

THE PHONOGRAPH AND ITS FUTURE.

By THOMAS A. EDISON.

Of all the writer's inventions, none has commanded such profound and earnest attention throughout the civilized world as has the phonograph. This fact he attributes largely to that peculiarity of the invention which brings its possibilities within range of the speculative imaginations of all thinking people, as well as to the almost universal applicability of the foundation principle, namely, the gathering up and retaining of sounds hitherto fugitive, and their reproduction at will.

From the very abundance of conjectural and prophetic opinions which have been disseminated by the press, the public is liable to become confused, and less accurately informed as to the immediate result and effects of the phonograph than if the invention had been one confined to certain specific applications, and therefore of less interest to the masses. The writer has no fault to find with this condition of the discussion of the merits and possibilities of his invention; for, indeed, the possibilities are so illimitable and the probabilities so numerous that he—though subject to the influence of familiar contact—is himself in a somewhat chaotic condition of mind as to where to draw the dividing line. In point of fact, such line cannot with safety be defined in ordinary inventions at so early a stage of their development. In the case of an invention of the nature and scope of the phonograph, it is practically impossible to indicate it to-day, for to-morrow a trifle may extend it almost indefinitely.

There are, however, certain stages in the developing process which have thus far been actually reached; certain others which are clearly within reach; and others which, though they are in the light of to-day classed as possibilities, may to-morrow become probable, and a little later actual achievements. It is the intention of the writer in this article to confine himself to the actual and the probable, to the end that a clearer conception of the immediate realizations of the phonograph may be had. He concedes to the public press and the world of science the imaginative work of pointing out and commenting upon the possible. It is in view of the liberal manner in which this has already been done, and the handsome treatment he has received at their hands, that he for the first time appears *in propria persona* to discuss and comment upon the merits of one of his own inventions.

In order to furnish a basis upon which the reader may take his stand, and accept or combat the logic of the writer in his presentment of the probabilities of the phonograph, a few categorical questions are put and answers given upon the essential features of the principle involved:

1. Is a vibrating plate or disk capable of receiving a complex motion which shall correctly represent the peculiar property of each and all the multifarious vocal and other sound-waves?

The telephone answers affirmatively.

2. Can such complex movement be transmitted from such plate, by means of a single embossing-point attached thereto, to effect a record upon a plastic material by indentation, with such fidelity as to give to such indentations the same varied and complex form; and, if so, will this embossing-point, upon being passed over the record thus made, follow it with such fidelity as to retransmit to the disk the same variety of movement, and thus effect a restoration or reproduction of the vocal or other sound-waves, without loss of any property essential to producing upon the ear the same sensation as if coming direct from the original source?

The answer to this may be summed up in a statement of the fact that, by the application of power for uniformity of movement, and by attention to many seemingly unimportant and minor details, such as the form and material of the embossing-point, the proper *dampening* of the plate, the character of the material embossed, the formation of the mouth-piece over the plate, etc., the writer has at various times during the past weeks reproduced these waves with such degree of accuracy in each and every detail as to enable his assistants to read, without the loss of a word, one or more columns of a newspaper article unfamiliar to them, and which were spoken into the apparatus when they were not present. The only perceptible loss was found to be in the quality of the utterance—a non-essential in the practical application of the apparatus. Indeed, the articulation of some individuals has been very perceptibly improved by passage through the phonograph, the original utterance being mutilated by imperfection of lip and mouth formation, and these mutilations eliminated or corrected by the mechanism of the phonograph.

3. Can a record be removed from the apparatus upon which it was made, and replaced upon a second without mutilation or loss of effective power to vibrate the second plate?

This is a mere mechanical detail, presenting no greater obstacle than having proper regard for the perfect interchangeableness of the various working parts of the apparatus—not so nice a problem as the manufacture of the American watch.

4. What as to facility of placing and removing the record-sheet, and as to its transportation by mail?

But ten or fifteen seconds suffice for such placing or removal. A special envelope will probably be required for the present, the weight and form of which, however, will but slightly increase the cost of postage.

5. What as to durability?

Repeated experiments have proved that the indentations possess wonderful enduring power, even when the reproduction has been effected by the comparatively rigid plate used for their production. It is proposed, however, to use a more flexible plate for reproducing, which, with a perfectly smooth stone point—diamond or sapphire—will render the record capable of from 50 to 100 repetitions, enough for all practical purposes.

6. What as to duplication of a record and its permanence?

Many experiments have been made, with more or less success, in the effort to obtain electrotypes of a record. This work has been done by others, and, though the writer has not as yet seen it, he is reliably informed that, very recently, it has been successfully accomplished. He can certainly see no great practical obstacle in the way. This, of course, permits of an indefinite multiplication of a record, and its preservation for all time.

7. What are the requisite force of wave impinging upon the diaphragm and the proximity of the mouth to the diaphragm to effect a record?

These depend in a great measure upon the volume of sound desired in the reproduction. If the reproduction is to be made audible to an audience, considerable force is

requisite in the original utterance; if for the individual ear, only the ordinary conversational tone (even a whisper has been reproduced). In both cases the original utterances are delivered directly in the mouth-piece of the instrument. An audible reproduction may, however, be had by speaking at the instrument from a distance of from two to three feet in a loud tone. The application of a flaring tube or funnel to collect the sound-waves and the construction of an especially delicate diaphragm and embossing-point, etc., are the simple means which suggest themselves to effect this. The writer has not as yet given this stage of the development much attention, but sees no practical difficulty in gathering up and retaining a sectional part of the sound-waves diffused about the original source, within a radius of, say, three feet (sufficiently removed not to be annoying to a speaker or a singer).

The foregoing presentment of the stage of development reached by the several essential features of the phonograph demonstrates the following as *faits accomplis*:

1. The captivity of all manner of sound-waves heretofore designated as "fugitive," and their permanent retention.

2. Their reproduction with all their original characteristics at will, without the presence or consent of the original source, and after the lapse of any period of time.

3. The transmission of such captive sounds through the ordinary channels of commercial intercourse and trade in material form, for purposes of communication or as merchantable goods.

4. Indefinite multiplication and preservation of such sounds, without regard to the existence or non-existence of the original source.

5. The captivity of sounds, with or without the knowledge or consent of the source of their origin.

The probable application of these properties of the phonograph to the various branches of commercial and scientific industry presently indicated will require the exercise of more or less mechanical ingenuity. Conceding that the apparatus is practically perfected in so far as the faithful reproduction of sound is concerned, many of the following applications will be made the moment the new form of apparatus, which the writer is now about completing, is finished. These, then, might be classed as actualities; but they so closely trench upon other applications which will immediately follow, that it is impossible to separate them; hence they are all enumerated under the head of probabilities, and each specially considered. Among the more important may be mentioned: Letter-writing and other forms of dictation, books, education, reader, music, family record; and such electrotypes applications as books, musical boxes, toys, clocks, advertising and signaling apparatus, speeches, etc., etc.

Letter-writing.—The apparatus now being perfected in mechanical details will be the standard phonograph, and may be used for all purposes except such as require special form of matrix, such as toys, clocks, etc., for an indefinite repetition of the same thing. The main utility of the phonograph, however, being for the purpose of letter-writing and other forms of dictation, the design is made with a view to its utility for that purpose.

The general principles of construction are a flat plate or disk, with spiral groove on the face, operated by clock-work underneath the plate; the grooves are cut very closely together, so as to give a great total length to each inch of surface—close calculation gives as the capacity of each sheet of foil, upon which the record is had, in the neighborhood of 40,000 words. The sheets being but ten inches square, the cost is so trifling that but 100 words might be put upon a single sheet economically. Still, it is problematical whether a less number of grooves per inch might not be the better plan—it certainly would for letters—but it is desirable to have but one class of machine throughout the world; and as very extended communications, if put upon one sheet, could be transported more economically than upon two, it is important that each sheet be given as great capacity as possible. The writer has not yet decided this point, but will experiment with a view of ascertaining the best mean capacity.

The practical application of this form of phonograph for communications is very simple. A sheet of foil is placed in the phonograph, the clock-work set in motion, and the matter dictated into the mouth-piece without other effort than when dictating to a stenographer. It is then removed, placed in a suitable form of envelope, and sent through the ordinary channels to the correspondent for whom designed. He, placing it upon his phonograph, starts his clock-work and listens to what his correspondent has to say. Inasmuch as it gives the tone of voice of his correspondent, it is *identified*. As it may be filed away as other letters, and at any subsequent time reproduced, it is a perfect record. As two sheets of foil have been indented with the same facility as a single sheet, the "writer" may thus keep a duplicate of his communication. As the principal of a business house or his partners now dictate the important business communications to clerks, to be written out, they are required to do no more by the phonographic method, and do thereby dispense with the clerk, and maintain perfect privacy in their communications.

The phonograph letters may be dictated at home, or in the office of a friend, the presence of a stenographer not being required. The dictation may be as rapid as the thoughts can be formed or the lips utter them. The recipient may listen to his letters being read at a rate of from 150 to 200 words per minute, and at the same time busy himself about other matters. Interjections, explanations, emphasis, exclamations, etc., may be thrown into such letters, *ad libitum*.

In the early days of the phonograph, ere it has become universally adopted, a correspondent in Hong-Kong may possibly not be supplied with an apparatus, thus necessitating a written letter of the old-fashioned sort. In that case the writer would use his phonograph simply as a dictating-machine, his clerk writing it out from the phonograph at leisure, causing as many words to be uttered at one time as his memory was capable of retaining until he had written them down. This clerk need not be a stenographer, nor need he have been present when the letter was dictated, etc.

The advantages of such an innovation upon the present slow, tedious, and costly methods are too numerous, and too readily suggest themselves, to warrant their enumeration, while there are no disadvantages which will not disappear coincident with the general introduction of the new method.

Dictation.—All kinds and manner of dictation which will permit of the application of the mouth of the speaker to the mouth-piece of the phonograph may be as readily ef-

fected by the phonograph as in the case of letters. If the matter is for the printer, he would much prefer, in setting it up in type, to use his ears in lieu of his eyes. He has other use for them. It would be even worth while to compel witnesses in court to speak directly into the phonograph, in order to thus obtain an unimpeachable record of their testimony.

The increased delicacy of the phonograph, which is in the near future, will enlarge this field rapidly. It may then include all the sayings of not only the witness, but the judge and the counsel. It will then also comprehend the utterances of public speakers.

Books.—Books may be read by the charitably inclined professional reader, or by such readers especially employed for that purpose, and the record of such book used in the asylums of the blind, hospitals, the sick-chamber, or even with great profit and amusement by the lady or gentleman whose eyes and hands may be otherwise employed; or, again, because of the greater enjoyment to be had from a book when read by an elocutionist than when read by the average reader. The ordinary record-sheet, repeating this book from fifty to a hundred times as it will, would command a price that would pay the original reader well for the slightly-increased difficulty in reading it aloud in the phonograph.

Educational Purposes.—As an elocutionary teacher, or as a primary teacher for children, it will certainly be invaluable. By its difficult passages may be correctly rendered for the pupil but once, after which he has only to apply to his phonograph for instructions. The child may thus learn to spell, commit to memory, a lesson set for it, etc., etc.

Music.—The phonograph will undoubtedly be liberally devoted to music. A song sung on the phonograph is reproduced with marvelous accuracy and power. Thus a friend may in a morning call sing us a song which shall delight an evening company, etc. As a musical teacher it will be used to enable one to master a new air, the child to form its first songs, or to sing him to sleep.

Family Record.—For the purpose of preserving the sayings, the voices, and the last words of the dying member of the family—as of great men—the phonograph will unquestionably outrank the photograph. In the field of multiplication of original matrices, and the indefinite repetition of one and the same thing, the successful electrotyping of the original record is an essential. As this is a problem easy of solution, it properly ranks among the probabilities. It comprehends a vast field. The principal application of the phonograph in this direction is in the production of

Phonographic Books.—A book of 40,000 words upon a single metal plate ten inches square thus becomes a strong probability. The advantages of such books over those printed are too readily seen to need mention. Such books would be listened to where now none are read. They would preserve more than the mental emanations of the brain of the author; and, as a bequest to future generations, they would be unequalled. For the preservation of languages they would be invaluable.

Musical Boxes, Toys, etc.—The only element not absolutely assured, in the result of experiments thus far made, which stands in the way of a perfect reproduction at will of Adeline Patti's voice in all its purity, is the single one of quality, and even that is not totally lacking, and will doubtless be wholly attained. If, however, it should not, the musical-box, or cabinet, of the present will be superseded by that which will give the voice and the words of the human songstress.

Toys.—A doll which may speak, sing, cry, or laugh may be safely promised our children for the Christmas holidays ensuing. Every species of animal or mechanical toy—such as locomotives, etc.—may be supplied with their natural and characteristic sounds.

Clocks.—The phonographic clock will tell you the hour of the day, call you to lunch, send your lover home at ten, etc.

Advertising, etc.—This class of phonographic work is so akin to the foregoing that it is only necessary to call attention to it.

Speech and other Utterances.—It will henceforth be possible to preserve for future generations the voices as well as the words of our Washingtons, our Lincolns, our Gladstones, etc., and to have them give us their "greatest effort," in every town and hamlet in the country, upon our holidays.

Lastly, and in quite another direction, the phonograph will perfect the telephone, and revolutionize present systems of telegraphy. That useful invention is now restricted in its field of operation by reason of the fact that it is a means of communication which leaves no record of its transactions, thus restricting its use to simple conversational chit-chat, and such unimportant details of business as are not considered of sufficient importance to record. Were this different, and our telephone conversation automatically recorded, we should find the reverse of the present status of the telephone. It would be expressly resorted to as a means of perfect record. In writing our agreements we incorporate in the writing the summing up of our understanding—using entirely new and different phraseology from that which we used to express our understanding of the transaction in its discussion, and not infrequently thus begetting perfectly innocent causes of misunderstanding. Now, if the telephone, with the phonograph to record its sayings, were used in the preliminary discussion, we would not only have the full and correct text, but every word of the whole matter capable of throwing light upon the subject. Thus it would seem clear that the men would find it more advantageous to actually separate a half-mile or so in order to discuss important business matters, than to discuss them verbally, and then make an awkward attempt to clothe their understanding in a new language. The logic which applies to transactions between two individuals in the same office applies with the greater force to two at a distance who must discuss the matter between them by the telegraph or mail. And this latter case, in turn, is re-enforced by the demands of an economy of time and money at every mile of increase of distance between them.

"How can this application be made?" will probably be asked by those unfamiliar with either the telephone or phonograph.

Both these inventions cause a plate or disk to vibrate, and thus produce sound-waves in harmony with those of the voice of the speaker. A very simple device may be made by which the one vibrating disk may be made to do duty for both the telephone and the phonograph, thus enabling the speaker to simultaneously transmit and record his message. What system of telegraphy can approach that? A similar combination at the distant end of the wire enables

the correspondent, if he is present, to hear it while it is being recorded. Thus we have a mere passage of words for the action, but a complete and durable record of those words as the result of that action. Can economy of time or money go further than to annihilate time and space, and bottle up for posterity the mere utterance of man, without other effort on his part than to speak the words?

In order to make this adaptation, it is only requisite that the phonograph shall be made slightly more sensitive to record, and the telephone very slightly increased in the vibrating force of the receiver, and it is accomplished. Indeed the "Carbon Telephone," invented and perfected by the writer, will already well-nigh effect the record on the phonograph; and, as he is constantly improving upon it, to cause a more decided vibration of the plate of the receiver, this addition to the telephone may be looked for coincident with the other practical applications of the phonograph, and with almost equal certainty.

The telegraph company of the future—and that no distant one—will be simply an organization having a huge system of wires, central and sub-central stations, managed by skilled attendants, whose sole duty it will be to keep wires in proper repair, and give, by switch or shunt arrangement, prompt attention to subscriber No. 923 in New York, when he signals his desire to have private communication with subscriber No. 1001 in Boston, for three minutes. The minor and totally inconsequent details which seem to arise as obstacles in the eyes of the groove-traveling telegraph-man wedded to existing methods will wholly disappear before that remorseless Juggernaut—"the needs of man"—for will not the necessities of man surmount trifles in order to reap the full benefit of an invention which practically brings him face to face with whom he will, and, better still, doing the work of a conscientious and infallible scribe?—*North American Review*.

POWER FOR ELECTRIC ILLUMINATION.

THE electric light being simply the conversion into heat and light of the energy due to chemical action in a battery or of the energy developed by the consumption of fuel, and utilized through the medium of a motor and magneto-electric machine, the question which presents itself for consideration at the outset in contemplating the introduction of this mode of illumination is the cost of the necessary power. That the magneto-electric machine possesses immense advantages over the battery in point of economy and efficiency needs no demonstration here, and it is to the employment of that apparatus to which we have reference. According to late investigations by M. Tresea, 1,860 burners supplied with a current from a Gramme machine required 7 horse power or 4 horse power per 100 burners; when, however, a less powerful apparatus was used, producing but a single light, the expenditure was $1\frac{1}{2}$ horse power. So that, like all other commodities, the electric light is cheap at wholesale and dear at retail. Generally, however, it appears that 100 burners require 1 horse power, and by determining the cost of the latter the direct expense of the light is reached. To this, however, must be added cost of machinery, interest on capital, maintenance, wages, etc. For an approximate idea of the relative outlay we again have recourse to French investigations. M. Fontaine, in his recently published work, states that the electricity as a means of illumination is 75 per cent. cheaper than candles. M. Jamin, on the other hand, calls attention to published statements, wherein it is proved that the electric light is 65 per cent. dearer than gas, this assertion appearing in the *Annales des usines à gaz*. These opinions represent probably extreme views of the advocates and opponents of the general introduction of electric illumination. M. Jamin adds, however, that the Lontin Company in Paris are now offering to rent magneto-electric machines and all apparatus for producing the light at a cost of 10 cents per hour per hundred burners, the number of the latter and period of use to extend over certain contracted periods. The lights furnished to the Louvre by the Denayrouse-Jablochhoff Company, according to the same authority, far surpass gas lights in brilliancy, and an economy of about 30 per cent. is effected.

In the above cases power is furnished by consumption of fuel. There are many instances, however, where natural sources of power may be utilized, and it is to these more especially that we desire here to draw attention. Whether it will ever be practicable to employ the rise and fall of the tides in New York Bay or the currents in the rivers to actuate motors which in turn shall drive magneto-electric machines is at least an open question. The destruction of the reefs at Hell Gate has for one result the augmenting of the force of the current at the lower end of the island, and it would seem possible that some arrangement of water wheels could be contrived whereby this power might be utilized and a part of it used for supplying electricity for purposes of illumination. The same might be done on a small scale elsewhere. With a machine such as the Lontin, which is capable of giving a numerously divided current, or by the use of the simple Jablochhoff candle, where the entire paraphernalia of the electric lamp is obviated altogether, it would appear that the matter of lighting up a village or town by electricity has become an easy matter. A small water wheel, or even windmill, might furnish the power at little cost, and the remaining expenditures for maintenance would manifestly be small.

THE RADIOMETER AND THE SPHEROIDAL STATE.

THE following lucid exposition of the latest theories explaining the action of Crooke's radiometer, and the cause of the phenomenon known as the spheroidal state, was given by Professor Barrett in a recent lecture at the London Institution. He said: "To Mr. Stoney is unquestionably due the great honor of having been the first fully to explain the true theory of the radiometer." It was in the course of these investigations that Mr. Stoney has been quite recently led to show that the force which is so active in the high rarefaction (that is necessary for the effective rotation of the radiometer) is also present at ordinary atmospheric tensions. Now, it is this force which forms the new explanation of the spheroidal state. In order to understand the action that occurs it must be recollected that, according to calculation, the number of molecules of air that at ordinary pressure occupies the space of a pin's head is 1,000,000,000,000,000,000; when the radiometer globe is exhausted of these molecules of air, as far as we can do it by mechanical means, there are still some few millions remaining, and these are in constant motion. Heat makes them move more rapidly, cold more slowly. If we have two surfaces placed very near each other, one surface hot and the other cold,

from the hot surface the molecules will be thrown off with greater rapidity than they reached it; and if the cold surface be near enough they will "bombard" it. Hence there will be a tendency in the hot and cold surfaces to retreat from one another, and when with one of these, as in the radiometer this is possible, it ensues, this force would obviously disappear (1) if the residual molecules could be wholly removed or so lessened in number that their action would be insensible, or (2) if the surfaces were so far apart that the augmented molecular activity had expended itself before reaching the cool surface. Applying the same kind of reasoning to the spheroidal state of liquids, we can see that it is only at relatively short distances from the metal that the interaction will occur. Professor Barrett showed by experiment that the spheroidal state could be produced with fluids from which there could be no vapor given off, as the old theory required, and also that it could be produced in cases of very slight differences of temperature.

THE HAIR HYGROMETER.

DR. KOPPE, of Zürich, publishes in the *Austrian Journal* for February 15 an ardent plea for the reintroduction of the hair hygrometer. He shows by Prof. Wolf's experiments the utter untrustworthiness of observations with the wet and dry bulb thermometers near the freezing-point—a fact which is self-evident from the records of the self-registering thermometers given in the Quarterly Weather Reports—and argues that if at the central observatory of Zürich the experience of the instrument is unsatisfactory, it must be utterly undeserving of credit at outlying stations. The modern form of the hair hygrometer is due to the late Goldschmidt of Zürich, and the main feature in it is that while in the old instrument the hair is adjusted to indicate the true values of humidity by altering its length till the index marks 100 at a time of fog, in Goldschmidt's instrument this adjustment can be effected at any time. A wooden frame covered with muslin is introduced into the case of the hygrometer. If this muslin be wet, the hair is at once brought into a state of complete saturation, whatever be the temperature or the hygrometrical condition of the air. The weight employed for stretching the hair is not more than half a gramme, while the average strength of a hair is 100 grammes. Dr. Koppe maintains that a hair so prepared will give very satisfactory results, and his practical experience is that one of these instruments has worked without deterioration for many years at Zürich. The actual arrangement proposed is a combination of the two types of instrument. The dry bulb thermometer is inclosed in the same case as the hair hygrometer, and the wet bulb thermometer is placed outside.—*Academy*.

CERTAIN CONSEQUENCES OF THE CONSTITUTION OF THE SOLAR SPECTRUM.—A. CORNU.—The author has been led to the conclusion that the position and relative brightness of the dark rays of the solar spectrum may be explained by the action of an absorbent stratum existing upon the sun, analogous in its chemical composition to that of volatilized aerolites. He infers also that the center of the earth consists chiefly of metallic masses, and especially of iron.

TRANSIENT VARIATION OF PERMANENT MAGNETISM.—J. M. GAUGAIN.—The transient variation of a bar is positive when the bar has been magnetized at a temperature of about 350°, and negative when the magnetization has been performed at any temperature not exceeding 100°. The temperature at which the transient variation = 0 varies in different bars of steel.

GELATINE NEGATIVES.

By REV. H. J. PALMER, M.A.*

THE recent publication of a new film process of exceeding simplicity, and one which may be readily accomplished in all its operations by every amateur who pleases to make the attempt, has elicited so much notice in many directions that I have ventured once more to trespass upon your time and patience, in the hope that I may augment the interest of our meeting to-night by enabling you to witness all the details of this process from beginning to end, and also that I may convey additional information to the many who are seeking it on this subject.

My first proceeding is to take a clean glass of quarter-plate size, and, having placed it upon a level surface, I pour upon it three drachms of a thirty-grain solution of gelatine in dilute ox-gall. I distribute the pool from the center to the edges of the plate, with the help of the tip of the forefinger, which answers better for the purpose than a glass rod, and then remove possible bubbles with the point of a penknife. For this preliminary film, as well as for the emulsion itself, I find that Nelson's opaque is better adapted than the clear photographic gelatine. The latter does not leave the glass so readily, and the opacity of the former effectually prevents blurring, and, at the same time, does not affect materially the printing capacity of the negative.

The remarks on the subject of halation made at the last meeting of the Edinburgh Photographic Society had reference, I imagine, to gelatine negatives on glass, and not to these film pictures. I have never met with the slightest tendency to blurring in my films, and the entire absence of it when opaque gelatine is employed enables me to give up the plan I had first adopted, namely, of backing up each film with a glass coated with colored gelatine and sugar. In the film negative of the "Interior of Wallasey Church" the large east window is as clear and sharp in all its detail as would be the case with a wet plate. I have exposed dry plates of all kinds upon this subject, and, in spite of a backing of color, blurring invariably takes place at this point in the picture.

We now sensitize our dried film by pouring upon it a pool of emulsion, and distribute the latter over the surface with the tip of a clean finger. To avoid waste of emulsion this operation is better conducted upon a dish or tray, and any spilt gelatine may be restored to the vessel of emulsion for further use. It is important that the proportion of gelatine per ounce be the same in both the preliminary and the sensitive coating. If this be not the case, the film will curl and give trouble under the developer. Some gelatines which I have been using lately manifest a tendency persistently repellent of the emulsion. When this is the case it is better to add a few drops of ox-gall to the latter. It will now flow better over the surface, but will still require to be humored a little by tilting the glass toward each side

in succession, so that the surplus emulsion may run round the edges of the plate two or three times.

When thoroughly dry the film is readily stripped from the glass, and may be exposed in the camera. The best method of securing a sufficient "taut" surface in the dark slide is, in the first instance, to make the sheet slightly longer than the required size. It is then laid face down upon a sheet of blotting paper; a glass is pressed into close contact with it, the two ends are moistened with the tongue, folded over, and so fastened to the back of the glass support. In changing the film a knife readily effects the separation, and the glass is ready for a fresh sheet.

Mr. Kirkby has suggested that these films should be prepared upon ferrotype plates of the larger size, so that a perfectly rigid support may be provided for use in the dark slide. I have tried this plan, and find that the plate will take the gelatine as readily as glass. It will be necessary to secure perfect flatness of the plate during the coating, and the film will strip off for development and printing with perfect ease.

Of the requisite exposure I need say little. It will suffice to mention that the films I am about to develop were exposed in bright sun at 8:30 A.M. yesterday, with Dallmeyer's rapid rectilinear, stop No. 2, for twenty seconds. I place the film in a dish of water for a few moments, pour this off, flow over a ten-grain solution of bromide of potassium, and then follow with the ordinary alkaline developer. When detail is fully out if necessary I apply an acid silver intensifier, and then fix with hypo., washing copiously before and after each operation. The negative is conveniently kept from slipping into the sink by the assistance of a camel's hair brush, and the latter useful little accessory helps me to draw the finished film on to a glass plate, and also to sweep out any air-bubbles which may have interposed between the surfaces.

The films must be allowed to dry spontaneously, or inevitable cockling or splitting will be the result. When desiccation is complete, a knife is inserted under one corner, and then swept rapidly beneath the edge of the film. A pause in this operation will sometimes cause a sudden crack across the negative, as will also the temperature of a hot room. It is essential that no attempt be made to remove the negative from the glass upon which it has dried until all tackiness of surface has disappeared. If this be neglected, the resulting negative will be useless until it has been wetted and redried, like the specimen I have here.

One word of caution is necessary with regard to density. What would be considered a decidedly weak negative in any other dry process will be found to possess sufficient printing vigor in the case of a gelatine film.

PATIENCE IN DRY PLATE PHOTOGRAPHY.

THE advent of sunny days and clear skies is welcome to none more than the dry plate photographer. He has patched up his dark tent, if he carries one, during the winter, and corrected the defects of his apparatus, or possibly perfected that dry plate process which, for sensitiveness and simplicity, is to beat all the world. He is only waiting for the spring, or early summer, to begin work, for the time when the foliage is just set, and when there are still masses of white cloud floating about to aid in softening sunlight effects and adding transparency to his shadows. If he can get a still day, when the warm sunshine comes and goes, lighting up hilly landscapes like patchwork, the horizon clear and transparent from recent rains, and the distant cliffs sharp and bright against the sky, it is all he wants, unless, indeed, he has it in his mind to have a bit of water in his picture. Then he seeks out some placid pool, or lazy stretch of river where contrast is afforded by the yellow reeds and overhanging green of the willow, and sets down his camera where a fallen tree or a patch of bushes composes a picturesque foreground. In all probability he has had the spot in his eye for the past few months, and has studied the standpoints half a dozen times, in which case there is little left in the way of adjusting apparatus and focusing. He knows what he will get long before he has developed the plate, and congratulates himself already, as if the picture were hanging up in the library at home.

But he must be a patient man. No dry plate worker was ever successful in his calling who was flighty and hurried in his manipulations. It is like angling. No fisherman ever yet had a good day's bottom-fishing who could not go to work systematically, or had a deficiency of patience. We have heard of a dry plate photographer who actually desisted from his work to apply a coating of whitewash to a cottage, in order to throw the high light of his picture in a certain point, and the result was one well worth waiting for. A fine picture of the Thames near Cookham, in our possession, would have been sadly marred by an ugly fence that occupies a prominent position in it, had not the photographer spent some time in tastefully twining a bit of ivy round one of the posts, and thus broken its rigid outline. Now it is as if the post had actually been chosen as an appropriate foreground, instead of being, as it was, an adjunct impossible of removal. Again, there is a light breeze, or a big cloud that for the moment gives an inky aspect to the water, and chills the whole pleasant scene before you. Exposure at that instant would have been to render your former work vain, and to produce a mediocre picture, instead of one full of life and brightness. You must sit down and bide your time. Take a book with you, if you like, and read. But do not expose after all your trouble. The chances are that by the time you have removed your plate, the proper moment will have arrived. Half in sunshine, half in shadow, will produce your best picture, in which the shadows will be transparent and the atmosphere transparent.

And patience, more than ever, is necessary in the development of dry plates. Do not hurry. Inform yourself well beforehand what it is you are about to develop. Is there much dark foliage about it that will require working up, or does it present a delicate skyline which will rapidly fog? Proceed slowly and cautiously, but when the right degree of development has been reached, then act promptly. Do not allow your shades of distance to fog by pushing to extremes; intensifying, can always be managed afterward, when the picture is fixed, you must remember. At the same time, in the case of foliage and undergrowth, they are nothing unless fully developed, in the same way as their beauty is wholly lost if there has been any shaking during exposure. In a word, if you cannot be patient, you will never be a good dry plate photographer.—*Photographic News*.

New printing inks, based upon gas-tar, are coming into use in France. They are said to consist of 10 parts tar, 36 parts lampblack, Prussian blue 10 parts, and glycerine 10 parts, the oils, gum-resins, etc., present in ordinary printing ink being dispensed with.

* Read before the Liverpool Amateur Photographic Association.