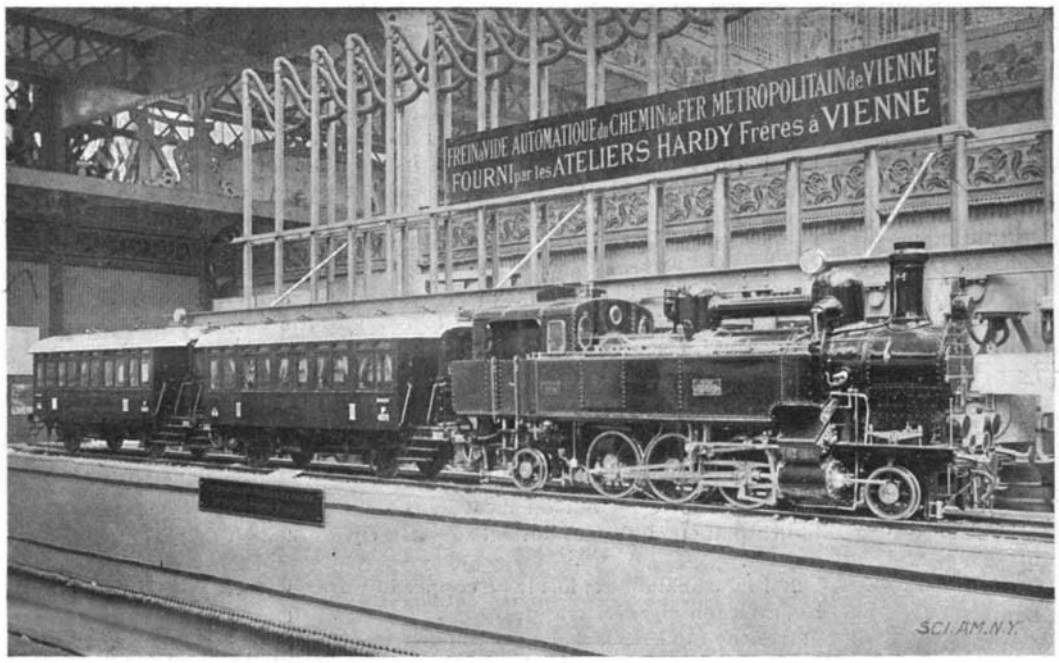
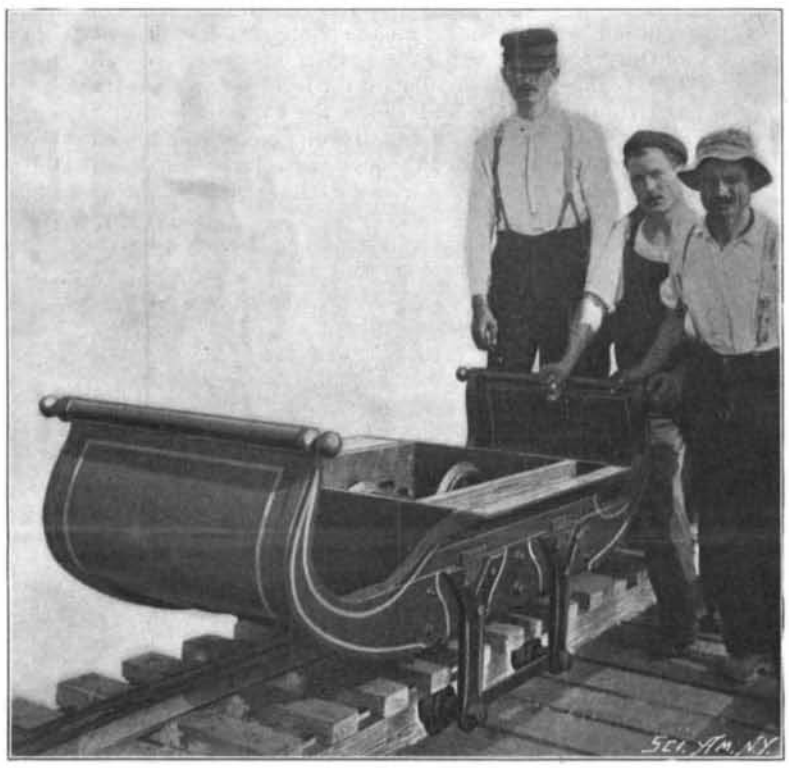
MODELS IN AUSTRIAN SECTION OF THE PARIS EXPOSITION.

In the civil engineering section of the Paris Exposition are to be seen a number of models showing the public works which have been carried out in different countries of Europe. The Austrian exhibit contains two models of this kind, which illustrate a series of improvements lately inaugurated in Vienna. The first of these is the Metropolitan Railway system, which is now practically finished. For several years the need of a rapid transit system was felt in that city, and a number of projects were studied. The Emperor Francis Joseph, in his annual discourse of 1891, expressed the wish that the affair might be carried out in the near future. This led, in fact, to active preparations on the part of the government. The idea of the Metropolitan was not only that of transportation within the city limits, but also to make connection with the suburbs, even those at some distance; it was to be used for freight transportation and to supply the city with provisions. With this in view, the work was carried out on a large scale. The line is double track throughout, with an extensive signal system. Two large main stations have been erected; the first of these is at Heiligstadt, on the Francis-Joseph line, and the second at Hütteldorf-Hacking, on the West line. The system includes four different sections, which have a total of about 16 miles. The first is a suburban line which passes from Heiligstadt to the western part of the city and thence to the suburbs. The Belt line, the second, runs parallel to the first as far as Nüssdorf, then skirts the city to Gumpendorf, joining the lines of the Vienna valley and that of Vienna-Trieste. The third section, that of the Vienna valley, leaves from Hütteldorf and follows the river to the Custom House, with a junction to the Praterstem Place; it makes connection with the Vienna-Warsaw and other main lines. The last section is that of the Danube Canal, starting from the Custom House station; it follows the canal to Heiligstadt, with a branch line to the Belt railroad. The first three of these lines are now completed and the fourth is to be finished next year. The construction was carried out with great difficulty and expense, owing to the nature of the ground to be passed over and the necessity of satisfying the different conflicting interests, but the work of the first three lines was finished in the beginning of 1897. According to the configuration of the ground to be passed over, the line is in some places elevated, and in others it runs in a tunnel or cut. The elevated portions are generally supported upon a viaduct, and it is only in a few places in the outlying districts where it runs on an embankment. Over certain wide streets metal bridges have been constructed; these are ballasted to deaden the sound.

In the illustration will be seen a well-executed model of the locomotive and train used on the Metropolitan. The road has been laid out under conditions which differ considerably from those of a main line; the grades reach two per cent and the stations are very near together. It is necessary to provide heavy locomotives, having great tractive power, sufficient adherence and capable of going around sharp corners. As will be noted the locomotive has three pairs of driving wheels and a front and rear truck; it has no tender, the supplies being carried upon the locomotive; its design is in general that of a modern type of European heavy locomotive, with all the recent improvements. In order to decide what kind of train it was best to use, the committee examined the systems in use at present in Berlin, London, Liverpool and New York, and came to the conclusion that the cars used on the New York Elevated present the greatest advantages, the stops being but fifteen seconds, while at Berlin and London, where compartment cars are used, the stops are thirty seconds. Accordingly the American type of car was adopted. The train is made as short as possible, the first-class cars being suppressed. A system of vacuum brakes, manufactured by Hardy Brothers, of Vienna, is used. The trains run from 5:00 A. M. to 11:00 P. M., and when the system is entirely finished, the interval between trains will be from 3 to 6 minutes, with 12 minutes on the Belt line.



MODEL OF LOCOMOTIVE USED ON VIENNA METROPOLITAN ROAD.

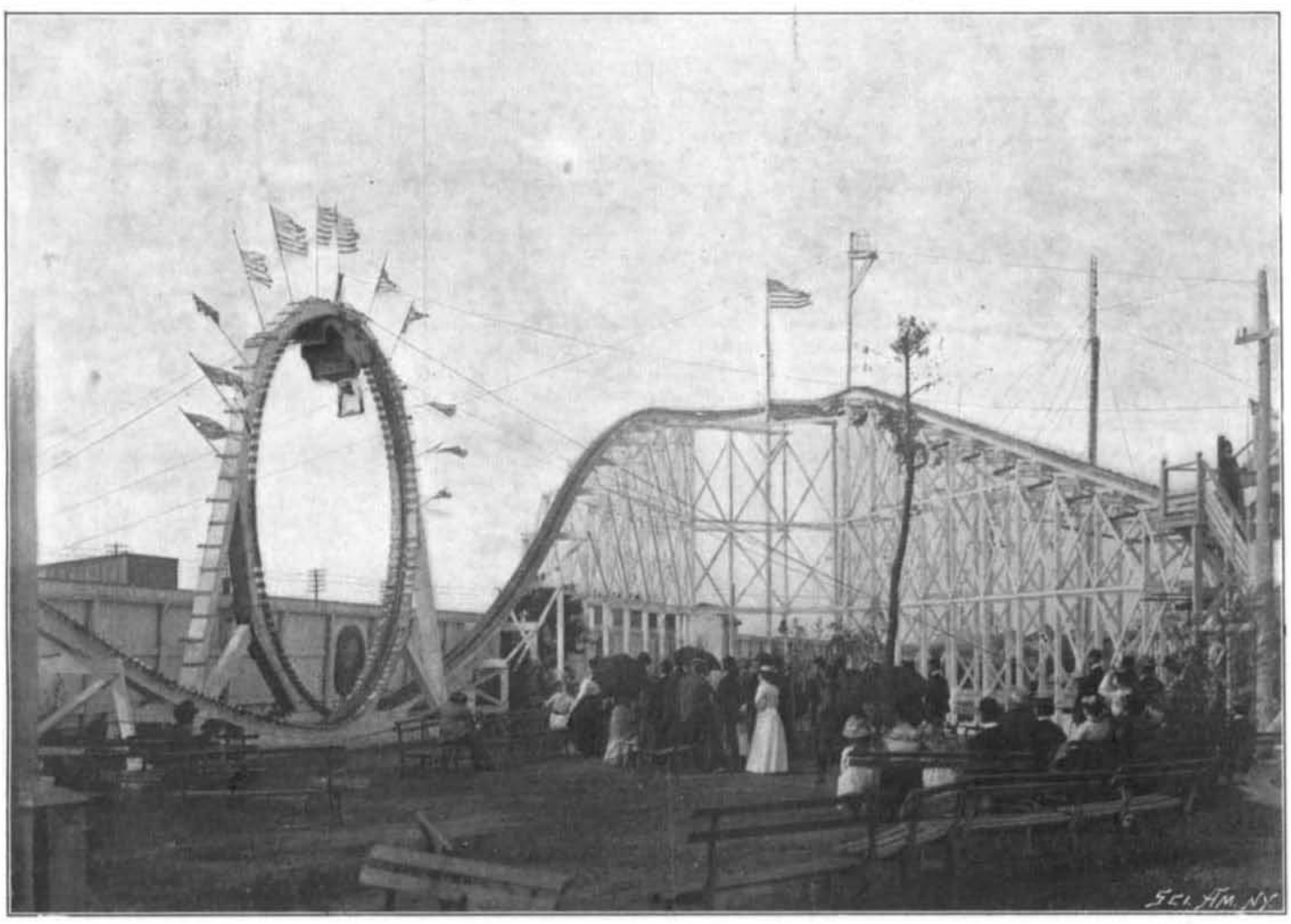


A VIEW OF THE CAR.

The erection of the various stations of the road was carried out in consultation with one of the leading architects of Vienna, M. Otto Wagner. Besides the two main depots of Hütteldorf and Heiligstadt and that of the Custom House, are those of Gersthof, Hernals and Ottakring, for passengers, and that of Michelbeuern for market products. There are numerous way-stations upon all the lines. At the main stations five or six platforms are provided, one for each line; they are joined by underground passages in most cases. For the lines below the level, the superstructure is relatively light, and contains only the different offices; for the overhead lines a structure of much larger size is erected.

CONEY ISLAND'S CENTRIFUGAL RAILWAY.

That discoveries and inventions of great scientific importance are often applied to the purpose of contributing to the pleasure of the amusement-seeking public is proved clearly enough by the mechanical toys and scientific curiosities sold in the shops of our large cities. One of the most remarkable of such applications of scientific methods, remarkable chiefly for the size of the apparatus employed and for the curious phenomenon presented, is to be found in the Boyton centrifugal railway, which has been added to the attractions of Coney Island. It can be safely said that those who have ridden in one of the cars of this odd road of Boyton's have been very strongly impressed with the meaning of the term "centrifugal force."

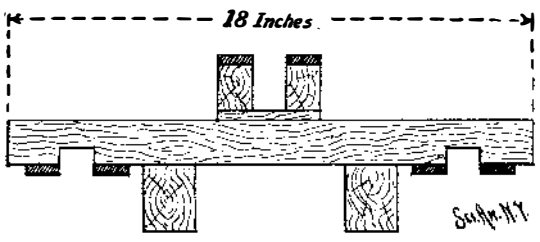


THE BOYTON CENTRIFUGAL RAILWAY, SHOWING THE CAR AT THE HIGHEST POINT OF THE LOOP.

The railway consists of an elevated inclined track curving upward and downward near its middle to form an oval loop, the vertical or major axis of which is 24 feet long and the horizontal or minor axis 20 feet long. The cars used are 6 feet long by 3 feet

wide, and are supported by two driving wheels 1 foot in diameter, arranged in tandem to run upon a single central rail on the upper surface of the ties. Four auxiliary wheels 6 inches in diameter, running upon two rails secured to the under surface of the ties, are also employed. When in motion a car retains the upright position exactly as would a bicycle, the auxiliary wheels being used only to steady the car when the velocity is very small.

The highest point of the railway is 35 feet from the ground; and between this point and the beginning of the oval loop is a stretch of track 75 feet in length.



CROSS SECTION OF THE TRACK.

The car is hauled up by a cable to the point of maximum elevation and is then cut loose. With a constantly accelerating speed it plunges down the incline of 75 feet, dropping a distance of nearly 35 feet in this brief interval, whirls around the loop, and reaches the station after running up a heavy grade, whereby its speed is considerably reduced. So great is the velocity of the car when it reaches the end of its downward plunge of 75 feet, that, at the highest point of the oval, it is held against the track in opposition to the force of gravity, by the centrifugal force alone. If a bucket of water be swung around at arm's length not a drop will be lost, provided the motion be swift enough. And the passengers in the car can no more fall headlong from their seats than the water in the whirling bucket.

The six-inch auxiliary wheels running on the under rails would prevent the car from falling when it reached the top of the oval. But such an accident, even without the auxiliary wheels, could hardly occur, since the centrifugal force is always greater than that of gravitation.

A representative of the SCIENTIFIC AMERICAN who rode in the car stated that although a chain was stretched across his body while seated in the car to hold him in, in case of accident, at no time during the ride was he brought in contact with the chain, but that at all times he felt himself held firmly in the seat by centrifugal force alone.

The "Deutschland" Again Breaks the Eastward Record.

Each successive trip of the "Deutschland" seems to carry with it a new record. The most memorable ocean voyage, so far as speed is concerned, was that of the "Deutschland" and the "Kaiser Wilhelm der Grosse," which left New-York September 4, in close company, and for a considerable portion of their voyage were in plain sight of each other. Although it was not a race in name, it was in fact. The "Kaiser Wilhelm der Grosse" left an hour earlier than the "Deutschland," and the latter overhauled and passed her, and made a record passage of five days seven hours and thirty-eight minutes, the average speed being 23 36 knots, and she would probably have done better had it not been for the fact that in the first day's run there was a moderate sea and a slight fog. The succeeding days she logged 535, 540, 549, 545, and 306 knots. The "Deutschland" beat the "Kaiser Wilhelm der Grosse" by five hours and twenty-seven minutes between the Sandy Hook lightship and the Lizard. The previous record of the "Deutschland" was five days eleven hours and forty-five minutes, consequently the eastward transatlantic record was lowered by four hours and seven minutes.

THE Princess of Wales has presented to the London Hospital the wonderful apparatus which has been employed in Copenhagen for the cure of certain intractable skin diseases by means of light. As is well known, it is the chemical rays—the blue, violet, and ultra-violet—which exert this curious beneficial effect. To use the apparatus the patients simply lie on couches, while the light of the sun, or, failing that, the rays from an electric arc lamp, are focused upon the affected part of the skin. To obviate the heat which is always generated by focusing the sun's rays in this manner, the rays undergo concentration and cooling by means of a curious "reversed telescope." The rock crystal lenses, which are impervious to heat rays, inclose a column of distilled water. The patient is submitted to this treatment for about an hour at a time, but the treatment being quite painless, not the slightest inconvenience is experienced, and the operation has been proved to be eminently successful.

KHAKI neckshields are now worn in sunny weather by the London police force.

COLOR SCREEN FOR TELESCOPES.

The color screen for improving the definition of refracting telescopes, recently invented by Prof. T. J. J. See and Mr. George H. Peters at the United States Naval Observatory, has already led to discoveries of the highest interest. This apparatus consists of a small cell containing fluid through which the light of the stars passes in reaching the eye. The cell is attached to the eyepiece of the telescope, as shown in the figure.

The fluid used in the cell is deadly poisonous, and so corrosive that if a drop of it were to get into the eye, total blindness would follow. The scientists use the following mixtures, each of which has its advantages:

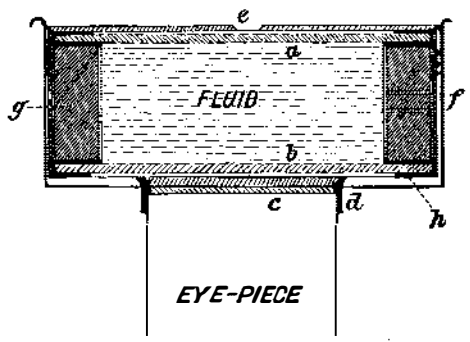
1. Bichromate of potash, dissolved in water, which is a brownish solution. This removes the blue halo which usually surrounds the stars, but allows the outstanding halo of reddish light to pass through. This fluid performs very well on most of the stars and the bluish planets, but does not act so perfectly on reddish objects.

2. Picric acid and chloride of copper in water, which has an intensely green appearance. This solution removes the blue rays, and also the red ones, very perfectly, while the green and the yellow are transmitted as if the fluid were perfectly transparent. This is the best combination yet made and yields splendid results.

3. Chromate of potash dissolved in water; this is very good for most objects, but it has not yet been used so much as No. 2.

4. Chromic acid dissolved in water, an intensely red solution, which removes all the violet, blue, and most of the green rays, but transmits the yellow-green, yellow, orange, and red. This fluid is of especial use in the study of Mars, and shows the canals beautifully sharp. The canals are usually of greenish or bluish color, and when viewed through the color screen, filled with chromic acid, appear as dark lines on a yellow or reddish background.

Prof. See has only begun his work on Mars, but it will be continued through the coming opposition of the planet in February next, and doubtless some important additions will be made to our knowledge of Mars, which of late has attracted so much attention.



The illustration gives a vertical section of the cell; *e* is the aperture for the eye; *a* and *b* the two parallel planes of glass confining the fluid; *g* the ring of glass upon which the plates rest; *h* thin rings of rubber inserted to make the joint tight; *f* two small holes in the ring of glass, by which the cell can be filled after the case is screwed down with the metal cap; *c* is the head of the eyepiece, and *d* a brass collar holding the cell on to the eyepiece.

All these researches on the color screen grew out of Prof. See's discovery, October 10, 1899, of some faint belts on Neptune, when the atmosphere about Washington happened to be quite smoky from West Virginia forest fires, and the smoke of the sky cut off the blue light like a color screen in the tailpiece of the telescope. It then occurred to him to construct an artificial cell which would reproduce the condition which accidentally arose from the smoke in the air, and he and Mr. George H. Peters then constructed the first color screen ever applied to a telescope. The color screen removes the blue halo about the planets and allows the astronomer to measure the diameters more accurately than has hitherto been possible. Prof. See has been hard at work all spring and summer on the diameters of the planets and satellites, and already has results which will add no little to the fame of the Government Observatory. The diameter of Neptune has been found by previous astronomers to be about 35,000 miles; the measures made with the great equatorial of the Naval Observatory indicate that the real diameter is nearly 8,000 miles smaller, or 27,190 miles.

In the case of Uranus the diameter is diminished from 34,000 miles to about 28,500 miles. Saturn has his diameter diminished over 1200 miles; while that of Jupiter is reduced some 300 miles.

Venus has been subjected to elaborate investigation, and the diameter found to be 7,553 miles, with an uncertainty of only ten miles.

This is probably the most exact determination of the diameter of a planet ever made, except that of the earth, which is found by geodetic measurement within about a quarter of a mile; and shows what future investigation with color screens will do for exact astronomical measurement.

In the case of Mercury, Prof. See finds a diameter of only 2,460 miles, which is about 570 miles smaller than the received value. This indicates that the planet nearest the sun is in reality very little larger than our moon, which it resembles in many respects.

This new determination of the diameter of Mercury has led Prof. See to adopt a new value for the mass of this planet which has heretofore been in great doubt among astronomers. The Government astronomer thinks he has new evidence that the mass of Mercury is one fifteen-millionth that of the sun, which is only one-half that generally used among scientists.

A Simple Photographic Printing Paper Formula.

A photographic printing paper which closely resembles platinotype has been recently used in Belgium. To prepare the sensitizing solution, the following formula is used:

Water	100 parts.
Ferric oxalate	15 "
Oxalic acid	2 "
Nitrate silver	3 "

These proportions should be kept as indicated; if, for instance, more than three parts of nitrate of silver is used, the image will lack detail in the shadows and the half-tints will be wanting. The printing of the paper is carried out in the same way as for platinum paper; that is, until the image is well distinguished upon the sensitive surface. After printing, the paper is placed in a developing bath composed as follows:

Water	100 parts.
Borax	6 "
Tartrate of soda	6 "

The ingredients are dissolved, and a few drops of a 20 per cent solution of bichromate of potash are added; if more bichromate is used, the image will be hard and full of contrast; and if less, the image will be gray and feeble. A certain latitude is thus obtained, and negatives of different intensity may be provided for. After development, which lasts five or six minutes, the prints are washed for a few minutes in running water and then toned in the following bath:

Water	1,000 parts.
Chloroplatinite of potassium	1 "
Chloride of sodium	10 "
Citric acid	10 "

The prints are placed in the bath until they have reached the desired intensity. They are then fixed in a two per cent solution of ammonia; the fixing lasts about ten minutes, after which the prints are well washed as usual.

The Yellow Invasion.

From time to time our French contemporary, Le Monde Illustré, devotes an entire number to such subjects as a hypothetical war, in which the Chauvinistic tendency of the French press to magnify the deeds of their countrymen is very manifest. The issue of August 25 is given up entirely to "La Chine et l'Europe en l'an 2,000," by that versatile writer, M. Henri de Noussanne. Such fictions as these, while not particularly novel at the present time, are quite suggestive, especially as we are now actually menaced by the yellow peril. The author goes on to describe how the empire of China waxes strong under Japanese leadership in the year 2,000. A quarrel finally arises and the European ambassadors retire; there is discord between the Powers, and some torpedoes are exploded in Hong Kong Harbor. The result is the commencement of war on the largest possible scale. The success of the Chinese is immediate, and European women and children are sold as slaves. The most formidable naval battle in history follows, and the Chinese march upon Russia as an objective point. Siberia is conquered; the Chinese win a battle at Moscow, and all Europe has a panic, and, finally, Germany is occupied. Then follows an account of a thrilling battle on the Rhine. Atmospheric electricity is put into service by the European artillerists, science thus coming to the rescue of the overwhelmed Europeans, causing the Chinese to flee. The Chinese troops were immediately set upon by the remains of the armies of the allies, their communications were cut, and for six months Germany, Austria, and Asiatic Russia were inundated with the dead and dying Chinese. A great naval battle also takes place, in which the maritime power of the Chinese was broken. Japan was definitely separated from China. Europe organized for the universal welfare and took for its device that of industrious Belgium, "*L'Union fait la force.*"

The Benzine Risk.

In most printing offices benzine is used to wash the ink from type. Some weeks ago a boy in such an office, while handling a can of benzine, set it down with unusual force, causing some of the benzine to fly out; it fell on a gas stove, and this resulted in serious damage to the printing office, but fortunately no one was injured. It is surprising that more accidents of this nature do not occur. With the use of such an inflammable and explosive substance as benzine the greatest precaution should be used, and in no case should any benzine or naphtha be used for cleaning or other purposes in a room which has any light or fire, except, of course, the electric light.