Retriever steamer. The results in favor of liquid fuel showed a reduced consumption in the ratio of 2.5 or 2.7 to 1 as compared with coal; but against this economy had to be placed the cost of the separate generators and their furnaces, and of a force-pump. The retort, too, was liable to explosion, in consequence of the deposit of solid carbon within it.

The first employment of the author's system in metallurgical operations was at the Millwall Ironworks. The oil furnace was an adaptation of an old scrap-iron furnace 7 ft. square and 2 ft. 9 ins. high, having a fire-grate 2 ft. 6 ins. wide and 7 ft. long. It was fitted with bricks, and was used as a combustion chamber. Three oil injectors played directly upon the metal to be heated, lengthwise of the furnace. In August, 1871, the results of comparative experiments showed that—

The time taken to heat the furnace with coal was six hours.
 " " " by above system (five) was 5 h.
 " " " by the author's system (four) was 2 h. 6 m.

In five hours and a half—the total time occupied in making up, together with the intervals between the charges—68½ gallons of liquid fuel were consumed, being at the rate of 12½ gallons per hour; 21 piles of scraps, each of 2 cwts., were charged into the furnace, or a total of 42 cwts., while the weight of iron taken out was 37 cwts. 20 lbs., showing a loss of 4 cwts. 92 lbs., or 11½ per cent. The furnace consumed 6,720 lbs. of coal in 12 hours to keep up the heat against 1,405 lbs. of liquid fuel, showing a ratio of 4¾ to 1 in favor of the oil, the consumption of which was at the rate of 17 lbs. per hundred weight of iron. The loss of iron treated by coal was from 22 to 25 per cent., whereas with liquid fuel it was only 11½ per cent. by system four, and 16½ per cent. by system five.

The author in 1875 proceeded to Canada to experiment on the reduction and smelting of the refractory iron ores of that country, many of which were magnetic and contained 32 per cent. of titanic sand. The sole object of these trials was to prove that the Canadian ores could be successfully treated by means of petroleum as fuel. The experiments proceeded satisfactorily, and pig-iron was readily produced from the ore, though it was found that oil fuel in smelting operations must be used in connection with an air-blast under pressure. The experiments were interrupted by the severity of the weather, and not until recently had the refractory and other ores been smelted and reduced at a minimum cost by liquid fuel or native petroleum.

The results of the use of liquid fuel in Russia and other foreign countries were given in the paper, together with the conclusions of Mr. Isherwood, Chief Engineer of the United States Navy, on its employment in steamers. The author made the general deduction that although liquid fuel might be burned without the employment of steam, yet it was consumed most economically and with the best results in the presence of steam; and, of course, the more highly superheated the steam the better was the performance.

AUSTRO-HUNGARIAN HIGH GRINDING.

PROFESSOR FREDERICK KICK lately delivered a lecture before the German Polytechnic Institute, Prague, on the system of milling at the Buda-Pesth mills. He said that he did not intend to give a dry account of an excursion to the Buda-Pesth mills, stating what he saw there, but rather to give the gist of the thoughts things he had seen had given rise to.

The substance of his remarks was as follows: The first thing that strikes the observer is that the Buda-Pesth mills have in the last few years undergone altogether astonishing alterations and improvements, the most important of which is decidedly the introduction of roller mills. Although perhaps all mills are not put on so perfectly modern a basis as the Fabrikshof (Ofen-Pesth Steam Mill), yet in all large mills the stones are replaced by rollers for all stages of grinding except the ending and grinding of bran, and new middlings purifiers, particularly the Carl Haggemacher machines, and also centrifugal silk-dressing machines (the latter not universally), have been put up. The introduction of roller mills into the large mills of Pesth is in itself sufficient proof of their economic value. Granted that those large milling establishments, which in many cases each grind considerably more than 1,500 cwts. of wheat per day, have greater liberty of action in choosing and adopting new machinery, by reason of larger capital, than small mills, which do not work continually, but only do job lots, still there can be no doubt that even for smaller establishments roller mills are decidedly advantageous. In Pesth it is calculated that 10 to 15 per cent. more good white flour is made by adopting roller mills, which gives an additional value of 40 kreutzers for each cwt. of wheat. If this statement of Adolph Fischer is compared with that of Otto Müller, the latter being to the effect that with roller mills it is calculated that each indicated horse-power will grind 2.7 to 5.5 cwts. of wheat, as compared with 3.3 cwts. ground with the same power by millstones (thus showing in one case an increased and in the other a smaller absorption of power, or of its equivalent fuel), we find this grain altered in the first case to 38 kreutzers and in the latter to 43 kreutzers. This great variation in the quantity of wheat ground by each indicated horse-power is well worthy of notice, and it will therefore be further mentioned.

First of all he considered the different rolls themselves, regardless of the construction of the roller mills. Commonly speaking, by rollers are meant those with smooth faces. The action of these is, indeed, a squeezing one even then, if both the rolls have not the same speed. But the action differs totally if grooved rollers are used, such as are, for instance, employed by Ganz & Co. After comparing these chilled-iron grooved rolls with the old grooved steel rolls, Professor Kick noticed the Zipser wheat cutting machine, the favorable results obtained by the same being attributable to a slight shearing action; but in his opinion chilled-iron rolls are more durable than these, the face of which consists of toothed steel rings. As regards grooved rolls, stress was laid on the fact that they are used with better advantage in the large Pesth mills than in small mills, because in the former for each break, and for the reducing of the coarse bran, rollers may be made use of, specially grooved in point of breadth or fineness of grooves, whereas the same rolls will have to do a variety of work in small mills. After a few remarks respecting porcelain rolls, which are mentioned as not to be recommended, the speaker proceeded to the question, "How is it that roller mills can require so varying a motive force for grinding the same quantity?"

The reason he finds to be in the variable friction in the bearings, which differs according to the size of the bearings and the pressure. In small roller mills, as, for instance, the Wegmann Ganz, the Henry Haggemacher, the small Escher Wyss & Co., etc., roller mills; the loss of power thus occasioned amounts to 1.2 to 2.3 horse-power for two pair of

rollers, taking the coefficient of friction only at 0.06. In large roller mills for grinding middlings this loss of work increases to as much as 5 horse-power for one pair of rollers. The result is that the maker of the roller mill has to take this into account in choosing his dimensions and the pressure. The miller ought also to make due use of the screw regulating the minimum distance of the rollers from each other, and to work only with the absolutely necessary amount of pressure. A further consequence of the above is that the owner of small mills should avoid the roller for grinding middlings, as absorbing too much power, and rather to use the stones as heretofore for grinding the pure or clean middlings, because the roller mills for middlings necessarily require a great pressure. The principal advantage of the roller mills consists without doubt in the making of a larger amount of a good semolino and clean middlings, but whether it is profitable to grind the pure fine middlings into flour is doubtful, particularly as long as the efforts of reducing the friction have not been more successful than heretofore. As regards the various constructions of roller mills, Professor Kick remarks that generally they do not influence the quality of the flour. The old roller mills designed by Salzenberger and made by Escher Wyss & Co., having three pair of rollers, one above the other, made as good a quality of flour as modern roller mills. A proof of this assertion is the "Walzenmühle," in Pesth, and the assertion cannot be contradicted by saying that the old roller mills were unable to make their way into universal use, because the reason why the former were not more widely adopted was their extremely high price.

Against the use of the so-called reducing roller, which, being itself grooved, works against a grooved segment and loosens the meal, no perfectly justified objection can be made; for, although it is true that the bran may be sometimes ground up, still, as in that case roller and segment were made to work against each other too much, it is more the fault of the workman than of the machine. The detachur loosens the meal coming from the roller excellently well, and its work cannot be made bad by carelessness, as in the case mentioned; but this is almost its sole advantage, and it is not absolutely necessary in small mills. It is evident that, instead of a detachur, a disintegrator may be used for loosening the meal, but it is also clear that the more vehement the action the more the quality of the flour will be deteriorated. Professor Kick referred to the difference in the shade of flour made from the same pure middlings by rollers and by stones, and stated that it was a fact that flour made by the latter was of a yellower tint than that made by rollers from the same purified middlings. Rollers with differential speed give a more yellowish flour than those rollers for grinding middlings into flour which run with equal speed. Chilled-iron rollers give a more yellowish flour than porcelain rollers, and millstones which are not ventilated a more yellowish flour than those with ventilation. What can be the reason of these differences? He had heated fine yellowish wheaten flour No. 00. The experiment was made so that the flour was suspended on saucers in a hot-air bath, and the temperature carefully raised to 100° C. (212° F.), when, on being examined, not the slightest difference in the color was visible, not even by the application of Pekar's flour test. Raising the temperature to 158° C. (316° F.), the flour became a little less yellow and rather darker, but the difference in the shade of flour hardly amounted to one number. It was only after heating the flour to 200° C. (392° F.) that the well-known brown color appeared. From these experiments it is apparent that the difference of color cannot be caused by heating during the process of grinding. The same wheaten flour, No. 00, rubbed in an agate mortar in very small portions, and at a pretty great pressure, showed a decisive whiter color. Of two flours, therefore, all other circumstances being equal, the one more finely reduced will have the whiter color. How can the result of this experiment be brought into accordance with the above facts?

If the runner of a pair of millstones at work is taken up, all furrows of the bedstone will be found to be full of fine flour; the disintegration is therefore carried on on a bed of flour, and it is consequently less intense; the result is that the flour, because coarser, is more yellow. If, however, the flour is blown out by ventilation, the action of the stones is more intense, the bolster of the flour is partly removed, and the flour is more finely ground, and, therefore, whiter in color. Flour from rollers can only be made whiter than that by the stones, from the same pure middlings, through the former grinding finer than the stones, and through being better freed from the fluffy particles of middlings. It is well conceivable, and in conformity with the above statement, that the rough porcelain rollers give a whiter flour under the same circumstances than the smooth chilled-iron rollers. It seems a contradiction that rollers with differential speeds should give more yellowish flour than those with equal speeds; but this apparent contradiction is removed if we take into consideration that at present the rollers having equal speed are all worked with greater pressure than those having differential speeds. As regards centrifugal dressing machines, Professor Kick remarked that he has seen them in various Pesth mills, and that they were particularly esteemed for dressing soft middlings. Their principal advantage he considered to be the smaller space required. Referring to new semolino purifiers, those of C. Haggemacher were specially mentioned as excellent, and as being used in many of the Pesth mills. Finally, Pekar's flour test was noticed, and illustrated by an experiment.—*Oesterr. Ung. Mueller Zeitung.*

PAPER NEGATIVES.

By CAPT. W. DE W. ABNEY, R.E., F.R.S.

I HAVE for the last few months been engaged in some work in which it seemed desirable to employ paper instead of glass as a basis for the ordinary emulsion; and, after various trials, I found that the following plan answered well in every respect, more particularly as regards cleanness of the back surface of the paper, while with careful manipulation the negatives develop admirably. Ordinary smooth Saxe paper is coated with paraffine made as follows:

Paraffine 50 grs. (about).
 Benzole ½ ounce.

To which is added enough India-rubber solution made as under to bring the total quantity up to one ounce:

India-rubber 5 grains.
 Benzole 1 ounce.

To make this India-rubber solution, I have found that if bits of the black India-rubber tubing be cut up into shreds and placed in the benzole, in time it will dissolve *per se*, though sometimes it takes months to do so. If there be no hurry, this is the best method of obtaining a solution which

is free from all turbidity. The India-rubber first swells up to an enormous size, and finally passes into solution, with the exception of a small portion of apparently insoluble matter, which floats in the fluid as a gelatinous mass. This can easily be filtered out. Failing this supply of India-rubber solution, it may be made by dissolving the well-known India-rubber paste in benzole. This is never so free from specks as the last solution, but still it answers the purpose.

To prepare the paper I use a cotton-wool brush, the cotton having been previously well boiled in carbonate of soda, and then thoroughly washed and dried. Through a glass tube of about a quarter-inch internal bore and about four inches in length a loop of string is passed, and a tuft of cotton pulled partially into the bore, a good brush remaining outside. The paper is then brushed over back and front with this solution, and the benzole allowed to evaporate spontaneously. A coating of the India-rubber solution (without any paraffine) is next given to one surface of the paper, and, when dry, it is ready for coating with emulsion. The paper is turned up to form a tray, about one-eighth inch side being sufficient, and a small spout is left at the most convenient corner. The paper dish is then supported on a sheet of glass, and the emulsion poured on in the manner adopted for coating a plate; when dry it is ready for exposure.

I need not here enter into the various methods which may be adopted for placing the sensitive sheet in the proper position in the camera or the method of developing, the one being well known to calotype workers, while in the other there is no deviation from the formula usually employed. After fixing and washing, it is advisable to pass a little dilute acetic acid over the image, as this removes any tendency to a pink coloration which is sometimes observable. The image appears (usually) of an olive green tint by reflected light, while by transmitted light it is of a warm black tone. If the last coating of India-rubber be efficient, there is very little difficulty in getting excellent results. If the developer can penetrate to the paraffine there is danger of a saponaceous matter being formed, which tends, by its contact with the colored alkaline developer, to tinge the whites. This points to the fact that the pyrogallol acid solution of alkaline developer should be freshly made up, and if this be attended to the discoloration in any case will be but slight. I have produced some hundreds of negative pictures on this material, and they can be printed from without being waxed, when the subjects are not of a very small size, or when they do not possess any great minutiae in detail.

I have not tried enlargements, but it seems to me there is no doubt that they would be effective.—*Photo. News.*

A SIMPLE PHOTO-PRINTING PROCESS.

By M. GOBERT.*

THE communication that I have the honor to make is interesting to the photographer and to the lithographer. From the photographic point of view the process which I am going to describe does not constitute a novelty, since the material employed is nothing but bichromated albumen, whose photo-chemical reactions are perfectly well known. As far as lithography is concerned, the interest appears to me to have a certain importance, since it calls into play a new feature which gives an answer, at least partially, to a weighty question which cannot but occupy the attention of lithographers and printers.

It is known that the quarries which furnish the lithographic stones are not numerous, that they are being worked out, and that France has to depend upon her neighbors for stones of the first quality. The state of things is not new. It is considered grave and important by competent persons, so much so that researches and experiments have been made to remedy it by endeavoring to replace the lithographic stones by other kinds of material. I certainly have not myself undertaken the task of solving this problem, but chance photographic manipulations have brought out some very unexpected and curious results.

Common glass and plate glass, directly and without the interposition of any substance, can be used in lithography to replace the stone. It is sufficient merely to roughen the surface of the two kinds of glass, which can be best done by means of acid. It will have been remarked that ground glass is easily and regularly wetted by water, which it is almost impossible to accomplish on a polished plate. It is this property, which up till now has not been utilized, that allows drawings to be made in printer's ink upon roughened plate or common glass. The strong plates of our printing frames are perfect for this purpose.

The following is a brief description of the process:—Bichromated albumen is used, three grammes of bichromate of ammonia being added to one hundred grammes of albumen. This solution, by preference, should be filtered. Covering the plates is very easily accomplished by the very simple means which have so often been described, which goes by the name of the "tournette," or whirling apparatus. The film should be very thin. The plates, which are prepared in daylight, are placed to dry in a dark place. I recommend that they should not be prepared in advance, for they rapidly lose their good qualities. The bichromated and dried albumen becomes insoluble in 6 to 8 hours even in absolute darkness. The sensitiveness of this preparation is very great, an exposure of only a minute to direct sunlight, or four or five in the shade, being sufficient. The light produces insolubility in the albumen, and also, which is more important, a complete imperviousness to water.

Immediately after exposure, a printer's roller charged with greasy ink is passed over the plate in such a way as to give a black coating to the surface, after which the plate is immersed in a dish of plain water. Those parts not acted upon by light almost immediately dissolve, and carry with them the excess of ink; a clean, vigorous, and sharp image is developed, which adheres perfectly to the plate, and is fit for pulling lithographs from in the usual manner, taking care, however, not to use acid gum, since the least trace of acid destroys the adhesion of the albumen. The gum solutions should be absolutely neutral.

The above description shows that the process is only applicable for the reproduction of subjects executed in line. Up to the present time I have not been able to obtain satisfactory or regular photographs in shades.

In conclusion, I would add that bitumen of Judea, applied to a ground-glass plate, should also give images of great purity, and capable of being used for pulling-off lithographs; also, by drawing directly upon ground glass with solutions of gum lac, resin, bitumen, India-rubber, etc., impressions may be pulled from original designs.

* *Bulletin de la Société Française de Photographie.*