Process for Printing Photographs on the Lithographic Press.

BY HERMAN REINBOLD.

The art of printing photographs and other half-tint subjects on a type press has been brought to great perfection, and many of the best process workers are experimenting in this field, with more or less success. The writer, who has given a description of a process of this kind in one of the latest numbers of the *Lithographer and Printer*, and which was well received by the press, has lately made experiments with a process for printing photographs on the lithographic press.

The photo-mechanical processes, known as lichtdruck, phototype, artotype, heliotype, etc., and whose originator was Albert of Munich, have all given more or less good results, though it takes years and years of experience, a good knowledge of chemistry and photography, and even then accidents occur so often, the manipulations are so many, and the process is so slow, that at least here in this country it could not be made a paying business as yet. In Germany lichtdruck is more generally used, and most of the work is printed on the steam press, of a construction expressly made for that purpose.

The principle upon which the photo-mechanical processes is based is that of the action of the light on chrome-gelatine, which, after being exposed to the light, attains properties like those of the lithographic stone. The trouble of these processes is, and always will be, the difficulty of making the gelatine film stick to the glass or metal or stone; and the softness of the film makes it very subject to accidents.

After a number of impressions the film is hurt by the pressure, the prints get flat, the ink is taken up unevenly, afterward the gelatine gets holes and bubbles, and the washing, which has to be done very often, finally spoils it entirely. Therefore with the greatest care only a limited number of good impressions can be taken from one plate.

All efforts to do away with the gelatine have proved to be unsuccessful; and though various substitutes have been mentioned, none of them was satisfactory. The lithographic stone has not a fine enough grain to print a photograph directly on it, as it is done in photo-lithography, and therefore the gelatine is used exclusively either on glass or metal, generally copper.

The writer has made many experiments with gelatine, and his aim was to do away entirely with it, and finally he succeeded in this. The following lines give an exact description of it. It is well known that the process of photography is an electric one, the light having the effect upon the bromide and iodide silver combinations to produce an electric current, which decomposes the silver salts, thereby precipitating the silver as a black, fine powder. Of course, the stronger the light has acted, the more of the salt is decomposed, and thereby the photographic effect is produced. Now, the electric nature of the photographic process can be successfully used for half tone printing in lithography.

A perfectly level zinc plate is polished with fine pumicestone powder and water, until no more scratches are visible. This plate is then amalgamated with mercury by laying it into a pan containing the metal for a few minutes, during which time it is rubbed over with a soft camel's hair brush. When taken out, the little drops of quicksilver adhering to the surface are removed and the amalgamation is quite even, which can be readily seen, as the zinc must look like a mirror; the plate should be kept free from dust before used. In order to prohibit the mercury to dissolve or amalgamate the back side of the plate, it may be covered with asphaltum or varnish.

The plate is now ready to be coated with the sensitive collodion. It is coated in the dark rooms like a negative glass plate with positive or so-called chloride of silver collodion, and dried.

After this it is exposed under a negative from one to four minutes, according to the strength of the negative and the light; but it should never be exposed to full sunlight. Of course it takes some experience to get the right time of exposure, and for the beginning a Vogel photometer may be used with advantage.

In the dark room the picture is developed in the same manner as a glass negative, and cut with hyposulphite of soda and washed. Dry in a heat of about 120 degrees. It will be readily understood that the silver precipitated by the action of the light will form an amalgam with the mercury, while at the other places the mercury will remain intact.

A mixture of two parts of alcohol and one part of ether will dissolve the film, leaving the metals combined.

Zinc has the property to be saponified in the presence of an acid and an alkali, thus prohibiting grease or resin to stick to it. This property has already been used in lithography, and in Europe a great many firms use zinc instead of lithographic stones, both on account of its cheapness and ease of handling it. But the salts used now to bring about saponification are not strong enough; and where the grain is very fine, the plates and prints get soon blurred.

This is due mostly to the resin and acid which the ink contains, and which of course neutralize the alkali. Lately a salt has been discovered by which this difficulty is entirely overcome, and which makes enough zinc soap alkaline to print an almost unlimited number of prints from the same plate without the least difficulty. This chemical is aluminum palmitate $(C_{16}H_{32}O_4 + AlO_2)$. One three-thousandth part of it added to benzine is enough to saponify this liquid into a solid body, which will not take any grease or ink.

A bath is made of 90 per cent alcohol and 10 per cent palmitate of aluminum. After having the zinc plate put into a 5 per cent sulphuric acid fluid for a moment, and have it dried, flow the plate with the above bath. When the alcohol is evaporated and the plate washed once more to remove the alumina, the plate is ready to be printed from. No etching fluid or gum is necessary, but it should be washed and wetted just like the stone. If the plate should show a tendency to blur after a number of prints, put it into very weak acid, and afterward in the bath weakened with 25 per cent alcohol. If this does not make it better, the plate was over or under exposed, or the zinc was not clean.

The plate in its appearance is quite level; the light parts are grained, while on the high parts it looks as if polished. The grain obtained in this way is so fine that, it can hardly be seen with the naked eye, and if printed with a photograph tint ink, will make prints equal to the best lichtdruck. Any number of prints can be taken from one plate. The plates cannot be saved, as the action of the oxygen in the air destroys the properties of the chemical combination in a few weeks. Therefore the plates should be used immediately after made. The success depends largely on the negative, like all processes where photographs are used for reproduction.

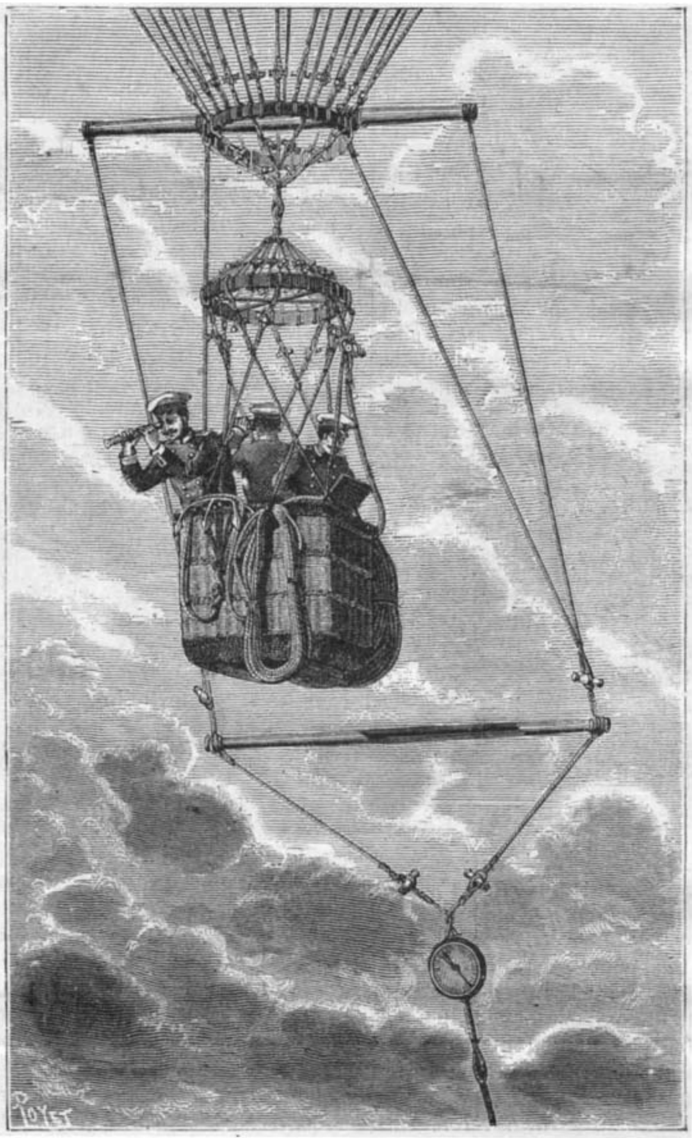

Fig. 1.—CAR OF A MILITARY BALLOON.

CAPTIVE BALLOONS FOR ARMY USE.

Some of the military powers of Europe, desirous of an aerostatic plant, and after more or less successful experiments, have been obliged to have recourse to France, that is to say, to the true country of balloons, for the construction of their apparatus. Mr. Gabriel Yon, an old companion of Henri Giffard in his steam balloon experiment of 1855, and the constructor of the Dupuy de Lome screw balloon, as well as of a large number of postal balloons during the siege of Paris, has studied and brought out a system of transportable, captive balloons, for which he has successively received large orders from the Italian and Russian governments. In this the former has priority, and the first captive balloon of Mr. Yon's make, provided with his hydrogen gas apparatus and windlass for ascents and descents, was experimented with at Rome by him and the officers of the Italian army. At these experiments, which took place last July, the Italian Minister of War was also present. The success was complete, and, owing to the results obtained, the Russian Government ordered from Mr. Yon two sets of the apparatus. One of these was recently tested at the Flaud Works, in the vicinity of the Champ de Mars.

As we were present, we shall describe these new and interesting aerostatic apparatus. We shall study in succession the three distinct and independent parts of which they consist, viz.: (1) the balloon, (2) the gas apparatus for inflating it, and (3) the windlass for maneuvering the ascension cable.

The balloon is of Chinese silk, and is of 19,425 cubic feet capacity. The netting is made of Naples hemp. The fabric of the balloon is rendered impermeable by ordinary balloon varnish, having boiled linseed oil as a base. The netting and cordage are covered with a preparation having catechu for a base, in order to preserve them against the action of dampness. The upper and lower valves are of wood and metal combined, and their tightness is perfect, the joint being formed under spring traction, through the pressure of metallic bars upon a band of elastic rubber. The upper valve is seen from above, in Fig. 2, where the four traction springs are clearly shown.

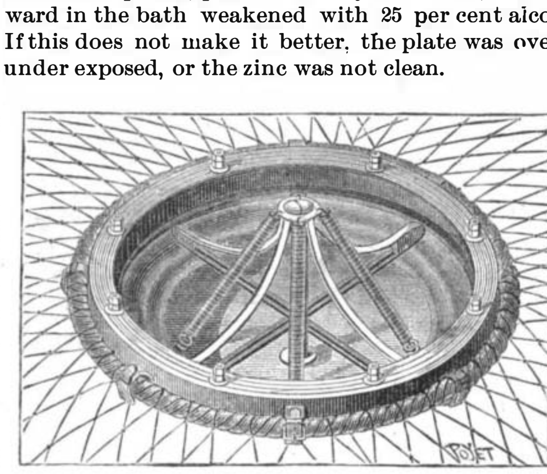

Fig. 2.—UPPER VALVE.

The suspension of the car is very happily carried out. Its connection with the netting occurs at a central point, that allows the balloon to assume all the inclinations possible without moving the car from a vertical position, such a condition being indispensable for the success of the observation. The car, as shown in Fig. 1, is freely balanced between two suspension trapezes that are well combined.

A dynamometer, which connects the ascension cable with the entire affair, permits of measuring the ascensional power at the moment of starting, and of knowing at each moment of the ascent the traction that the balloon is exerting upon the cable. This latter is 1,600 feet in length, and around it is wound an insulated copper wire that permits the officers below to be in permanent telephonic communication with the observers in the car.

The devices for arresting motion, such as the brake-rope and anchor, which are for use in cases of free ascent, are very strong and efficient.

The balloon is inflated by means of a continuously operating hydrogen gas generator. The apparatus in which water is decomposed by iron and sulphuric acid is mounted upon a four-wheeled carriage, which may be easily drawn by two horses (Fig. 3). It consists of a boiler plate generator, lined with lead to prevent the action of the acid upon it, and surmounted by a cylinder for the reception of the iron filings. The whole is hermetically closed by a cap and bolts. The requisite water and acid are distributed automatically, in proper proportions, by pumps actuated by a small steam engine. The steam is led by a large rubber tube, which connects with a boiler that we shall presently speak of.

On making its exit from the generator, the gas passes into a purifier, wherein it bubbles up through water which is continuously renewed by a special pump actuated by the connecting rod of the motor. After this, it traverses two driers, which contain caustic soda and calcium chloride. The two driers are shown to the left in Fig. 3. To one of them is seen adapted the movable pipe, D, of varnished canvas, which leads to the balloon.

The residuum of the reaction, consisting of a solution of iron sulphate, flows to the exterior of the generator through a pipe, A, adapted to a siphon. The pipe, B, permits the water in the purifier to flow out in the same way. The pipe, C, beneath the carriage runs to an external reservoir of water. On a campaign, the feed pump takes its water from a spring, pond, river, or other source.

The weight of the gas apparatus, mounted upon its carriage, is 6,300 pounds, and the production of hydrogen is from 8,800 to 17,600 cubic feet per hour of effective running.

The steam windlass for maneuvering the ascension rope is likewise mounted upon a four-wheeled carriage (Fig. 4). It comprises a vertical tubular boiler of the Field type, which furnishes steam to a two-cylinder motor that actuates a shaft whose cranks are at right angles. Upon this shaft is mounted the system of gearings that actuates the traction pulleys. The cable, upon unwinding from the drum under the driver's seat, runs through this mechanism, and is finally connected with the balloon through the intermedium of a universal motion pulley at the upper part of the carriage. This pulley yields to all the inclinations of the cable, as in Giffard's system of captive balloons. The mechanical part is rendered complete by an air brake, which moderates the velocity of ascension, and by a safety brake for stoppages.

The entire mechanical portion, complete, weighs 5,100 pounds, and the effective power capable of being developed by the motor is that of five horses, upon the piston indicator.

In addition to the two carriages and apparatus just described, there is a third carriage for the reception of the folded balloon and its car and accessories. This car, with its appurtenances, weighs 4,840 pounds. A complete aeronautic plant, consequently, weighs 16,500 pounds, distributed between three carriages. The supplies necessary for inflating the balloon and running the engine, that is to say, the iron, acid, and coal, may be placed in the ordinary baggage wagons of an army in the field.

The experiments with the Russian plant last September were a perfect success, and ended with a free ascension by Mr. Yon, his pupil Mr. L. Godard, Jr., and General Boreskoff, of the Russian Engineer Corps. Grand Duke Vladimir, having been informed of these experiments, has become deeply interested in aeronautic affairs, and we believe that, owing to his recommendation, the government of the Czar is about confiding to Mr. Yon the construction of a steerable steam balloon designed for the study of aerial torpedo warfare.

The importance of the long neglected balloon is today being everywhere recognized. Its utility, from a military standpoint, was so well demonstrated by the aerial postal service during the siege of Paris that all nations are desirous of having an aerostatic equipment. Following France, England and Germany have organized captive balloon services, Italy and Russia are following their example, and, before long, other countries will be pursuing the same course. Captive balloons for observation may, in certain cases, secure a victory by informing the general in chief as to the strength of the attacking corps and as to the maneuvers they are performing.

How much service would such balloons have been able to render France during the war of 1870, while the enemy was so skillfully hiding its movements!

At a few hundred feet altitude, when the weather is clear, it is possible for the aerial observer to take in an immense panorama, and see everything beyond hills and forests.—*La Nature.*

A SIMPLE recipe is given in *L'Illustration* for making luminous paper. The composition consists of forty parts ordinary paper pulp, ten parts water, ten parts phosphorescent powder, one part gelatine, and one part bichromate of potassa. The phosphorescent powder is composed of sulphides of calcium, barium, and strontium, well ground and mixed together. The bichromate of potassa acting on the gelatine renders the paper, which is manufactured in the ordinary way, impermeable.

Preservation of Torpedo Boats.

The English Admiralty, having taken into consideration the special character both of the hull and machinery of first and second class torpedo boats, have issued a series of regulations for their more effectual preservation. After reminding officers in charge of the craft that they are built of very thin steel—only one-sixteenth inch thick—and that the utmost care is required in their management, their lordships order that no portion of the hull should on any account be devoid of paint or other anti-corrosive composition in good condition. The bottoms of all torpedo boats in the reserve which are not in use are to be coated with red lead only, and not with experimental composition. Whenever practicable, the boats are to be hauled up or docked for examination every two months, and the interval between such examinations is never to exceed four months.

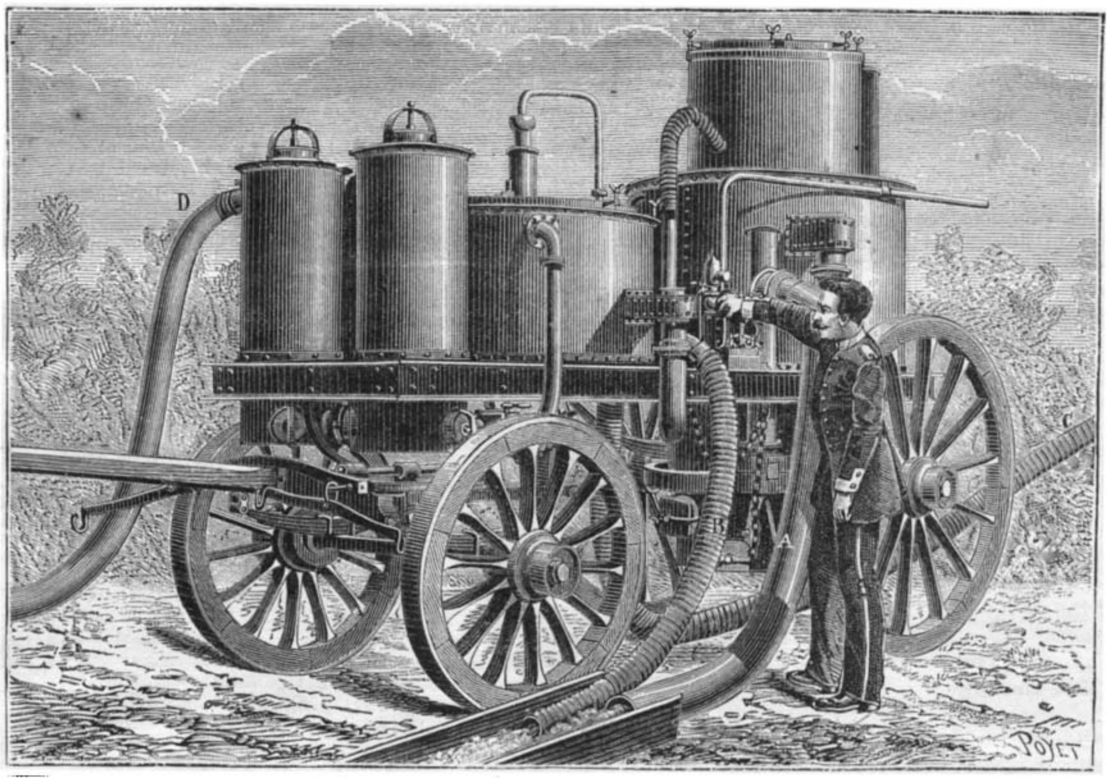

Fig. 3.—HYDROGEN GAS APPARATUS.

In order to reduce the amount of corrosion to a minimum, should any of the inside of the vessel be bare of paint or composition, pieces of zinc are to be placed on the inside of the vessel, as low down as possible, so as to be immersed in bilge water, should there be any. The zinc should be in metallic contact with the frames of the vessel, or other parts of the structure if preferred, and the arrangements should be made under the advice of the Admiralty chemist.

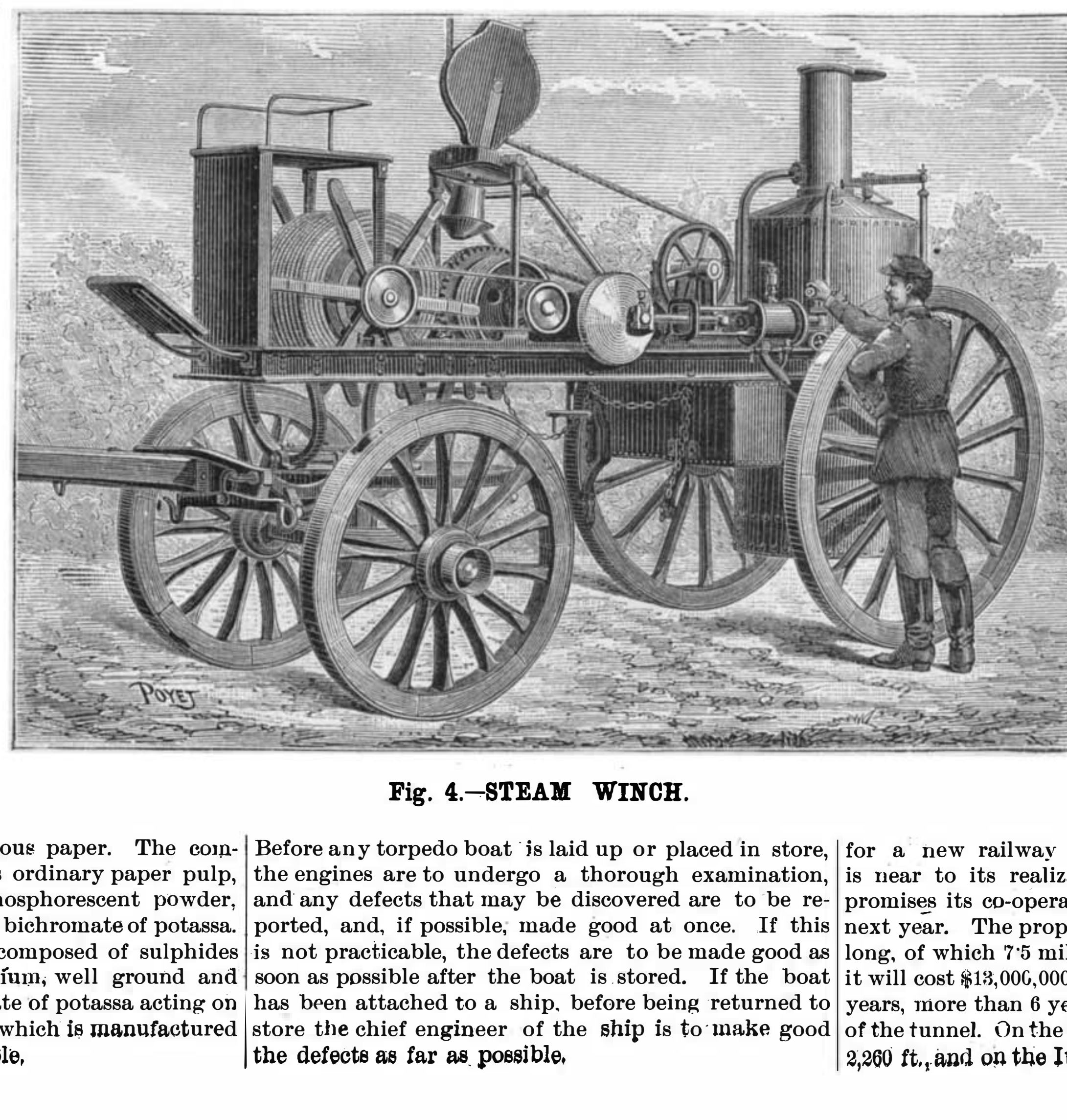

Fig. 4.—STEAM WINCH.

Before any torpedo boat is laid up or placed in store, the engines are to undergo a thorough examination, and any defects that may be discovered are to be reported, and, if possible, made good at once. If this is not practicable, the defects are to be made good as soon as possible after the boat is stored. If the boat has been attached to a ship, before being returned to store the chief engineer of the ship is to make good the defects as far as possible.

The engines are to be thoroughly disconnected; the whole of the working parts are to be cleaned and oiled and readjusted. The internal parts are to be drained out, and all the doors and covers are to be so left that periodical examinations may be made of the interiors. The after part of the propeller shaft is to be withdrawn, so that it may be cleaned and oiled, and the stern tube is to be drained out and painted, or otherwise put into a state of preservation before the shaft is replaced. The engines are to be turned several times every week, the boiler is to be thoroughly washed out with fresh water, and the chief engineer is to superintend the examination, and see that the firebox and tube plate are properly gauged, to ascertain if they have received any injury during the time the boat has been under steam. The safety valve and all other boiler mountings are also to be examined, but the safety valve spring is not to be screwed down. After being washed out, the boiler is to be gently warmed to a temperature well above that of the atmosphere, and then closed and kept so.

If unslaked lime can be readily obtained, a small quantity in suitable pans is to be laid on the top of the tubes before closing up the boiler, but the boiler is not to be kept open more than a day or two for this purpose. The bilges are to be cleaned and the bunkers cleared of coal, and the interior of the boat is to be examined throughout, the lining of the bunkers being removed for that purpose if necessary.

Any damage to the paint work is to be at once repaired, and the boat is to be put in every respect in as good a condition, both as regards her machinery and her cleanliness, as when she was issued from store. The Admiralty have authorized some important experiments to be conducted at Portsmouth, with the object of determining the value of liquid fuel for the use of ships of war.

There are various systems before the world, but the particular system which is to be tried is that of Baron Adelsward, which has been largely introduced into the French navy. The coal oil is placed in a tank, where it is raised to a high temperature by steam from the boiler. It is then allowed to pass to the furnace doors, where it comes into contact with a jet of steam and is driven into the furnace, which has been previously heated in the usual way. The inventor claims that his system is suitable for the propulsion of armor clads, but the experiments at Portsmouth will be confined to No. 22 torpedo boat, one of the boats of the largest type, which have lately been received from Messrs. Thornycroft. Should the trials prove successful, there can be little question of the superiority of the liquid fuel over coal for consumption in these small craft, quite apart from the question of economy. In the first place, there will be no stoking required, thus enabling the complement on board to be reduced, and in the next place there will be no necessity for the use of forced draught and the arrangement of fans by which it is produced. These are important advantages when the confined space below deck in the torpedo boats is considered.

THE project of excavating a tunnel through Simplon for a new railway between Italy and Switzerland is near to its realization. The Italian government promises its co-operation, and the works will be begun next year. The proposed railway line will be 32·6 miles long, of which 7·5 miles will pass through the tunnel; it will cost $13,000,000, and its completion will take 10 years, more than 6 years being required for excavation of the tunnel. On the Switzerland side the tunnel will be 2,260 ft., and on the Italian, 2,036 ft. above the sea level.