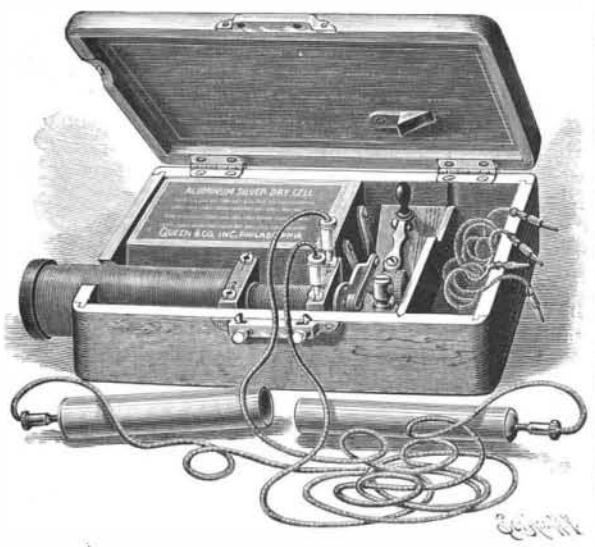
that Haydn, Ramberg and their imitators, who have introduced into the orchestra of their "infantile symphonies" the cuckoo, the quail, the nightingale, and the wild cries of the kestrel, have entirely forgotten the jovial songster of the swamps. Handel alone has taken pity on these animals, and made mention, in his "Israel in Egypt," of the toads and frogs. By his peculiar accompaniment, he imitates in his oratorio the motions and the leapings of the frog. We give the famous passage of the oratorio in question in Fig. 2.



A DRY CELL FARADIC BATTERY.

As regards the notation or reproduction of the noises of the frog, that is not any easy thing to do; far from it. Yet Landois has endeavored to note a few of the "songs" that ring out upon the edges of the ponds and swamps, and it must be confessed that the attempt of this learned author has not been entirely unsuccessful. Thus, the music of Landois, executed by a harsh, youthful voice, is capable of recalling pretty closely the croaking of the green frog. The music in question is given in Fig. 1.

Although the notation of the croaking of the green frog (Rana esculenta) is difficult, the registering of the jerky notes of the spotted frogs and tree frogs is quite easy. The spotted frog, which is generally considered mute, nevertheless utters shrill sounds and plaintive cries when it is struck or when it is attracted by a mole or some aquatic rat. It has none the less a "song," which is quite simple, it is true, at the period of spawning.

It is well to take into consideration the fact that the males alone "sing." We know that the period of spawning with the spotted frog is relatively early as compared with that of the green frog. As soon as the first spring pools appear and the snow disappears from the fields and meadows, the spotted frogs come forth from their winter quarters and proceed to deposit their spawn upon the edges of the ponds. Mr. Zograf reates that in the vicinity of Moscow the music of this frog begins as early as the month of March. Formerly, by reason of the prolonged thaws, the frogs were deceived and made their exit from their winter quarters earlier. The spotted frog does not utter melodies of long duration, as is the case with his relative the green frog, but merely repeats a single note with a surd bass voice (Fig. 4).

As regards the tree frogs and the Pelobatides, their voice is sonorous and clear, and may be compared to the sounds of a silver bell. We would remark that it is, for the most part, representatives of the Pelobatides that, at the beginning of twilight or in the evening, are heard repeating the sound "wok" or "oonk" with a clear and sonorous voice at the margin of stagnant water. This is why these animals are called "wok" by the peasants in certain districts. As their voice very frequently resounds on dark nights when the sky is covered with heavy clouds, the people become frrghtened when they hear the characteristic "wok" and "oonk," for they see a connection between these strange sounds and the tears of the souls of the drowned. It is especially in the isolated villages of Russia that this belief is prevalent. Numerous examples of it might be cited. Thus, the Russian novelist, Ivan Tourgeneff, mentions it in his admirable work, Biejuine Lougue. The sounds of these frogs vary between fa and do (Fig. 4).

It remains for us to say a few words concerning the "music" of toads. Let us say at once that it is very simple and not very harmonious. Here again it is during the period of spawning that the most noise is made. Their songs vary according to the species. Thus, for example, the Bufo variabilis has a harsh, jerky voice, while the B. cinerius emits a sound like that of the representatives of the Pelobatides, although its voice is not so strong. As for the rush toads, the male of which is provided with a vocal sac, and which makes itself heard at the beginning of twilight, they cry now "glookglook" and now "rahrah," like the frogs. Mr. Zograf, moreover, tells us that he has heard them utter a prolonged "Ker-r-r-r-r."

In a general way the sounds of frogs may be registered as follows: "Brekeke-brekeke, krekete! Kpate too-oo-oo! brekete, brekete! brekete, kwarr, brekete, too-oo!"—La Science en Famille.

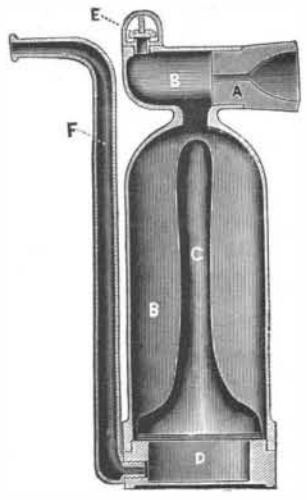
## "DRY CELL" MEDICAL BATTERIES.

The illustration represents a new form of "Dry Cell" Faradic Battery, placed on the market by Queen & Co. (Inc.), of Philadelphia. This type is specially adapted for home use (preferably under the advice of a physician) and is extremely compact, convenient to handle, and durable, thus being admirably suited for carrying about when traveling. The cells are sealed, so that there is no leakage of acids, as in older forms, and the battery is perfectly clean and "nice."

Three sizes are made, all mounted in handsome mahogany boxes. Size No. 1 contains two cells and will produce a current stronger than most people can endure, which, however, can be graded down so as to be imperceptible to the most sensitive nature. The change is effected gradually, by sliding the secondary coil on and off the primary. A special switch shuts current off entirely when the case lid is closed. Size No. 2 is larger than the preceding, and contains four dry cells instead of two. There is also a difference in the method of current regulation, which in this style is accomplished by a switch "controller." Battery No. 3 or Physician's Battery No. 1 is the largest of the series, and is amply sufficient for the requirements of most doctors who want a compact and portable apparatus. The cell block contains six cells, which produce a very powerful current. Samples of the batteries were exhibited at the World's Fair and received the highest award for "compactness; range of action; efficiency, and beauty of workmanship." The examining judge was Dr. W. J. Herdmann, of Ann Arbor, Mich. When the cells in any of the above become exhausted (which occurs only after long service), they can readily be renewed at a slight expense, by sending the containing block to the makers.

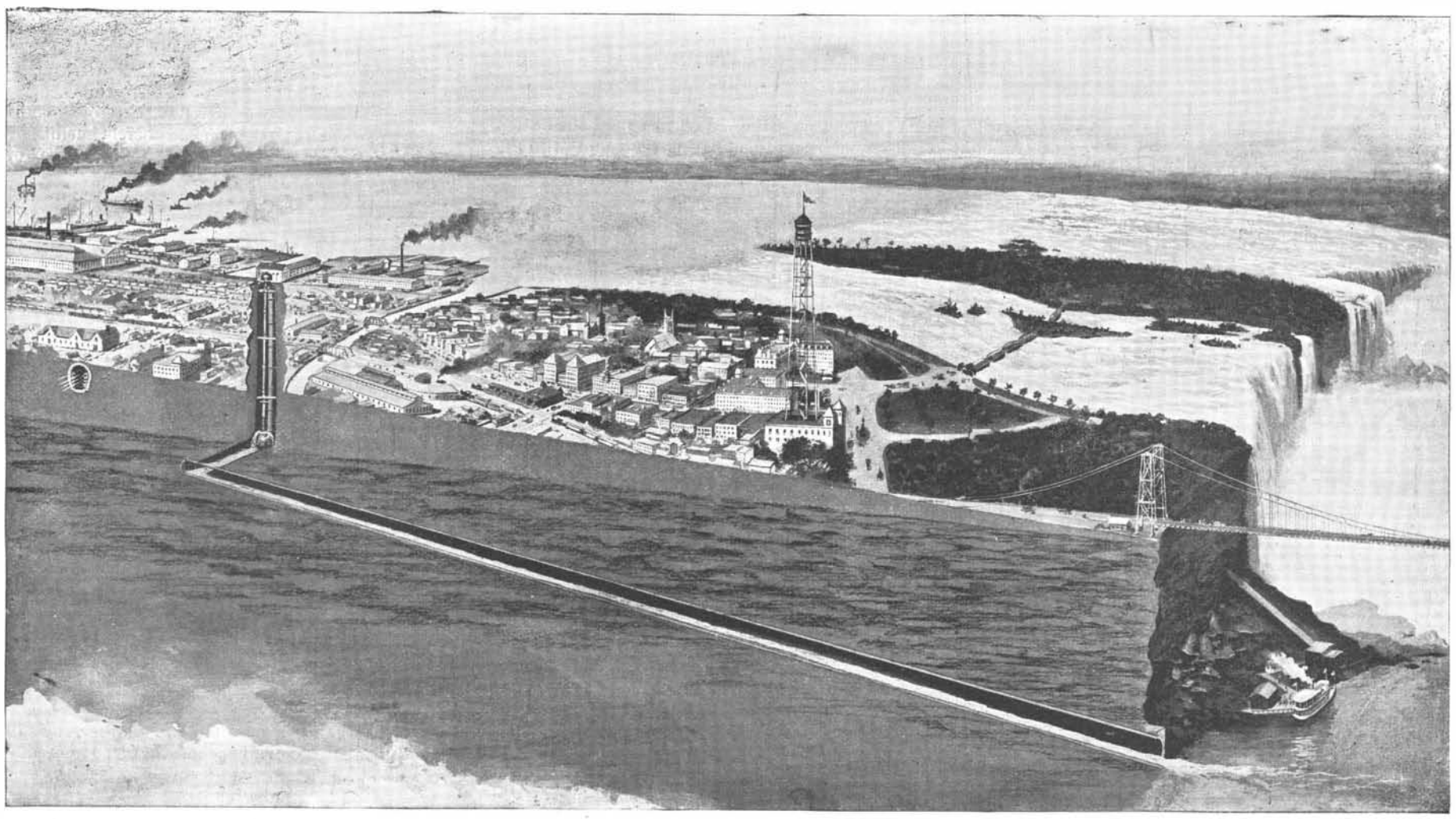
## THE HARMLESS SMOKER.

The design shown in section in the illustration, which has been recently patented by Mr. Ryerson D. Gates, of Chicago, has already been introduced to a considerable extent, the object of the device being to break off and cure the tobacco habit. This is accomplished by means of a delusion which does not deprive the "user of the weed" of the pleasure of smoking, but does away with the evil effects of the habit. With it, one smokes a cigar without drawing any smoke into the mouth or down into the lungs, and is at first so deceived by the effect as not to distinguish the difference. A rubber bulb, C, is in free communication with a chamber, D, in the base, with which the stem, F, is connected, and by drawing on the latter the suction causes sufficient collapse of the bulb—which is shown in collapsed form in the picture—to create a partial vacuum in the surrounding smoke chamber, B. This draws the smoke through the small end of the cigar, placed in the tip, A, and when the lips are opened in the natural way the expansion of the bulb forces the smoke out of a valve, E, immediately below the nostrils, but no smoke comes out of the mouth. It is impossible to get any nicotine in the mouth by smoking in this way, and cancer of the throat and similar troubles caused by smoking are simply out of the question.




## UTILIZING THE WATER POWER OF NIAGARA FALLS.

In the SCIENTIFIC AMERICAN of March 5, 1892, we gave a full description, with numerous illustrations, of



GREAT TUNNEL AND ONE OF THE WHEEL PITS AT NIAGARA FALLS.

the work on the great water power tunnel, 7,250 feet long, at Niagara Falls, showing also the extensive scale on which the supply canals were laid out, and the general arrangements for utilizing a water power of about 125,000 horse. The first mill to make use of the power rendered available by the tunnel was that of the Niagara Falls Paper Company, for some months past using 3,000 horse power, to be increased to 6,000 horse power. A concrete subway is also ready for the wires of the Pittsburg Reduction Company, whose plant is about 2,500 feet from the power house, from which the company will be supplied with about 3,000 horse power for use in the reduction of aluminum. The arrangements for the electrical transmission of power to the city of Buffalo are also nearly completed. This power is to be transmitted by means of wires carried upon poles from a 50,000 horse power electric station which the Niagara Falls Power Company have near completion on the main canal. The right of way has been acquired, and all the contracts made for two lines, one of which crosses Grand Island while the other follows down the shore. Two lines are provided that one may be held in reserve, the line through the island being 13⅛ miles long while that following the shore has a length of 18½ miles. The Cataract Construction Company also own a controlling interest in a company which is developing the water power of Niagara on the Canadian side of the river, and wires from the Canadian station join those of the main line on Grand Island. The transmitting line reaches Buffalo just inside the city limits, where the power will be taken by a Buffalo company formed for its distribution in the city.

In the electric power station three turbines of 5,000 horse power each are in position, and the dynamos are ready to be placed. They are of the Westinghouse alternating system, each with its revolving field directly connected to the vertical shaft of a 5,000 horse power twin turbine built from prize designs, furnished, after a severe competition, by Messrs. Fuesch & Piccard, of Geneva, Switzerland. The wheels are of the Fourneyron or Boyden type, and work 250 revolutions per minute under about 140 feet head. They are of cast bronze of the quality used for propellers of steamships. The water is delivered through a seven foot penstock into the center of the turbine, being discharged upon the 32 blades of the wheel through directing passages formed by 36 deflecting plates. It is expected that the governing mechanism will control the speed under ordinary changes of load with a variation so slight as to be hardly perceptible, gates controlled by the governor opening more or less of the discharge opening, and the efficiency of the wheel being proportionally maintained with only a third of the full gate opening. The weight of the vertical shaft in the wheel pit is sustained by closing the bottom of the casing and causing the water to push upward upon the underside of the disk carrying the blades of the upper turbine. The shaft is of rolled steel tubing about a foot in diameter, with smaller solid portions in the journals, and no fly wheel is required, the heavy fields of the dynamo carried on the shaft affording sufficient momentum and inertia.

The dynamos are constructed upon the two-phase alternating current system, with stationary armature and revolving fields, and are designed to generate a potential of 2,000 to 2,400 volts, which will be increased or diminished by step-up or step-down transformers for transmission or local use. Motor generators will be run for the production of continuous current when required, so that the station will be able to furnish continuous or alternating current of any potential. Two-phase Tesla motors will be used. The station is designed eventually to comprise ten units of 5,000 horse power each, and the wheel pit and building will be extended toward the river and new wheels put in as required. Meantime power from the station itself will be available for carrying on the work, extending the wheel pit and the main tunnel, and the many mechanical operations connected with grading and inaugurating the industrial city which will grow up about this source of cheap and continuous power.

### Ruskin on the Locomotive.

In a recently published volume of lectures by Ruskin he says:

"I cannot express the amazed awe, the crushed humility, with which I sometimes watch a locomotive takes its breath at a railroad station, and think what work there is in its bars and wheels, and what manner of men they must be who dig brown ironstone out of the ground and forge it into that! What assemblage of accurate and mighty faculties in them; more than fleshly power over melting crag and coiling fire, fettered and finessed at last into the precision of watchmaking; Titanian hammer strokes, beating out of lava these glittering cylinders, and timely respondent valves, and fine-ribbed rods, which touch each other as a serpent writhes in noiseless gliding, and omnipotence of grasp; infinitely complex anatomy of active steel, compared with which the skeleton of a living creature would seem, to a careless observer, clumsy and vile—a mere morbid secretion and phosphatous prop of flesh. What would the men who thought out this, who beat it out, who touched it into its polished calm of power, who set it to its appointed task and triumphantly saw it fulfill this task to the utmost of their will, feel or think about this weak hand of mine, timidly leading a little stream of water color which I cannot manage, into an imperfect shadow of something else—mere failure in every motion, and endless disappointment? What, I repeat, would these iron-dominant genii think of me, and what ought I to think of them?'

### DECISIONS RELATING TO PATENTS.

**U. S. Circuit Court—District of Massachusetts.**

EDISON ELECTRIC LIGHT COMPANY ET AL. v. BOSTON INCANDESCENT LAMP COMPANY ET AL.

This was a suit by the Edison Electric Light Company and others against the Boston Incandescent Lamp Company and others. Complainants moved for a preliminary injunction.

Colt, J.

The second claim of the Edison incandescent lamp patent (No. 223,898) is for "the combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted, for the purposes set forth."

The defendants' lamp, constructed after the Pollard patent of November 1, 1892, contains all the elements enumerated in this claim, namely: a carbon filament, all-glass receiver, from which the air is exhausted, and conductors passing through the glass. The only difference between the two lamps is that the defendants use a film of powdered silver for the conductors passing through the glass in place of platinum wire, which Edison points out in the specification of his patent as the material to be employed and which is always found in the Edison lamp of commerce. In other respects the lamps are identical. While Edison uses platinum wire, he does not limit himself to this form of conductor in his claim. The language of the claim is "conductors passing through the glass," and therefore, on its face, the claim covers all kinds of material capable of carrying the electric current. If the claim had been limited to conductors of platinum wire, as the filament is limited to carbon, the case might be different.

The invention of Edison resides in the carbon filament. The other elements of the combination were old and subordinate and represent, so to speak, only the environment of the filament. For this reason I do not think the court should seek to restrict the plain meaning of the language of the claim. And there is another reason for giving the claim a broad construction. Edison made an important invention. He produced the first practical incandescent electric lamp. The patent is a pioneer in the sense of the patent law. It may be said that his invention created the art of incandescent electric lighting. Where a valuable invention has been made, the court will uphold that which was really invented and which comes within any fair interpretation of the patentee's claim. (Merrill v. Yeomans, 11 O. G., 270; 94 U. S., 568,573.)

The argument of the defendants is that this claim of the Edison patent must be limited to the use of platinum wire as a conductor, or its known equivalent, and that powdered silver was not a known equivalent at the date of the Edison patent. Looking generally at the state of the electrical art at the date of the Edison patent and comparing platinum wire and powdered silver simply as elements, apart from any specific combination or invention, it cannot be said that one was not a known equivalent of the other, because powdered metals, including silver, have been recognized since 1860 as conductors of electricity. In asserting that powdered silver was not a known equivalent of platinum wire, the defendants must mean that it was not a known substitute in the combination or invention of the Edison patent or in the art of incandescent electric lighting, and I think the evidence proves this to be true; but, in dealing with an invention which is broadly new, I am not prepared to accept the proposition that, in order to constitute infringement, an equivalent in a patented combination must have always been known at the date of the patent or must have been such as would occur to a skilled mechanic exercising only ordinary mechanical skill.

While the language of the Supreme Court in Rees v. Gould (15 Wall. 187) and other cases seems to support the defendants' contention on this question, the later decisions by that court are not reconcilable with the broad proposition that in all cases the substitution of an equivalent will avoid an infringement, provided it was not known at the date of the patent, using the word "known" in its ordinary sense. (Morley Sewing Mach. Co. v. Lancaster, 47 O. G., 267; 129 U. S., 263; 9 Sup. Ct., 299; Clough v. Barker, 22 O. G., 2157; 106 U. S., 166; 1 Sup. Ct., 188; Union Paper Bag Machine Co. v. Murphy, 13 O. G., 366; 97 U. S., 120.) In the Morley case, Mr. Justice Blatchford, speaking for the Court, says:

"A difference in the particular devices used to accomplish a particular result in such a machine would always enable a defendant to escape the charge of infringement, provided such devices were new with the defendant in such a machine, because, as no machine for accomplishing the result existed before that of the plaintiff, the particular device alleged to avoid infringement could not have existed or been known in such a machine prior to the plaintiff's invention."

In that case the patent was for a machine for automatically sewing shank buttons to a fabric, and it was the first machine to accomplish this result. In the defendant's machine the feeding and sewing mechanisms were new and had been patented, yet the Court held that it infringed the Morley patent. The feeding and sewing devices of the Lancaster machine in the art of automatically sewing shank buttons to a fabric were as unknown at the date of the Morley patent as a conductor made of powdered silver at the date of the Edison patent in the art of incandescent electric lighting.

In dealing with a pioneer invention which creates a new art it hardly seems logical or reasonable to say that, because in the progress of such art some new substance or device has been discovered which can act as a substitute for one of the elements of the patented invention, any one can appropriate the invention by the employment of such substitute; and, further, if equivalency signifies equivalency in the particular combination or invention, it is difficult to point out in this class of cases what known equivalents existed at the date of the patent, for the reason that the combination of elements in which the invention is embodied was first made known by the patentee. The doctrine of equivalents as applied to primary inventions rests upon a more satisfactory basis by the elimination of the qualification of age or time and by holding those things to be equivalents which perform the same function in substantially the same way. The fundamental question is whether the alleged infringer makes use of the essence of the patented invention, not whether he has adopted a known equivalent or made a patentable improvement on the invention.

The motion for preliminary injunction is granted.

### Tuberculosis and Butter.

It is hard to get away from the malign influence of the cow. Such at least is the case if we may trust the investigations of bacteriologists and sanitarians. The statistics of slaughtered animals in Prussia, Hanover, Switzerland, and other European countries show that from 2 to 12 per cent of the cattle are tuberculous, and though their flesh is not often dangerous, yet the milk must in most cases have been so. We can guard against tuberculous milk by sterilization, but now danger is threatened us from the butter. Several years ago Heim showed that butter from tuberculous milk contained bacilli and could produce infection. Bang (Deut. Zeitsch. f. Thiermed., vii., p. 5) reached similar conclusions.

Professor Roth, of Zurich, has, however, recently made experiments of more striking significance (Correspond. bl. f. Schweit. Aertz.) He went into the markets and purchased butter from twenty different sources representing different cantons of Switzerland. He then inoculated guinea pigs with this butter. In eighteen series of experiments the results were negative, but in two the inoculations were followed by tuberculosis. In other words, ten per cent of the butter of the Swiss markets contained tubercle bacilli.

Quite independently of Roth, Dr. Brusaferro, of Turin, made experiments with the butter of the Italian markets. In nine tubs he produced infection once, which gives about the same proportion as Roth's.

It is not to be supposed that 10 per cent of market butter is necessarily dangerous, for in many instances the number of bacilli is small and quite unable to cope with the juices of the stomach. Still, infected butter is not safe to the predisposed, and the fact of its existence in Europe at least should be borne in mind. What makes the matter additionally serious is the fact that there is not, so far as we know, any practical way of sterilizing butter.—Medical Record.

### Mounting Photographs.

The satisfactory mounting of photographs is a troublesome operation, and the following suggestion from a contributor to the Outlook may be of assistance to amateurs: I have found a method by which a photograph or engraving can be mounted on the thinnest paper without curling or wrinkling. If the picture is a photograph, it should be ironed out smooth with a hot iron and then trimmed. Mix a little gum arabic in hot water, so as to make a rather thick mucilage. Place the picture on the page in position and mark just inside the corners. Remove the picture and take some of the mucilage on a ruling pen and draw a heavy line of mucilage from one point to another, so as to make a line of mucilage all around the place where the picture is to be. As soon as the mucilage is sticky put the picture in place and a book over it to keep it flat. When dry, you will have a smooth mount that will not curl.