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THE PUBLIC WORKS OF CANADA.

NOTES ON THE NEW CUT FOR THE GRENVILLE CANAL, AND THE DAM NOW BEING CONSTRUCTED ACROSS THE OTTAWA RIVER.

HITHERTO, little notice has been taken by the public papers, of the important and costly works which have, year after year, been constructed in the Dominion of Canada. Whatever notice has been taken of them has been of a mere editorial character, of a rather desultory nature, and not emanating from the pen of any official connected with the Department of Public Works. This is to be regretted, particularly as these works are often on a gigantic scale and very costly, and for the payment of which a large proportion of our revenue has to be applied. There are, at the present moment, very few of our own population, and a far less number of our neighbours in the United States, and fewer still in the mother country, who have the slightest conception of the magnitude and public importance of the works previously built and some now in the course of construction by the Board of Works in Canada. Whether this neglect has arisen from an oversight by former governments, or from a difficulty on the part of our public journalists to obtain the necessary detailed information to enlighten the public on these important matters, we cannot say; but as a conductor of an illustrated scientific journal, whose duty it is to give publicity to all works of a public nature, or public improvements of any kind carried on in the Dominion, we feel it incumbent upon us, even at a considerable increase of expense, hereafter to illustrate, and furnish details of the construction of all public works of importance being now or to be built in this country, so far as such information can be given without affecting the public interests.

We are happy to say that the Honorable Commissioner of Public Works at once courteously acceded to our request—when called upon—to be afforded with the necessary information, and we feel that the Chief Engineer of the Board of Works will fully enter into the view we take in this matter of the importance of placing on record, in the columns of this Magazine, for future reference, diagrams and details of the construction of many of the Public Works over which he has for many years had the chief control.

It certainly has been a great oversight in the past, that the magnitude and importance of our great canals have not been more prominently noticed in public papers. *The Engineer—Engineering—Iron*, and other English scientific journals, not only give great publicity, and fully illustrate the important works of England, but give publicity, also, to all important works that are being constructed on the Continents of Europe and America generally—Canada excepted; and the columns of the *Scientific American* also frequently contain descriptions and illustrations of foreign works—and yet the important hydraulic works of Canada, to see which the Russian Government but recently sent over Engineers, with letters credential to the Government of Canada, to examine and report upon them—are so little thought of in our country, that the great mass of our population is totally ignorant of the magnitude of works which are being carried on within a few miles of their own doors.

It is not our intention in this introductory article to report officially upon any of the public works now in course of construction; but we hope to do so as soon after the close of the year as possible. We have only recently returned from Carillon, where works of great importance are being constructed, and yet how few know of the *gigantic dam* now being built across the river Ottawa, within one mile and a half of the village—or, of the new cut and enlarged locks for the Grenville canal at the same spot. This large dam, which, when completed, will be over 2000 feet in length, and the largest, probably, in North America, is intended to throw back the waters of this great river some miles, so as to avoid the delay which takes place in towing vessels up the present canal, and to allow vessels of larger tonnage to descend through the new locks. Some idea may be formed of the great hydraulic power to be stemmed, when we mention the fact that the waters of the river Ottawa, last spring, rose twenty feet above the summer mark ; and some conception can then be formed of the strength of the dam required to resist a body of water of so great a magnitude and over 2000 feet wide, rushing over its top, bearing with it fields of ice, trees and other debris. The dam that shall shoulder back and resist, for years to come, the ever-rushing waters of this the greatest tributary of the St. Lawrence must be a work of the first magnitude ; for so powerful a river is the Ottawa that, when its waters reach the St. Lawrence, they force back those of its mightier rival for some distance, and the dividing line between them can be distinctly traced for many miles, as they struggle on side by side, until forced to mingle in the boiling waves of the Lachine rapids, at the foot of which they issue forth in one united body.

REMOVAL OF THE HELL GATE ROCKS.

(See page 356.)

The great obstruction impeding the ship travel between the Atlantic ocean and New York city *viâ* Long Island Sound is located at a promontory of Long Island, called Hallett's Point ; it extends out into the East river, approaching Ward's Island, which occupies three fifths of the width of the river at that point, and some dangerous rocks are found in the immediate vicinity. The narrow channel thus formed has been a danger and a difficulty to navigators ever since this part of the country was first explored, and the rush of water taking place through the pass gave it the name of Whurl Gate, afterwards Hurl Gate, whence the name by which it is now known was easily derived.

Our readers have been informed, from time to time, of the progress of the great work of excavation, which has now been completed ; and the blast which will shortly take place will put an end to this difficulty in navigating this now dangerous pass, and end the years of labour that have been so perseveringly bestowed upon it. A very widespread interest has been centred on the operations ; and the work is one of national importance, although this city is of course more interested in it than any other section of the country.

The first mention of preparations for commencing this work is found in the report by Lieutenants Davis and Porter, of the United States navy, made in the year 1848. This document gives a very accurate description of the course of the tidal currents, the dangers to navigation caused by rocks, obstructions, etc. ; and it recommends that Pot Rock, the Frying Pan and Way's Reef be blasted and scattered. The two former are single rocks of a pointed shape ; the latter is long and has the character of a ledge. The report also recommends that the middle channel be improved by blasting so as to make a clear channel of sufficient depth for common vessels and steamboats ; and it also speaks of the increased facilities for naval defense which this improvement would afford. The difficulty of blockading the port of New York, with her two outlets instead of one, would be at least doubled. Lieutenant Porter did not exactly agree with Lieutenant Davis as to the best plan for improving the channel. They both recommended the removal of the small rocks—Frying Pan and Pot Rock—from the middle of the channel, and Porter included a part of the reef at Hallett's Point. But the art of blasting under water was almost unknown at that time, and engineers agree that even the little improvement recommended by them could not have been effected without the inventions and discoveries which have since been made. The process adopted in those times for submarine blasting was to take down cans of powder, place them against the side or top of the rock, and explode them by means of a galvanic battery. This did well enough for rough and jagged rocks and boulders ; but so soon as the surface had been leveled off, it was of little or no use to attempt to continue the operation.

In 1852, Congress having made an appropriation of $20,000 for the removal of rocks at Hell Gate, Major Fraser, of the Engineers, began operations according to the Maillefert process above described. The sum of $18,000 was expended on Pot Rock, and the depth of water was increased from 18·3 feet to 20·6 feet.

This is all that has been accomplished up to 1868, when the duty of an examination of Hell Gate was committed to General Newton of the United States Engineers, who made his report in January, 1867. For operating on the rocks in the middle of the channel a steam drilling cupola scow was constructed. It had a well hole in it 32 feet in diameter, through which 21 drills were worked, while the scow lay on the surface of the water directly over the rock to be operated on. This formidable machine was first used in the spring of 1869, on Diamond reef. A large number of holes were drilled into this rock, varying from 7 to 13 feet in depth, 4½ feet in diameter at the top and 3½ at the bottom, and the rock was broken up by charges of nitro-glycerine of from 30 to 35 lbs. Coenties Reef was operated on in 1871. Ninety-three holes were drilled and charged with nitro-glycerine, and seventeen surface blasts were made. In 1873, three hundred and seven holes more were drilled and thirty-nine surface blasts were made. The amount of nitro-glycerine consumed was 17,127 lbs., and the reef was thoroughly broken up. The *débris* had been partly removed, when, in 1875, Congress, owing to a mere clerical blunder, failed to include Diamond reef in the appropriation, and work at that place had to be suspended. In 1872 the drilling scow was towed to Frying Pan rock. Seventeen holes were drilled and eleven surface blasts made.

COMMENCING THE WORK.

Operations for removing the reef at Hallett's Point were begun in August, 1869. A coffer dam was built of heavy timber, securely fastened to the rocks by bolts passing through the framework. This structure is shown in our engraving, Fig. 1.

The coffer dam was pumped out about the middle of October, and operations on the interior for sinking the shaft were begun early in November, and continued till the middle of June, 1870, when work was suspended on account of the funds appropriated for this part of the work being exhausted. At that time 484 cubic yards of rock had been taken out, at a cost of $5,75 per yard. In the inner part of July, operations were resumed, and during that fiscal year the shaft was sunk to the required depth of 33 feet below mean low water, and the heads of the ten tunnels opened to distances varying from 51 to 126 feet. Two of the cross galleries had also been opened. The amount of rock excavated from this place that year was 8,306 cubic yards, and the drilling was all done by hand. During the next year the use of steam drills partially succeeded hand drilling, and the work was pushed more rapidly. The number of feet of tunnel driven during the year was 1,653, and of traverse galleries 653·75. The quantity of rock removed was 8,293 cubic yards.

A sectional view of one of the cross galleries or avenues is given on engraving Fig. 2 ; and a ground plan of the work, Fig. 3, gives an excellent idea of the extent of the excavation, which is now complete. A longitudinal section of one tunnel called by General Newton "Grant heading," is given in Fig. 4.

An exceedingly well executed model of the works is now on exhibition in the United States Government Exposition at Philadelphia. It is made exactly to scale, and well represents the nature and extent of the vast operations that have now been successfully completed. The rock bed of the river is, in the model, raised from the pillars that support it, so that a close inspection of the interior may be made. There are 172 of these pillars, pierced with about 4,000 drill holes ; and the shell, or roof, or bed of the river varies from 6 to 16 feet in thickness. No less than 30,000 cubic yards of broken stone will be left under water, all of which will have to be removed by dredging. The model referred to is accurately represented in our Fig. 5, and Fig. 6 shows a birdseye view of Hallett's Point, with the large coffer dam inclosing the entrance to the submarine works.

THE RIVER SURVEY.

A detailed survey of the upper surface of the reef was made in 1871 by Mr. William Preass, assisted by Mr. F. Sylvester. They took more than 16,000 soundings, each separately located, by means of instruments, from the shore. Great pains were taken to delineate exactly the surface of the rocks. The appropriation of 1871 was $225,000, just one half the amount asked for by General Newton, who regretted that the beginning of operations on the Gridiron was thus prevented, as he considered this rock more dangerous to the navigation of large vessels than the Hallett's Point reef. For the next year he asked $600,000, but got less than half that sum. About the middle of November, 1873, work was suspended for want of funds, but at the end of the first fiscal year, June 30, 1874, it was found that, for the four months and a half during which operations had been carried on, 896 lineal feet of tunnels had been opened, and 4,648 cubic yards of rock removed. The total length of tunnels and galleries then amounted to 6,780·67 feet. The excavation now being nearly finished, the manner of finally blowing up the whole mine began to exercise the minds of the engineers.

EFFECTING THE BLAST.

General Newton finally suggested his own plan for blowing up the reef at Hallett's Point, which was to perforate each pier with drill holes entirely or partly through its mass, a sufficient number of those being provided to complete the destruction of the pier when fully charged. The charges in the different holes of the same pier were to be connected together, and a fuse composed of a quick explosive, would connect the system of charge in each pier with those of the neighboring piers. By this mode the communication of heat or the electric spark to a few centres of explosion would suffice to propagate it through the whole system, because the explosion of the connecting fuse would advance more rapidly than the demolition of the rock. General Newton's plan is the one that has been adopted, although a few slight changes, principally suggested by himself, have been made. Instead of depending on explosives to convey the fire from pier to pier throughout the mine, an electric spark will be sent directly to every centre, insuring the simultaneous explosion of the whole mine, unless some unexpected difficulty shall intervene to prevent it. General Newton decided that the minimum amount of explosives could be determined by placing one charge in each square pier and two in each oblong pier, but this mode would make the lines of least resistance the maximum, and thus increase the shock, which would be propagated through the reef to the dwellings upon the land. It was therefore determined to decrease the lines of least resistance, which will multiply the number of blasts and increase the quantity of explosives, but will, at the same time, reduce to a minimum the vibrating influence through the reef. It is hence calculated that the exterior effect, except an agitation of the water, will be small.

THE FORM OF THE REEF.

Hallett's Point reef is in the shape of an irregular semi-eclipse, the major axis, which lies next to the shore, being 770 feet in length, and the minor axis, projecting straight into the channel, about 300 feet. The cubic contents, above the depth of twenty-six feet at mean low water, amount to 51,000 yards. Besides the risk of striking the reef, it produces eddies on both sides of it according to the directions of the tidal currents, and is as much in the way of vessels coming down in the ebb in the effort to hug the shore and thus avoid being drawn on the Middle Reef.

THE EXPLOSIVES.

The explosives used in tunnelling at Hallett's Point have been nitro-glycerine and its compounds, and gunpowder, the latter being used only when the rock was weak and seamy. Nitro-glycerine was always used for driving the headings of the tunnels. To drive a heading, the drill holes are made at an angle with the face, so that the charge lifts out the rock by its explosion. A cavity being made in the middle of the heading, holes are drilled around it and the surrounding rock blown into it. Only one blast is exploded at a time, and great care has to be taken not to shake the structure overhead by too heavy vibrations. There is consequently no volley firing, and the galvanic battery is not used for discharging the blasts.

THE DRILLING.

The average of twelve month's work with six Burleigh drills was the excavation of 225 lineal feet of heading per month. Up to June, 1872, the work had been prosecuted by hand drillings, with the exception of 20,160 lineal feet of drilling by the Burleigh drill, and 7,000 feet by the diamond drill. That by the Burleigh drills was done by contract so much a foot; and the diamond drill, purchased for the purpose of exploring the rock ahead, was put in competition with it. The cost of drilling, after a long trial with the Burleigh drill, is found to be between 36 and 37 cents per foot. The number of feet of holes, drilled by each machine per shift of eight hours, was thirty feet. The diamond drill, owing to the encounter of frequent veins of pure quartz in the rock, often gives out and has to be repaired. Owing to the restricted area of the tunnels and galleries, the work of excavation was almost exclusively that denominated heading, without the advantage of enlargement. The rock, after being blasted, was lifted by hand into a box resting on a truck car, which was run down to the place upon a railtrack, and thence drawn by a mule to the shaft, where the box was hoisted by a derrick and its contents emptied into the dump cars, to be rolled away and deposited in the pile. Calling the cost of blasting and removing one cubic yard $1.00, the following gives the proportion of each item of expenditure:

Blasting	0.46
Transporting rock to shaft	0.17
Hoisting	0.0328
Dumping	0.0203
Pumping	0.1037
Incidental	0.2132
	$1.00

The work of excavation having been finished, the drills were set to work perforating the roof and piers with holes to receive the final charges which are to explode the mine. These holes were made from two to three inches in diameter, and from six to ten feet apart, and their average depth was about nine feet. The size of the holes and their direction and distances apart were made to vary according to the character of the rock to be broken. The drilling of these holes up into the roof of the mine soon increased the leakage of water into the works from 300 gallons per minute to 500, it being impossible to avoid tapping a seam occasionally. Many of the holes that were found to be leaking were plugged up temporarily, and the leakage thus reduced. The outside gallery and No. 4 heading were deepened so as to concentrate all the leakage, and cause it to flow to the shaft end of that heading, where the pumps are placed.

THE COST OF THE WORK.

The following shows the amount of the appropriations made by Congress each year for the Hell Gate and East River improvements, and the whole amount expended up to the date of the last report of General Newton to the chief engineer:

1868	$ 35,000	1873	$225,000
1869	180,000	1874	250,000
1870	250,000	1875	250,000
1871	225,000		
1872	225,000	Total	$1,690,000

Amount expended, $1,434,129.99

Since this report was made Congress has appropriated $250,000.

Total amount of appropriations to date	$1,940,000.00
Total amount expended to August 1, 1876	1,6[illegible]6,841.45
Estimated cost of of completing the entire work of improving Hell Gate and the East River	$5,139,120.00

Care has been taken to test the various kinds of explosives. Up to the middle of 1874, nitro-glycerine had been principally used for blasting purposes. Several hundred lbs of mica powder were then tried, some giant powder, several thousand lbs. of rendrock, and later considerable vulcan powder was used. All of them are nitro-glycerine compounds. Neither of them was found to be as powerful as the glycerine itself; but it was repeatedly demonstrated that, with 10 ozs. of rendrock or vulcan powder, they could break as much rock as they formerly did with 8 ozs. of nitro-glycerine, while the cost per lb. was less than one half that of the glycerine.

THE FINAL EXPLOSION.

The blast is to be effected by 96 batteries of 10 cells each, which are to be placed in a bombproof structure. The cells are charged with the fluid known as electropoin and bichromate of potash in dilute sulphuric adid. The zinc and carbon plates are 4x6 inches, and oppose an area when lowered into the fluid of 40 square inches each. The cells are connected for intensity, about forty two of them forming one battery, the intensity of which is sufficient to ignite simultaneously one set, consisting of eight groups of 20 fuses in continuous circuit, equivalent to 160 fuses. There are, in all, 23 sets to be exploded by 23 such batteries. In order to ensure the simultaneous explosion of these 23 times 160 fuses, a novel apparatus will be interposed into the circuit of each of these independent sets. The apparatus consists of a gravity circuit closer, a brass pin closing the open circuit when the batteries are lowered down, after the charging of the mines are finished, by dropping into a cup filled with mercury, both brass cup and pin being part of the circuit. It is understood that there are 23 brass pins and as many mrecury caps in the instrument forming the circuit closer. The simultaneous explosion of all the mines will hence, if no accident changes the programme, be accomplished in the following way: After the wires are connected with the pole of the battery and the brass pin and cup respectively, the plate containing the brass pin is to lifted and held by a cord containing the fuse, the destruction of which, by a separate battery, will cause the closing of the circuit by the contact of the brass pins with the mrecury in the cups, and the explosion must follow.

REMOVAL OF HELL-GATE LOCKS.

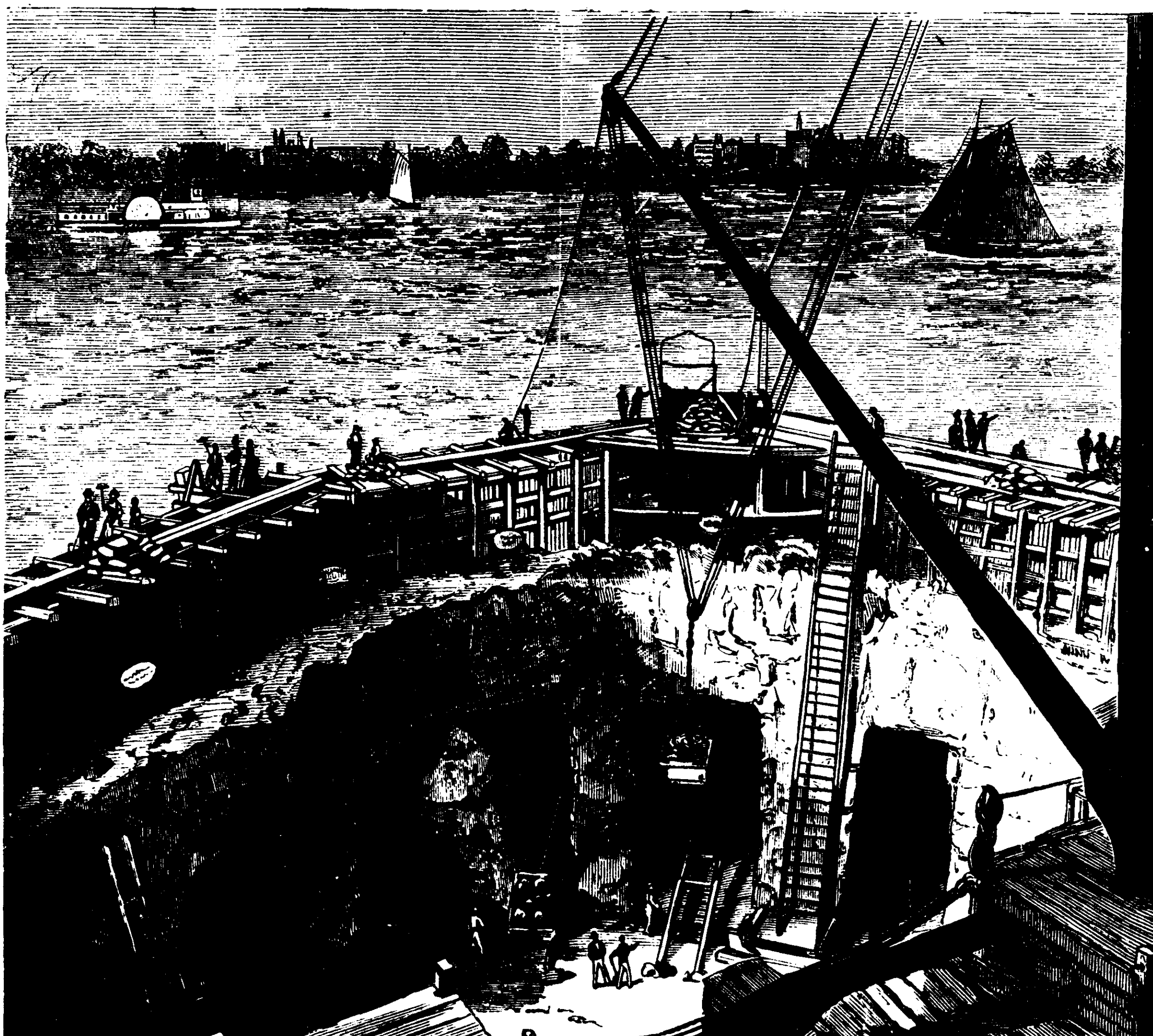


Fig. 1.—COFFER DAM, MAIN SHAFT, AND ENTRANCE TO HEADINGS, HELL GATE, EAST RIVER.

Fig. 2.—SECTION VIEW OF A TRANSVERSE AVENUE, HELL GATE.

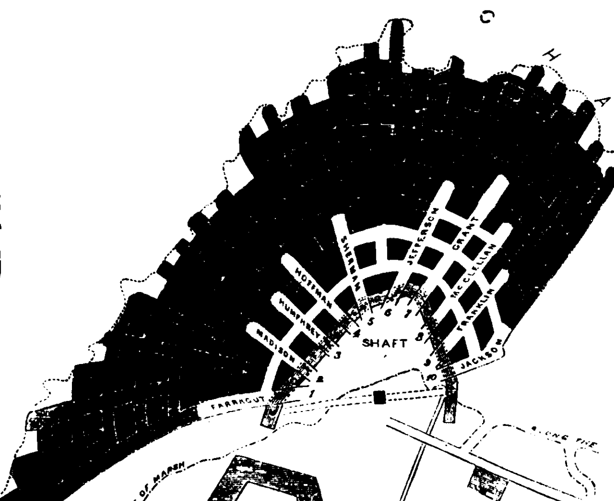
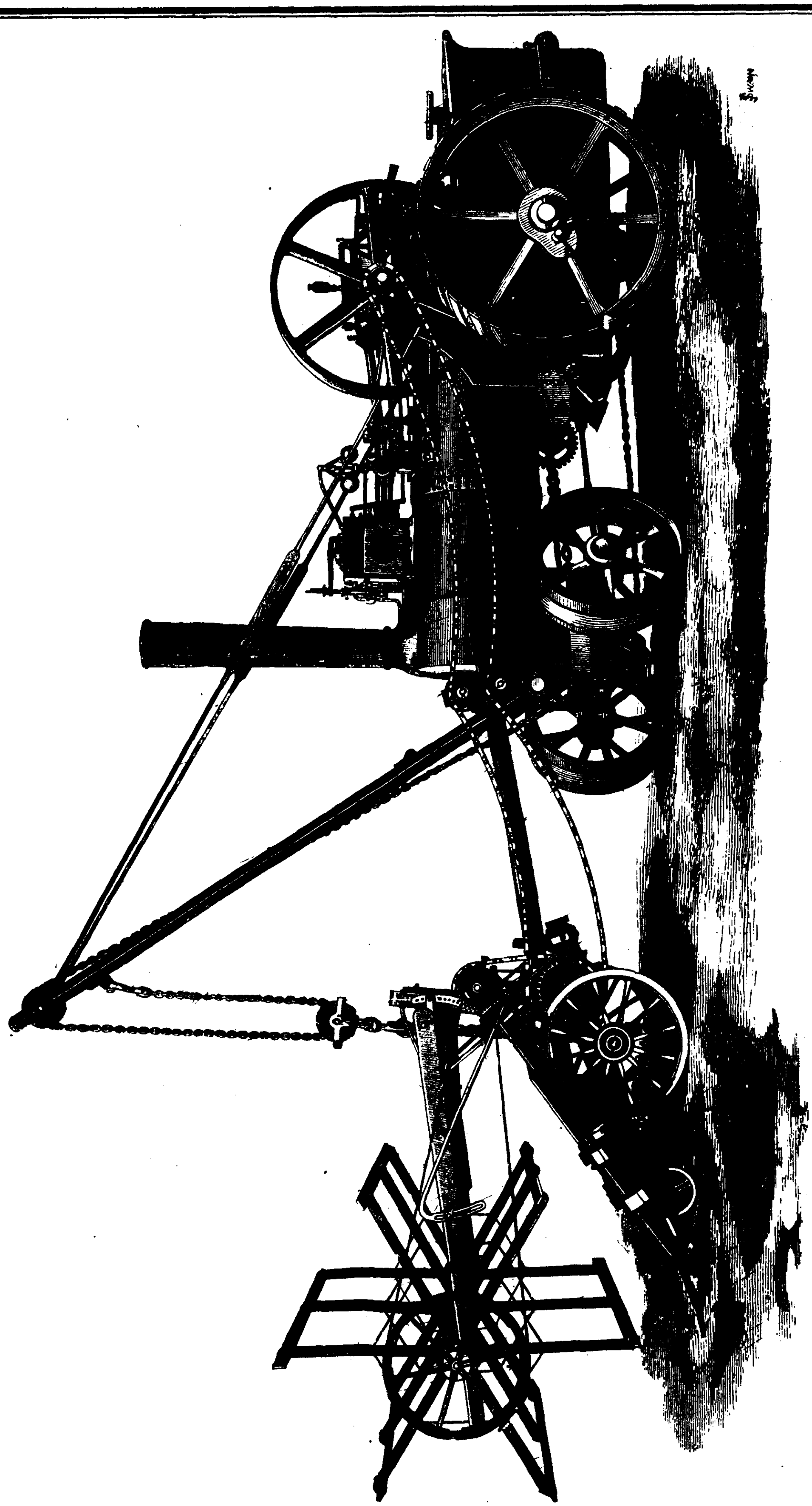


Fig. 3.—GROUND PLAN OF THE WORK AT HELL GATE.



AVELING'S STEAM REAPING MACHINE.

PINKER'S PATENT HYDRAULIC BOAT LOWERING APPARATUS

(See page 368.)

In describing the system of working the hydraulic lifeboat apparatus illustrated in the accompanying engraving, and patented by Mr. J. Pinker, Great Mersey-street, Liverpool, it may be stated that the boat is in every way the same as now in use, there being no alteration or addition ; the chocks in which the boat sits are the same ; the outer half being jointed, can be disengaged by a line pulled by a man who has the management of working the boat. The davits are jointed to the ship's side or on the main deck, the level passing from that joint under the keel and upon the inboard side of boat, and beyond her middle line, and of sufficient height to clear the blocks and drift of line, or such other disengaging gear as may be applied. From a shackle above the level of the upper deck a chain is connected with each davit, and is continued from that position, passing over the sheaves direct to the crosshead of the piston of a hydraulic cylinder, disposed under the beams as shown. The cylinder is always charged and ready at any moment for use. The officer appointed to take chargé of the boat proceeds to his boat on the alarm being given, the people get in to the number required, together with the boat's crew, while the boat is in the chocks. The gripes being cast adrift, the officer pulls a line and the outer chocks slide out, the boat launching herself at the same time. Another line which is connected to the valve or cock of the hydraulic cylinder being pulled will allow the oil or water to pass from the cylinder. The piston will then travel the required distance to allow the davits to take a horizontal position, the boat at this time being ready to be let go by the disengaging gear on a fovourable condition of the waves, the boat being 15ft. from the ship's side.

The advantage claimed for the system is that it requires only one man to work the entire arrangement, he being able alone to start the boat from a state of rest in the chocks and cast it adrift 15ft. from the ship's side. A weather boat can be used with the same safety and expedition as a lee boat, the time necessary for the entire operation being about ten seconds. The whole of the gear is simple and not liable to get out of order, and can be thoroughly understood by any person after a few minutes' explanation. To replace the boat in the chocks a pump is employed which will force oil or water on the front side of the piston of the hydraulic cylinder, and will bring the boat and davits back to their normal position.

BARKER'S HYDRAULIC BRAKE.

This brake, which has recently been tried under a new arrangement, by which it is fitted on the locomotive engine and placed under the sole control of the driver, consists of four main parts, viz., an accumulator, a steam-pump, a water-tank, and a regulator. The accumulator is conviently placed under the foot-plate of the engine, and the steam-pump is attached to it. The tank is placed in the tender tank, and the regulating apparatus is attached to the engine just to the right of the stopping and starting gear, and convenient to the driver. The accumulator consists of two horizontal cylinders of different diameters, connected end to end and opening into each other ; the large cylinder is for steam and the smaller one for water. Each cylinder has a piston, the two being on the same rod, and therefore moving together. The interior of the steam-cylinder is placed in direct connection with the boiler of the locomotive by means of a steam-pipe, so that the water in the smaller cylinder is always under pressure. The function of the accumulator is to maintain a supply of water under pressure for the transmission of power to the brake blocks. The steam-pump is fixed to the accumulator, and its office is to fill that receptacle with water against the boiler pressure on the steam-piston. The tank contains a supply of water for use in the accumulator, which is returned to it after it has done its work in putting on the brakes. The regulator is the main agent in the driver's hands for putting on and taking off the brake power.

In working the hydraulic brake, assuming it to be out of action, the tank is first filled with water and steam turned on to the accumulator, which is done by the driver from the foot-plate of the engine. The steam pump is then started and the accumulator filled with water from the tank against the steam-pressure on the larger piston in the accumulator. When the accumulator is full of water the steam-pump is shut off automatically and all is ready for a stop. As soon as the necessity for making a stop arises, whether it be from nearing a station or from an observed obstruction on the line, the driver to apply the brake gently pulls forward the handle of the regulator. By so doing a horizontal lever is pressed down, and a valve is opened which causes the water from the accumulator to be forced, under the full steam-pressure of the boiler, along a main pipe passing under the carriages in the centre of the train. From this main pipe smaller pipes or branches are led to hydraulic cylinders, of which there is one to each pair of wheels. The water, acting on a ram in each cylinder, causes a rod to project from the cylinder, which rod being connected to a transverse beam, having the hanger and its brake block at each end, causes the block to be pressed against one side of the wheel. The cylinder, at the same time, makes a slight retrograde movement, and as the brake blocks on the side of the wheel are connected with it by rods, they are necessarily drawn towards the wheel, which is thus gripped between the two blocks. Its rotary motion is thus arrested and the progress of the train retarded. The brake gear being direct acting, and the ordinary levers being dispensed with, the brake blocks wear evenly and do not require adjustment. Just before the train comes to an absolute stand, the driver gently pushes the handle of the regulator back, by which action he closes the supply valve and opens a relief valve. This allows the water in the brake cylinders to be retured to the tank, under the influence of a back pressure imparted to the water by springs which are placed inside the brake cylinders. Directly the water has left the accumulator to the extent of half an inch, the steam pump is started automatically to make good the deficiency from the tank, so that a perfect circulating system is thus maintained. By a simple attachment any two pairs of blocks can be thrown out of gear, the water being shut off from the main and the cylinder being thus relieved from pressure and rendered inoperative. This precaution is adopted in case a set of brake block gear should at any time become deranged, when it can be shut off, the remaining brakes still retaining all their effectiveness. The connections between the carriages for the main pipe are of a very simple character. The hydraulic mains are coupled by a length of strong indiarubber hose, fitted to a nozzle-and-hose holder, a weighted cam or claw is made to firmly grasp each end of the hose, and to hold it up to the main pipe. A cock is attached to the tube at the end of each carriage, and the handle of each cock can be connected by a chain. In the event of a breakaway or parting of the train, the cocks at the point of separation would be reversed, and the water thus shut off. The result would be that the brakes in the fore part of the train would remain operative in the usual way, while the rear portion could be braked from the guard's van by hand, if so arranged. This arrangement is, in fact, adopted on the Midland train, where the guard can work the brake-blocks of his van by turning a handle in the usual way, should it be necessary, by reason of the carriages being attached to an engine not fitted with the brake apparatus. A train thus fitted has been running on the Midland Railway between London and Bedford since the 2nd of June last, and appears to be giving every satisfaction. A second train has been similarly fitted, and is about to be placed on the line between Bedford and Leicester. In some instances the train approached the station at an estimated speed of from forty-five to fifty miles per hour. The brakes were not put until the engine reached the platform, but the train was stopped within the length of the platform. This was not with experimental, but with ordinary practical working, and with a driver who stated he had only been on that particular engine for about a week. Neither on the engine nor in the carriages was any unpleasant jerking perceptible.

PATENT HORSE RAKE.

THE READING IRONWORKS COMPANY, READING, ENGINEERS.

(See page 364.)

The horse rake exhibited at the Royal Agricultural Society's Show at Birmingham, embodics many of the best features of Ransome's patent rakes, with which are combined some useful improvements. The set of the teeth can be regulated at pleasure, by means of a screw handle attached to the rocking bar, so that the ground can be just skimmed when corn is being gathered, or well searched when hay is being raked. Each tooth is fixed on a separate ferule and acts independently, and so can follow the inequalities of the ground, but they cannot rise all together to drop their load until the proper moment. The drawings are self-explanatory. The rake, we may add, is extremely well made.—*The Engineer*.

UNPRODUCTIVE RAILROADS.—It is said that there are investments to the amount of $700,000,000 in the railroads of the United States that do not pay a dollar of income to the holders of the stocks and bonds.

STEAM REAPING MACHINE.

(See page 357.)

It will be seen in a moment that the arrangement is in principle very simple. Mr. Aveling has taken one of his well-known steam crane traction engines and coupled it on to a Crosskill reaping machine. The engine has been too often referred to in our pages to need description here. The reaping machine is of the old or Bell type, modified and improved. The knife reciprocates at the foot of the inclined platform, a crank under the platform communicating motion to it. The machine is carried on four wheels, two small ones in front, and two much larger, of wood, behind. The corn is carried off the platform as cut to the right or left, according to the position of a clutch taking into bevel wheels, by endless bands traversing the platform, the cut corn being laid in a swathe ready for binding.

The machine is coupled in front of the engine by two angle iron bars or shafts, as shown, which pivot on the sides of the smoke box. The crane chain is hooked into the bight of a second chain, secured at each end to the framework of the machine. The whole can be removed from or attached to the engine in a very few minutes. The system of working is as follows :—The machine being fixed to the engine, the crane is set in motion, and the reaping machine is lifted off the ground, the shafts turning on the centres in the smoke box. The crane brake is now made fast, and the road gear being put in motion the engine proceeds to the field of corn to be cut ; the brake being released, the machine is dropped on to the ground as shown in our engraving. The engine is then started, and travels forward, cutting a track of about 11 ft. wide at the rate of nearly three miles an hour, the reaping machine being driven by the pitch chain shown at the side in our engraving. When the end of the "bout" has been reached, the driver stops the engine and picks up the machine, which is then high above the corn. The engine can then be turned round in about its own length, and the machine being again dropped, another bout is cut, and so on.—*The Engineer*.

HORTICULTURAL BUILDINGS.

Much has been done of late years to extend the application as well as cheapen the production of glass for horticultural and other purposes of decorative utility, and many beautiful works have been produced in iron and glass since the honoured pioneer of this particular work erected his 1851 Exhibition building. Yet it seems strange that the improvements in buildings composed of iron, wood and glass, should have made, speaking comparatively, what appears to be only a limited advance. Now the purpose to which the buildings we are speaking of are usually applied, that is to say, the protection and cultivation of plants, is, in its practical pursuit, one of the most enjoyable as well as being one of the best promoters of health, and to the generality of females, one of the most fascinating of occupations. Looking at the subject from this standpoint, it is to be regretted that the bulk of those whose lives are spent in the pent-up dwellings of cities are debarred almost entirely from the ever-pleasing companionship of plants. This, in a great measure, arises from the hitherto heavy first cost of horticultural buildings, and window plant and fern cases, and partly because it is not the usual custom to furnish buildings with any such structures, whereas it ought to be the general rule to afford some means of cultivating and protecting plants during the severer portions of the year. We hold, then, that any effort to produce and introduce the use of glass structures, and so place them within the reach of a larger range of persons than heretofore, is deserving of all encouragement. With this object in view, we direct attention to the improvements in horticultural buildings, introduced by Messrs. Cranston and Luck, of Birmingham.

It is not within our scope to discuss, from a horticultural point of view, the principle of their horticultural buildings ; on the contrary, we shall content ourselves by explaining the constructive details of these buildings by the aid of the accompanying illustrations. The diagram to the left of fig. 1 is an end elevation of a half-span greenhouse and drawn to a scale of 10 feet in width ; the figure to the right is a 'lean-to" structure of 7½ feet wide, and the central figure an elevation of a "span roof." The former may be arranged against walls of any ordinary height, the width of the house as a rule being about the height of the wall against which it is intended to stand. For instance, in fig. 1 the house is shown as built against a back wall of 9 feet high, and as this is intended to be a permanent and not a temporary building, it has dwarf walls under it, rising 12 inches above the ground level. In localities where it is desired to have these houses temporary, or movable, as a tenant's fixture, woodwork secured to rough wooden posts is let firmly into the ground, and thus forms a substitute for the walls of masonry or brickwork. The roof has compartments or planes of bars and glass, each from 3 to 4 feet deep, and these divisions are separated by so-called "radial ribs," fixed edgeways and running lengthways of the building under the lower ends of the bottom bars and glass, and between the top and bottom of all the others. Each radial rib, irrespective of the shape or size of the building, is perforated by openings close to each other from end to end for ventilation, and it has, moreover, a valvular apparatus fixed inside for properly regulating the ingress and egress of the outside and inside atmosphere.

This part of the arrangement is very clearly shown in the perspective elevation, fig. 2. It is, perhaps, superflous to remark that these radial ribs have been specially designed so that under all circumstances of the weather, even during the most severe storms, they are thoroughly rain-proof, and when closed, nearly air-tight. To the bottom of each radial rib the upper ends of the bars are secured, and upon the top side of it the feet of the bars rest. The roof-bars are so framed that the glass is put in without putty, and in such a way as to render them as air and water-tight as possible. The so-formed external aspect of the roof presents to the eye a series of plants fitted with glass, divided vertically by small wooden bars, and horizontally by the radial ribs, so fixed as to make the top of one plane recede a few inches whilst the lower end of the plane immediately above it projects and overhangs. The radial ribs are fixed to timbers put together in the shapes necessary to receive them, and they thus act as principals which span the house at intervals of from 7 to 8 feet. The above description of the roofing principle applies equally to all the horticultural houses built by Messrs. Cranston and Luck, whether of half-span, lean-to or span-roofed buildings. Half-span buildings, as represented on fig. 1, can readily be made to fit upon walls of any height between 5 and 10 feet, and as they vary little in price from the cost of ordinary lean-to houses, it is not necessary to go to the expense of heightening any existing wall for the purpose of receiving the greenhouses; thus where an existing wall is 7 feet high, a half-span house, like that shown in fig. 1, can be erected aganst it at about the same outlay in wood and glass as a lean-to building of like dimensions, against a higher wall. This patented construction admits of a great variety of forms, and may be applied to any situation against walls or as shown by the engraving, fig . 2, which represents a greenhouse or conservatory leading from a drawing-room, or it can be arranged to fill up any angles in the walls of a residence and gardens. Fig. 3 is a perspective elevation of an horticultural building or stove, of a more extensive character than the previous example, and is constructed of a cruciform figure. Figure. 4 is another and elegant example, constructed, as will be seen, without the central transept shown in fig. 3. In fig. 5 the arrangement of a greenhouse on the summit of a house is shown, thus utilising the roof-space and affording an admirable means of cultivating considerable numbers of useful plants, as well as fruits requiring heat and the protection of glass. All the examples have been photographed from houses that have been constructed by the firm in different parts of the country. From the example shown in fig. 5 it will be seen how easy it is to arrange a conservatory on the housetop, and this plan, we think, might be applied with advantage on our artisan dwelling-houses, since, by so doing, a now profitless and unsightly space would be utilised, besides adding more comfort and pleasure to the humble homesteads of our working classes, and healthy occupation in their leisure time. We have only one fault to find with the present construction, and that is, the ponderating wooden element over the metal one. No doubt the makers are partly right in their assertion that metal houses are too cold in winter and too hot in summer, but as they suggest that glass cannot be too liberally used in such buildings, the substitution of metal over wood in the roof construction speaks for itself, as it would be found advantageous ; for, besides rendering the construction lighter, as well as affording more glass and light room, still, fragile as glass is, there are ways of combining metal and glass into perfect air and water-tight joints without the use of paint or putty, &c., both liable to break or peel off with time, and still retain the characteristic features of these buildings.

DESIGNS FOR HORTICULTURAL BUILDINGS.

Fig. 2.

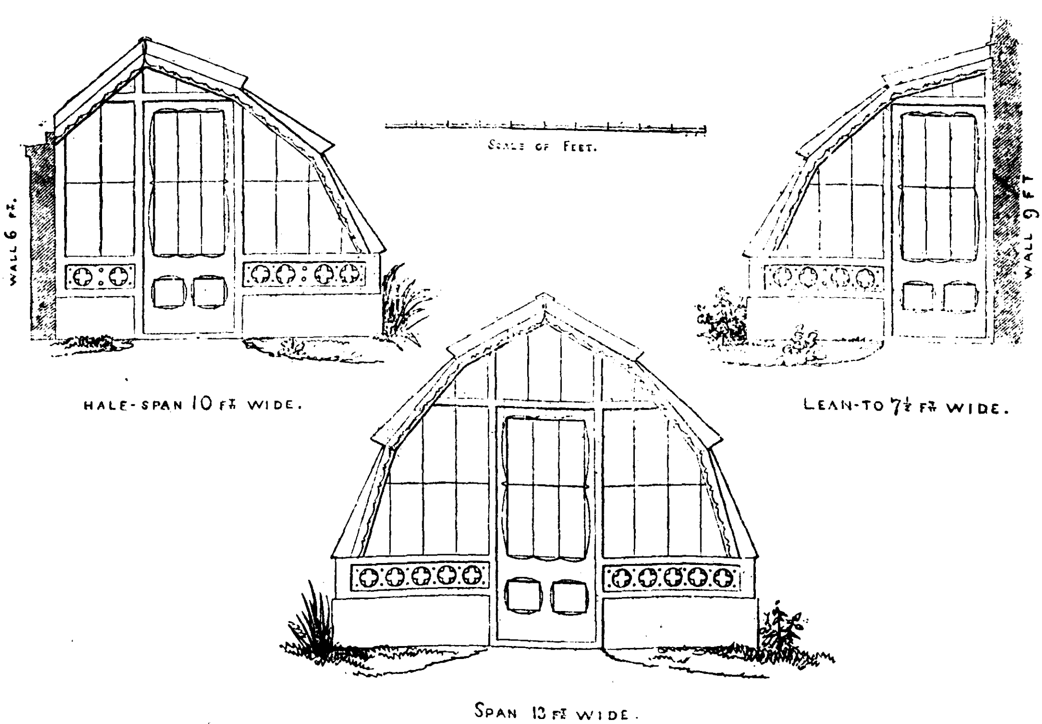


Fig. 1.

DESIGNS FOR HORTICULTURAL BUILDINGS.

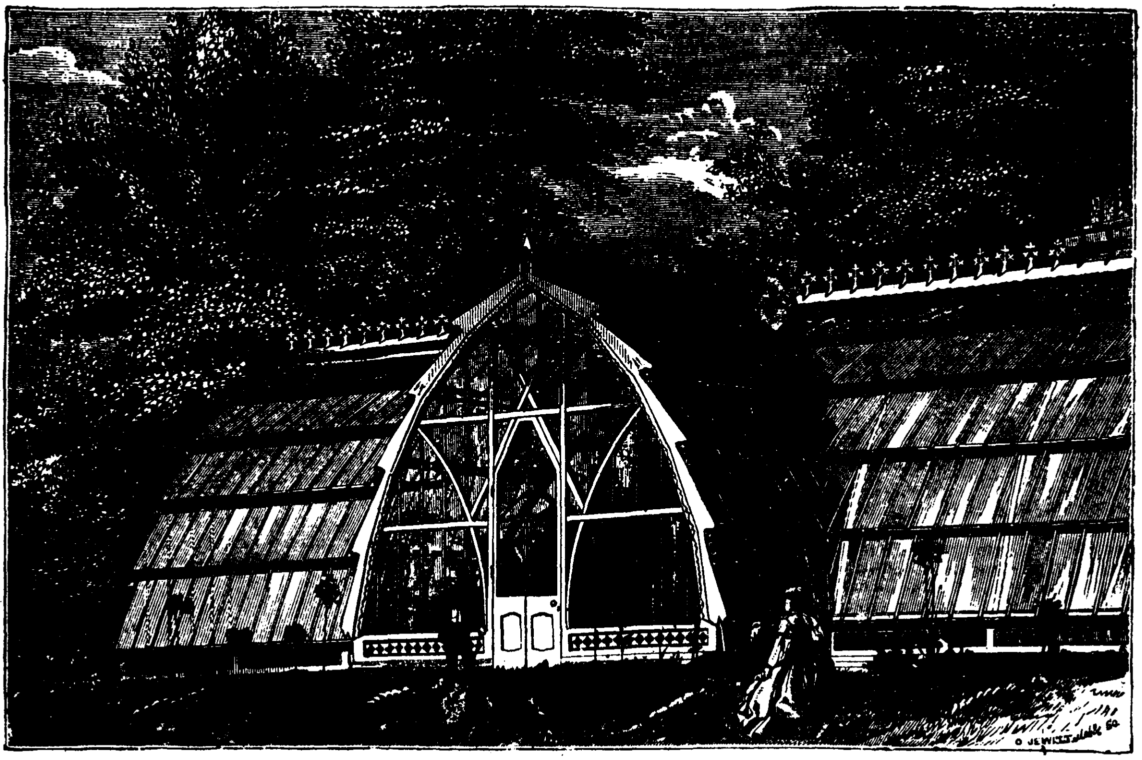


FIG. 3.

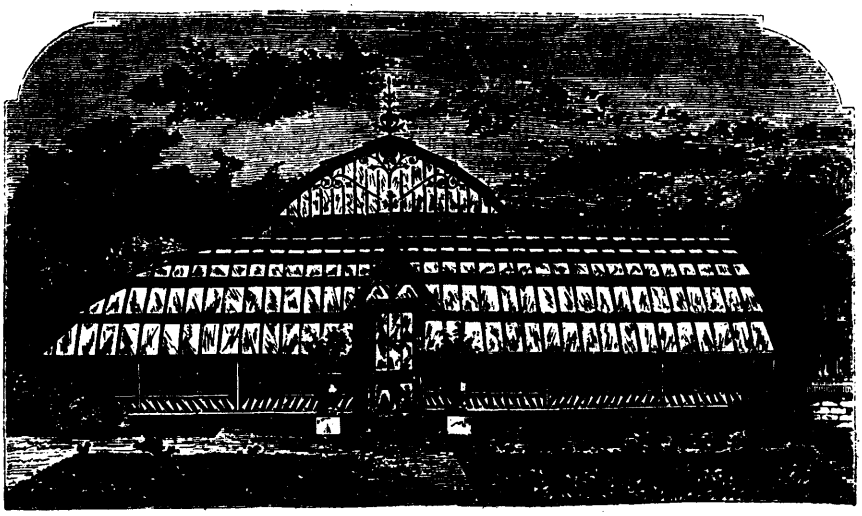


FIG. 4.

NOTES ON CURRENT TOPICS.

TELEGRAPH EXTENSION IN AFRICA.

It is proposed to cary a wire to the Cape across the African continent. There is at present telegraphic communication from Alexandria to Khartoum, a distance of eleven hundred miles, and surveys have already been made for its continuance to Gondokoro. From Khartoum to Delagoa Bay, where the South African lines terminate northward, is only about 2600 miles, shorter than existing lines on the other three continents. The route would lead under the Victoria Nyassa and Tanganyika lakes, and thence down the Shiré and Zambesi rivers to the sea, where a short ocean line would connect it with Delagoa Bay or Port Natal. A branch would go from Ujiji to Zanzibar. Of the 1500 miles or so of aerial line it is suggested that much might be erected without the expense of poles by taking advantage of the trees over thickly-wooded tracts, which are frequent in tropical Africa. The difficulty would be to keep the natives from utilising the wire in regions where iron is scarce and valuable, but this might be got over. The undertaking, if it could be established and kept in working order, would be exceedingly lucrative, and would in many ways aid in opening up Africa to commerce and civilisation.

THE RAILROAD AND RAILWAY.

Railway management is not quite the same thing on both sides of the Atlantic, but it comes to about the same in the end. On the railroad there is only one class, but the smoking car on the one hand and the Pullman on the other sift passengers into classes almost as perfectly as our own system. On the whole, perhaps, the American system has more good points as regards passengers. The amount of peculation in each is probably about the same. The American conductor or guard bleeds the companies freely. Enquiries made a short time ago showed that seven conductors on a Western railroad, out of five hundred and fifty dollars received during a certain period, had only accounted for one hundred and twenty-five. One enterprising operator having got the ticket agent away for a night took the whole opera troupe by his train, skilfully spreading the cash receipts over three months' reports. There is one ugly feature common to both England and America, and that is the diabolical trick of upsetting trains by placing obstructions on the line. A person named Adams not long ago confessed to having occasioned several accidents in New York State by removing a rail, altering a switch, and in other ways. His excuse was that he had no intention of causing destruction of property or life; but that he intended signalling the train in time, and hoped to obtain a post on the line as a reward. There was some reason to believe the fellow; but the obstruction of the Irish Great Northern on Saturday last, which was very near causing serious accidents, is not open to the same favourable construction. It seems to have been actuated by pure malice or savagery; and it is to be hoped that when the miscreant is discovered he will receive appropriate punishment.

HOUSE DRAINAGE

We are glad to perceive that the Society of Arts has taken up a question, the importance of which can scarcely be overrated, and to which we have repeatedly called the attention of our readers. The wet system as applied to the removal of refuse has many conveniences, but unless there is a good system of general sewerage, and unless the house drainage is properly connected with the main system and sufficiently ventilated, the danger to health is greater than under the old plan. But we know that ventilation is very partially applied to drains, and that owing to the carelessness or dishonesty of builders and the indifference, and sometimes worse, of the local authorities, house drains, even in the wealthier quarters of London, are very insufficiently connected, and seldom ventilated, while the practice of having water-closets indoors adds materially to the danger. The council of the Society of Arts propose to ask for additional powers to be conferred on the local authorities, in order that they may be able to enforce a sufficient connection between house drains and main sewers; and it would be well if provision were made for a general examination of such connections. It is not, as has been intimated, in the poorer neighbourhoods alone that such deficiency exists, but some in the most aristocratic quarters of the metropolis also. Recently, in a very good street, a gentleman who bought a house for his own residence, had no long lived in it when evil smells were found to rise just in front of his dining-room window. On an examination it was discovered that, although the house-drain was connected with the well-constructed street sewers, it had simply been led from an old cesspool, which before the making of the sewers, had received the drainage of the house, and which, when compelled to connect the drain, the owner had been too lazy or too penurious to fill up

THE FLYING YORKSHIREMEN.

Mr. Ralph Stott was to have flown from Dover to Calais on Saturday last, and after gracefully sweeping round that port returned to the cliffs of Albion, doing the journey there and back in sixty minutes, whatever the force or direction of the wind. Of course he did not do it—the thing is impossible; but he gives as a reason for postponement the injunctions of his medical advisers. It is curious that in so many respectable newspapers we should find this barefaced hoax, or worse, treated seriously. The apparatus, which is said to have been tested privately, is described as about 300 lb. in weight, 5 feet long, 2 feet 6 inches wide, and 4 feet high. This, we are told, includes the car and machinery. There are no wings or tails, or rudders. In general terms Mr. Stott is said to describe his machine as a strong-built light frame, in which a "peculiar" mechanical arrangement is placed, and acted upon by a spring. This spring is compressed by a screw and wheel something like the brake of a railway van, and when it is desired to set the machine in motion, one end of the spring is allowed to press against the forepart of the frame, whilst the other part presses the mechanical arrangement. The only part of this wonderful machine that has been shown to the outward world is a piece of spirally twisted wire. The description given above in the projector's words is unintelligible. If it means anything, it suggests a feat like getting into a wheelbarrow and wheeling one's self, with the superadded difficulty of overcoming the force of gravity and rising into the air. A later paragraph announces that "Mr. Stott, the Dover aeronaut, left yesterday (Wednesday) morning for Germany, with the view of exhibiting his aerial machine to Prince Bismarck. Before starting he declined an offer by a gentleman of £2000 if he would only raise the machine from the ground. He has promised, he said, to let Prince Bismarck witness the first trial." It is probable that there are persons on this side the Channel who will shortly be more anxious to see Mr. Stott than Prince Bismarck can possibly be.

DIPSOMANIA.

There is an old saying to the effect that Providence is peculiarly watchful over drunken men and children. A man lately got drunk about Consett, and straggled on to a mineral line, where he lay down between the rails. A train passed over him while in that position, but harmlessly, for when the driver returned to the spot he found the man asleep an uninjured. This is rather a confirmation of the proverb. On the other hand, the American papers report that a Professor Westbrook after delivering a temperance lecture at a place in Ohio, got drunk, fell between two railway carriages, and was cut to pieces, an impressive commentary on his own lecture. However, to supplement the work of Providence, a new British institution to promote legislation for the control and care of habitual drunkards was the other day inaugurated at the Charing Cross Hotel. It is proposed, instead of sending confirmed drunkards to prison, to send them to an asylum, where means will be taken to cure them of their propensity to drink. The matter is a very delicate one. It is to be feared that at present there are many perfectly sane persons in lunatic asylums, kept there sometimes at the instance of interested relatives; and if every thirsty soul is to be made eligible for such a retreat, there will be an end of good fellowship, or no end to the number of asylums that will have to be built. Drunkenness certainly destroys many thousands annually, but so do many other vices, more socially offensive, which nobody ever thinks of putting down by the strong hand; and this is especially a case in which example is much more powerful than either precept or legislative interference.—*Iron.*

NATIVE SILVER.—A solid mass of metallic silver ore was recently found in the Globe mining district, Arizona, lying on the surface of the ground, weighing 2200 pounds. A careful assay showed it to be worth at least $20,000.

LARGE SAWS.—Messrs. Henry Disston & Sons exhibited at the Centennial the largest circular saw ever made, 100 inches in diameter, with fifty teeth; a rim circular saw, 60 inches in diameter; a 60-inch circular saw, with inserted teeth of the chisel pattern; and various specimens of steel.

AMERICAN PROTECTION.

Mr. Henry C. Carey, of Philadelphia, in a pamphlet entitled "Commerce, Christianity and Civilisation *versus* British Free Trade," has taken up the old-fashioned well-worn cudgels in defence of protective tariffs and carefully-nursed home industries. The alliterative title of his pamphlet appears to have been an afterthought, as, indeed, was the pamphlet itself. Works in this form labour under the great disadvantage of suggesting that as no publisher could be found rash enough to invest his money in them, the author, rather than remain mute and inglorious, has actually parted with ready cash for the satisfaction of seeing himself in print—an evidence of either his earnestness or his vanity. There is no disguise about Mr. Carey's counterblast to English free-traders. It is made up of eight letters addressed to *The Times*, but not published in that journal. Every effort was made to secure the appearance of the letters. A friend in London—probably one of those mysterious persons who are supposed by the outside world to have "influence with the press,"—was entrusted with the delicate task of obtaining their insertion. So far as can be ascertained, the mind of *The Times* was quickly made up, and the letters were refused admission to its columns. Mr. Carey tells us that his friend — the influential gentleman previously referred to—explains the brutal indifference of *The Times* in the following way: "he said, in effect, that that paper, in common with nearly all English journals, was so hopelessly given over to the advocacy of free-trade doctrines as to make it wholly useless to offer the letters for publication." Like Madeira of old, the letters have had a couple of voyages, and now present the odd appearance of a correspondence with all the letters on one side and none on the other. The reasons which decided the rejection of Mr. Carey's letters are not far to seek. He begins with Adam Smith, cites the opinions of Mr. Huskisson, and goes on to prove that the great commercial superiority of France over England, and the greater measure of wealth and prosperity enjoyed by the people of the former country, are due to the rigid protective duties with which French people have sympathised ever since the days of Colbert. Now, if Mr. Carey were a young gentleman fresh from the University, who had passed some leisure mornings in reading up political economy, this stuff about Colbert and protection would be comprehensible enough, but that this kind of thing should be advanced by a nature man of business is inconceivable. When a singularly-gifted American—Dr. Oliver Wendell Holmes—said that "when good Americans die they go to Paris," he struck the right chord in ridiculing the fanatical love of his countrymen for France, *i. e.*, Paris. The Frenchman is, according to Mr. Carey, the most perfect of creatures, always—we suppose—after the free-born American citizen. Freed from the most oppressive of all taxes, the Frenchman grows in love of the beautiful, in love of freedom, in that love of his native land by which he is everywhere so much distinguished—each and every stage of progress marking the growth of real civilisation. We will not pause to discuss the wonderful estimate of our friends across the Channel further than to remark that the French people are the least educated in Europe, and that their love of freedom only exists among the minority for the time being—who, when they get the upper hand, will most assuredly maintain the censorship of the press and every other restrictive law in its integrity. To mere sellers of "cinder-pig and shoddy" (*et tu Brute!*) like the English, France hardly appears a paradise of sound political economy and æsthetic culture. There is hardly sufficient distance between France and ourselves to supply us with illusions. We know that Britanny cannot read, and that Paris let loose is not quite an exposition of the principles of the beautiful and the free; but all these matters of detail are lost in the wonderful argument by which Mr. H. C. Carey demonstrates the soundness of the protective system. Taking the year 1856—a remote date on which to base a discussion in which trade interests are involved—he finds that among her exports France shipped manufactured goods—textile fabrics—to the value of 140,000,000 of dollars, or exactly the value of the three millions of bales of cotton and the hundred thousand hogsheads of tobacco exported in the same year by the Southern States of the Union. With considerable ingenuity, he raises the question of freight, as proving that the chances of prosperity must always be in favour of a manufacturing over an agricultural country, because it costs a less percentage to ship valuable goods than raw material. The beautiful fabrics of France would require but five-and-twenty ships to convey them, while the bulky products of the States would demand entire fleets. "How many ships were required?" he asks. "Thousands! How many seamen? Tens of thousands!" So far, Mr. Carey confines himself to facts and interrogations, and is on tolerably safe ground, but in the very next sentence falls into that extraordinary blunder which affects the otherwise supple mind of intelligent America. "Who paid them?" is the next question asked in his politico-economical "Cock-Robin." The planters! Who paid the charges on the cotton until he reached its final consumer? The planter; whose share of the two, three or five dollars a pound paid for his cotton by his customers in Brazil, Australia or California, amounted to but a single dime." This is, perhaps, the most tremendous statement ever made by any writer in any country on any subject. The planter did none of the things ascribed to his agency by Mr. Carey. Not the producer, but the distant Brazilian, Australian or Californian really paid the high prices to which the raw cotton of the planter was ultimately raised. This error of Mr. Carey's completely explains the confusion of his mind on the subject of free-trade. It is the consumer who "pays the pipers," whether that musician take the shape of a shipowner, a manufacturer or an almost prohibitive duty. This truth, which was made sun-clear a third of a century ago, has not yet dawned upon the American protectionist. The imposition of a high rate of duty is not "taxing the foreigner." Far from it. Nobody but the ultimate consumer suffers. Customhouses take their share—merchants, commission agents and capitalists, who advance gold to pay duties with, take a handsome profit on the duty—the whole of which falls with crushing weight upon the shoulders of the last buyer.

So far as can be gathered from Mr. Carey's extraordinary pamphlet, that country is the best off which consumes its own productions, for that seems to be the meaning of "bringing consumers and producers into near connection with each other." On this principle, China and Japan were once eminently happy countries, for they sufficed to themselves and suffered no stranger within their gates. Steam, also, has done little to improve the condition of the world, and especially of the English people, who are not to be compared with the egg-farmers of France! But we fear to weary our readers with a recapitulation of Mr. Carey's worn-out fallacies. These ancient arguments were, we had facied, "hung up for monuments," for they sound in modern ears like the clash of antique armour.—Iron.

An Oil Pipe Three Hundred Miles Long. — The Pennsylvania Transportation Company has been chartered by the State of Pennsylvania for the purpose of transporting oil from the oil regions to the principal Atlantic seaboard cities. The plan proposed is to run the oil through a four inch pipe along the surface; the forcing power will be nine hundred pounds to the square inch; there are to be stations at distances of fifteen miles, at each of which an engine of a hundred horse-power will be erected to work a pump to continue the flow from point to point. The company having decided upon the construction of the work, the president sought the services of General Harman Haupt of the Hoosac tunnel fame, and who, during the war, was chief of the Bureau of Military Railroads, who pronounced the scheme, after a thorough examination, to be entirely practicable, and he is now acting as engineer-in-chief. In view of the enormous product of oil in this country—thirty thousand barrels per day—and the rank it now holds among the leading articles of export, coupled with the exorbitant charges for railroad carriage from the wells to the seaboard, by the completion of the enterprise and its successful operation a complete revolution will be accomplished in the handling of this article. The estimated cost of the entire work, including fixtures, &c., is one and a-quarter million dollars. The Pennsylvania Company is the parent company, but there is also the Baltimore Transportation Company, chartered by the State of Maryland, and some five other companies are expecting to unite. The first objective point or terminus will be Baltimore, as being the most feasible and direct route for the pipes, following which other termini will be established in Philadelphia, New York, &c. The pipes being laid on the surface, and there being no obstacle in the way of forcing the oil to any height, the line will literally be an air line, and the distance from the oil regions to Baltimore is three hundred miles. The oil will be distributed from the pipes into immense reservoirs with refining establishments adjacent. The feasibility of this enterprise, so far as the passage of the oil through the pipes is concerned, has been fully established by the present system in operation in the oil regions, where the aggregate length of the pipes conveying the oil from the several wells to the reservoirs is nearly two hundred and fifty miles.—*Boston Traveller.*

DESIGNS FOR HORTICULTURAL BUILDINGS.

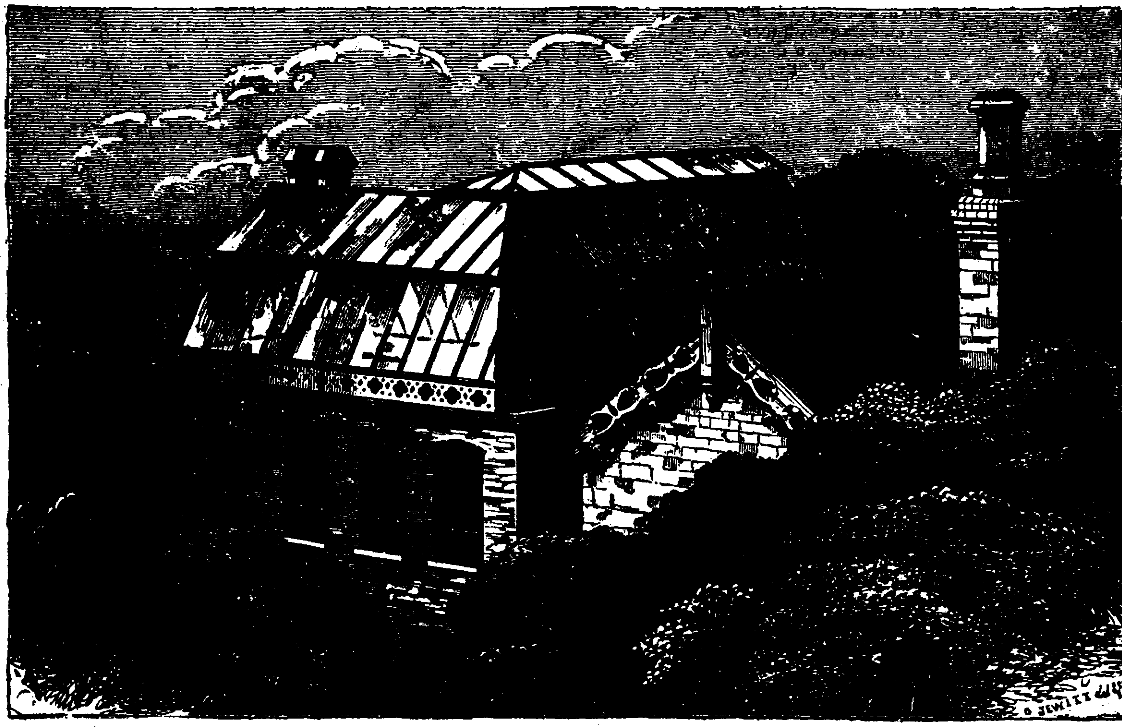
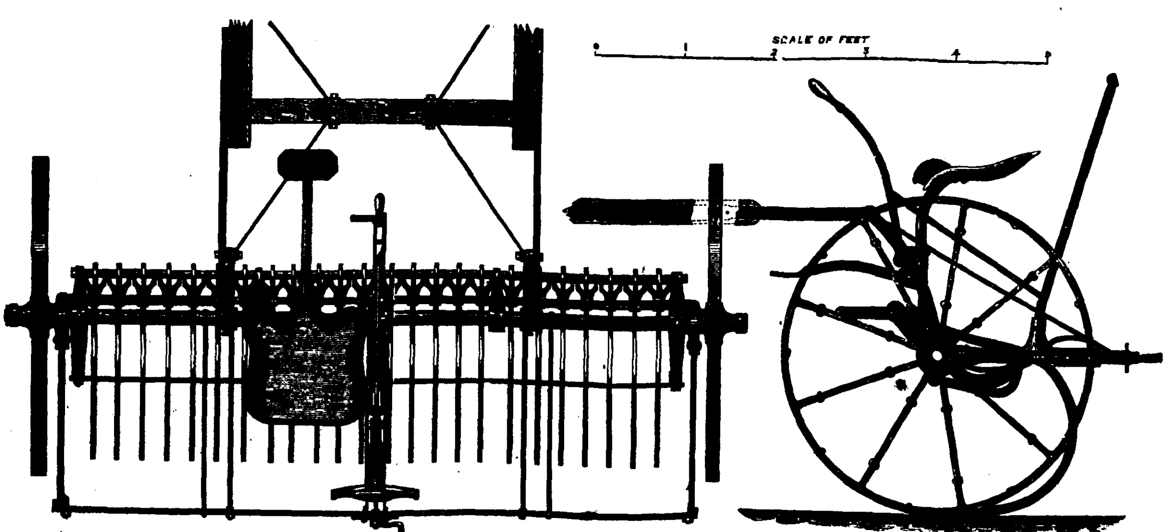


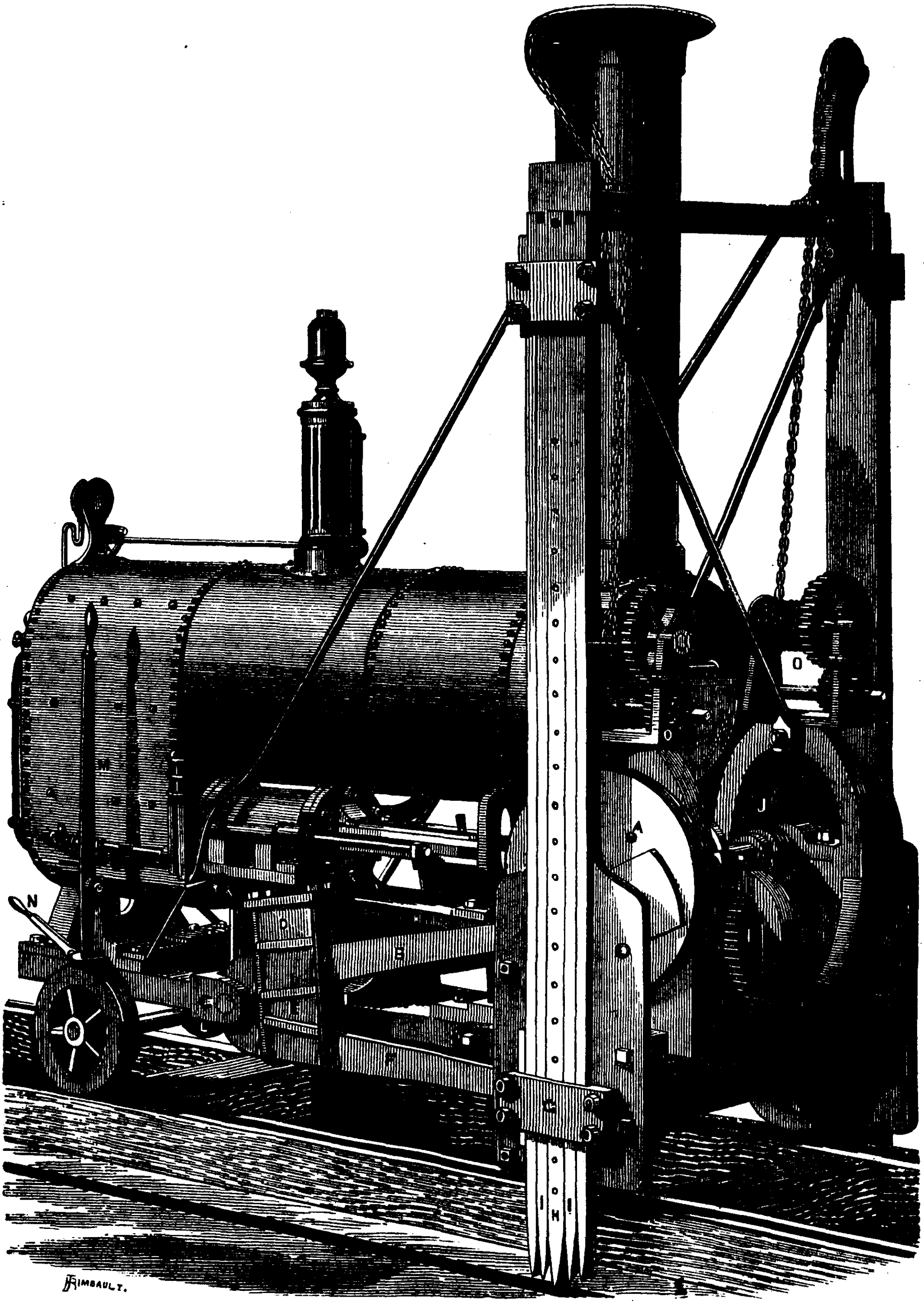
Fig. 5.

PATENT HORSE-RAKE.—Reading Iron Works Co.



QUARRYING MACHINE AT THE PHILADELPHIA EXHIBITION.

CONSTRUCTED BY THE STEAM STONE CUTTER COMPANY, RUTLAND, VERMONT, U.S.A.



PRACTICAL HINTS.

VARNISH AND OIL.—All kinds of varnish or oil measures can be effectually and quickly cleaned by boiling in soda lye. Or, if that is objectionable, bisulphide of carbon will dissolve anything of this kind completely, no matter how old. French and Belgian colza oil, provided they be unadulterated, are undistinguishable.

BLACK STAIN.—The following was obtained from a French *menuisier*, who is justly celebrated for the beauty of the objects of marqueterie he turns out. I give the recipe in French, for the sake of exactitude, in his own words, and append English translation :— "Presque tous les bois peuvent être peints en noir, par le procédé suivant : on prend de l'extrait de bois de campêche que l'on fait bouillir dans 2 litres d'eau ; lorsque l'extrait est dissous, on ajoute 4 grammes de chromate jaune de potasse (non pas le chromate rouge), et l'on agite le tout. L'opération est alors terminée et le liquide peut servir soit pour l'écriture, soit pour la teinture, sur bois ; sa couleur est d'un très beau violet foncé, qui, appliqué sur le bois, devient d'un noir pur." Almost any wood can be dyed black by the following means : — Take logwood extract, such as is found in commerce, powder, 30 grammes (1 ounce), and boil it in 2 litres (3½ pints) of water ; when the extract is dissolved add 4 grammes (1 drachm) of yellow chromate of potash (not the bichromate), and agitate the whole. The operation is now finished, and the liquid will serve equally well to write with or to stain wood. Its color is a very fine dark purple, which becomes a pure black when applied to the wood.

VARNISHING SCREENS.—It requires experience and practice to varnish screens satisfactorily, and therefore amateurs do not often succeed ; but the following directions may be of use : Cut up the best white size into small pieces, put into a large gallipot with a little water at the bottom, and melt by the side of a fire. When the whole is liquid and very hot apply with a large flat brush very evenly, quickly, and completely over all the panels of the screen, keeping the size very hot all the time. When the first coat of the size is dry, apply another in the same way, and when that is also perfectly dry it may be varnished with the best white hard spirit varnish, using a flat brush about 2 in. wide, and laying the varnish on very evenly up and down the panels. The screen must be, during the sizing and varnishing, kept in a room with a warm, even temperature, and the palest and best size and varnish should be used.

PORTLAND CEMENT ON WOODWORK.—Portland cement has many uses in the garden and elsewhere, not generally apparent. Some of them are enumerated by the *Garden* as follows : When made into a thin solution like whitewash, this cement gives woodwork all the appearance of having been painted and sanded. Piles of stone may be set together with common mortar, and then the whole washed over with this cement, making it look like one immense block of gray sandstone. For temporary use a flour barrel may have the hoops nailed, so as not to fly apart and the inside washed with a thin paste of Portland cement, and it will serve for a year or more to hold water. Boards nailed together and washed with it make good hot water tanks ; and it is of use in so many ways that it may be regarded as one of those peculiar things in a garden which it is always good to have at hand.

TOOL SHARPENING.—The *Tichler-Zeitung* states that a razor recovers its edge if left for half an hour in water which contains sulphuric or muriatic acid in the proportion of one part by weight of acid to nineteen of water. The razor is carefully wiped on being taken out of the acidulated bath, and passed over an oilstone. The acid bath is said not to hurt the blade ; on the contrary, the quality of the metal in some cases improves by the immersion. So with scythes and sickles. The time lost in the harvest field in the early morning in sharpening scythes would be spared by laying the blades for half an hour in a bath prepared as above described. As soon as taken out of the bath they should be wiped, and a soft sandstone hone passed along would leave a good and uniform edge behind.

AMERICAN RAILROADS.—At the close of 1875, the amount of capital expended upon American railroads had risen to $4,658,208,630. The aggregate earnings of the various miles in 1875 were $503,065,505 ; and after payment of working expenses and interest on bonds, dividends were paid on shares and stock to the aggregate amount of $74,294,208.

QUARRYING MACHINERY.

(See page 365.)

Amongst the various stone-dressing and working machines at the Philadelphia Exhibition is one contributed by the Steam Stone Cutter Company, of Rutland, Vermont, which we illustrate on page 000. The engine is of six horse-power, and is carried on a wrought-iron four-wheeled frame, running upon rails laid down over the site upon which the machine is to work. On each end of the main shaft is a flywheel A, carrying a crank-pin to which is attached the connecting rod B, which with F is coupled to the frame by the pin C. The upper end of the lever B passes through a sliding plate attached to the crank-pin, and a reciprocating motion is imparted to the lever B by the revolution of the flywheel. The corresponding end of the lever F passes through a guide G bolted to the bottom of the vertical frame shown in the drawing. Motion is communicated from the upper to the lower lever by means of coupling bars between which rubber blocks D E are placed. The end of the lever F passing through the guide G gives motion to the group of five cutting tools I H. These bars are of steel placed side by side, and move in top and bottom clamps, as shown. The two bars I have chisel ends set diagonally, while the others are square. The middle bar H is wider than the other and extends to a somewhat lower level. By this arrangement, when the machine is advancing, the front pair and the middle chisel operate, and in travelling in the opposite direction the rear cutters come into action. Within the top clamp there is a series of serrations, in which corresponding serrations in the chisel bars fit, so as to prevent any movement.

Upon the main shaft is a worm J, which drives the wormwheel K, the shaft of which extends diagonally towards the back of the engine and terminates in a bevel wheel. On the rear axle are two other bevel wheels, which can be moved to and fro by means of the lever M, so that either can be thrown into gear with the bevel wheel first mentioned, and the machine is moved to and fro by this mechanism. Motion to the cutters is given by means of the lever F, which drives them up and down the upper clamps serving as guides in the fixed standards. The machines are made to cut channels at three different distances apart—4 ft. 6 in., 6 ft. 3 in. and 6 ft. 7 in. The standards can be set to any angle between a vertical position and one of 45 deg. The number of blows struck per minute is 150 on each side, and the rate of advance is 6 ft., the depth of cut varying from ½ in. to 1 in. according to the nature of the material, and channels can be cut to a depth of 6 ft., but a depth of 13 ft. in sand stone has been cut. Machines are also exhibited by the same makers with cutting gear only on one side instead of on both, like that shown in the drawing.—*Engineering.*

HINTS ABOUT GRINDING.

In the course of an article concerning grindstones, a writer in the *Iron Age* has the following on the action of the stone on the metal : Edge tools are fitted up by grinding, very much as a plank would be reduced in thickness were a large plane employed in which were set a hundred or more of very small gouges, each cutting a narrow groove. The sharp grit of the grindstone being harder than the iron or steel, cuts very small channels in the surface of the metal, and the revolving disk carries away all the minute particles that are detached by the grit. If we were to examine the surface of a tool that has just been removed from a grindstone, under the lens of a powerful microscope, it would appear as it were, like the rough surface of a field which has been recently scarified with some implement which formed alternate ridges and furrows. Hence, as these ridges and furrows run together from both sides at the cutting edge, the newly ground edge seems to be formed of a system of minute teeth rather than to consist of a smooth edge. For this reason a tool is first ground on a coarse stone, so as to wear the surface of the steel away rapidly. Then it is polished on a wheel of much finer grit, and finally, in order to reduce the serrature as much as possible, a whetstone of the finest grit must be employed. This gives a cutting edge having the smallest possible serration. A razor, for example, does not have a perfect cutting edge, as one may perceive by viewing it through a microscope, and yet the serrations are actually so much smaller than a human hair that the minute teeth cut the hair in twain, but when the serrations on the edge of the razor become so battered up and dull that they will not sever a hair or cut a man's beard off, the edge must be honed and strapped until the system of minute teeth will be so much smaller than a hair that several of them will take hold of the smallest hair at once. These suggestions will furnish something of an idea of the operation in grinding and whetting edge tools. Beginners are sometimes instructed when grinding edge tools to have the stone revolve toward the cutting edge, and sometimes from it. When the first grinding is being done, this is a matter of indifference, but when the finishing touches are applied near and at the very edge, a grinder can always complete his task with more accuracy if the periphery of the grindstone revolves toward the cutting edge, as the steel that is worn away will be removed more easily. Whereas, when a stone runs in the opposite direction, the grinder cannot always tell exactly when the side of the tool is fully ground up to the edge. This is more especially true when the steel has a rather low or soft temper. The stone when running away from the edge will not sweep away every particle of the metal that hangs as a "feather," but when the stone revolves toward the edge, there will be no "feather edge" to deceive the eye of the grinder.

PATENT OFFICE PUBLICATIONS.

We reprint, in full, a leading article from the *Engineer* on Patent Office Publications in England.

About a year ago we published a paragraph in praise of the manner in which the Patent Office did its work as far as the printing and publication of the specifications were concerned. We regret that we are no longer able to speak in the same terms of the department, as the work is falling into serious arrears and the quality of that work is deteriorating. Our readers need not be told that this is owing to the ill-judged alteration in the mode of printing the specifications ordered by the Master of the Rolls, which have been frequently referred to in these pages. To make good our allegation of delay, we may state that only about 150 specifications of 1876 have yet been issned, although eight months of the year have already expired. (It will be understood that the publication of the specifications must always be apparently six months in arrears, as that is the period allowed for taking the various steps in the grant of letters patent.) When we say that the applications now number about 100 per week, it will be seen that the arrears are somewhat formidable. There is in addition a large number of specifications filled before they are due, and these ought to have appeared some months ago. So much then for the increased rapidity of production which was claimed by the proposer of the new scheme. With regard to the quality of the work, we have no hesitation in pronouncing it to be bad, but we must not be understood as imputing blame to the contractors, as the faults are those of the system. The lines are in many places rotten, and where there is much detail the drawings are simply useless. As an example of this we refer to No. 37 of the current year, which is a patent for a sewing machine. No expert who was careful of his reputation would, we think, like to pronounce an opinion based upon an examination of the drawings of that specification, especially if the description did not happen to be particularly plain. The mechanism of small articles like sewing machines requires rather an enlarged view than a reduced one in order to render the construction perfectly clear. The object of the specification of a patent is to "particularly describe and ascertain the nature of the invention, and in what manner the same is to be performed." We deny that the new mode of publication will at all facilitate this end, but we reserve for another article the further discussion of this branch of the question, and in a few weeks we shall have a larger number of specifications to deal with.

We are unable to pronounce any opinion on that part of the scheme relating to the publication of the specifications in book form, as no weekly volumes have yet been issued. It is proposed, we understand, to bind up about twenty-five or thirty copies of each week's specifications (the blue covers being removed) into a book, and it is expected that persons will be found ready to purchase these volumes. Vain hope! It has been our lot in life to meet with divers kinds of crazes, but we do not believe that there is any living person outside Bedlam who would encumber his library or office with a set of such books. We are not referring to public instutitions and free libraries, as they already receive the Commissioner's publications gratis. The cost alone would be serious matter, as according to a calculation we have made, based upon the price of the separate specifications already issued, the charge for each weekly volume could not well be less than 35s. We are, of course, assuming that the cost of each volume would be the aggregate cost of the specifications constituting it, and the fact of the price being printed on the specification itself as well as on the wrapper, which was not so before, justifies us in this assumption.

Some years ago a correspondent pointed out in these columns that it was the practice of the Commissioners of Patents to secrete a certain number of copies of each specification in their vaults for some mysterious reason. This entailed a serious expense, as the public were not allowed to purchase any of these, the Commissioners preferring to commit the extravagance of reprinting the specifications when any demand arose. It appears to us that the Patent Office is about to be guility of the same blunder as before, but in a slightly different form.

We should state that the price of the specifications has been slightly reduced, the small ones being now 2d. instead of 4d. as heretofore. It must not, however, be inferred that the price is in every case 50 per cent. less. But as we pointed out in February last, when the scheme was first mooted, it is not at all likely that the sale will be increased to any great extent. If a person really requires a copy of a certain specification, he is not likely to refrain from purchasing it because the price is a shilling, nor is he likely to buy two copies if it costs say 8d.

We print a letter which points out a small but serious inconvenience attendant upon the new system. Our correspondent asks but a modest boon, and we willingly give publicity to his request, but under the new *régime* of the Patent Office, the public is regarded rather as a "vile body" on which experiments may be made, than as an assemblage of persons whose convenience should be the primary object.—*Engineering*.

PATENT SPECIFICATIONS.

(To the Editor of ENGINEERING.)

SIR,—As I understand that your paper has paid particular attention to the so-called "reforms" which have recently been introduced into the Patent Office, may I beg you to use your influence in order to prevent the perpetration of an absurdity with which we are threatened? On applying for copies of a certain specification the other day, I was informed that it was out of print and that it would not be reprinted in the old form. See what this involves. The patent in question having been the subject of much litigation, and many legal opinions and reports having been given on it, it follows that all the references to such and such a line of such and such a page of the original edition will not apply to the new edition, smaller type being used in the latter case.

On the general question of the policy of the alterations which the Patent Office authorities have just inaugurated, I do not wish to say anything beyond this, that they are totally unnecessary and uncalled for. It might at least be conceded that the old plan should be followed in reprinting the specifications of the patents up to the end of 1875.

Your obedient servant,

Chancery-lane, August 30, 1876. LEX.

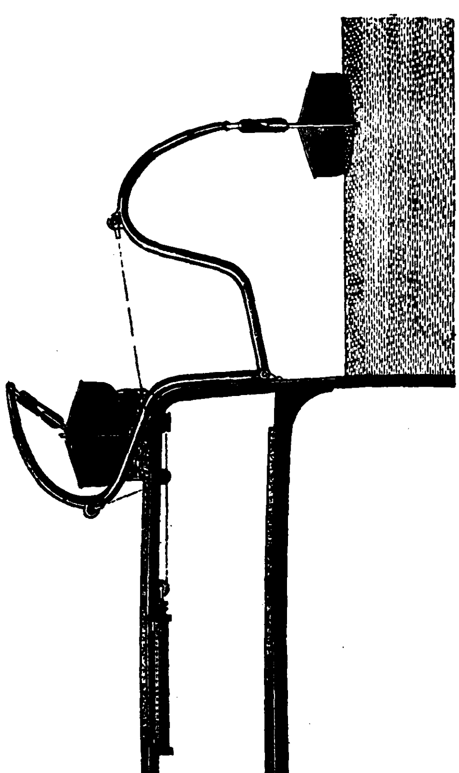
STOW AND BURNHAM'S FLEXIBLE DRILL.

(See page 368.)

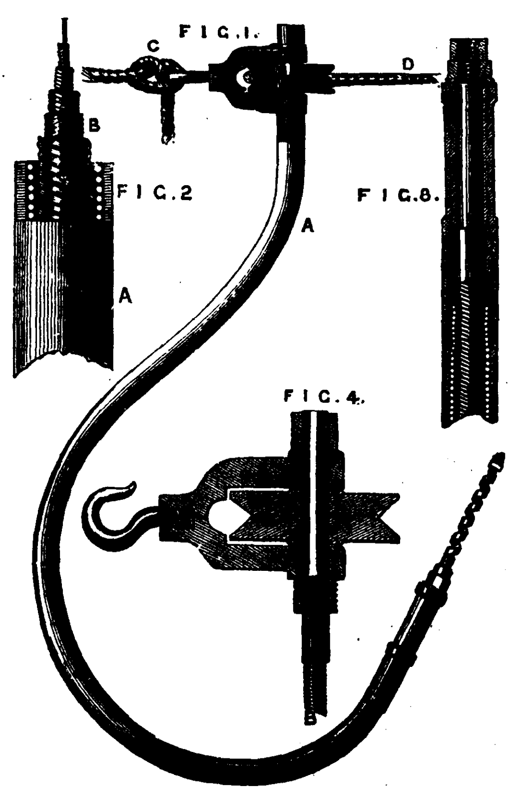
Among the minor exhibits at Philadelphia, one of the most ingenious is the flexible drill which we illustrate by the accompanying engraving, and which is manufactured by Messrs. Stow and Burnham, of Philadelphia. It consists simply of a flexible tube lined with a spiral wire, and through which is passed a closely coiled spiral, having at each end suitable connexions for a small sheave and for the drill respectively. These details are clearly shown in the drawing. A link passes around the sheave and has a hook attached to it, for the purpose of holding a tension rope when the drill is in use. The sheave is driven by a cord from a countershaft direct, or through a system of pulleys when the work to be done is removed to any distance. The largest-size drill yet made is 1 in., which is worked by a 1 in. cable, and the smaller sizes range from ⅜ in. upward, increasing by eighths of an inch; the lungest cable hitherto employed is 15 ft. The successful application of this drill has been shown at the Exhibition, by taking it round several bends and drilling ¾ in. holes in the Hamilton steeled chilled wheels.

This arrangement has been for some time past very largely used for dental surgery, and the idea of transmitting power round angles by a spiral cable is not new. Probably the first application was made in Belgium, where it was employed to transmit the power of windmills in driving stones, and later in at least one factory in this country it is used for driving countershafts. But the application for drilling purposes is as new as it is ingenious and efficient.

DESIGN FOR A COUNTRY HOUSE.



PINKER'S BOAT LOWERING APPARATUS.



FLEXIBLE DRILL.

THE FAMILY FRIEND.

This part of the MAGAZINE, for the future, will be devoted to instructive domestic reading for the *Home Circle*, such as SHORT PLEASING STORIES, DRAWING, MUSIC, BOTANY, NATURAL HISTORY, POPULAR GAMES, and amusements for boys and girls, NEEDLE WORK, AMATEUR MECHANICAL PURSUITS, and all the elements of a *practical domestic education* ; also GARDENING and AGRICULTURAL NOTES.

FLORAL CULTURE.

CYPRESS VINE (Ipomea Quamoclit.) Nat. Ord. Convolvulaceæ. *Linn.—Pentandria Monogynia.* One of the most popular of all summer climbers, flowers small, thickly set in a most beautiful dark *green* foliage, forming a striking contrast. *Tender annuals.*

DATURA (Trumpet Flower.) Nat. Ord. Solanaceæ. An ornamental genus of plants, many of which possess attractions of the highest order, and are not nearly so extensively cultivated as they ought to be. In large clumps or borders of shrubbery they produce an excellent effect. The roots may be preserved in sand through the winter in a dry cellar. *Half-hardy perennials.*

DATURA HUBERIANA, a splendid and effective variety, with dark *purple* stalk and branches. The blossoms are very large and double, pendant, dark *lilac* colored on the outside, the inside is almost pure *white.*

DELPHINIUM Perennial Larkspur). Nat. Ord. Ranunculaceæ. *Linn.—Polyandria Trigynia.* Plants remarkable for their great beauty, diversity of shades, and highly decorative qualities. They also differ greatly in their habit of growth ; some produce magnificent spikes of flowers, while others are dwarf, and completely covered with bloom. The double varieties are very beautiful. The principal color is *blue*, shading from the softest *celestial* to the darkest *purple blue*, while all are more or less shaded or marked with some other color. With the exception of D. cardiopetalum all are *hardy perennials.* For annual varieties see Larkspur.

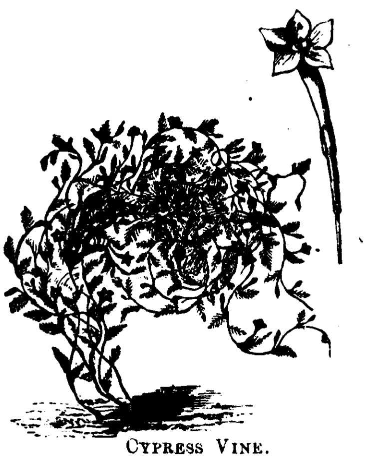
DELPHINIUM HYBRIDUM NOVUM, choice mixed hybrids from named flowers.

DIANTHUS. Nat. Ord.- Caryophyllaceæ. *Linn.—Decandria Digynia.* A magnificent genus, which embraces some of the most popular flowers in cultivation. The Carnation, Picotee Pink, and Sweet William, all "household words," belong to this genus. D. Chinensis and its varieties may be considered the most beautiful and effective of our hardy annuals ; the double and single varieties, with their rich and varied colors in beds or masses, are remarkably attractive ; while the recently introduced species, D. Heddewigii, with its large rich colored flowers, two to three inches in diameter, close, compact habit, and profusion of bloom, is unsurpassed for effectiveness in beds or mixed borders.

DIANTHUS CHINENSIS (*China or Indian Pink*), single, many colors mixed, hardy annual, very showy and fine for bedding.

DIGITALIS (Foxglove). Nat. Ord. Scrophulariaceæ. *Linn.—Didynamia Angiospermia.* Very ornamental and exceedingly showy plants for shrubberies and other half shady places ; from Europe. *Hardy perennials.*

DIGITALIS GLOXINOIDES, new and beautiful varieties with Gloxinia-shaped flowers, highly recommended ; 3 ft.



CYPRESS VINE.

DATURA FASTUOSA HUBERIANA VARIETATES.

DIANTHUS CHINENSIS.

DELPHINIUM HYBRIDUM NOVUM.

DIGITATIS GLOXINOIDES.

DELPHINUM FORMOSUM.

ANTIDOTES FOR POISONS.

Under this term people are inclined to place only those things which, if taken internally, produce death. Physicians, however, consider it merely a *relative* term, and call anything a Poison that does more harm than good to the body. A little of a good thing may be useful, but, beyond the point of usefulness, may be injurious. An exaggerated injury, from the same cause, may well be termed a poison. There is not a single poison in the entire list which, in proper quantities, and under favorable circumstances, may not be used with advantage to the human body; and, on the other hand, there is scarcely a single thing in ordinary use, which, if indulged in beyond the requirements of the body, or its ability to properly dispose of it, may not be followed by symptoms of derangement of the economy; and, in the above qualified sense, is not miscalled if termed a Poison.

In the majority of cases, the poison is introduced into the body through the stomach. As soon as swallowed, a portion of the agent may commence *destructive* action upon the mouth, throat, or stomach, as in the case enumerated of Acids, Alkalies, Phosphorus, etc. While some substances act in this way, others pass from the stomach through the mucous membrane, without injuring it, into the *blood*, and are carried by it to the brain and other portions of the nervous system, where the *really* injurious action begins, by overpowering them; so that the breathing and action of the heart are not kept up. To this class of poisons belong Alcohol, Aconite, Belladonna, Opium, Strychnia, etc.

A slight knowledge of the *mode* of action of a substance will, therefore, of itself suggest an antidote or remedy. If an Alkali has been taken, an Acid will *neutralize* it, converting it into a compound less hurtful. The new compound is, perhaps, *injurious*, but not so *active*, and can be removed from the stomach somewhat at leisure. On the other hand, if an Acid has been taken, an Alkali would naturally suggest itself as an antidote.

Some substances cannot be *neutralized* by any convenient article; the poison is then to be *removed* from its lodging place as soon as possible, and its effects *counteracted*.

If the agent does not act upon the stomach *directly*, but upon the brain and nervous system, reaching it *through* the blood, a recollection of what was said when certain gas have been inhaled will meet the case, Artificial respiration would, of course, be resorted to. This should continue until enough of the poison in the blood has been eliminated (thrown out) by the natural processes constantly going on *in* the body, until the brain and nervous system are able to resume one of their old duties, of attending to the respiration and circulation of the blood.

As few persons have the necessary knowledge of the different poisons, each of these substances will be spoken of somewhat in detail, and alphabetically arranged, so that, in case of need, immediate reference can be made to the particular substance supposed to have been taken.

Before saying anything further, it should never be lost sight of that the substance swallowed as a poison must be considered as two parts: The portion of that taken which has *already* had an opportunity of acting upon the mucous membrane (lining) of the throat and stomach, if the poison acts in that way, or which has already passed from the stomach into the blood, if the poison acts in the other way; and the portion in the stomach *yet* to be disposed of.

It is the latter portion, perhaps, in most instances we are called upon to first deal with; and the means employed is, to evacuate the stomach with the least possible loss of time. This is done with the stomach pump, and by emetics.

Stomach Pump.

No directions for poisons are complete without reference to this piece of apparatus. With people who know nothing about the matter, it is very popular. The writer knows of but one physician among all his acquaintances who professes to keep one, and unless this particular instrument is different from all other complicated instruments rarely used, he does not believe the owner of it could get it to work in an emergency, if he wished. Not a single apothecary, as far as he knows, keeps one; and the writer does not know, among all his intelligent acquaintances, a single non-professional person who could use a stomach pump with success if he had a dozen of them at his command. A handful of salt and a tumbler of water can always be had; and anybody can mix a heaping teaspoonful of ground mustard with a cup of water, and get a person to swallow it. Either, swallowed, will empty the stomach; a "stomach pump" will do more.

As has probably been observed, the *simplest* things, and those most likely of all others to be had everywhere, are the ones only spoken of in this pamphlet. The same purpose carried out at this point, leads us to say nothing now about the stomach pump; and, for the same reason, it possibly will not be referred to again.

Emetics.

For the purpose of rapidly emptying the stomach, in the decided majority of cases, before the arrival of a physcian, and after it too, there is nothing like an Emetic. The easiest had, also, is usually the best. There are few places where these things cannot be had—*Ground Mustard, Common Salt,* and *Warm Water*.

Ground Mustard.—Take a tablespoonful, mix with a tumbler of water to about the consistence of milk. Give the person one-fourth of it at once. Then follow with a cup of warm water. In about a minute, give the person the same quantity again, followed by the warm water. If vomiting does not take place, continue giving until it does, letting a minute or so pass between each dose. Plentiful drafts of tepid water materially *assist* the action of the emetic, and the free use of it should, therefore, not be omitted. Mustard is not only useful as an emetic, easily found, and as readily given as anything else, but it is *stimulating* in character. This feature gives it a peculiar value in most cases where an emetic is demanded, for there is often, with the necessity for its use, a stimulant needed. The amount derived from Mustard is not always enough; sometimes it is; but when not, so much has been contributed.

Common Salt is even easier had than ground mustard, and is as certain in action. It is given, a teacup of water with as much salt dissolved as the water will hold, every minute or so, until vomiting occurs.

Warm Water, given cup after cup, is a safe emetic; but as the above mentioned articles are so easily had, it is rarely relied on alone for the purpose. Usually it is given to assist the action of the others, on the principle, perhaps, that a distended stomach is often easier emptied than an empty one. After vomiting has occurred, frequent drafts of warm water are often given to cleanse out the stomach. In many instances, for this purpose, warm milk, gun arabic water, flour and water, the white of an egg in a teacup of tepid water, and such substances, are given instead, with the expectation that their gummy, viscid properties fit them to entangle and detach particles of the poison adherent to the mucous membrane (lining) of the stomach. Besides, they are soothing to the perhaps irritated condition of the parts.

Tickling the inside of the throat by the finger, or with the tip of a feather, in many instances alone will induce vomiting. Usually, after an emetic has been given, this is used to hasten its action.

Sulphate of Zinc is another valuable emetic, often found in private houses. As much as will lie heaped up on a common two-cent piece is twenty grains, which is a dose, when dissolved in water. This quantity should be given at a single draught, followed by a cup of tepid water, and repeated every three minutes until three or four doses have been taken, or vomiting occurs. If there is none in the honse, send to the nearest apothecary for sixty grains of the Sulphate of Zinc ("White Vitriol"). Empty the package containing this quantity into half a pint of tepid water. Stir rapidly with a stick, and it will soon dissolve. One-third of this half-pint should contain, of course, twenty grains of the sixty put in, and that quantity should be given at a single draught, followed, as all emetics should be, by draughts of tepid water. In a few minutes repeat, as directed about Mustard, unless profuse vomiting takes place.

Pulverized Ipecacuanha is another valuable emetic, particularly for children. It can be had of any apothecary by a messenger. Sixty grains (one drachm) of it may be requested. It is a ground root, and, as would be expected, does not *dissolve* in water, but mixes with it, like ground mustard. One-third of the sixty grains, which is twenty grains (as much in bulk as will heap upon a two-cent piece) may be given, mixed with a small teacup of tepid water, followed by a draught of tepid water. In a few moments, if vomiting does not occur, give another third, as you gave the first, to be followed in sixty seconds more by the last.

A good deal of trouble is often experienced in getting the person to *swallow*. This may be due to insensibility, fright, or stubbornness. The thumb of each hand may be slipped in outside and close against the teeth, along the line of junction, until the spot is reached behind where there are no teeth. Then through that vacant space slip the tips of the thumbs between the jaws, when a separation can be readily effected. The thumbs should be kept there, for the patient cannot bite the attendant while his fingers are in such a position, and the handle of a strong iron or silver spoon, or piece of smooth stick, thrust back far enough to forcibly depress the tongue. The liquid can then be poured down the throat, if the person is lying on his back. At first it will fill up the space at the base of the tongue, but a little more depression of the tongue by the leverage given by the spoon or stick will cause it to run down the throat. There need be no fear of the fluid getting into the windpipe, for a very sensitive valve over the entrance of the trachea (windpipe) amply protects it.

The *first* vomiting, as said before, does not necessarily *clear* the stomach of its contents. Much of the poison may remain *adherent* to the mucous membrane, requiring frequent *washings*, as it were, for detachment and removal. After the first vomiting, there is usually little trouble in keeping it up, simply by giving plenty of tepid water. Warm water alone is often, as said above, an Emetic ; and when none of the mentioned things can be had, must be wholly relied upon for the purpose.

Before the action of an Emetic can begin, a portion of the poison usually escapes from the stomach into the contiguous bowel. No vomiting can affect it ; so, after the contents of the stomach have been removed by the action of the Emetic, it is always well, if the poison belongs to what is called, for convenience, the Mineral class, to administer good quantities of milk, which, passing down, engages the activity of the poison. Flour and water will answer, but what is better, perhaps, is the white of eggs, mixed with water.

Now we will suppose all the *poison* has been *removed* by the above efforts from the stomach. The next thing is the removal of the *consequences* of the portion of the poison which has already commenced its work. If the mucous membrane has been injured, it should have rest from its usual work—digesting food—and be treated by suitable soothing applications, as barley water, gum arabic water, and such things. This should follow, where the poisoning is due to any of the articles embraced in the first class of substances treated of.

Deep Walnut Stain for Light Woods.—The employment of alkaline manganates for staining light woods in furniture and floors a beautiful, uniform, and durable walnut brown, is highly recommended by Viedt. The action depends upon the decomposition of the salt in the pores of the wood, with the separation in them of very finely divided brown hydrated peroxide of manganese. In practice, addition of magnesium sulphate to the solution hastens the reaction. The process may be conducted as follows:—Dissolve equal parts of manganate of soda and crystalized Epsom salt in twenty to thirty times the amount of water, at about 144°, and brush the planed wood with the solution. The less the water employed the darker the stain, and the hotter the solution the deeper it will penetrate. When thoroughly dry, and after the operation has been repeated, if necessary, the furniture is smoothed with oil, and finally polished. It is well to wash it carefully with hot water before smoothing it to prevent the efflorescence of the sulphate of soda formed. For floors the solution may be employed boiling hot, and if the stain is not dark enough a second application of a less concentrated solution should be made. After it is perfectly dry, it should be varnished with a perfectly colourless oil varnish. On account of the depth of penetration of the stain, a fresh application will not soon be required.

A Land without a Mill.—It is a somewhat curious fact that in the whole Island of Newfoundland, which has a territory nearly as large as the State of Pennsylvania, and a population of 150,000 souls,there is not a single grist mill of any description. Little grain is raised in Newfoundland, though as fine oats and barley can be grown there as in any part of the world, and in the western part of the island wheat ripens well. The people have been so accustomed from time immemorial to import almost everything except fish, that it is difficult for them to take the first step toward independence. The erection of grist mills would, without doubt, give greater encouragement to agriculture by supplying a home market for cereals, and we learn that a move has already been made in this direction. A grist mill is in process of erection in the island, and the machinery necessary to operate it have arrived. When completed, the mill will be compelled to import its wheat until a home supply can be obtained, and a shipment of grain has already been despatched from Montreal. We doubt whether any other country in civilised latitudes exhibits the phenomenon of being without so necessary an article as a mill.

ROMAN MAGNIFICENCE.

If anything was wanted to give us an idea of Roman magnificence, we would turn our eyes from the public monuments, demoralized games and grand processions, we would forget the statues in brass and marble, which outnumbered the living inhabitants, so numerous that one hundred thousand have been recovered and still embellish Italy ; and would descend into the lower sphere of material life—those things which attest luxury and taste—to ornaments, dresses, sumptuous living, and rich furniture.

The art of using metals and cutting precious stones surpassed anything known at the present day.

In the decoration of houses, in social entertainments, in cookery, the Romans were remarkable. The mosaic, signet rings, cameos, bracelets, bronzes, vases, couches, banqueting tables, lamps, chariots, colored glass, gilding, mirrors, mattresses, cosmetics, perfumes, hair dyes, silk ribbons, potteries, all attest great elegance and beauty. The tables of thuga root and Delian bronze were as expensive as the sideboards of Spanish walnut, so much admired in the Great Exhibition at London.

Wood and ivory were carved as exquisitely as in Japan or China.

Mirrors were made of polished silver. Glass cutters could imitate the colours of precious stones so well that the Portland vase, taken from the tomb of Alexander Severus, was long considered as a genuine sardonyx ; brass could be hardened so as to cut stone.

The palace of Nero glittered with gold and jewels. Perfumes and flowers were showered from ivory ceilings. The halls of Æliogabulus were hung with cloth and gold, enriched with jewels. His beds were silver, and his tables of gold. Tiberius gave a million of sesterces for a picture for his bed-room. A banquet dish of Dæsillus weighed five hundred pounds silver.

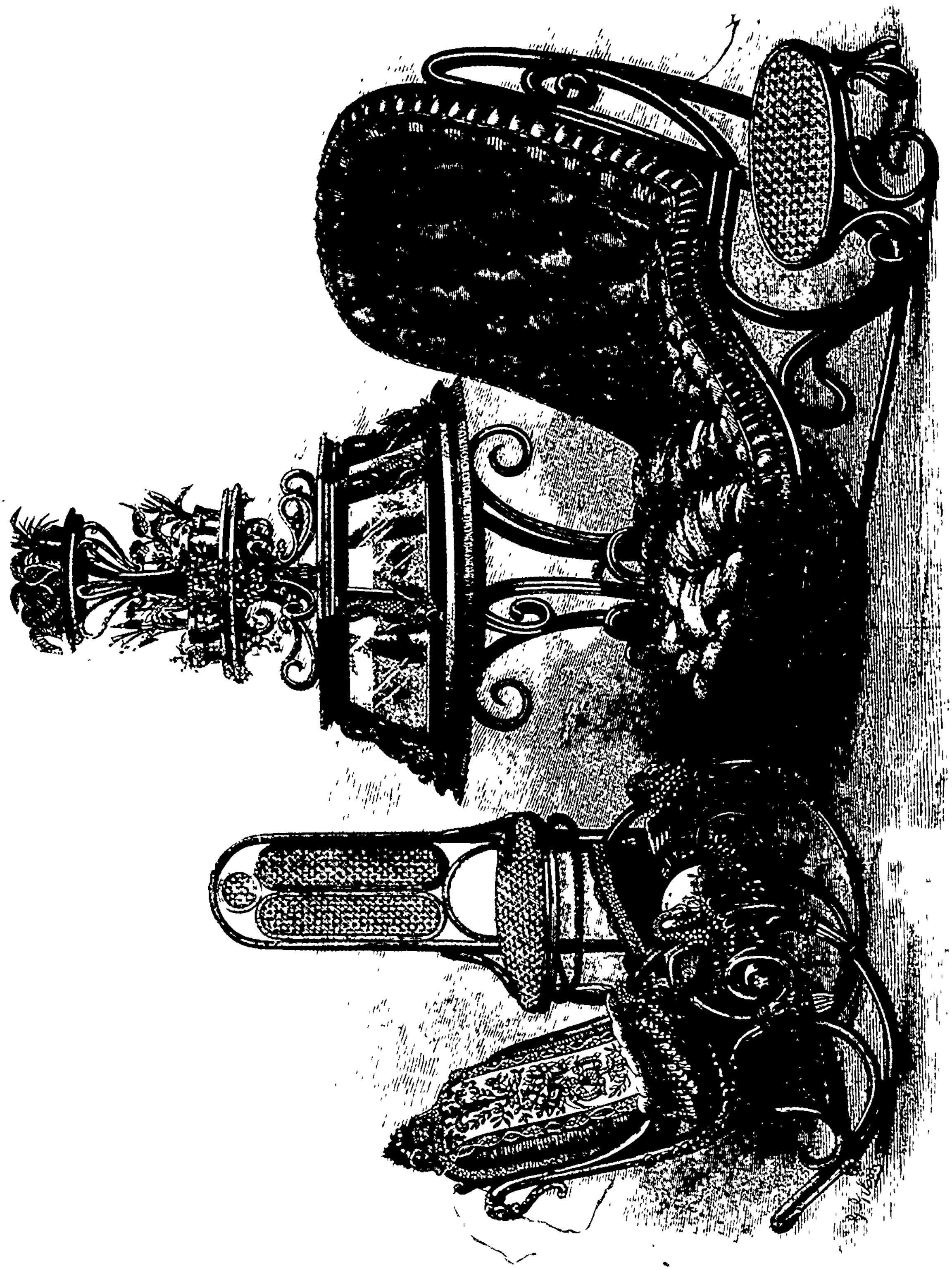
The Roman grandees rode in gilded chariots, bathed in marble baths, dined on golden plate, drank from crystal cups, slept on beds of down, reclined on luxurious couches, wore embroidered robes, and were adorned with precious stones.

They ransacked the earth and the seas for rare dishes for their banquets, and ornamented their houses with carpets from Babylon, onyx cups from Bythinia, marbles from Numidia, bronzes from Corinth, statues from Athens—whatever, in short, was precious or curious in the most distant countries.

The luxuries of the bath almost exceed belief, and on the walls were magnificent frescoes and paintings, exhibiting an inexhaustive productiveness in landscape and mythological scenes.—*Pen and Plow.*

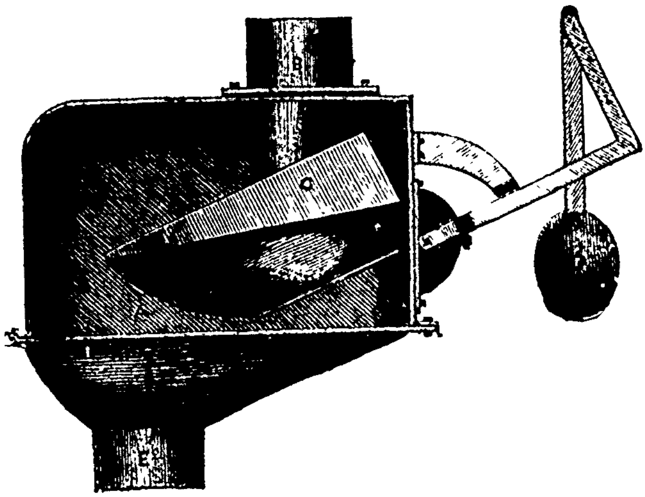
HOW PEBBLE JEWELRY IS MADE.

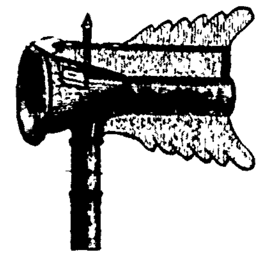
The following interesting facts concerning the manufacture of "pebble jewelry" are taken from the *British Trade Journal:* The gold used by jewelers is always alloyed with certain proportions of pure silver and the finest copper, according to the quality desired. The jeweler melts his metals in a crucible and casts them into ingots about two inches broad, three inches long, and one-eighth of an inch thick. The ingots are reduced to any degree of thinness by being passed between steel rollers. The sheets or plates of metal thus produced are intrusted to a workman, who, guided by drawings or models, clips out the pieces required for the various articles to be made. The pieces are given, along with the designs, to other workmen, who put them together. These men are seated at large tables, round the sides of which are a series of semi-circular recesses, each recess being occupied by a workman. After the pieces are brought to the exact size required, they are soldered together by means of a blow-pipe. Articles of an ornate character, such as brooches and bracelets covered with designs in filigree work or inlaid with pebbles, require great nicety of manipulation, and the number of parts which go to compose some of them is immense. Pebble bracelets of a finely worked geometrical pattern are made in which there are no fewer than 160 pieces of stone. In making an article which is to be inlaid with pebbles, the jeweler forms a back or foundation, to which a plate pierced with apertures for the pebbles is fixed, a convenient space being left between the two plates. At this stage the work is passed to the lapidary, who cuts and fixes the pebbles. The stones are first cut with a revolving disc of iron charged with diamond dust and oil, and roughly shaped with a pair of pincers. Each piece is then taken in succession and attached to a "cement stick"—a small piece of wood with a quantity of strong cement on one end. Held in that way the stone is ground to the



EXAMPLES OF BENT WOOD FURNITURE.

BANNER'S SANITARY SYSTEM.





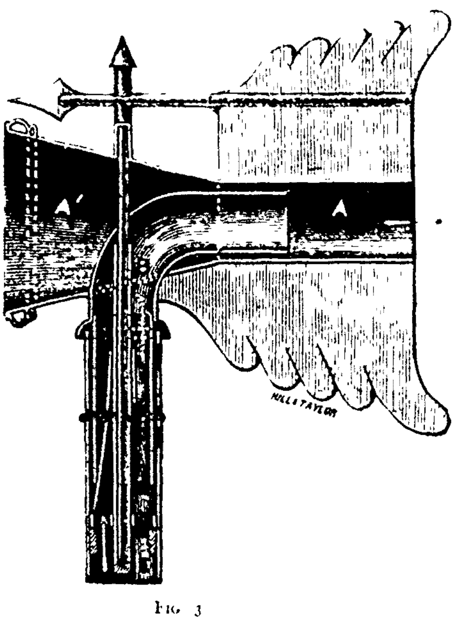


Fig. 3

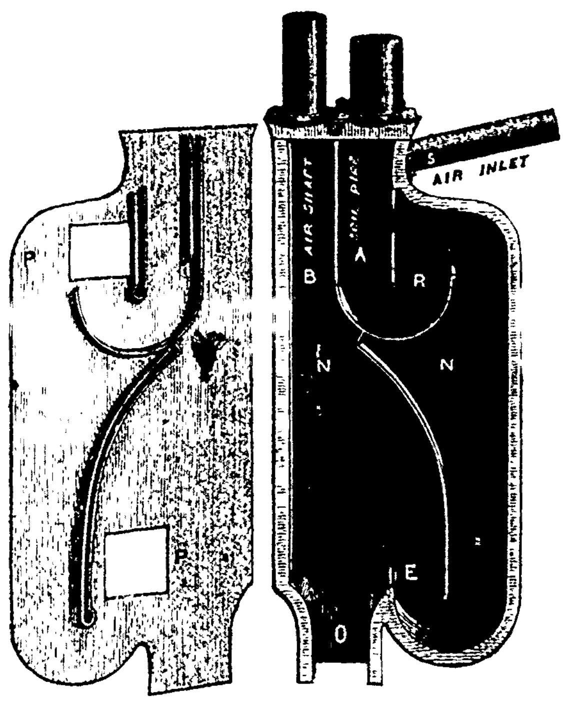


Fig. 2.

required shape on a revolving disc of lead charged with emery and water. When all the pieces are brought to the shape of the apertures designed for them they are set in shellac. The outer surface has up to this time been left rough, but after the cement has hardened the lapidary takes the brooch in his hand and manipulates it on the grinding disc until the stone is reduced to the level of the metal which surrounds it. The surface is next polished on a disc of tin charged with rotten stone and water, and the brooch is returned to the jeweler. Usually pebble brooches have in the centre a "cairngorm," or what is supposed to be one. The cairngorms are not "set" until the work on the other parts of the brooch is all but completed. The exposed surface of the metal of the face of the brooch is usually relieved by engraved scroll-work. Enameled jewelry has recently come into fashion to some extent, and fine specimens have been produced, the Runic patterns especially being very pretty.

RIGHT OF A PASSENGER TO A SEAT.

In the case of Barnet Le Van against the Pennsylvania Railroad Company, in Court of Common Pleas No. 4, at Philadelphia last week, the facts are given as follows: The plaintiff in November, 1868, purchased at Harrisburgh a ticket from the defendants for passage to Philadelphia, the train on which he was to take passage being known as the Cincinnati express. When the train reached the station at Harrisburgh it consisted of but two passenger cars, and an ordinary car, and a smoking car. The plaintiff asserts that he was constitutionally unable to ride in the smoking car, and the other car was full. The plaintiff was afflicted with a disease which made standing for any length of time poitively injurious to him, and, as some other cars were added to the train at this place, he asked permission of the brakesman, and was directed by him to enter one of them, a sleeping car, where he found a seat. When the conductor took up his ticket he demanded $1,50 extra for the privilege of riding in the car, which plaintiff refused to pay, alleging that his ticket entitled him to a seat, and that there were no seats elsewhere on the train. The conductor afterwards put plaintiff off the train about eight miles from Lancaster. He walked in to Lancaster and in the long walk his disease, as he alleges, was aggravated to such an extent that he has never entirely recovered from the effects of it. Le Van's suit for damages has been pending eight years. On the trial the company's version of the affair was that the conductor allowed the plaintiff to remain in the sleeping car until there were seats vacant on other parts of the train; that shortly after the train left Middletown the conductor requested him to take one of these seats and he refused, whereupon the train was stopped and he was ejected. There was no force, the defendants claimed, used on the plaintiff except the mere laying on of hands, so that he should not seem to assent to his being put off the train. It was the duty of the plaintiff, His Honour said, to accept the seat offered in the ordinary car, if such had been actually offered him, and that the conflicting versions of the affair must be reconciled by the jury. The jury, after a deliberation of over two hours, returned a verdict of $8,500 damages.—*Chicago Railway Review.*

BEWARE OF DUST.

The injuries done by dust are among the most serious to which mechanics and operatives are subjected. Wherever filings and fine particles of any kind are produced, it is very important to prevent their introduction into the lungs; even an occasional exposure may do harm, and one continued for months and years will certainly produce fatal results.

Dr. B. W. Richardson, of London, after several experiments with inhaling air through cotton, layers of crape, &c., informs us that he finds the best arrangement to be a number of feathers arranged around the outside of a perforated breathing tube of convenient size, so as to closely cover all the perforations; by breathing through the tube the feathers are drawn down to the perforations by inspiration, and by expiration they are lifted from the openings, and all the intercepted dust is blown off. The latter makes the arrangements with cotton or crape objectionable, as their pores are soon filled with the dust as well as the moisture exhaled by the breath. The tube is attached to an arrangement which allows it to be put on and taken off as easily as a pair of spectacles.

A natural protection against breathing dust is also afforded to most males of the Caucasian race in the beard and hairs around the mouth. These should not be removed by any persons exposed to a dusty atmosphere, who, therefore, do a very unwise thing if they indulge in the vice of shaving, which is nothing less than an attempt to improve upon nature's protective provisions. Three evils result from this practice: 1st. Stimulating the continual growth of the hair, which will become slow, and finally cease if not interfered with, while this stimulated growth is a steady unnecessary drain on the powers of the vital system. 2nd. The removal of a natural protection against cold from a place where this protection is more needed than is generally supposed. 3rd. The removal of a dust-protector, above referred to. Men inclined to pulmonary consumption should especially guard against shaving, and let their beards grow as nature intended, only curtailing a little when it becomes inconveniently long.

Another natural protection against dust may be secured by accustoming one's self to breathing exclusively through the nose, and only through the mouth when speaking.

MAT IN LEATHER WORK.

(See page 341.)

The leather used is sheep skin, or, as curriers call it, basil skin. The leaves, from any given pattern, are cut out with sharp scissors which cut firmly at the tips; curved scissors are useful, but not necessary for rounded leaves. As it is better not to pencil the leather, which gives a dark mark to the edge, those who are unaccustomed to draw and cut out by the eye may place a natural leaf or paper pattern on the leather as a guide for the shape. The leaves, when cut, are laid for a few minutes in warm or cold water; the leather is soon softened, and the water being squeezed out, they are pressed on a cloth. Observe that the colour from the leather stains Holding the leather leaf, thus rid of superfluous moisture, in the left hand, vein it with a blunt penknife, pressing it between the finger and thumb. Lay the leaves on cardboard, and dry them thoroughly by the fire; they should then be dipped in warm size, and again dried as before. Directions for making the size will be given presently. Common glue is the best cement for fastening the leaves on the wood. Before they are attached to the wood they should be thoroughly sized, the size not being made as liquid by heat as for dipping. Thin string or coarse silk twisted over a wooden plate or bowl, about an inch apart at the edge, forms a good method of pressing the leaves into the shapes required and which prevents them from adhering together. The best kind of size for applying over the work, when finished, is isinglass steeped over night in cold water, and let it simmer gently; then strain the liquor off clear; about a handful of either will make half a pint of good size. It may be kept in a bottle, and warmed by the fire when used. A hard brush is best, and the size may, with it, be used thicker than with a soft one. If it is thought necessary to colour either wood, leather, or both, this is done best with common water colour from a paint-box after the size is dry.

Horned Men in Africa.—There was a paper read before the British Association, written by Capt. J. S. Hay, relating to a strange malformation in the males of a tribe of people he has visited in Akem, in West Africa. An extract is as follows: Two diagrams which are laid before you depict to the best of my ability, and will at least convey some idea of a malformation which is, I believe, peculiar to this tribe. I have at least noticed it in no other. The malformation in question is confined to the male sex, and consists of a protuberance or enlargement of the cheek bones under the eye, which take the form of horns on each side of the nose. The malformation begins in childhood, but is not, so far as I am aware, hereditary. It presents no appearance of being a diseased structure, nor is it a raised cicatrice, after the fashion adopted by many African tribes. On the contrary I have seen children with this peculiarity of structure, whose parents were doing their utmost, though ineffectually, to stop it by medicines and applications. In the meantime, to set all speculation and conjectures at rest, and to corroborate a statement that doubtless may appear extraordinary, I have lost no time in writing to a missionary, a native of the country, to procure me, if possible, skulls in which the phenomenon appears; and as soon as these arrive it is my intention to exhibit them, in connection with a paper on the subject, which I propose to read at the Anthropological Institute in England.

BANNER'S SANITARY SYSTEM.

(See page 373.)

We have from time to time alluded to individual appliances forming part of Mr. Banner's system of sanitation, but have never before dealt with the system as a whole. We think that on account of the importance of getting rid of the deadly sewer-gas and the great interest which has been created by these inventions, a complete though brief description of the appliances themselves, and also of their action, will not be found uninteresting or uninstructive. All D traps—those fruitful sources of danger—are superceded by one really efficient tray, which forms a complete barrier between the soil-pipe and other connections on the one hand, and the house drain in direct communication with the sewer on the other. The soil-pipe is really ventilated, not ostensibly so by a small pipe carried up to the roof with no means of creating a current, but by an inlet for fresh air just above the trap, and by an outlet consisting of a pipe of sufficient sectional area surmounted by a cowl which exerts a drawing force up the pipe, in all states of the atmosphere.

The patent lever trap shown at fig. 1 consists of an air-tight chamber, A, of cast iron, with an inlet pipe, B, projecting several inches into its interior. On the end of this pipe is sprung an indiarubber band projecting slightly below it. The copper pan, C is, in the normal state, kept pressed up against the indiarubber band by the weight, D, acting through the lever attached to the chamber by dotted lines ; but when the flushing takes place, the column of water in the pipe, B, by filling the pan, overbalances the weight, D, and causes the parts to assume the position shown in the engraving. As the upper edge of the pan, however, never falls so low as the end of the pipe, B, the latter can never become unsealed. As soon as the rush of water ceases, the weight, D, brings back the pan to its original position. It should be stated that the fulcrum of the lever is perfectly airtight, so as to prevent any escape of gas. The lower part of the trap terminates in an outlet, E, communicating with the house-drain and sewer. It will be noticed that the lever is bent up at right angles, and that the weight is suspended by links from its end ; when the pan is in the act of tilting, the centre of gravity of the weight, D, is brought nearer the fulcrum, thus reducing the load and allowing the pan to remain tilted, until it is thoroughly flushed, and yet retaining sufficient power to bring the pan back again to its normal position when the flushing is over. The reason of this action is that before flushing, the pan, when full, weighs over 15 lb., while the utmost weight opposed to it on the lever is less than 15 lb. ; but, after flushing, the pan and the water left in it weigh under 7 lb. while the load on the lever is over 7 lb. The water cannot rise in the soil-pipe to a greater height than 12 inches above the chamber ; but the weight on the end of the lever is sufficient to maintain in the soil-pipe a permanent column of several inches of fresh overflow water, in addition to the clear water left in the pan after the thorough flushing. Besides the air-tight joint formed by the pan being pressed against the indiarubber ring, there is a water-seal of 3 inches in the pan in addition to several inches up the soil-pipe. There is, therefore, at all times a water-seal against the drain, cesspool or sewer, varying from 6 to 9 inches, after the pan is brought back to its normal position.

A cheaper, though not less efficient trap, without moving traps, has also been invented by Mr. Banner, as shown in fig. 2. A is a passage to which the soil-pipe is connected ; R is the first dip, and E the second, the distance between them being 2 feet ; O is the outlet connected with the house drain, and P P are two plates of glass in the cover to admit of the trap being readily inspected at any time without break of joint. The air-inlet pipe which forms an integral part of Banner's patented system, may either be connected to the trap at S, or direct to the lead soil-pipe, a little above the trap, which is the preferable arrangement. This trap is only 5 inches thick, outside measurement, and may be fixed against the wall, like a gas-meter, in a cellar or area, or may, indeed, be let into the wall itself, if space be an object. One trap in the basement of a house will suffice for any number of closets, baths, &c., and may be used to ventilate the soil-pipe only, or the soil-pipe drain, sewer or cesspool as well. In the former case the air inlet is at S, and in the latter by the sewer gratings, while the ventilating cowl is connected with A or B respectively, or with both, by means of a "pair of breeches pipe." It is not necessary to do more than allude to the grave objections to ordinary siphon taps, viz., that the least exhausting action in the sewer is liable to unstrap them, and that, from the water merely dribbling into them, they often remain so clogged up with filth as to be absolute generators of foul gases ; but a further indictment has been preferred by Mr. Rogers Field, C. E. against these old offenders, viz., that even when in proper working order, the contained water is capable of absorbing sewer gas, which is forced through it by the action of the sewer itself. In the improved trap under notice, as the chamber is of greater area than the soil pipe, the water rushes down from the closets above in a sufficient body to completely wash out the upper dip, and there is a further fall of 2 feet, equal to a force of 20 lb., to perform the same action on the lower dip. As the space between the two is kept absolutely air-tight by the water seals, no gas from the sewer can enter, and any effluvium from the soil-pipe is carried away at once by the current of air induced by the cowl above, through the inlets provided for its free admission.

A section of the ventilating cowl in its improved form is given at fig. 3. The horizontal tube, A, with its bell mouth, A1 , and the inner tube, B, bent at right angles, are connected together, and swivel on the central spindle within the vertical pipe, E, in connection with the shaft to be ventilated. The vane keeps the bell mouth always directed to the wind, which on entering becomes compressed to a certain extent in the annular space between the two tubes ; on expanding again, after passing the end of the inner tube, it induces a current up the vertical pipe, and so effects a thorough and continual ventilation in the direction shown by the arrows. It will be seen that the action of this cowl could only be suspended in a dead calm, which practically never occurs in this country, for meteorological records show that, even when the wind is said to be still, it is moving at the rate of from 1½ to 2 miles an hour, which is sufficient for creating a current through the cowl ; but the average speed for a whole year is from 10 to 12 miles an hour.

The great advantage of this ventilating cowl is that it is most efficient when most needed, that is to say, during gales, when, owing to the pressure of the wind, all intended sewer outlets are converted into actual inlets, and the increased pressure within the sewer and drains, united to the force of the wind blowing down the pipes usually put up for ventilating the sewer, and left open or merely capped, forces the gas thus locked up in them, through defective traps, into the houses. Some interesting demonstrations were made by Mr. Banner during the exhibition in connection with the last Social Science Congress at Brighton to prove that a mere so-called sewer-ventilating pipe carried up to the roof of a house does not necessarily ventilate the drain, but merely allows of an escape of the excess, the pipe always remaining full ; in fact, it now seems difficult to imagine how such a length of pipe of small diameter, closed at the lower end, could ever have been relied upon to take off sewer-gases without any agency to induce a current.

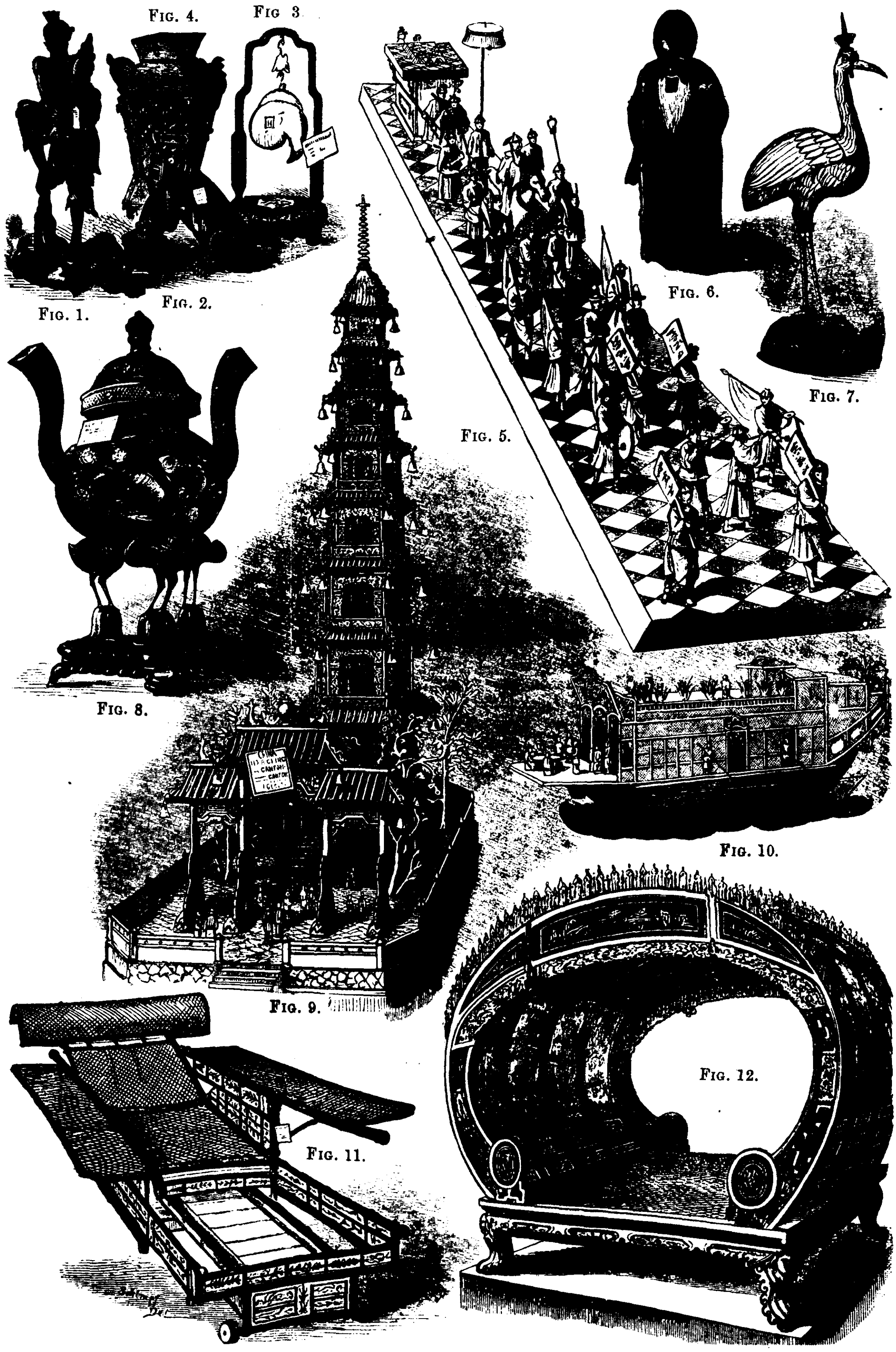
This cowl may be employed to advantage for thoroughly changing the air of public buildings, and in all other cases, such as ships' holds, where natural ventilation is inadequate. We are informed that a modification of the cowl will shortly be applied to carriages on some of the leading railways for the purpose of ventilation.—*Iron.*

Printing on Wood.—Mr. Maurice Young, of the Milford Nurseries, near Godalming, is endeavouring to carry out a process, patented by Mr. Whitburn, which might be made useful in decorations. We mentioned it long ago, but the operation may be thus described :—A given design is in the first instance drawn, and afterwards engraved on a wood block, from which an electrotype is taken ; this is then inked with a printing-roller, and printed with an ordinary hand-press in the usual way, with the difference that the slab of wood to be printed on is laid on the platen first, and the electrotype block on the top face downwards ; this block, too, must be laid on the place required, by hand, for the purpose of procuring a correct register. The ink used somewhat differs from the ordinary printing-ink, which would fail to give that sharp, clear outline which the process secures. The result of the printing is as sharp as though it were printed on paper, and is for the most part executed in dark brown or black inks. Artistic results may thus be produced, under proper guidance, at a trifling cost.—*The Builder.*

The Oldest Conductor.—The oldest conductor in the United States passes Randolph every day. His name is Isaac Woods, he is sixty-two years of age, and has been on different railroads for over forty years. In all this time he has never wrecked a train or met with any accident of any kind. He is one of the most faithful conductors on the Atlantic and Great Western road, and is content to die in harness.

GERMAN FURNITURE AND FANCY WORK.

THE CENTENNIAL EXPOSITION.



CURIOSITIES IN THE CHINESE DEPARTMENT IN THE MAIN BUILDING.

THE AQUARIUM.

THE FRESH-WATER AQUARIUM.

In this article I will proceed to describe, as shortly as possible, how to keep a fresh-water aquarium. I may as well tell you that it is not so easy to do as some people imagine ; it is sometimes a great source of trouble to the owner, and he soon gets tired of it.

The first thing is to procure a suitable vessel for your aquarium. There are several kinds of vessels employed for this purpose. The first and most useful is the rectangular glass tank. In buying one of these take care to get it as shallow as possible ; the deep ones are objectionable on account of their exposing such a small surface of water to the air, for it is absolutely necessary that the water should have as much surface exposed to the air as possible. I will explain the reason for this further on. The square or rectangular vessels are by far the best, for they do not distort the appearance of the fish like the circular vessels ; but then they cost at least twice as much as any other kind of aquarium, made of a propagating glass inverted, the knob fitting in a hole in a pedestal, the weight of water therein keeping it firm. Rockwood arches are not suitable for this kind of aquarium, a pillar or pile of stones being the best for this kind ; it is the best form for the young aquarium keeper, and, in fact, is the best for his fishes and his pocket ; they vary in price from one to fifteen shillings. The ordinary goldfish globes are almost useless, and I should advise you not to use them at all ; there are many other forms of aquaria, but the two first mentioned are by far the best. Having procured your aquarium you must now proceed to stock it.

THE WATER.

Great attention must be paid to this ; the water must be as pure as possible ; spring water must not be used, for it almost always contains one or more salts in solution or suspension ; rain water, when procured in the country and allowed to settle for a few days, may be used ; but if you can get other water it is much better—mind you, it must be procured in the country, and not in towns, for if rain water be collected in or about towns, it is almost always contaminated with soot, smoke, and other substances which are always floating in the air of towns and cities ; the best water that can be got is that from a clean pond. If there are any ponds in your neighbourhood, select the cleanest one ; if the water is not clear enough for you to see the bottom at a depth of three feet and a half, it is not much good, but may be used if you can procure no other. By seeing the bottom, I do mean seeing it indistinctly, but clearly ; you ought to see every pebble, however small, quite distinctly. This water will be found nearly pure if there are fish and plants already there. The next best water is that procured from a river or brook. I am inclined to think the brook water the best, for most rivers have the sewage of the towns they pass through flowing into them, which does not improve the water. To those who live in large towns and cities it is impossible to get pond or brook water conveniently, then you have to use the ordinary water supplied by the waterworks ; when you have to use this you must purify it yourself ; do not filter it, for that will do more harm than good. Fill your aquarium with the water, and set your plants in it ; do not put any fish in yet ; place it in a sunny window where the sun will be the longest on it. If there is rock work in your aquarium, turn it round every day, so as to let the sunlight have free access to all interstices ; in about three or four weeks glass and rock work will become covered with a confervoid growth, the plants and confervæ becoming covered with minute bubbles of oxygen gas, some clinging to the plants, and others rising to the surface of the water. Your fish may now be placed in it with safety, for the water has become purified by the action of the plants and sunlight combined.

There are many kinds of plants used for the aquarium ; but I shall confine myself to the best of them ; of course you cannot keep all the plants mentioned here in a single aquarium, but you may keep two or three kinds in a single vessel, if the specimens are small.

VALISNERIA

is, undoubtedly, one of the best plants for small or large aquariums ; it is not an English plant ; it is found in the south of Europe, and is named after an Italian botanist whose name was Valisneri ; it has long been cultivated in England by aquarium keepers and microscopists, the circulation of the sap being visible with the aid of a powerful magnifying glass or microscope ; it has the appearance of long grass, and looks very pretty when covered with bubbles of oxygen gas ; it requires to be planted firmly ; it may be procured at the aquarium dealers and some large nurserymen.

ANACHARIS

is the next best plant to the valisneria ; it may be obtained in almost every pond and river. It is remarkable for its rapid growth ; it is easily planted, requiring to be only tied to a stone and the stone buried in the sand at the bottom of the aquarium, or it may be put on the surface of the water and allowed to grow there. I believe it is sometimes called the water tyhme.

THE WATER SOLDIER.

This plant is rather scarce ; it should be planted in the centre of the aquarium ; lives well, but does not increase in size much when confined in an aquarium.

THE FROGBIT

is also a very pretty plant ; it has white flowers ; lives well in an aquarium ; looks something like a small water lily ; found in almost every brook and ditch.

WATER MILFORD

is a very slender plant ; it must not be planted too thickly among other plants, or it will soon die.

THE WATER CROWFOOT

is found in almost every ditch and pond ; it grows quickly ; is apt to die suddenly without any apparent cause ; but this does not matter much, as it is easily renewed.

THE HORMDORT

lives well, but don't grow much in an aquarium ; it is found in ponds.

THE AWLWORT

is a very pretty flower under water ; does not live long in an aquarium ; it is rather scarce.

WATER VIOLET :

scarce ; but it is very pretty if you can get it ; grows well, but requires a great deal of attention.

THE WATER STARWORT

is a very useful plant ; grows well, and lives a good time in the aquarium.

DUCKWEED

is not very pretty ; suitable for small or large aquariums ; it does not live very long in confinement.

There are many other kinds of water plants suitable for aquariums, such as the small yellow water lily, marestail, and the water plantain, any many others, but they are generally too large for ordinary aquariums.

The following are suitable fish :—

THE STICKLEBACK.

This fish derives its name from three, sometimes ten, sharp pointed spines which stick out of its back and sides ; it is one of the very few fishes that build a nest. The reason why they build nests is that the sticklebacks are very fond of each other's eggs, and they must therefore be protected from the ravages of one another ; the nests are very small, and sometimes hard to find if the bank overhangs the water, or it has got holes in it. If you can find a nest with the eggs in, put it in your aquarium : there the eggs will hatch, and you can watch the growth of the fish from the time it emerges from the egg to maturity. They are very pugnacious, and are almost always fighting ; they are found in almost every brook and ditch if the water is clean. The shape of the nest is tubular, the nose and tail of the fish projecting out at each end when the fish is in it ; it is made of vegetable substances.

THE MINNOW.

In small aquariums this is one of the best fish that can be kept ; it is always a favourite with the young aquarium keeper ; they may be caught in most brooks and rivers ; they may be also obtained in Covent Garden Market at the conservatory, where you may get everything relating to the aquarium ; they can also be procured at many fishing tackle shops, where they are sold for bait.

THE PERCH.

This is a very handsome fish. Large perch cannot be kept in an ordinary aquarium, for they will devour the smaller fish or hunt them to death. Perch, however small, must not be put in an aquarium with minnows, for it will eat them when they are almost as large as itself.

The Carp.

This is a fine hardy fish, but is seldom kept in an aquarium; the reason why I cannot tell, for I consider it a very fine fish, quite equal to the perch. It will live out of water for a considerable time, if the gills are kept moist.

The Chinese or Golden Carp.

This fish is more commonly known as the goldfish. It is a native of China. It is a hardy fish, and lives very well in an aquarium, the colour of its scale making it very attractive. The silver carp comes from the same country. It is similar to the golden, except in colour, which its name betokens. The Crucian and the Prussian carp are much the same as the other kinds; they differ only slightly in colour.

The Roach, Dace and Bleak

are not fit for the aquarium, as they live such a short time in captivity. Sometimes the roach will live, but mine never did. A friend of mine had one for eighteen months; it might have been alive now, but a large golden carp hunted it to death.

The Tench.

This ie another fish that does not live long in captivity. It is scarcely worth keeping, as it hunts the smaller fish to death.

The Gudgeon.

This fish lives a moderate time in captivity; it is a curious-looking fish. It is very fond of a dark corner or hole in the rockwork where it can hide.

The Miller's Thumb

is also known by the name of tammy, logge, and the bullhead, but its proper scientific title is *cottusgabio*. It is a very curious fish, and is very voracious, and will eat minnows and other fish, if they are small enough. It is best to give it a vessel to itself, with a small rockwork cavern made in it where it can hide; it will spend the most of its time in this, only coming out to get its food. The chub, bream, barbel, pike and trout are generally too large or require too much attention to be kept in an ordinary aquarium.

The Common Newt,

eft, or evat, belongs to the same group of animals as the frog and toad. It is very pretty in an aquarium, but the rockwork must be above the surface of the water to enable it to come out of the water and rest in the air, for it is amphibious. It is found in almost every ditch, brook, and pond, and is easily caught with a common hand net, by first throwing a few small worms into the water to attract them; then they are easily caught with the net.

The Frog.

This is a very curious-looking animal, and will soon get tame in an aquarium. The best way to get frogs is to collect some of the spawn seen floating on ditches and transfer it to your aquarium, where it will hatch. Then you can watch the growth from the tadpole to the frog stage. It is amphibious, therefore must be allowed to come out of the water now and then.

The Crayfish

is the largest of the fresh-water crustaceans. It does not live very long in the aquarium, but it is well worth the trouble of keeping, for it is very curious. The fresh-water shrimp will only live a very short time in captivity. They are found in ditches and brooks; they are sometimes called the fresh-water screw. They are scarcely worth the trouble of keeping. There are one or two more fresh-water crustaceans, but they are too small for the aquarium; besides, the fish eat them.

Mollusks.

A few water-snails are very useful to clear the glass sides of the aquarium from the confervoid growth which usually collects there. The best kinds are *Plunoribus corneus*, and the *Palingina viviparia*. There are many other sorts, but these are the best.

The Common Water Spider (*Arggranetra aquatica*)

is one of the best insects than can be kept in an aquarium. It is perfectly harmless, and the web it spins under water is very beautiful. Water beetles ought to be kept in a vessel by themselves, for they will kill each other and the other insects too, but there is one beetle that may be kept with safety, and that is the *Hydrophibus piceus caddis*. Worms are very curious things; they may be kept with safety in the aquarium. The caddis worm is the larva of the caddis fly, of which there are about 150 kinds. For further information on beetles and other insects, you are referred to larger works on the subject.

General Management.

The water in your aquarium need never be changed, only a little put in now and then to supply the loss by evaporation. You must imitate nature as much as you can. A tall, narrow vessel will never do to make an aquarium in, as the surface of the water is so small that it cannot absorb the requisite quantity of oxygen from the air to support life in it; the fish must breathe. The manner in which fish breathe is very simple. It opens its mouth and lets in a quantity of water, then it shuts its mouth and drives the water over the gills. Thus the oxygen in the water comes in contact with the blood and revivifies it, is afterwards converted into carbonic acid, which is composed of carbon and oxygen gas chemically combined. Now the plants come into action. The plants do not breathe, of course, but they must live, and water plants do not generally receive much nourishment from the sand or mud they are planted in like land plants. Now the fish require oxygen to breathe, and the plants require carbon to live. Carbonic acid being soluble in water, it would poison if it were not removed by the plants, which take the carbonic acid and separate its constituents, taking the carbon and setting free the oxygen gas again for the support of the fish. Now if there are no plants in the aquarium, the surface of the water must be very great to enable it to absorb the requisite amount of oxygen for the support of the fish, which is does very slowly if it is not agitated like in the seas and rivers.

You may feed the fish on gentles, small worms, paste, and small fragments of raw meat. Perch and other large fish may have small minnows given to them. A microscope is almost indispensable; without it half the pleasure of the aquarium is lost. They may be purchased very cheap; a very good one may be got tor ten-and-sixpence.—*The Young Fancier's Guide.*

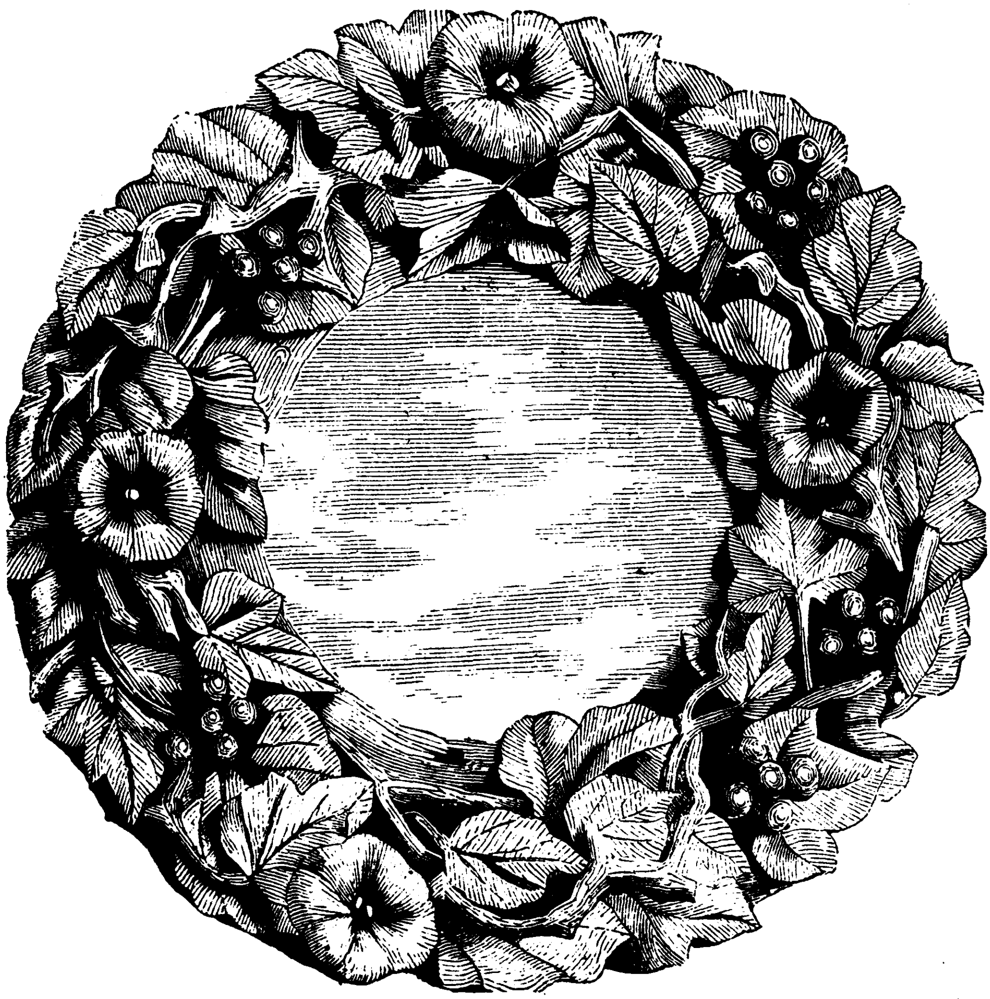
THE JUNGLE FOWL.

A restricted genus of these birds is one of peculiar importance. The head of the birds constituting it is generally surmounted by a fleshy vertical crest, the base of the lower mandible furnished with two flattened wattles, and the tail-feathers, fourteen in number, rising in two almost upright planes, with ample coverts in the male sex. Here we find our domestic cock and hen.

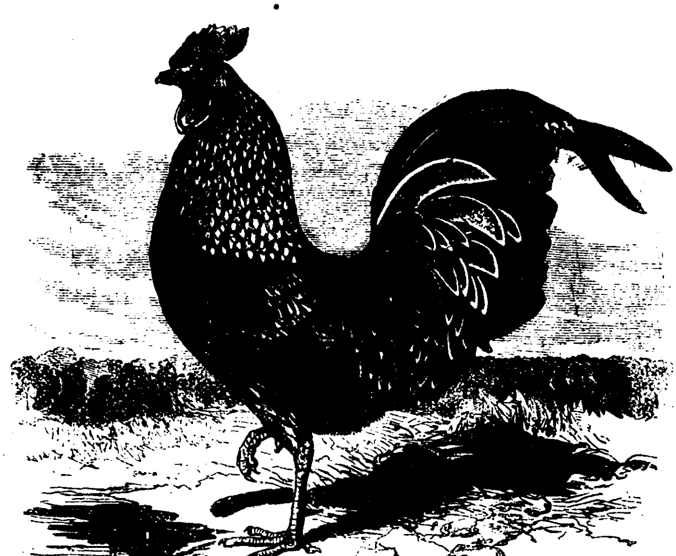
Many fanciful and superstitious feelings are still retained regarding the domestic cock, and his nocturnal crowing; and even his more familiar morning salutation is supposed by the ignorant to dispel all spirits, "whether on sea or fire, in earth or air."

It has been supposed that our different races of domestic poultry were originally derived from Persia, from the circumstance of Aristophanes calling the cock "The Persian bird." But that this is erroneous is evident from the fact that modern researches have utterly failed to discover any birds of the genus *gallus* in that country. If, however, it is merely meant that the Greeks, during their intercourse with the Persian nation, may have obtained from that people a breed previously domesticated, then there is reason for such an idea, poultry being known to have existed in Persia in a domestic state from a very remote antiquity. No doubt can be entertained that these birds were well-known over many parts of Europe and Asia for several hundred years before the Christian era. When Themistocles took the field to combat the Persians, he saw, it is said, two cocks fighting against each other; and hence he alluded, while haranguing his troops, to the invincible courage of these birds. "Observe," he said of the cock, "with what intrepid valour he fights, inspired by no other motive than the love of victory; whereas you have to contend for your religion and your liberty, for your wives and children, and for the tombs of your ancestors." Nor was this appeal uttered in vain; the Athenians achieved on this occasion one of the most memorable victories emblazoned on their annals. Themistocles died about the 449th year preceding the Christian era, and must, consequently, have been the contemporary of Nehemiah.

According to M. Temminck, our domestic cock seems to have originated from the Jago Cock, a very large wild species, which inhabits the Island of Sumatra, and from the species **Bankiva**, another primitive cock, found in the forests of Java. For this opinion the following reasons have been assigned: — The resemblance of their females to our domestic hens; the size of our village cock, which is intermediate, between that of the Jago and Bankiva; the nature of the feathers, and the forms and distribution of the barbs, which are absolutely the same as in the domestic cock; and because it is in those two species alone the females are provided with a crest and small barbles, characters which are not found in any other of the primitive species which are known.



MAT IN LEATHER WORK.



THE JUNGLE FOWL.

THE JESTER.

English Artists and the Centennial Exhibition. — "English artists," observes the London correspondent of the *Manchester Guardian*, "will entertain a high notion of American taste when they learn that the three representatives of this country, to whom medals have been awarded at the Philadelphia Exhibition, are Mr. Fildes, for his picture of The Casual Ward; to Mr. Hall for his Batting; and to Mr. Jopling (save the mark) for his—it does not matter what; at the same time neither Mr. Millais nor Mr. Leighton is to receive the decoration conferred by the Commissioners. By the way, it seems that the English Commission has not been a happy family, and that from the very first there were jealousies and bickerings, which ended at last in a general disruption. Had there been a medal allotted for amenity and tact, there is little doubt that, following the precedent which apparently ruled the selection of artists to be decorated, it would have been by unanimous consent awarded to Professor Archer, who is now returning home somewhat sooner than the duration of the Exhibition led one to imagine. His return, however, has been the signal for certain members of the Commission, who had come to Europe for change of air and scene, to go back again to Philadelphia, and to take charge of the various sections of goods and works of art, which were originally confided to their supervision. Altogether the history of our official connexions with the American Centennial has been a scandal, and the occasion of a renewal of a number of those jobs of which at one time it was hoped that South Kensington preserved the secret and the monopoly."

The great success, says the *Pall Mall Gazette*, which has so far attended the trial at Spezzia of the 100-ton gun constructed by Sir William Armstrong's firm for the Italian Government, necessarily calls attention to the two ironclad vessels which have been built by the same Government to carry these monster cannon. One of these, the *Duilio*, is already afloat, and her sister ship, the *Dandolo*, will, it is said, be launched in July next. They are both enormous turret-ships of about the same size as the *Inflexible*, having a displacement of upwards of 11,000 tons each, and they carry armour 22 in. thick on a teak backing. It is doubtful, however, whether they will attain an equal rate of speed with the English vessel; and although they are to be armed with Sir William Armstrong's 100-ton gun, as against the 80-ton variety of the Woolwich Infant to be provided for the *Inflexible*, neither is reckoned by foreign naval critics as being so powerful as our latest ironclad. There is, we believe, no insuperable difficulty either in the way of mounting the turrets of the *Inflexible* with 100-ton guns, should that weapon prove—as now seems possible—greatly more efficient than the 80-ton gun upon which our official artillerists have hitherto prided themselves. In addition, it is satisfactory to know that not only have these great guns been constructed, but also that the thick armour-plates are being rolled by a private firm in this country. We have thus at hand the means of speedily remedying any inferiority that we may temporarily show at any point. Still, it is well to bear in mind that within two years from the present time the Italians will have ready for sea a pair of first-rate turret ironclads, carrying the heaviest guns afloat, which might well turn the scale in a decisive naval engagement in the Mediterranean. Our interests at stake are of such magnitude that we cannot, as a mere question of marine insurance, afford to run the risk of defeat at sea by any possible hostile combination. Nearly every foreing Power thinks it is, or ought to be, the heir to our large carrying trade; and a blow to our naval supremacy, by whomsoever struck, could scarcely fail to be universally popular. It does not follow, of course, that because Italian politicians have of late been credited with very dangerous designs, they would attempt in earnest to carry them into effect; but the cost of the *Duilio* and *Dandolo* is out of all proportion to the revenue of the Kingdom of Italy, and she has certainly no commercial marine requiring such vessels for its defence. By the year 1878, the day may have passed for these unwieldy and expensive ships—the Germans have already retired from the ruinous competition in large ironclads—and we may find it more effective, more convenient, and cheaper to crowd the narrow seas with rams, swift torpedo craft, and heavily armed gunboats, than to continue to pile together guns, armour-plates, and endless machinery on these floating batteries. But, however this may be, the most satisfactory consideration is that some of the most powerful vessels in their day that have ever borne the English flag were built by foreign Powers.

COMMON ERRORS IN REGARD TO DIET—BEEF-TEA.

Florence Nightingale says, on this subject, that one of the most common errors among women in charge of the sick, respecting sick diet, is the belief that beef-tea is the most *nutritive* of all articles. "Now, just try," she says, "and boil down a pound of beef into beef-tea, evaporate the water, and see what is left of your beef. You will find that there is barely a tea-spoonful of solid nourishment to half a pint of water in beef-tea." There is, nevertheless, a certain nutritive value in it, as there is in tea; we do not know what. It may safely be given in almost any inflammatory disease, but it should never be alone depended upon, especially where much nourishment is needed.

EGGS OR STEAK.

Again, it is an ever-ready saying "that an egg is equivalent to a pound of meat," whereas it is not so at all. Much trouble has occurred from this mistaken notion. It is a question whether, weight for weight, eggs are *equal* to beefsteak. Also, it is seldom noticed with how many patients, particularly of nervous or bilious temperament, eggs disagree. Most puddings made with eggs are distasteful to them in consequence. An egg, whipped up with wine, is often the only form in which they can take this kind of nourishment.

MEAT WITHOUT VEGETABLES.

Again, if the patient is able to eat meat, it is supposed that to give him meat is the only thing needful for his recovery; whereas, scorbutic (scurvy) sores have been actually known to appear among sick persons living in the midst of plenty, which could be traced to no other source than this—namely, that the nurse, depending on meat *alone*, had allowed the patient to be without vegetables for a considerable time, these latter being so badly cooked that he always left them untouched. To all intents and purposes, he really had no fresh vegetables at all.

MILK, BUTTER, CREAM, ETC.

Milk, and the preparation from milk, are most important articles of food for the sick. Butter is the lightest kind of animal fat, and though it wants the sugar and some of the other elements which exist in milk, yet it is most valuable both in itself as fat, and in enabling the patient to eat more bread.

ALBUMEN.

The reason of it is just this: Animals require in their food an albuminous constituent, a starchy one, and another of fat. The first, or albuminous (the purest form of which is the white of an egg), enters largely into the formation of the human body, the muscles being chiefly composed of it.

SUGAR.

The second, or starchy component, does not enter into the structure of the body as such, but is converted into sugar during digestion, and has much to do with the formation of the tissues and heat.

OILS.

The oily parts enter largely into the composition of the brain, nerves, and, in fact, all other portions of the body, and, when broken up and consumed, supply a good portion of the fuel for heat of the body.

COMMON SALT, PHOSPHATES, ETC.

Besides these three mentioned, which are most conspicuous, there are other substances, as common salt, phosphates, iron, etc. These are supplied through food, but our space will not permit more than a mere reference. All food *must* contain these substances in proportionate quantities. If it does not, the appetite *craves* the one wanted, and if not properly supplied, the part of the body suffers into which the wanting component enters.

BUTTER WANTED WITH BREAD.

To feel assured of this, if the reader thinks a moment, he will remember that no one likes bread alone, but wants some butter with it, which supplies the oily part, and the appetite craves, too, a piece of meat, cheese, or an egg—the albuminous part. We want butter with our rice or potatoes, because rice or potato is almost pure starch, and wanting in fatty matter; so nature says we must *add* the wanting parts.

DOMESTIC RECEIPTS.

Corn Starch.

To one table-spoonful of corn starch add enough cold water or cold milk to make a perfectly smooth paste. Then pour this into half a pint of boiling milk and carefully boil a few minutes, stirring it all the time, and putting in a little salt. Sweeten to the taste and add any essence or spice liked by the person who is sick. Then set aside to cool.

This like everything else which contains milk, requires great care to prevent it from *scorching*, and the least of it can be observed by the person for whom prepared. For this reason, a saucepan with thick sides is usually preferred, and the heat should always be applied to the *bottom* of the vessel. In stirring, be cautious not to splash against the sides of the utensil more than can be helped, for there the scorching usually takes place.

Arrow-Root.

Take a table-spoonful of arrow-root and mix it with enough cold water to make a paste free from lumps. Pour this slowly into half a pint of boiling water, and let it simmer awhile until it becomes thick and jelly-like ; sweeten to the taste, and add a little nutmeg or cinnamon. Instead of the half-pint of boiling water, the same quantity of boiling milk, or half milk and half water, may be used. This will make it more nutritious.

Oatmeal Gruel.

Mix a table-spoonful of oatmeal with a little cold water until it makes a smooth paste ; pour this gradually into a pint of boiling water and boil slowly for twenty or thirty minutes, stirring it all the time, and being very careful not to let it scorch in the least. Salt, spice, and wine or brandy should be added to it, unless there is some good reason for not doing so.

For good reasons, the Scotch oatmeal was generally ordered, but the Bethlehem, Canada, and, quite recently, the brand known as Ohio oatmeal, have been found quite as useful and palatable. On the score of economy alone, under these circumstances, it may be well to give the domestic brands a fair trial.

Boiled Flour.

Take a pint of good wheat flour, tie up in a piece of muslin in a firm mass, as you would a pudding, put it into a pot of boiling water, and let boil from morning until bedtime. Then take it out and let dry. The next morning remove the muslin, peel off and throw away the thin rind of dough, and with a nutmeg-grater grate down some of the hard, dry mass into a powder. One, two, or three table-spoonfuls of this powder may be used, by first slowly and carefully rubbing it down into a smooth paste with a little milk, then mixing this paste carefully with a pint more of suitable milk, and bringing the whole to a boiling-point. Be careful, as you must with everything else containing milk, to keep from scorching ; and this can best be done by applying the heat to the *bottom* of the vessel alone, not to the sides.

The boiled flour, thus prepared, can be given by a spoon or through a nursing-bottle.

Panado.

Take a slice of wheat bread, break into fragments, and sprinkle over a tea-spoonful of ground cinnamon, put into a cup ; pour on it a pint of boiling water, and boil a few minutes until well mixed, when some sugar with a little grated nutmeg must be added. If desirable, a piece of butter may be put in, and also some wine or brandy.

Barley-water.

Take nearly an ounce of pearl barley and wash it well. Then pour on a pint of boiling water and carefully boil to one half. Strain the liquid through a towel, then add some sugar and lemon-juice. A small piece of orange or lemon-peel, dropped in while boiling, makes it more acceptable to many persons.

Currant-Jelly Water.

A table-spoonful of currant jelly thoroughly mixed through half a pint of cold water.

A sick person may drink as much as wished of this acid water. As with all other drinks for the sick, a little at a time, and often repeated, is the way it should be given.

Toast-Water.

Carefully remove the crust from a slice of stale bread, and toast the slice through on both sides, but do not burn it. Break the slice into three or four pieces, and put them into a pitcher with a small piece of orange or lemon-peel. Pour on a pint of boiling water, cover up with a napkin, and, when cold, strain off the water for use.

It should be freshly made, especially in warm weather.

Toast-Soup.

Take a thin slice of stale wheat bread, and toast until it is brown through and through ; but be careful that you do not burn it. While it is still hot, spread some butter over it, but no more than will strike into the bread without leaving any on the surface. Now break it into fragments, put the pieces into a pitcher, and pour on rather more than half a pint of boiling water. A little pepper and salt improves the taste ; so they may be added.

This drink is usually found very acceptable to sick or delicate persons, and at the same time is quite nutritious. It was much recommended under the name of "toast-soup," by the late Dr. William Darrach of this city, and gave satisfaction wherever used.

(To be continued.)

SUFFOCATION.

There are several gases, which, when inhaled, are followed by symptoms of Asphyxia. The little valve (epiglottis) over the entrance of the trachea ("windpipe") is so extremely sensitive that it will not even permit a drop of water to pass without a spasmodic closure of the opening, followed by coughing. It is not only sensitive to solids and liquids, but also to the presence of most gases. At one time it was thought that all gases were taken past it into the lungs, and absorbed from thence into the blood. The opinion now seems to prevail that most of them irritate the valve spoken of at the entrance of the trachea (windpipe), and closure of the entrance follows. The breathing is thus interrupted much as it is in drowning, where the liquid cuts off the passage of air to the lungs; or as in hanging, where the ligature prevents the entrance of air. In such cases death results from Asphyxia.

Polishing Wood Carving. — Take a piece of wadding, soft and pliable, and drop a few drops of white or transparent polish, according to the color of the wood. Wrap the wetted wadding up in a piece of old linen, forming it into a pad ; hold the pad by the surplus linen ; touch the pad with one or two drops of linseed oil. Pass the pad gently over the parts to be polished, working it round in small circles, occasionally re-wetting the wadding in polish, and the pad with a drop or so of oil. The object of the oil is merely to cause the pad to run over the wood easily without sticking, therefore as little as possible should be used, as it tends to deaden the polish to a certain extent. Where a carving is to be polished after having been varnished, the same process is necessary, but it can only be applied to the plainer portions of the work. Plain surfaces must be made perfectly smooth with sand paper before polishing, as every scratch or mark will show twice as badly after the operation. When the polish is first rubbed on the wood, it is called the *bodying in ;* it will sink into the wood and not give much glaze. It must, when dry, have another body rubbed on, and a third generally finishes it ; but if not, the operation must be repeated. Just before the task is completed, greasy smears will show themselves ; these will disappear by continuing the gentle rubbing without oiling the pad.

Steel Wheels.—The Boston and Albany Railroad recently took off a set of steel car-wheels that had run 523,000 miles, a greater distance than was ever run by any car-wheels before in America or any other country. The average running distance of a common chilled-iron car-wheel is only 30,200 miles.

Imperial Polka Mazurka.

WRITTEN AND COMPOSED FOR THE YOUNG LADIES' JOURNAL BY J. L. BROWN.