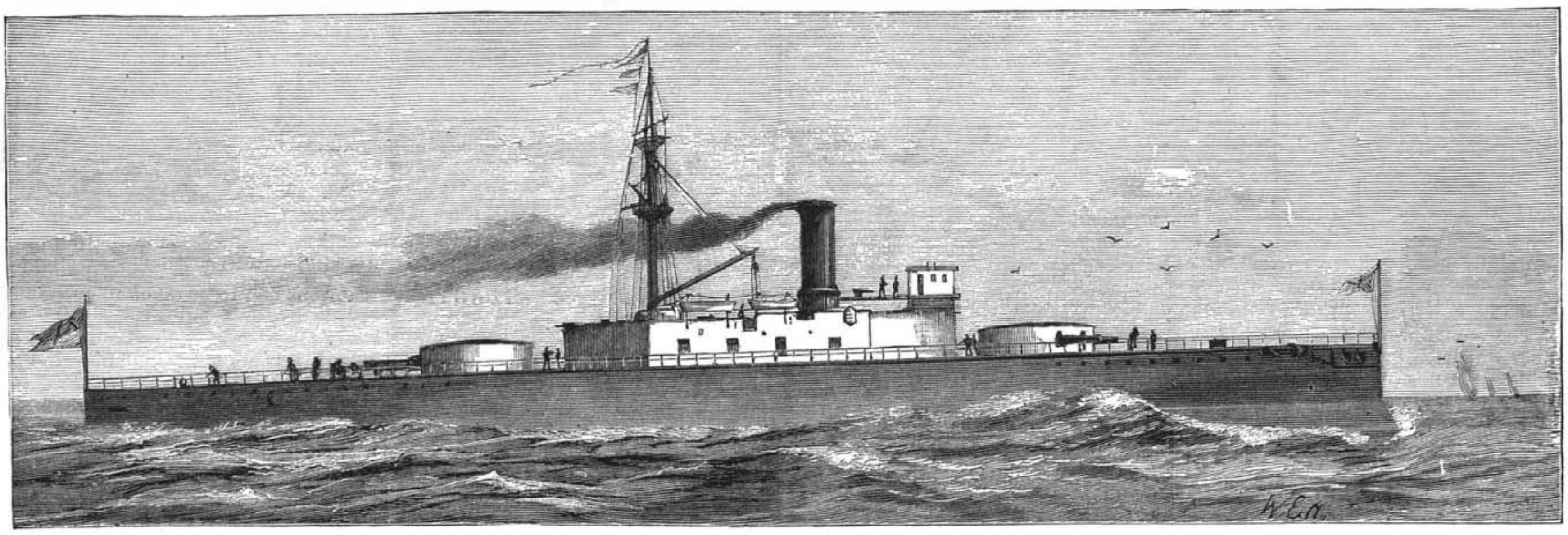
H. M. S. TRAFALGAR.

This great turret ship, whose construction was begun at Portsmouth as recently as January, 1886, was launched September 20. She takes rank as the largest armorclad yet constructed for the British navy, her displacement when she is fully ready for sea amounting to nearly 12,000 tons, or rather more than that of the Inflexible. Her horse power is 50 per cent greater, and consequently her anticipated speed, 16½ against 14 of the older vessel. The Inflexible is 320 feet in length, 76 feet in breadth, her hull is built of iron, and her cost, completely armed, 810,000*l*. The Trafalgar is 345 feet in length, 73 feet in breadth, her hull is built of steel, and she will cost 920,000*l*. How one regrets the old days of "wooden walls," when such a sum would have sufficed for the construction of a whole fleet, instead of being sunk in a single ship! Launching and being ready for commission are two very different things. The Trafalgar will not be fit for sea, that is, with guns, stores, and crew all on board, till some time during 1890. Her armor alone weighs 4,230 tons, and very little of that is at present on her. Her principal armament will consist of four steel breech loading 67 ton guns, two being in each turret. These guns will be worked by hydraulic power. Besides these she carries in the box battery eight five inch breech loading guns. Of quick firing artillery there will be eight six pounder Hotchkiss guns and eleven three pounders. She will also be provided with torpedo tubes, and has a cast steel ram on her stem. Among other arrangements tending to the security of the ship, the Trafalgar is provided with an extraordinary number of water tight compartments. Her hull is sectionalized by twenty-seven bulkheads, rising through the several decks, and the decks themselves serve to multiply the number of compartments, so as to give the ship the greatest power of flotation when damaged below the water line, whether by shot, torpedo, or ram.—*London Graphic.*



H. M. S. TRAFALGAR, THE LARGEST IRONCLAD IN THE BRITISH NAVY, LAUNCHED AT PORTSMOUTH SEPTEMBER 20.

Carrier Pigeon Service.

Steps have been taken in nearly all European countries to establish military communication by means of carrier pigeons in time of war. England, France, Germany, Belgium, and Italy have definitely organized military carrier pigeon services, and some have subsidized the private training establishments, with the right to use the pigeons in war.

This method of communicating originated in China, or, at least, in the East, and it was most likely in use by the ancient Arabians. William of Orange and Napoleon I. used these messengers during their wars; but the greatest service was that rendered in 1870 between Paris and Tours.

During the siege of Paris, 150,000 official dispatches and about one million private communications, representing a money value of about $38,000, were conveyed by these pigeons. In this case the messages were reduced by microscopic photography, so that a tiny piece of silk paper, 1¾ inches long by 1¼ inches wide, could contain 3,500 messages of 20 words each, or 70,000 words. The total dispatch thus arranged weighed at most less than one-quarter of an ounce, and was secured by a light thread to the tail feathers of the pigeon. Upon arrival the dispatch was removed, enlarged by photography, and deciphered.

A large percentage of the birds are lost either through birds of prey or other misfortune, and it is necessary to send many duplicates to insure delivery of a dispatch. In one case 80 per cent of birds were lost in a short period, as Wurzburg, where 3,000 birds were sent out and only 600 were recovered.

The greatest attention to training carrier pigeons is paid in Belgium, and that government subsidizes this industry most liberally, in order to utilize the private establishments in case of war. The English government has done likewise. In Germany the war department possesses 6,000 carrier pigeons, and has the right to use 100,000 birds belonging to the carrier pigeon postal society. A law was passed in France, July 15, 1885, stipulating the enrollment of all private carrier pigeon training establishments, to be available in case of war.

The results of observations have caused a great deal of misconception about the nature of these birds. The best known ornithologists and carrier pigeon trainers hold contrary views and indulge in heated controversies.

It is, however, well established that carrier pigeons, like all high-flying birds, have keen eyes and also possess instinctive sense of direction, but many agree that they have a peculiar feeling, or exercise reason to a certain extent.

An Italian engineer states that in order to see a distance of 165 to 186 miles between two points on the earth's surface, it will be necessary to ascend to a height of 6,000 meters (19,680 feet); but whereas this distance is frequently covered, yet, if a pigeon is sent to a height of 4,000 meters (13,120 feet), it would lose its power to fly and drop lifeless to the earth.

The fundamental theory of the flight of these birds is not yet established, and it will be no easy task to ascertain the true scientific conditions. Ordinarily, the birds are carried in a closed vessel to the place whence they are to fly back home, and the whole secret of carrier pigeon service depends upon the attachment of the pigeon for its home, no matter how distant that may be. They do not always find their homes, but always endeavor to do so, and it has happened that birds have returned to their home roost after an absence of years. The birds are first trained for short flights, and then to take longer distances, in order to train them both to fly and to learn how to find their way home. In flying, the bird is indefatigable, and travels both day and night, without ceasing, unless overcome by hunger. The speed of an average pigeon is estimated at about one thousand yards per minute.

Certain reports from Italy state that especial attention is paid to training carrier pigeons in Parma, Modena, Reggio, and other places where there are carrier pigeon societies. The military carrier pigeon stations are most efficiently arranged, though they have only been introduced in Italy for military purposes during the last ten years. The first Italian military carrier pigeon station was established at Ancona in 1876, which was followed by that at Bologna in 1879. During the grand field maneuvers of the Italian army in 1882, this service was carried on so successfully that twelve military carrier pigeon stations were established, to embrace all parts of the kingdom. A correspondence was carried on between Italian army detachments at Umbria and Bologna, separated by an air line distance of about 135 miles. Forty-two carrier pigeons were sent, all but three of which returned in the following times:

12	pigeons	returned	in	3	hours	and	12	minutes;	rate	42	miles per hour
10	"	"	"	3	"	"	57	"	"	$34\frac{1}{3}$	" " "
14	"	"	"	3	"	"	57	"	"	$27\frac{1}{4}$	" " "
2	"	"	"	5	"	"	18	"	"	$25\frac{1}{4}$	" " "
1	"	"	"	7	"	"	45	"	"	17	" " "

3 of the pigeons failed to return.

In the table the time given is the average for each group of pigeons; the greatest speed was attained by one of the first 12, which returned in 2 hours and 55 minutes, or at the rate of 46⅓ miles per hour.

The most remarkable of recent experiments was made in 1885, between the city of Rome and Maddalena Island, a distance of 178 miles in an air line, 149 miles of which were across the sea. The birds were carefully trained, in stormy and fair weather, to carry messages across the sea, and some of them performed the journey at the rate of 45 miles per hour. Two-thirds of the birds sent from Maddalena arrived at Rome in times varying from 4 hours and 50 minutes to 8 hours and 18 minutes; and the first arrival reached Rome before the cablegram announcing their flight from Maddalena Island. Only two-fifths of those sent from Rome reached Maddalena Island, which was doubtless owing to insufficient training.

Experiments with sea voyages for carrier pigeon services have also been made at the Cagliari naval station, which was established to reconnoiter the seas. Birds have covered the distance to Naples, 280 miles, in 9 hours. The longest voyage made in Italy was from Turin to Ancona, 310 miles, which the pigeons performed in the rain in 10 hours and 3 minutes. These experiments and strategical considerations have led to adoption of a limit of about 155 miles as the maximum distance between Italian military carrier pigeon stations.

A most interesting experiment was made by Mr. J. Wagner, of Boston, Mass., who sent 9 carrier pigeons to London by mail steamer on October 9, 1886. Shortly after their arrival they commenced their long flight home across the Atlantic Ocean. Up to January 10, 1887, three of these birds had returned; one arrived in Boston direct from London, the second was recovered near New York City, and the third was found in the Allegheny Mountains in Pennsylvania. The owner's address was painted on the birds' wings, and when they were found, the birds were returned to the owner. The other six birds were not recovered.

All kinds of experiments have been made to ascertain to what extent correspondence can be carried during rain, fog, snow, contrary winds, and in storms, and then to ascertain how the pigeons would cross ranges of mountains, especially the Alps, all of which have resulted satisfactorily. If the earth is covered with snow the pigeons will only make short flights, and in stormy weather they will stop on their journey until the weather moderates.

In cold climates only short journeys can be performed in winter, in which season it will be also necessary to provide stopping places or relays, even in southern stations.

The latest experiments in training pigeons have resulted in making the pigeons both go and return. This feat has been successfully accomplished in Germany and France.

In case of necessity the pigeons can be domiciled at a station in about twelve days, at the expiration of which period they will be available for messenger service.

The value of carrier pigeon service, in case of war, is being more and more appreciated, especially as the cost of the service is so small, and further developments may be confidently expected.

The successful flights across the seas render the use of carrier pigeons to convey messages from ships in distress to life saving stations, or to ports from whence assistance may be sent, extremely probable in the near future.—*Public Service Review.*

Effect of Electric Light on Books.

The *Revue International de l'Electricite* observes that Professor Wiesner, of Vienna, has drawn attention to the discoloration of books in the Technical School library, due to the use of the electric light. A large number of the works have become very yellow, and the director of the school requested Professor Wiesner to ascertain the cause. Experiment has shown that the discoloration is due to the action of light upon the paper containing ligneous substances, such as wood, straw, and jute. When the lignine is removed by chemical means, the effect is not produced. The yellowing is said to be due to a phenomenon of oxidation. Ordinary dispersed daylight exerts very slight action, especially in a dry room. On the other hand, the arc electric light and all intense, luminous sources emit numerous refrangible rays, and these favor the yellowing. The same process of yellowing we know takes place when papers bleached with certain substances are exposed to strong sunlight.

Slopes for Cuttings and Embankments.*

In rock cuttings, many instances may be adduced of the sides of excavations differing very slightly from the perpendicular, while the corresponding embankment may have slopes of about ¾ horizontal to 1 vertical. Excavations in chalk are commonly made (when the chalk is solid) with slopes varying from ¼ to 1 to ½ to 1, the slope being increased when the material is loose. Embankments in chalk may have slopes from 1 to 1 to 1½ to 1. Excavations in gravel will stand sometimes at a slope of ½ to 1, but more frequently at 1 to 1. Excavations and embankments in strong sand will stand at inclinations rather greater than in gravel. Embankments of gravel, if good, will stand well at 1¼ or 1½ to 1.

Very few clays can be trusted, either in excavation or embankment, at a less slope than 2 to 1. Both quicksand and peat require the aid of draining before excavation is practicable, and the great quantity of earth which they invariably swallow up renders the formation of an embankment upon either a work of great difficulty, unless the surface to be covered is previously prepared by means of fascines or hurdles to support the superincumbent mass. In materials of a rigid and unyielding character (such as rock and chalk), the practical limit to the depth of a cutting, or to the height of an embankment, goes far beyond that point at which a tunnel or viaduct would be more economical. In such materials, too, it does not become necessary to augment the inclination of the slopes with an increased height of embankment or depth of cutting, a step which is essential in soils of a yielding character, and becomes more necessary in proportion as the rigidity diminishes.

In yielding soils there is a limit of safety in the height of embankments and the depth of cuttings. The reason of this is obvious; the rigidity of an unyielding soil will admit of mass lying upon mass, like a wall, until the height becomes so great as to crush the base by the superincumbent weight; while a yielding soil has not sufficient tenacity to support its own weight to any great height, but sinks down bodily and spreads out at the sides. Gravel or sand will not, in general, permit with perfect safety a cutting of much above 70 feet to 80 feet in depth, or an embankment much exceeding 50 feet or 60 feet in height; and in clay the limits of safety are far more contracted. In some cases an embankment may be carried to a much greater height than it otherwise could, by forming it in several lifts above each other, and thereby allowing time for the weight to settle gradually, and to distribute itself equally over the base. The spreading of the foot of the embankment may be frequently prevented by cutting steps in a portion of the subsoil, and punning up a footing of some more rigid soil, in the form of a revetment. The consideration of the variable law which regulates the slopes required in yielding materials according to the depth of the cutting or the height of an embankment (increased height or depth requiring increased inclination of slopes) may, perhaps, fairly lead to the conclusion that where the height or depth is considerable the inclination of the slopes should not be in a regular, straight line, but rather in a curve, so as to have the greatest inclination at the bottom, where there is the greatest pressure, and the least at the top. This system would approach nearest to the analogy of nature, where rigid angular lines are found only in the unyielding rocky crags, while all the slopes of the more yielding soils are undulating.

Fire from Nitric Acid.

There was recently a prosecution before one of the Prussian courts of the agent (one Lack) of a banking house in Berlin, for jeopardy caused to a train of railroad cars. The main question was whether fuming nitric acid could, under the circumstances, occasion spontaneous ignition—which, after hearing the sworn testimony of the court's expert chemist, Dr. Jeserich, was decided in the affirmative. The agent had sent ten kilos (22 lb.) of fuming nitric acid from Berlin, intended for some point in Bavaria, per railroad. The acid was contained in a strong stone jar, tightly closed by a stone stopper and cement. The whole was packed in straw within a wooden case. Since such caustic and dangerous liquids would not be transported by railroad as express freight, the contents of the box were represented to be clothing, and by this means the concealed acid was sent by a passenger train. During the journey, and when near the station Butterfeld, the car containing the express freight was discovered to be on fire.

Before the flames had made serious progress, the car was uncoupled and switched off on a side track, and the fire extinguished with comparatively slight damage, and no person was injured. Examination showed that the jar had leaked, and the acid had come in contact with a roll of woolen cloth, whereby the latter was set on fire. Dr. Jeserich gave it as his opinion that all woolen goods, and all hair of animals, horn, etc., have the property of igniting spontaneously when coming in contact with fuming nitric acid; and he stated that all the new explosives, about which there has been so much said and written lately, such as roburite, melanite, etc., are due to the action of nitric acid on hair and wool. Herr Lack, the agent who made the misrepresentation about the acid, was condemned to two months' imprisonment.—*All. Vers. Presse, Berlin.*

* Sir C. H. Gregory, in London *Architect.*

A WATCH CAMERA.

Numerous ways have been invented to compress the essentials of a photographic apparatus into a compact space, that its true character may be concealed, but we call to mind none more effective for this purpose than the watch camera illustrated herewith, which comes to us as an English invention, made by William J. Lancaster, of Birmingham, England.

A substantial watch case, presumably about the size of the well-known American Waterbury watch, is provided with two hinged covers arranged to fly open in the usual way, one protecting the back and the other the front of the camera. The bellows of the camera may be made of rubber or in the form of a volute spring having flanges on the back of each convolution to make it light-tight when extended.

On the front is secured a suitable lens of the wide angle type. Arranged on the interior of the bellows is a cone-shaped spiral spring. On releasing the catch of the cover, the latter flies open, while the spring on the interior of the bellows at the same time extends it forward ready for use, as shown in Fig. 1. In the body of the watch are two spring-hinged doors, which act as shutters and are held closed by a small L shaped catch formed on the end of a short pin, which is operated by the fingers on the outside edge of the watch. The sensitive plate is held in a rectangular pocket just back of the shutter doors, by pivoted buttons, and is protected from light by the back cover. The plate is inserted and removed in a non-actinic light.

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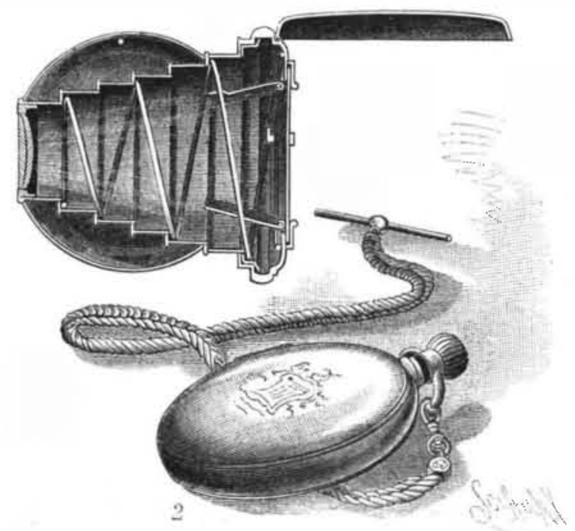

IMPROVED WATCH CAMERA.

In operating the camera, supposing it to be filled and closed, as shown in Fig. 2, we simply hold the watch in a vertical plane with the front cover side toward the object and release the catch, which allows the bellows behind the cover to extend. When ready to capture the picture, the shutter catch is released, allowing the shutter doors, by means of a peculiar mechanism, to instantaneously open and close and thus make the exposure. By carrying a small thick cloth bag not much larger than a boy's marble bag, closed at the mouth by an elastic, it is possible to remove the exposed plate from the camera in daylight and insert a fresh one. After exposure the plate is developed in the usual way. It will be seen that only one picture can be made at a time, and some device for changing the plates is necessary to make the apparatus of value. The inventor states that the same principle of construction is applicable to other peculiar novel forms, such as cigarette cases, match boxes, purses, lockets, and charms.

By means of other special attachments, we see no reason why a genuine timepiece may not be combined with the photographic watch in such a way that a race horse can be instantly photographed at the same moment the stop movement of the watch is manipulated. Thus the time and picture of the horse can be recorded at the same instant. Cannot some ingenious American inventor perfect this idea?

Vaporizing Sulphur for Red Spider.

The vaporizing of sulphur for the destruction of red spider is largely practiced by one of the leading grape growers in the following manner for market. The pipes are thickly covered with pure sulphur, and are then heated to their highest possible capacity, the fires being hard driven all night. The house becomes so charged with sulphurous fumes that the attendant cannot remain in it for any length of time. This is repeated for three or four nights in succession. I may mention that this remedy is only employed when the spider attacks with such persistency that a jet of water thrown violently from the hose on the foliage has not the desired effect. The grower in question affirms that no harm ever comes of such a lavish use of sulphur, and I know that his houses of Alicantes are second to none in the country. This was confirmed by the attendant, who informed me that he has used in one season thirty-two pounds of sulphur for a house one hundred feet long. It is worthy of note that this individual is a grape grower by birth. He comes of a family which comprises seven well-known market growers. His father was one of the cleverest grape growers around London. So that we have the guarantee that this strong sulphur remedy is the result of careful observation extending probably over nearly half a century. Many of the operations of our best market growers are of a hole-and-corner description. Practiced by one or two individuals, they are jealously guarded, and it is only now and then that a ray of light is let in on them. The method of destroying red spider with sulphurous fumes lies in a nutshell. It is simply accurately gauging the amount of it that will be destructive to the insect while doing no harm to the vines. This knowledge will not be acquired by leaps. It is only to be done by a series of experiments, gradually increasing the amount of sulphur until the spider is killed. If this point is reached and no damage is done, the destruction of red spider becomes a very easy matter. Syringing with clean water for the destruction of red spider when once it has got firm hold is almost useless. But well washing the foliage in combination with plenty of root moisture and good food is a fine deterrent. I see this in the case of two small Alicante vines that were planted in a house containing Hamburgs, which, owing to scarcity of water, the roots being inside, are badly attacked. The two vines in question became infested, but wishing them to get established I kept them well watered, and syringed thoroughly the under sides of the leaves twice a day. I cured these vines, and now there is no spider on them, although they are growing side by side with infested ones.—*J. C. B., in the Garden.*

An Ingenious Expedient.

The *American Analyst* gives the following ingenious plan for extinguishing a fire in a mine. The Calumet and Hecla copper mine in the upper peninsula of Michigan is the most extensive mine in the world. Several weeks ago the timbers which support the pumps and "man engines," which are very extensive, caught fire on the 1,600 foot level. The entrances to the mine were hermetically sealed, and it was thought the fire could be extinguished by steam, which was poured into the level in great quantities through a four inch iron pipe extending five hundred feet into the mine. Prof. Alexander Agassiz, of Boston, president of the mining company, arrived on the scene a few days after the fire broke out. He conceived the idea of flooding the mine with carbonic acid gas. Chemicals were procured and the gas was manufactured in great quantities and forced into the mine by heavy pressure from the engines. The plan was entirely successful, and when the mine was opened a few days later, not a trace of fire remained. An engine was set to work pumping out the gas and another to forcing in fresh air, and it is expected that the air will be such as to permit work to be speedily resumed.

What a Patent Should Mean.

A correspondent expresses his views as follows: If a patent means anything, it should mean that after the applicant has in good faith paid the U. S. government the required sum for a patent, the supreme court of the nation, after due examination of all former patents, binds itself for a specified number of years to absolutely defend the inventor against all claims whatsoever of infringement upon former inventions or attempts at infringement upon his invention.

Yet, alas! such is not the case. And hence, thousands of useful inventions sink back into oblivion, through dread of expensive litigation after the expense of a patent.

The government is the proper authority to pass final decision, and, as it can bear the expense millions of times easier than the average individual, ought by all means to do so, that a patent once granted may, like a perfect warrantee deed, be absolute. If necessary, let the investigation fee be raised to $25 or $30, and the full cost of a sure patent to $100, and it certainly will be far better all around in the end. Inasmuch as a patent is not absolute, it is a sham, ay, base fraud.

S. L.

A Good Idea.

A writer in the New York *Tribune* recommends the appointment of an expert in all banks, who will be capable of taking the place and doing the work of any man in the concern, from the president down. He is to be empowered to say to the president or cashier, "I will go over your assets to-day," or send the teller or other employe on a short vacation at any time, while he takes his place. By this plan no one would dare abstract a dollar from the bank, as he could not tell at what moment the expert would examine his books and discover the shortage.