MANUFACTURE OF GELATINO-BROMIDE DRY PLATES.

There are few travelers at present who have not become photographers; and so it is not surprising that the manufacture of photographic apparatus and products should have become very extensive. We have already given statistics concerning the manufacture of gelatino-bromide plates, showing that the annual amount of production in Europe is estimated at ten million dollars. A few data of an analogous character concerning sensitized paper will give further proof of the present extent of the trade in photographic materials.

The paper employed for forming images is manufactured almost entirely by one French house, which turns out 50,000 reams per annum. This paper is afterward covered with a layer of albumen, and is rendered sensitive. The paper thus prepared is worth, at the lowest figure, $100 per ream, and the value of the annual product amounts to $3,000,000. The other sensitized papers, such as gelatino-bromide of silver, carbon, etc., amount to $1,000,000. If to this we add the chemical products and the woodwork, we shall arrive at an annual total of $10,000,000.

It will be seen that the manufacture of dry plates itself forms half the total production of photographic materials. All professional and amateur photographers now use these. But are there many who know how they are made? We think not. For our part, wanting to know something about it, we applied for this purpose to one of our largest French manufacturers, Mr. D. Hutinet, who was good enough to show us all the details of his large factory on Parmentier Avenue, Paris.

It has seemed to us that it would be interesting to every one, and instructive to the profession, to know the mode of manufacture of the dry plates that they are constantly using, and this has decided us to write the present article.

Dry plates are plates of glass covered with an emulsion of gelatino-bromide of silver. The manufacture of them comprises a series of operations that we shall now pass in review.

1. *Preparation of the Emulsion.*—A large number of formulas have been published in special treatises, and one of the simplest of these is the following: Introduce into a wide-mouthed bottle: Distilled water, 300 cmc.; bromide of ammonium, 18 grammes; good gelatine, 12 grammes. (The operation being performed in a room into which light is admitted through ruby-red glass.)

After the gelatine has swollen, put the bottle into a water bath and raise the temperature to 40° C.

In another bottle dissolve 27 grammes of crystallized nitrate of silver in 150 cub. centimeters of distilled water. Pour the silver solution in a thin stream into the gelatine, and, at the same time, keep the latter constantly agitated by a circular motion, even after the two liquids are united in the same bottle. After this, put the bottle into a water bath and raise the temperature to the boiling point. Care must be taken to stir the emulsion with a long glass rod, and to continue the boiling for from fifteen to twenty minutes. After this, allow the temperature to fall about 35° or 40°, and add from 12 to 15 grammes of gelatine that has previously been swollen in a little distilled water.

After these successive operations, the emulsion must be poured into a basin and allowed to cool in darkness. After the jelly has set, it must be washed in order to free it from useless and injurious salts, and passed through a filter and collected in a piece of muslin stretched over a sieve. After having been washed for twenty minutes under a faucet, the emulsion must be put into a bottle into which is introduced a third proportion (say 12 or 15 grammes) of gelatine.

After the gelatine and emulsion have been rendered homogeneous, the latter is ready to be spread over the plates.

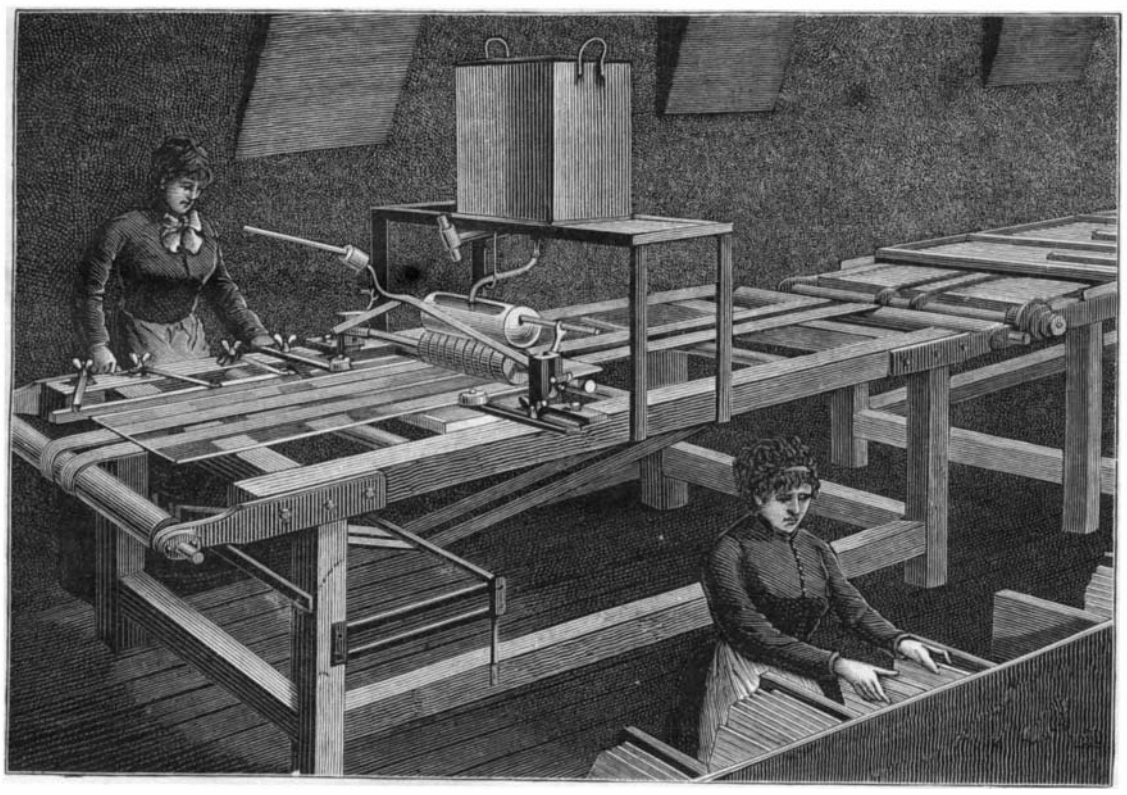

Fig. 1.—APPARATUS FOR COATING GELATINO-BROMIDE PLATES.

2. *Coating the Plates.*—When it is a question of manufacture on a large scale, the spreading of the emulsion over the plates offers very serious difficulties. The duration of the operation must be as short as possible, since the emulsion constantly changes state. Spreading by hand is always imperfect, on account of the inequality in thickness of the layer obtained.

The operation of spreading the emulsion is done mechanically at Mr. Hutinet's factory.

Our obliging guide was indispensable to us for visiting his factory, as alone we should not have dared to take a single step on account of the darkness that reigned therein. Upon entering the laboratory, we saw nothing but black walls and a few luminous red points, but as our eyes gradually got used to the darkness they saw numerous small lanterns with red glasses placed here and there. By and by we distinguished shadows; they were workmen at work.

Finally, after a quarter of an hour, our eyes got used to the darkness, and we went up to the room containing the machine that does the coating (Fig. 1). This room is sixty-five feet in length.

The glass, which has been previously cleaned, has exactly the width that it is to preserve when cut, and its length is 4 feet. Each strip is placed upon two endless belts, which are actuated by a steam engine.

The glass thus carried along passes under a roller, which presses very lightly against its surface, a counterpoise serving to balance it. The emulsion is contained in a vessel which is heated by a water-bath, and which is seen in the center of our figure. It flows out slowly, and in the desired quantity, through a glass cock, and falls into a vessel of the same length as the roller. This vessel contains small apertures in the bottom, through which the emulsion flows uniformly over the roller, which, in its rotary motion, covers the glass therewith. The strips of glass are placed one after another, and travel a distance of forty feet, and during this the emulsion hardens.

3. *Drying the Glass.*—At the end of the table the strips are taken up and placed in a drier (Fig. 2). This consists of wooden racks placed in a room which is heated as follows: The air from the outside is filtered through wadding, and is heated by steam pipes under the double floor of the drying room. From thence it ascends in the four corners of the room as far as to the ceiling, and is afterward distributed throughout every part. Under the racks at each side there are gratings that allow of the passage of air, which is sucked in through the draught of the 78 foot chimney of the factory. Thus the hot air, coming from above, becomes charged as it descends with the moisture produced by the drying of the glass. Owing to this arrangement, there is little or no dust.

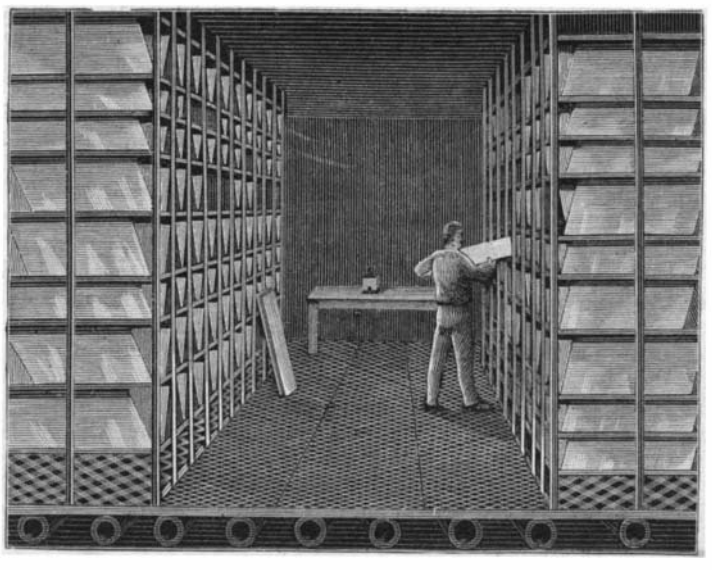

Fig. 2.—DRYING ROOM.

4. *Cutting the Plates.*—When dry, that is to say, six or eight hours after having been placed in the racks, the strips are taken to the cutting room. Each strip is divided into the proper number of plates by a very simple apparatus, maneuvered by a girl (Fig. 3).

This apparatus consists of two grooved pieces of wood, whose distance apart is regulated at will by nuts. As we have already said, the strip is cut to the proper width before it is coated. At the end of the table there is a board, against which the glass abuts. The distance between this and the ends of the wooden guides determines the size of the plates, which are cut by means of a diamond. During the cutting, the plates are examined one by one by other girls, and those that have any defects are thrown aside, while the others are gathered up and packed.

5. *Putting up in Packages.*—The packing apparatus (Fig. 4) consists of three parts. The lowermost of these extends beyond the level of the table, and carries six grooves, and sheets of fluted paper placed therein exactly fit into these latter. On each side of the bottom piece there are two vertical ones, which are movable and provided with grooves that correspond to those of the former. The plates are introduced, one by one, into these grooves, and fluted paper is placed on top. This done, the lower part, through a mechanical move-

Fig. 3.—CUTTING THE PLATES.

Fig. 4.—PACKING MACHINE.

ment, descends beneath the level of the table, while the two vertical ones separate. The six plates are then pressed together by the girl, but are kept from touching one another by the folds of the paper. They are afterward put up in packages, and two of the latter are placed in one box. A strip of paper is pasted over the top of the boxes, and after this the latter can be taken into the light.

This entire manufacture requires great care and the use of various expedients. For example, Mr. Hutinet informs us that in order to counteract the effect of heat, during the coating of the plates in summer, he has been obliged to construct a small conduit for the strips of glass to slide under, and which is supplied by water at a temperature of 12° C., derived from a well that had to be bored to a depth of 40 meters (131 feet).—*La Nature.*

Proposed Increase of Postage Rates.

A bill introduced in the Senate by the Hon. James F. Wilson, of Iowa, and now pending in both branches of Congress, provides that the rate of postage on fourth-class matter shall forthwith be doubled. The present rate is sixteen cents a pound. By increasing it to thirty-two cents, the bill proposes to make it the same as letter postage.

Such an increase would be a serious hardship to thousands of people, who now depend upon the mails for receiving necessary supplies from a distance. It will be admitted that few goods out of the long list now sent by mail will permit a freight of thirty-two cents per pound. It does not seem fair to these people to allow the growth of their dependence upon the common carrier, and then make its services almost prohibitive on no better grounds than those offered.

A strong claim can properly be urged, as well, for those lines of business which have been built up under the existing rates, and which would be crippled to the point of extinction were the rates doubled.

As it is, postage on fourth-class matter is greater than in other countries. Canada, for instance, permits the sending of seeds, plants, and samples for four cents a pound. The United States postal service carries these goods *en route* from Eastern Canada to the Northwestern British Provinces at this rate, while our own citizens, for the same service, are charged four times as much; and it is now proposed to make it eight times.

There is, moreover, too great a discrepancy already between rates in the different classes. Though people are not disposed to complain at a letter postage of two cents an ounce, we hope in time to see it reduced to one cent. Newspapers and magazines pay but four cents a pound, as they are properly regarded as important civilizers, and therefore entitled to legislative discrimination. Third-class matter, such as books, photographs, proof sheets, etc., the printing on which (we quote from the official bulletin) "is designed to instruct, amuse, cultivate the mind or taste, or impart general information," passes the mail censor at eight cents a pound. The fourth-class is eminently utilitarian. It is supposed to possess none of the desirable qualities recited for the third, and in their absence pays double the rate. Americans are proverbially fond of amusement, and they are also proverbially practical. But why a funny photograph or a comic song should pass the mails at half the rate charged for such useful articles as mineral specimens, seeds, queen bees, or dress goods, does not appear.

The present proposition to further burden this class of mail matter is not, as one might suppose, an effort to increase the intellectuality of the mails by limiting their contents to the instructive or amusing, but is a movement presumably in favor of the express companies. The monopoly which they formerly enjoyed has not been forgotten. At the present rates, private carriers can compete with the mails successfully in handling local business; but in case of long distances, and particularly anything approaching transcontinental carriage, the mails have so far the advantage that they carry everything which comes within the prescribed limits of weight and harmlessness.

It is, of course, an open question as to how far the Government may properly bring itself into competition with private enterprise. Our own views on the subject are very broad. If the Government can deliver our letters and telegrams, and transport our person and goods, with greater dispatch and economy than a private corporation, we are quite content that it should do so, and would regard the action as a matter for congratulation, and not complaint.

The measure now before Congress is suggested ostensibly to meet the deficiency in the revenues of the Post Office Department. During the current fiscal year this will amount to about $10,500,000, and during the coming year it is calculated that it will not be less than $9,000,000. We do not dispute the desirability of making this department self-supporting, but it does seem unwise to throw the entire weight of the deficiency upon a class already charged out of all proportion to the rest. If an increased rate is absolutely necessary, it might be distributed among the classes. But we don't believe that such is the case. Each year sees such a marked increase in the business of the department that, with the existing rates, it may safely be assumed that the income will speedily equal the expenditure, and will even warrant a further reduction in the rates.

Gutta Percha.

The extraordinary progress that has been made in electrical science within the last few years, and the consequent large consumption of gutta percha as an insulating material, has naturally caused apprehension lest the supply, owing to the great demand for it, and to the carelessness of the natives who gather it in the forests of India, shall soon give out. This has recently led to much investigation concerning the nature of the product yielded by trees of other genera (such as *Mimusops*, *Payena*, *Siderocarpus*, and *Bassia*) belonging to the same natural order (Sapotaceæ) as the percha tree (*Isonandra Gutta*). Mr. Pierre, in No. 46 (1885) of the *Bulletin de la Société Linnéenne* of Paris, has given a long list of the Sapotaceæ which grow in Annam, and which yield a juice that might, when concrete, serve as a substitute for gutta percha; but the trouble seems to be either that the trees grow too isolatedly or that their places of growth is too inaccessible. Mr. Edward Heckel, in a note presented to the French Academy of Sciences on the 11th of May last, made known to that body the possibility of obtaining a coagulable latex, similar to that yielded by the *Isonandra Gutta*, from the karite tree, *Bassia Parkii;* and in an another note to the Academy on the 23d of November, he gives the results of an examination made by himself and Mr. F. Schlagdenhaufen of the physical properties of the new product, and of its chemical composition as compared with that of gutta percha. From these researches, it appears that the two products are approximately identical. The gutta from the *Bassia* kneads in warm water with the same facility as typical specimens of commercial gutta percha, and moulds made with it are in nowise inferior to those prepared from the best quality of the last named material. The future of the new gutta for industrial purposes would therefore appear to be certain. The karite tree is very abundant in Africa, and is distributed throughout the entire basin of the Nile —a portion of the country which has hitherto been unproductive, but which now offers a source of wealth that it needs but willing hands to develop. The *Bassia* has hitherto been known only from a fatty matter of the consistency of tallow yielded by its seeds. This product, called karite butter, is used by the natives of Africa for cooking purposes, for filling their rude lamps, for making soap, for healing wounds, and as a pomatum for the hair.

The Automatic Sprinkler.

One of those admirable reports issued on occasion by the Boston Manufacturers' Mutual Fire Insurance Company has just been published, containing an account of some new tests of automatic sprinklers of various sorts, made on behalf of the Mill Insurance Companies by Mr. C. J. H. Woodbury. Architects and builders are not so much interested as mill owners in the details of the tests of each particular kind of sprinkler, but the statistics of the service performed by sprinklers in general in protecting property from fire, which Mr. Woodbury gives, are very instructive. It is about ten years since the first automatic sprinklers were introduced into factory buildings, and mainly, we imagine, through the earnest advocacy of the mutual insurance officials, they soon came into general use in such structures. For other buildings, such, for instance, as theaters, they were at first regarded as unsuitable, perhaps on account of the danger of freezing, but this prejudice is now nearly abandoned, and all the new first class theaters in this country, we believe without exception, are equipped with a full sprinkler service over the stage.

There may, however, be still some persons who regard their use as an experiment, and to such persons the statistics given by Mr. Woodbury will appear particularly important. For mills, at least, there is no longer anything of experiment in the sprinkler service. Since 1876, when the apparatus was first introduced, there have been 224 fires in factories furnished with them, and insured in the New England companies, while 631 fires have occurred during the same period in mills without their protection. No one will claim that the number of examples of each sort is not sufficiently large to afford a satisfactory test of the comparative value of the two systems, but it is rather startling to find that the total loss by all fires for nine years in the mills furnished with automatic sprinklers was less than $86,000, an average of $382 for each fire, while the losses in the mills without sprinklers during the same period amounted to $4,645,000, an average of $7,361 for each fire.

This is more than nineteen times the average loss in the sprinklered buildings, so that it is fair to infer that if all the mills had been required to put in sprinklers at the time of their first introduction, the companies would have saved $4,400,000 in nine years. Dividing this by the number of unprotected mills in which fires occurred, we have a quotient of $7,000, and as it would not probably have cost more than $2,000 apiece, on an average, to put sprinklers in these mills, it follows that the mutual companies might have furnished these mills with sprinklers at their own expense, and would even then have made a profit on the transaction of $3,000,000 in nine years, with a prospect of future profits at a considerably larger rate for an indefinite period. In the present case, the mill owners being their own insurers, the result would practically have been that they would have taken a dollar out of one pocket and put four dollars into the other, but the story has a moral for the managers of stock as well as mutual companies.

As the account shows, however, some of the sprinklers used in the mills nominally so protected were inefficient, so that heavy losses occurred in spite of their feeble efforts, and we should, perhaps, make our comparison between the unprotected mills and those furnished with the Grinnell sprinklers, which have shown themselves in 102 fires to be, perhaps, the most effective of all. In these 102 fires, all of which have occurred since 1881, the average loss has been $112.76, or much less than one-third the average loss with all sorts of sprinklers, and about one sixty-sixth the average loss by fires in mills without any sprinklers. To repeat, therefore, our comments in another way, supposing the number of mills insured in the factory mutual companies to be 2,000, if the companies had, at their own expense, put in Grinnell sprinklers in all of them in 1876, at a cost of $4,000,000, they would already have got all their money back, with $635,000 additional as interest, and would be in the steady receipt of about $525,000 a year as income from their investment.—*Amer. Architect.*

Cornwall Tin.

Dolcoath is the name by which the oldest and the deepest tin mine in the world is known. It is situated at Camborne, in the west of Cornwall. In the early part of the present century it was noted for its enormous production of copper ore, the sales of this mineral having amounted to about £5,000,000. It now produces tin only. In the interval between copper and tin, about the years 1853-55, a period in the sinking when the two minerals were so blended that they could not be separated so as to make them marketable, the whole mine could have been purchased for £3,000. The market value of the same to-day is £470,000 (4,700 shares at £100 each); so that each sum of £50 invested in it thirty years ago is now worth £7,000, and receives dividends every twelve weeks amounting to about £500 a year! The produce for some two or three years past has been forty to fifty tons of tin per week, obtained chiefly from only one of the eight or ten lodes in the mine. About 1,400 hands are employed, representing, perhaps, a thousand families; but within the last month a discovery has been made which will not only largely increase the profits—now over £100 per day —but will at once furnish employment for nearly a hundred additional workers, and before long some hundreds of families will be supported by work done on this newly opened lode of tin.

The value of the discovery is greatly enhanced by the fact that it has been made at a depth of nearly half a mile below the surface, by a cross cut from old workings at the very bottom of the mine, and the new lode is as rich as the old—so rich that any piece of ground measuring only eight yards square (cubic yards) contains more than £5,000 worth of tin, and, so far as can be judged, this marvelous deposit of mineral will be absolutely inexhaustible for generations yet to come.

These metalliferous lodes, or veins, run from east to west, and may be traced for one or two miles. The discovery is in the eastern part of the mine. Two other shafts to the westward are being sunk, and in the course of about two years, if the work is pressed on, they both may be expected to reach the depth at which this most extraordinary deposit of mineral is found, and so lay open further immense stores of tin.

In the adjoining property, still a little further west, and near the Dolcoath boundary, is yet another shaft, which has actually struck the run of tin ground which yields the Dolcoath riches.

A Model Catalogue.

One of the most practical and convenient of catalogues is the April edition of the Pope Manufacturing Company's, of Boston, New York, and Chicago, in which are illustrated and described nine Columbia bicycles and tricycles. The book is of fifty-two pages, and contains fifty-one illustrations, the mechanical drawings of the several machines, parts, and sundries being remarkable in mechanical clearness. The Columbia machines for the season of 1886 have undergone much improvement over those of past seasons, and the company has put upon the market this season five new machines, namely, a safety bicycle, a semi-roadster, a racing bicycle, a ladies' two track tricycle, and a racing tricycle. The catalogue will be sent free upon application.