost part of its excitability. This, however, is far from being the exact truth, the entire explanation; for if the eyes be closed to all external influence, a white spectrum will appear in the place of the black spot, showing that a reaction in the retina has set in, producing the sensation of light, and that it is this libration which is the cause of the two coincident portions of image and spectrum appearing gray, and those beyond darker and lighter.

### Backing Up of Sewer Gases.

To prevent the backing up of sewer gases through the ordinary pipe traps into the apartments of dwellings, a remedy heretofore mentioned in our columns is to lead a gas escape pipe from the drain pipe to the kitchen chimney. The fire here generally kept burning produces an upward current favorable to the carrying off of the gases in question. A correspondent tells us of a case, within his own knowledge, where this method proved insufficient, as the pressure of sewer gas was so great that it found its way through the stove pipe holes in the chimney. It is of course necessary in all cases that the chimney shall be tight; and in those cases where the sewer gas pressure is very strong, the escape pipe should be extended to the roof of the building independent of the chimney. Some architects provide a small gas escape pipe leading from the top of the bend of the sewer pipe trap, to the water leader of the roof.

### New Style of Photo Portraits.

The pictures are made upon the white ferrotype plate, which is now being manufactured largely, and which combines with great beauty the most simple manipulations, and all the advantages of the porcelain picture, without any of its defects.

The plate being of a very pure white and properly prepared, all that is necessary is to pour on the collodio-chloride, dry it by a gentle heat, expose it to vapor of ammonia

for a short time, and then print very slightly deeper than it is desired to be when finished. It is washed, toned, and fixed in a similar manner to the ordinary mode followed in making porcelain pictures. The result is a picture of exceeding delicacy and durability.

### IRRIGATION IN COLORADO.

The system of irrigation now quite extensively adopted in Colorado has worked a great change in the character of the soil, and transformed the once almost barren country into a magnificent wheat-growing region. From the large rivers



IRRIGATION IN COLORADO—LETTING WATER INTO A SLUICE WAY.

and streams, such as the Arkansas, the Platte, and the Bear rivers, long canals are dug, branching into smaller ditches, through which the fertilizing waters are conducted in every direction to the fields. Our engraving, for which we are indebted to *Harpers' Weekly*, shows two farmers opening a sluice of a main canal to let the water into a side ditch. These ditches form a regular network, as shown in the diagram.



The supply of water can be regulated at will. Towns are supplied with water on the same plan. At the head of each street is a sluice box for a lateral ditch running the whole length of the street, from which branch smaller ditches used for garden irrigation.

### An Evening at the Royal Microscopical Society.

At a recent meeting of the Royal Microscopical Society, held at King's College, an unusually interesting series of exhibits was shown, illustrating the progress of optical and mechanical ingenuity in the development of the instrument, which is rapidly becoming an indispensable article of furniture in homes where intellectual culture is promoted, all over

the world. One of the exhibits was a large microscope by R. and J. Beck, in solid silver, fitted with every conceivable piece of apparatus, all in silver. This luxurious work of art, intended for an American microscopist, and costing \$2,500, was of course the lion of the hour, and is perhaps the most costly microscope ever made. After mention of this, there is of course no further space to allude in detail to the numerous humble brass microscopes in the room. Fortunately it is the observer who utilizes it, rather than the instrument itself, who can claim the credit of a beautiful display, and to whom our advance in knowledge is due. So

here the attention was riveted by many objects of unusual interest, upon each of which a long theme might be discoursed. Conspicuous among these was the exhibition of insect dissections by Mr. Loy. They were perfect marvels. Several showed the complete muscular system in certain large lepidopterous larvæ. Various slides illustrated salivary glands and other wonders of insect anatomy. All the specimens were stained in various colors, mounted in fluid, in large cells, on slides 4 inches by 2. Mr. Guimarens had a very interesting series of preparations by Bourgogne, of Paris, illustrating the vine parasite in all its stages (*phylloxera vastator*). Near him Mr. Fitch was exhibiting a mounted slide containing a harvest spider (*phalangium*), upon the back of which, and attacking the eyes, was a red parasitic mite, probably a young *trombidium*. Dr. Gray had a very curious slide on view. It was a piece of skin from the neck of a domestic fowl from Ceylon, which was completely hidden from sight by a dense mass of fleas. The size of the specimen, only a small fragment of the original, was about one third of an inch square, and on it might be counted nearly one hundred fleas. Each of them had buried her lancets (I say *her*, because only one or two males were among the crowd of fleas) deep in the skin. A remarkable series of models and specimens illustrated in a beautiful manner the structure of the cochlea of the ear in various animals. Mr. H. Lee exhibited, with Moginie's

portable binocular, the larval form of the crayfish, from the Brighton Aquarium, a creature so unlike its parent that, till lately, it was considered a distinct species, and was known as the glass crab. It was a beautiful specimen. Among the vegetable preparations attracting notice was a charming slide of a fungus on wood, shown by Mr. Reeves, and named by him as a *stemonitis*. Curious deposits from solutions of silica were shown by Mr. Slack.

### Sagacity of the Partridge.

Instances of the sagacity of the partridge, woodcock, and other birds have often been related. But the most singular illustration of the deception practiced by the first of those wily species to protect their young is given by Mr. Henshaw, of the Government Survey west of the one hundredth meridian. While riding through pine woods, a brood of partridges, containing the mother and eight or ten young of about a week old, was come upon so suddenly that the feet of the foremost mule almost trod on them. The young rose, flew a few yards, and, dropping down, were in an instant hid in the underbrush. The mother meanwhile began some very peculiar tactics. Rising up, she fell back again to the ground as if perfectly helpless, and imitated the actions of a wounded bird so successfully that for a moment it was thought she had really been trodden upon. Several of the men, completely deceived, attempted to catch her, but she fluttered away, keeping just out of reach of their hands until they had been enticed ten or twelve yards off, when she rose and was off like a bullet. Her tactics had successfully covered the retreat of her young.

COMPOSITION OF WOOL GREASE.—According to Schulze and Ulrich, the bulk of the natural wool grease of sheep consists of compound ethers. A part of alcohols and fatty acids are in a free condition

Of all metals known, silver is the best electrical conductor