CANADIAN MECHANICS MAGAZINE AND PATENT OFFICE RECORD

Vol 5 MAY, 1877. No. 5.

NOTES ON BUILDING.

RUBBLE AND ASHLAR MASONRY.

IT not unfrequently happens in the erection of a private or public building, coarse ashlar is used which so nearly approaches to rubble work that, to the unprofessional eye, the difference is imperceptible, and cases of dispute have not unfrequently arisen, between architects and builders, as to under what class of masonry certain work performed should be paid. This doubt becomes particularly embarrassing, when no specification exists, describing precisely how the work is to be performed, which work probably was an after-thought, or change considered desirable in construction, but then the architect had one idea of how the work should be built, and the contractor another. As more than one instance has occurred in this Province where this ambiguous point has caused large claims to be made on the part of a contractor, and involved both parties in litigation, we give on page 149, a few illustrations to show the line of distinction between these two styles of masonry when, by intermediate steps, rubble masonry approaches so close to ashlar, both in appearance and cost, as to render the difference, to many, almost doubtful.

RUBBLE.

In England the word *rubble* was formerly applied to loose or field stones, which were built into walls with mortar or cement, such as we see in ancient buildings in the present day. Work of this description is the primitive rubble; but, as the demand for building stones became greater, quarries were opened, and a superior kind of work made with quarried stones. The walls built with them were properly bonded, so as not to depend upon the quality of the mortar for their strength and durability, and, as the taste for superior work increased, the rough and irregular shaped stones were scabbled or hammer-dressed, laid in regular courses, and, ultimately, brought so near to ashlar work that the question of cost between ashlar and rubble masonry became but of little account.

ASHLAR.

The term ashlar is derived from the Italian word *Asciare*, to chip, and is applied to common or free stones taken from the quarry and wrought or "chipped" for building purposes.

Plane ashlar is generally laid in horizontal courses from 10 to 12 inches in height; small *rock face ashlar* in courses from 5 to 7 inches in height; but when large stones exceeding 12 inches in height are employed for the construction of public works, it is called *block ashlar*. Fig. 8, is an illustration of *plane ashlar* work with chamfered and rusticated quoins and plinths. There are different kinds of ashlar work, but that sort principally used in the construction of private buildings consists of *plane ashlar*, that is when the stones which compose the ashlar facing are wrought quite smooth, and exhibit none of the marks of the tools by which they are cut. *Tooled ashlar* is so-called when the stones are wrought in a regular manner, so that the surface has the appearance of parallel flutes, placed perpendicularly in the building; and *random tooled*, when the surfaces of the stones are cut with a broad tool without care or regularity. It is called *chiselled*, or *boasted* when cut with a narrow tool; and said to be *pointed* when cut with very narrow tools; and when the stones project from the joints, with either smooth or broken surface, it is called *rusticated*.

Although rubble masonry may be laid in irregular or regular courses, ashlar work is generally confined to two methods of construction — *coursed* or *random coursed*. In rubble masonry there can be no specified size given for the thickness of the mortar on the stone bed when laid in irregular courses, but when it is *coursed* or *random coursed*, the stones should be bedded in just sufficient mortar to fill up irregularities and make a fair joint. With ashlar masonry, however, the beds and vertical joints are dressed back a few inches from the face of the wall, and should have close well fitting joints which, in superior work, should not exceed one-eighth of an inch in thickness, and the mortar should be very fine and clear from grit. The face of ashlar stones may be polished, worked in any way, or left rough, but in the latter case a drafted margin is generally run around them to insure accuracy in fitting the stones.

Now it is on this point relating to the size of the joints, and the regularity of the courses, that differences of opinion have arisen as to whether disputed work comes under the denomination of superior rubble, or ashlar masonry.

We will first, however, state that when rubble masonry is mentioned in a specification, without any description given of any particular kind of rubble work, it is presumed always to mean the irregular or uncoursed rubble of the country, built in walls with fair average size stones, and laid in mortar or cement, and thoroughly bonded, and the face of the wall neatly pointed up after the work is completed. If any other kind is intended, it should always be particularly described in the specification, since between regular coursed rubble with dressed bed, vertical joints and picked face, and coarse boucharded ashlar stone, there is very little difference in the cost. But the question has arisen, can stones that have been wrought, as if not for ashlar work, although not laid with close joints, be called rubble work? We think not. Wrought stones are, of course, ashlar stones, and the masonry built with them, whether in regular and equal courses, or in random courses, must still come under the term ashlar, although a question may arise as to inferior workmanship if the ashlar stones are laid on thick beds of mortar or cement, and not according to the usual custom; but this will much depend upon circumstances. It might so happen that the description of work may render it necessary, and even advantageous, to depart from fixed rules, as, for instance, when it becomes necessary to build in cold weather, when the thermometer registers below freezing point; in that case if the cold stones were laid on a thin bed of mortar or cement, one-eighth of an inch in thickness, or even a quarter of an inch thick, the mortar would at once become frozen, and if cement was used, its setting property would be completely destroyed, and be of no more use than sand; therefore, in order to give it time to harden, in the case of cement being employed, thick beds of it would be necessary, and so, when it becomes important to build in cement in very cold weather, a certain amount of extra thickness of the joints would be quite admissible, and ashlar masonry so laid could not be called rubble, on account of its having been so built. Besides, in some kinds of rough ashlar when the stones are bedded in cement, and when no fair external face is exposed to view, as in culverts, tunnels, &c., it would be absurd to confine the builder to the rigid rule of architecture, as if the face work was intended for a villa or public building.

No stones that have been wrought with tools fair on the face, or with radiated joints, as for drains and similar work, can be classed as rubble work. In the construction of large arches over vaults, in country bridges, tanks, and similar rough work, rubble masonry may be used, when stones can be obtained that are flat and thin, and do not require to be radiated, but simply dressed into shape and size with a mason's hammer; and good rough work can be made with them; but rubble masonry is never used in the construction of small circular or elliptical work unless the stones are of a description that requires but little working and particularly suited for the purpose. We are of opinion, therefore, that any work built with wrought ashlar stones, however rough, is still *ashlar work* of some description, and that no deviation from the rule respecting the thickness of the joints can cause it to be classed as rubble masonry, unless rubble masonry of a superior order.

For further information on this subject we refer the reader to the illustrations on page 149.

Fig. 1. Random Rubble (uncoursed), beds and joints not dressed.—This description is the most inferior description of walling.

Fig. 2. Random Rubble (built in courses.)—In work of this kind each course is built random, and may consist of two, three, or more stones in depth, pinned in with spalls. The courses are from 12 to 14 inches in height.

Fig. 3. Squared Rubble (uncoursed.)—Has the joints and the angles of the faces neatly squared with *tools locally used.* The beds are horizontal and the side joints vertical, but the beds are not dressed back from the face as for ashlar work. This description of work is only used when the stones have a fine cleavage, affording beds and joints which require little working. When this kind of work is allowed to run in short lengths, broken by high stones, it is called "*irregular coursed rubble.*"

Fig. 4. Square Rubble (built in courses.)—The courses are 10 to 14 inches in height. It is sometimes called "*irregular coursed rubble brought up to level courses.*"

Fig. 5. Is Coursed Rubble, or *Regular Coursed Rubble*, and consists of stones laid in courses, every course being of the same height; the height of the courses vary from 4 to 8 inches, but the beds are not hammered-dressed back from the face, as in ashlar work.

Block in Course.—This is a name given to a class of masonry which occupies an intermediate place between ashlar and rubble; the stones are larger, but the beds and joints are only roughly dressed, so the work cannot be described as ashlar, unless when worked as such. It is sometimes called "hammer-dressed ashlar," and is used chiefly in engineering work.

Fig. 6. Coursed Ashlar.—This is the most usual form in which ashlar is built; it is shown with chamfered and rusticated quoins and plinth. The stones are dressed on the face, sides and bed; the courses horizontal and of equal height, and the joints vertical.

Fig. 7. Small-rock face ashlar, with plane ashlar quoins.

Fig. 8. Plane ashlar, with rusticated quoins and plinth.

Fig. 9. Is a section of *ashlar masonry* in *small* culverts and drains, with joints radiated.

Fig. 10. Is a section of *rubble masonry*, in the same class of work, but which seldom makes good work, owing to the filling in behind to bring the face joints in line with the radiating point.

Fig. 11. Is a section of *rubble masonry* in large arches over *10 feet radius;* it is used in tanks, vaults, and similar course work, but only used when suitable stones can be obtained, which are broad and thin.

New Method of Horseshoeing to Supersede "Roughing."—A new horseshoe has been invented by Mr. A. B. Fleming, of Hillwood, Corstorphine. The shoe is of the ordinary shape, but has three holes punched in it,—one at the toe and one at either side of the heel,—and into these holes a set of keyed studs are inserted. The studs are of cast steel, and pointed so as to give the horse a firm grip of the frozen ground without slipping. Presuming that the horse is furnished with Mr. Fleming's new shoes in the beginning of winter, and the holes filled up with a plug of hard wood, or with a blunt stud if thought desirable, when a frosty day occurs, the groom or coachman has simply to take out the blunt stud, or extract the wooden plug with a brogue. The studs are then inserted in the holes,—the key of the spike fitting into a slit in the hole. A small wrench or pair of pliers is then used to give a half-turn to the stud, which is prevented falling out by the key. Into a slit in an angle of the stud corresponding with the slit in the keyhole of the shoe a small wedge of wood is driven home to keep the stud firmly in position. When frost disappears, or the stud is worn down so as to be ineffective, the small wedge of wood is taken out by a brogue, the stud is turned round till its key is opposite the slit in the shoe-hole, and then it is easily withdrawn. Mr. Fleming has not patented his invention.—*Builder*.

WHITE HOUSE WHITEWASH.

The *American Manfacturer* publishes the recipe for the whitewash used on the east end of the Presidential mansion—the White House: Take one-half bushel of nice unslacked lime, slack it with boiling water; cover it during the process to keep in the steam. Strain the liquor through a fine sieve or strainer, and add to it a peck of salt, previously well dissolved in warm water; three pounds of ground rice, boiled to a thin paste; one-half pound of powdered Spanish whiting, and one pound of clean glue, which has been previously dissolved by soaking it well, and then hang it over a slow fire in a small kettle within a larger one filled with water. Add five gallons of hot water to the mixture, stir it well, and let it stand a few days covered from dust. It should be put on hot, and for this purpose it can be kept in a kettle on a portable furnace. It is said that about a pint of this mixture will cover a square yard upon the outside of a house, if properly applied. Fine or coarse brushes may be used, according to the neatness of the job required. It answers as well as oil paint for wood, brick, or stone, and is cheaper. It retains its brilliancy for many years. There is nothing of the kind that will compare with it, either for inside or outside walls. Buildings covered with it will take a much longer time to burn than if they were painted with oil paint. Coloring matter may be put in and made of any shade desired. Spanish brown will make reddish pink when stirred in, more or less deep according to quantity. A delicate tinge of this is very pretty for inside walls. Finely pulverized common clay, well mixed with Spanish brown, makes a reddish stone-color; yellow ochre stirred in makes yellow wash, but chrome goes further, and makes a color generally esteemed prettier. It is difficult to make rules, bec. use tastes are different; it would be best to try experiments on a shingle and let it dry. Green must not be mixed with lime; it destroys the color, and the color has an effect on the whitewash which makes it crack and peel.

THE COMMON SALT GLAZE.—To the purest accident are many of the utilizations of common substances due. One of the producing causes of property of the Staffordshire pottery manufacture was the discovery of a cheap, durable glaze. The discovery was due purely to accident. At Stanley Farm, a few miles from Burslem, a maid servant was one day heating a strong solution of common salt, to be used in curing pork. During her absence from the kitchen, the liquid boiler over. Being in an unglazed earthen vessel, the solution, spreading over the outside, produced a chemical action which she little understood, and which did not compensate her for the scolding she received. Some of the elements of the liquid combined with those of the highly heated brown clay surface to produce a vitreous coating, or enamel, which did not peel off when the vessel was cold. The humble brownware vessel acquired historical celebrity. A Burslem potter, learning what had taken place, saw that glazed-ware might possibly hit the taste of the public, he introduced the system of glazing by means of common salt, a system at once cheap, easy and durable; and England has made many a million pounds sterling by the accidental discovery.

ASBESTOS PAPER.—*La France Nouvelle* gives the following account of the manufacture of an incombustible paper from asbestos. The new paper costs four francs per kilogramme. The paper mills are in the city of Tivoli, where Victoria made his successful attempt to manufacture this paper, which is specially adapted for valuable documents, etc. It has recently undergone most conclusive tests by the Marquis de Bariere, at an exhibition of objects made of this substance, now being held in the Corso at Rome. Two card-board boxes containing papers, one made of ordinary material and the other of asbestos, were thrown into the fire. The former was entirely consumed, while the latter remained intact, together with the papers it contained. The most useful employment that has been made of this substance up to the present has been the manufacturing of it into theatrical hangings. This is an excellent use of it, and it is evident that if what is said of it be true, its sphere of usefulness is likely to be greatly extended.

ATTACHING EMERY TO WOOD.—The best plan is to cover the wooden wheel with thick leather, and then to make a paste with very thin glue and emery, and lay it on with a knife. The glue must be about as thin as milk. These wheels, if made right, will cut a great deal better than any solid emery-wheel I have seen, and will not *glaze*. They cut best when mounted on a long thin spindle.

ALL SAINTS' CHURCH, CHELTENHAM.

(See page 132.)

The reredos of this church has lately been completed from the designs of Mr. J. Middleton, architect of Cheltenham, and the work has been executed by Mr. Boulton, carver, of the same place. The reredos runs round the east of the chancel, and is divided into five compartments, each compartment consisting of three arches. The divisions are marked by angels, 2 ft. 6 in. high, standing under canopies, above which rise marble pillars which are carried up to support the groining of the chancel. Of these angels some are holding symbols of the "Passion" while others have their hands joined in an attitude of prayer. Smaller angels playing on musicial instruments occupy the spandrels. The plinth and pillars are of English, Irish, and Italian marble, the larger angels of Caen stone, and the rest of the work is of alabaster. The three centre compartments, forming the reredos proper, contain representations in reliel of our "Lord bearing His Cross," the "Crucifixion," and the "Entombment," the other arches being filled in with incised work of black cement on an alabaster ground.

The pulpit is constructed of materials similar to those used in the reredos. The figures at the angles represent Noah, Joseph, Elijah, St. John Baptist, St. Chrysostom, and St. Augustine, the heads in the medallions being those of our Lord and the evangelists.

The dimensions of the chancel are 45 ft. by 25 ft.; those of the nave and aisles being 93 ft. by 56 ft. 2 in., internal measurement.

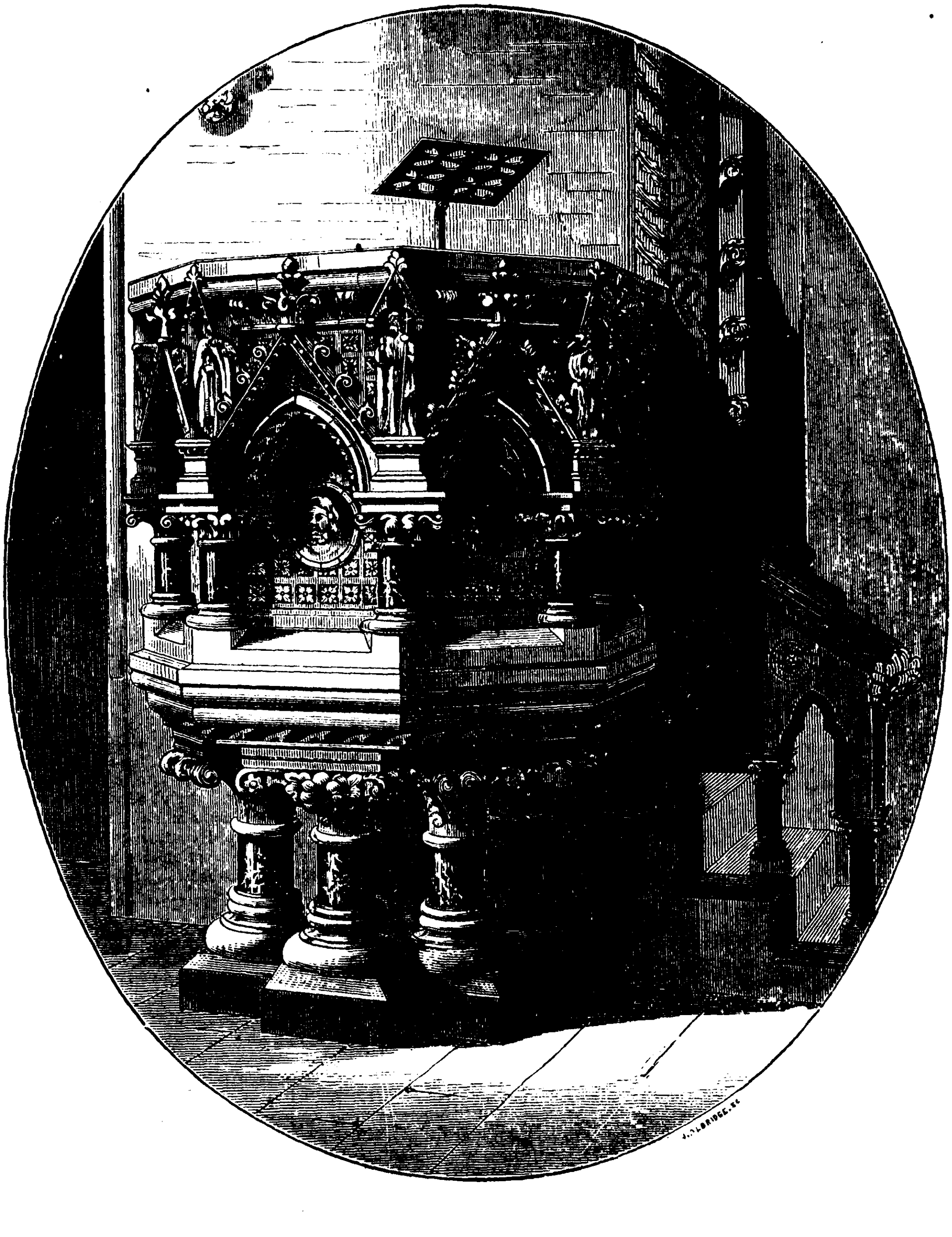
METALLIC FIRE-PROOF CURTAIN.—For theatres a fireproof curtain is made in corrugated plate by Voss, Mitter and Co., of Berlin. It is being fitted to the theatre in Dresden, now rebuilding after destruction by fire. Exposed to heat a brisk circulation of air is set up in the sections of tubes formed by the corrugations, the heated particles ascending, and colder particles flowing in to supply their place. The latter keep down the temperature so considerably that a sweating breaks out in the plate of which the curtain, or shutter, as it is, strictly speaking, is composed. The shutter made for the Dresden theatre is 46 feet wide. The method of riveting the plates of which it is composed, and of raising and lowering it, are the subjects of patents taken out by Mitters.

AN IMPORTANT INDUSTRY THREATENED.—According to a Newcastle paper, the craft of railway spring-makers is threatened with a very serious competition. A new circular spring has been invented; it is made entirely by machinery, and is said to be free from many defects of the present hand-made springs. The new springs are made of solid round bars of steel, highly polished, cut and bent into elliptical forms, and bound together in sets, to form springs. Four or five bars form the top and bottom of each spring; and it is intended as a further improvement to have a spiral spring, also machine-made, to be placed at the centre between the top and bottom set of springs. This would act as a duplicate: in case of accident it would support the entire weight of the carriage.

MACHINE-MADE HORSE-SHOES IN FRANCE.—M. Lockert read, on January 19th, a paper before the Paris Civil Engineers' Association, on the Thuillard and Dumont system of mechanical horse-shoe making. In ten hours, with one set of apparatus, eight workmen turn out 3000 complete horse-shoes; at the Esperance forges (Louvroil, near Maubeuge, dep. Nord), there are four sets of apparatus, and the total make therefore is 24,000 per diem equal to the work of 800 farriers working by hand. It is estimated that France possesses 3,500,000 horses, mares, mules, &c., each animal consuming on an average forty-eight shoes per annum, the total annual consumption being thus 160,000,000 shoes, which, at an average weight of 1½ lb., gives a consumption of over 126,000 tons of iron a year. At Joinville-le-Pont is another shoe-making forge; and in the discussion which followed the reading of the paper, it was stated that studies were on foot in France with the object of bringing out an apparatus superior in efficiency and simplicity to that described by M. Lockert.

THE Japanese are celebrated for the numerous applications to which they have put paper and *papier-maché*, but an Englishman has recently made what may be one of the most useful of all the newer uses to which paper has been applied. Captain Warren has found that common brown paper withstands for a long time the action of sea-water, and prevents the attachment of barnacles.

ALL SAINTS' CHURCH, CHELTENHAM : REREDOS.



ALL SAINTS' CHURCH, CHELTENHAM: PULPIT.

FISH CULTURE IN CANADA.

(See page 136.)

The propagation of fish by artificial means is a science to which particular attention has been given in many of the leading European Governments, and which latterly has been brought prominently before the people of Canada and the United States, and is to be considered as a valuable adjunct to the natural methods of fish-breeding.

It is but a few years since this new industry was inaugurated in Canada; but the rapid strides which it has made in the successful experiments carried on at Newcastle, in Ontario, by Mr. Wilmot, together wth the practical results which have been brought about in relation to this interesting procedure, has given it great popularity with the Canadian public, and it has been also, thus far, somewhat liberally ackowledged by the fostering patronage of the Government.

A very general desire now pervades the minds of the people of Canada to encourage, by every possible means, the advancement of this practical science; and also to obtain such general information in relation to the *modus operandi* of fish-culture as can be intelligently given. With this view as public journalists, our artist was despatched to the Government Fish-breeding Works at Newcastle, Ontario, in order to be an eye-witness of the operations engaged in there, and take sketches of the buildings and grounds in connection with the establishment; and also delineate, as minutely as possible, by principal drawings, the internal arrangements of the breeding-rooms, and the apparatus used in the practice of artificial fish-breeding.

The result of this visit has been that we are now enabled to present to our readers a series of pictures which will give a comprehensive idea of this national enterprise, and from which we trust the public will derive general information and useful knowledge.

Our pictorial illustration includes in it several drawings, each representing different sketches of the outside premises and grounds, as well as views and plans of the interior arrangements of the buildings, as are more particularly adapted for the work. These drawings will be found numbered for more ready reference.

No. 1 is a panoramic view of the buildings and grounds, and of the surrounding country. The building to the left of the picture, on the edge of the stream, is the Government Fish-Breeding Establishment, with its long, low reception house alongside; just here a permanent weir or barrier is thrown across the stream which prevents the upward passage of the salmon. Being thus stopped on their progress up the main channel, they are attracted by the rapid outflow of water coming through the reception house, and rushing up the current they pass through an ingeniously-contrived triangular-shaped weir (No. 3), and become entrapped within the house where they are kept confined till they become ripe for spawning. From this building the stream runs (along the side of the picture) downwards a distance of some two miles, where it empties into Lake Ontario.

Beneath the two large clumps of evergreen trees in front on the hillside and the main stream, the several nurseries and retaining ponds are shown, dotted here and there with miniature islands. In some of these ponds the parent salmon are retained for a while to recuperate after the exhaustion produced by spawning; others are used as nurseries in which the young fry are kept for a time just after they are hatched out, and have absorbed the umbilical sac.

The small building to the extreme right of the view was the old or original reception house, but it is now used as the gateway and general outlet from the ponds. On the extreme left, just above the main building, is an old mill with its raceway and mill pond beyond. From the higher elevation of this large reservoir a sufficient head is obtained to force through an underground pipe a large flow of water into the first and second apartments or breeding rooms, thus giving a constant and sufficient supply at all times for the hatching troughs.

The premises and ponds cover some ten acres of land; two public road leads from the grounds, one at each extremity of the picture, and converge together at the Village of Newcastle, about three-quarters of a mile distant, where an important station of the Grand Trunk Railway is located. The Town of Bowmanville is situated about four miles to the west, and the Town of Port Hope seventeen miles to the east. On the summit of the hill is the farm and private residence of Mr. Wilmot, the originator and founder of this institution.

No. 2 is a ground plan of the premises with the location of the buildings and ponds as described in the panoramic view No. 1.

No. 3 shows the inside arrangements of the reception house for entrapping and penning up the parent salmon. The fish enter this building through the triangular-formed weir, and become imprisoned in the first or large compartment. They are afterwards transferred (as represented by the assistant dipping them out with a small net) into the smaller pens above. The males and females are then separated and placed in different pens; in this way they remain quiet, and are more easily retaken at the time when they become ripe for laying their eggs. When mature, a dozen or more of these fish at one time are again caught with the hand net, and carried (only a few feet) to the tanks, arranged for their safe-keeping at the right hand side of the breeding-room, lower flat, No. 4, where the workmen are engaged at their work.

No. 4. Here the process of taking the ova from the fish and impregnating it is carried on; this is done by lifting from the tank a ripe female fish and holding her over a vessel securely, and gently pressing her body with the hand when the eggs will flow freely from her. (See figure No. 5.) After this operation is performed, she is liberated by dropping her into a raceway running from the room, down which she quickly swims into the pond marked A on the ground plan No. 2. A male fish is then taken from another tank, and operated upon in the manner as the female; the milt extruded from him is mixed with the eggs by a gentle stirring with the hand; this causes immediate impregnation. The ova are then dipped out of the pan with a small ladle, and put into a measure made to contain one thousand eggs; from this they are spread evenly on the hatching trays. (See apparatus plate No. 6.) These trays are made two feet long and ten inches wide, with a division in the centre, and hold four thousand eggs each; when filled they are carefully laid in the breeding troughs shown in figures 4 and 7. After the ova are thus deposited they are closely watched, and regularly cleansed from all sediments or other impurities which may settle upon them during the process of incubation.

The eggs are of a clear salmon color, but should any prove to be unfertilized, or become injured in any way, they change their appearance to an opaque white, when they are picked out with forceps and cast away, thus preventing the remaining ova from becoming contaminated. At the time of our artist's visit a *million and a half* of these vivified eggs were deposited on the hatching trays in these rooms.

No. 4 and 7 explain the manner in which the breeding troughs are distributed in the rooms. In the lower flat they are placed lengthwise, in the upper room crosswise of the building. Six of these are laid side by side with intervening aisles two feet wide for the convenience of the workmen in picking and washing the eggs. The troughs are each supplied with a constant flow of living water from the tanks which are fed from the raceway above, and are regulated in quantity by wooden taps as shown in the cut. In the lower flat a series of aquaria are shown; they are placed alongside the wall and contain young salmon and other fish which are kept for observation and also for exhibition to the numerous visitors who frequent the institution.

No. 8 represents the upper story of the building, which, after taking from it office rooms, leaves a large commodious apartment used as a museum in which are collected a number of specimens of fish of various kinds and other animals. This natural history depository is only of a few months' existence, yet it comprises numerous specimens of the salmon family and other fish, prominent amongst which are the large ones shown in the plate; the one on the right is a sturgeon weighing 280 lbs.; the one on the left is the *Tunny* or giant mackerel—its weight when alive was upwards of 600 lbs.,—a Greenland shark ten feet long, an immense moose deer, male and female cariboo, a bear, and other animals; also an alligator ten feet long. All of these specimens present a life-like appearance, and are artistically mounted.

No. 9 shows the front and side elevation of the fish-breeding house proper; its dimensions are 64 feet in length by 22 feet in width, with a cellar or lower flat built of stone, and two frame storeys above ground. The building presents a handsome and commanding appearance externally; and the arrangements inside are convenient and well adapted for the purposes for which they are intended. The whole establishment gives convincing proof throughout of the exercise of practical ingenuity and personal industry.

No. 10 gives a view of the retaining ponds (marked A. Fig. 2) into which the spent salmon pass from the main building after manipulation. It is about forty feet in diameter, and circular in form, with an average depth of water from two to three feet. At the time of our artist's visit, there were in this pond between *three and four hundred adult salmons*, weighing from six to sixteen pounds each. It is doubtful, indeed, whether in any other part of the world a more wonderful or pleasing exhibition can be enjoyed at one sight of such numbers of large salmon as were enclosed within this small space. This extraordinary display is not of long duration, lasting only about a fortnight, generally during the last week of October and first week of November. Such an interesting feature, in connection with the institution, caused our artist to make a particular sketch of the pond with its finny occupants.

No. 11 gives views of the several shapes of the eggs during incubation, and the growth of the embryo.

EXPLANATION OF NO. 11.

No. 1 shows the young ova developing the head (magnified);
No. 2 shows ditto developed (magnified);
No. 3, the head and body of the fish developed (magnified);
No. 4, young ova before the developing in natural size ;
No. 5 shows the ova of the natural size, after the vital principle has been developed. The body of the fish in this stage has a pinkish tinge and the eyes are very large.

No. 6, the shell of the ovum just burst, and the head of the fish protruding from it.

No. 7, the state of the ovum shown after the bursting of the shell, when the pulsations of the heart become visible.

No. 8, the shell just thrown off, the tail dropping, about a third part of the shell, which is transparent, is fractured by the fish in its exertions to extricate itself. Before the shell is broken the tail envelopes the yolk which is seen attached to the body of the fish.

No. 9, the tail in a short time becomes straight, and the fish more lively ; the mouth assumes a distinct form, and the lower and pectoral fins, which are quite transparent, are in motion simultaneously with the actions of the heart, which beats from 60 to 65 times in a minute.

No. 10 is a magnified representation of No. 7, the fish adhering to the shell, which is partly broken.

No. 11 represents No. 9 magnified ; the heart is before the pectoral fins, under the throat.

No. 12 is a still more enlarged view of No. 9, showing the direction in which the blood circulates, as seen by a microscope.

The blood flows from under the body of the fish through the blood-vessels, ramified along the sides of the back, and is then collected into the large vessel which runs along the front and bottom of the bag, communicating directly with the heart. An equal quantity of air, or some transparent matter, circulates with the blood. The blood is drawn by the heart from the large vessel alluded to, and thrown in regular pulsations into the vessels of the head and throat, where it assumes a dark colour. The rays of the gills are visible, and the fish soon begins to assume a brownish colour.

Salmon fry, or smolts, for some time wander about the sides of the stream, where the current is obstructed, but as they acquire strength, they trust themselves to the mid-stream, play in the pools and deep spots, and on the setting in of the spring rains in the following year, are carried down to the junction of the river with the salt water, where they remain till habituated to the novel element into which they then proceed. The growth of the smolts, or young fish, is very rapid, especially after they have reached the sea, where food is in abundance. Fry marked in April or May have returned by the end of June, weighing from two to three pounds and upwards, and a month or two later they have been found to weigh as much as six pounds. The small sized fish under the weight of two pounds are called "salmon-peel," all above that weight "grilse." The growth of the grilse during the second visit to the sea and for several subsequent years equals, if it does not exceed, that of the first year. The land-launce and other fishes constitute the food of the salmon when out of sea ; and that it is a voracious feeder may be inferred both from its rapid increase of size and its dental arrangement.

No. 13. Salmon (developed shape.)
No. 14. Salmon, male (in summer.)
No. 15. Salmon (in fall.)

The first practical experiments with Fish-culture in the Dominion originated with Mr. Wilmot at his private residence in Ontario, in 1865. Three years afterwards, when its benefits were made known, it was adopted by the Government, and has since been extensively carried on in several of the Provinces. The rapidly increasing popularity of the industry, together with the marked success which attended its operations, has had the beneficial effect of inducing the Government to erect six additional fish-breeding establishments (beyond the original one at Newcastle) in the Maritime Provinces and in Ontario. The Restigouche, a famous salmon river dividing New Brunswick and Quebec, had one built upon it in 1872. During the following year two more were erected, one at Gaspé Basin, the other on the Miramichi river ; following these, another was put into operation at Tadousac, at the mouth of the Saguenay river. In 1875, a salmon hatchery was built at Bedford, near Halifax ; during the same year the largest fish-breeding institution on this continent was erected at Sandwich, on the Detroit river ; this one is especially adapted for the artificial propagation of white-fish.

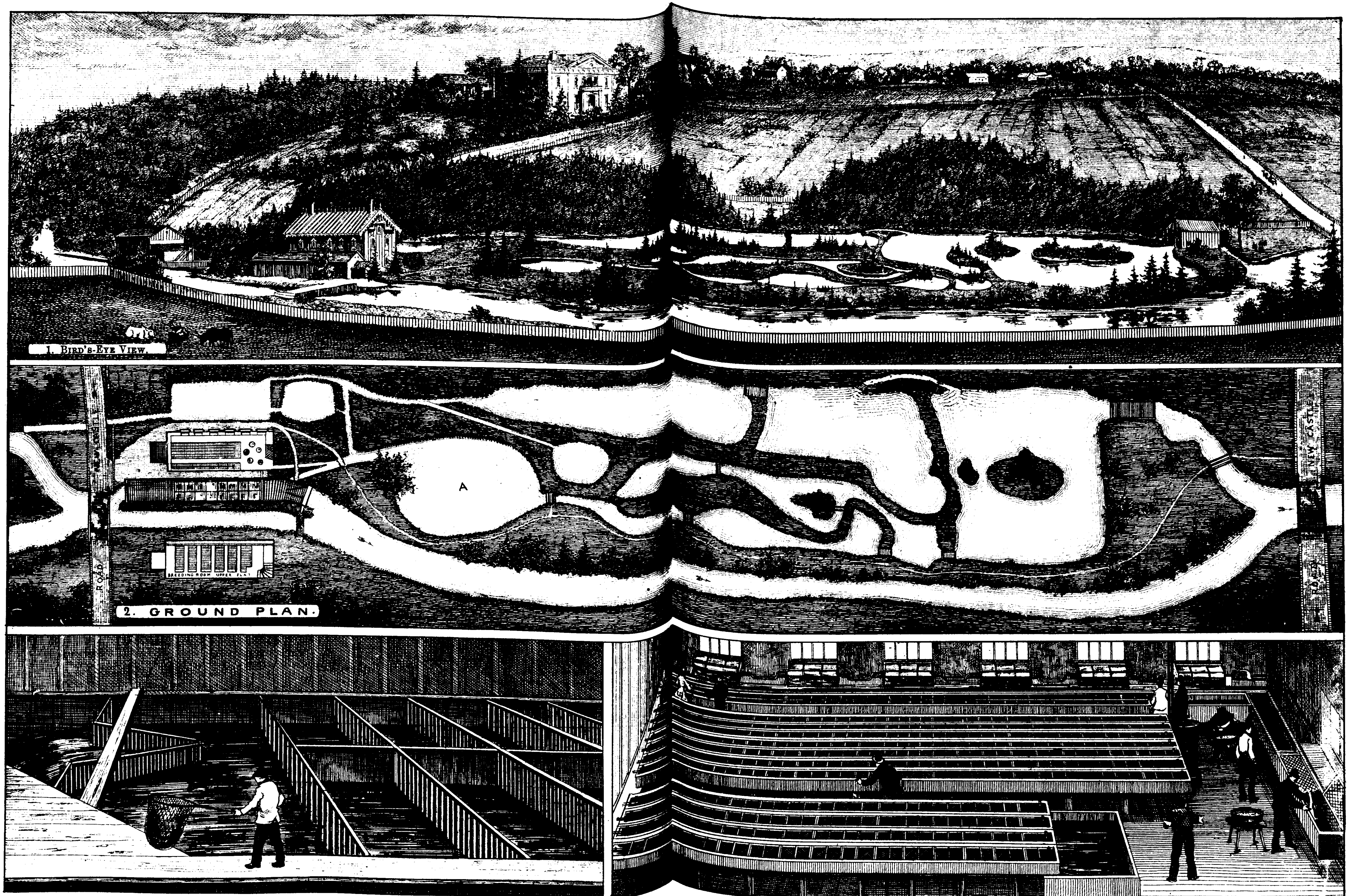
That our readers may be enabled to comprehend more fully the importance of this enterprise, and the amount of benefit which has already been derived from it, we give the following statement, taken from official returns, of the numbers of *young fish* which have been distributed from the Newcastle establishment :

Consisting of salmon, salmon-trout and white-fish, which have been reared in it	5,725,000
There are, at the present time, in the several breeding-rooms in the course of hatching out—*living ova* of salmon, trout and white-fish, and California salmon, amounting to	1,175,000
Making a total from this hatchery of .	6,900,000
From the other hatcheries in the Dominion, the young salmon and white-fish which have been planted in many of the rivers and other waters amount to	9,215,000
There are also on the hatching-trays of the several buildings in the Maritime Provinces and at Sandwich vivified eggs of the salmon and white-fish, numbering	12,400,000
These added together form a grand total of fry and fish-eggs of the most valuable species which have been produced at the several Fish-breeding establishments, for distribution in the waters of Canada, amounting to	28,515,000

CHOOSING A PHYSICIAN.—"To choose a physician," as Lady Mouncashel has well remarked, "one should be half a physician one's self ; but as this is not the case with many, the best plan which a mother of a family can adopt, is to select a man whose education has been suitable to his profession, whose habits of life are such as prove that he continues to acquire both practical and theoretical knowledge, who is neither a bigot in old opinions nor an enthusiast in new ; and, for many reasons, not the fashionable doctor of the day. A little attention in making the necessary inquiries will suffice to ascertain the requisites here specified ; to which should be added what are usually found in medical men of real worth—those qualities which may serve to render him an agreeable companion ; for the family physician should always be the family friend."

EXTRAORDINARY PHENOMENON AT SEA.— Capt. Hedderwick of the steamship *Victoria*, belonging to the Anchor Line, which has just arrived at Glasgow from New York, reports having encountered terrific weather on the outward passage to New York. On the 18th ult., when on the eastern edge of the Grand Banks, a terrific gale from the W. S. W. was encountered, and during the height of the storm there appeared on the trucks, yards, and stays large balls of fire of a phosphorescent nature, strung at intervals of one or two feet, and giving the ship the appearance of being decorated with Chinese lanterns, only the lights were far more brilliant. They settled on the vessel like a shower of meteors, and disappeared almost as suddenly as they appeared—an occasional one dropping from the yards and bursting with a loud report. One of them fell and burst almost in the face of the chief officer, but beyond dazling him for a moment, it caused him no inconvenience. Captain Hedderwick states that he has not known such severe weather for the last 21 years.

INSINCERITY IN ASKING ADVICE. — Nothing is less sincere than our manner of asking and of giving advice. He who asks advice would seem to have a respectful deference for the opinion of his friend ; whilst yet he only aims at getting his own approved of, and his friend responsible for his conduct. On the other hand, he who gives it, repays the confidence supposed to be placed in him, by a seemingly disinterested zeal, whilst he seldom means anything by the advice he gives but his own interest or reputation.—*Rochefoucault.*



3. Reception-House, Pens, Traps, &c.

4. Breeding-Room, Lower Flat, with Aquaria.

THE GREAT DOMINION FISH-BREEDING ESTABLISHMENT NEAR NEWCASTLE, ONTARIO.

LACHINE CANAL IMPROVEMENTS.

We copy from the *Canadian Illustrated News* the following report on the Lachine Canal Improvements:

This canal is eight and a half miles in length, and extends from the City of Montreal to the town of Lachine; thereby enabling vessels to avoid the St. Louis or Lachine Rapids which are the first of the series of rapids which interrupt the navigation of the River St. Lawrence, at a distance of 986 miles from the Straits of Belle Isle.

Its situation at the head of ocean navigation, and at the Junction of the Ottawa River with the St. Lawrence, makes it very important as the only outlet for the combined trade of those rivers.

The enlargement now being carried on consists in widening and deepening the prism of the canal, rebuilding the St. Gabriel and Cote St. Paul locks, the construction of five new locks, the Wellington dock or basin, and seven new bridges. From the Wellington Street Bridge to Cote St. Paul lock, the width of the canal is to be two hundred feet, and thence to Lachine, one hundred and fifty feet; the present average width being one hundred and twenty feet. The inside slopes as far as the St Gabriel lock will be lined with a vertical dock-wall, laid in hydraulic cement mortar, and above that point with heavy slope walls of dry rubble. The depth above Wellington Bridge will be thirteen feet, but the foundation of all masonry is laid at such a depth as will allow of future deepening, if required, to fifteen feet. The new locks will be built alongside the existing ones, and will be two hundred and seventy feet in length between the gates, and forty-five in width. The two lower locks are to have eighteen feet of water on the mitre sills, and the basins as far as Wellington basin are to be nineteen feet in depth; the other three locks are to have fourteen feet on mitre sills.

The approximate cost is estimated at about *six millions of dollars*, and the whole should be completed, according to the terms of the contracts, on the 25th of April, 1878. John Page, Esq., is the chief engineer, and John G. Sippell, Esq., is the engineer in charge.

SECTIONS NOS. 1 AND 2 extend from the mouth of the canal up the Wellington Bridge, and include the Wellington Basin and basin No. 2. The excavation of Wellington Basin was a heavy piece of work. The earth was conveyed by cars upon a railway track to the vicinity of the Victoria Bridge. The Basin, which is almost finished, is 1,250 ft. long, 225 ft. wide with a depth of 19 feet of water. It will afford extensive accommodation for ships of large size and capacity, the new locks being 270 ft. long and 45 ft. wide, and the uniform depth of the water, from the river up to the Wellington Basin, 19 ft. The old entrance locks are only 200 ft. long, with a depth of 16 ft. of water It is also contemplated building another large basin similar to Wellington Basin, and just below it.

The improvements on sections Nos. 1 and 2 consist of constructing new entrance locks Nos. 1 and 2, on the east side of the old ones, from which they are some little distance apart; constructing a basin, 500 ft. long and 300 ft. wide, between the new entrance locks; rebuilding the Mill street bridge, which will be a draw-bridge spanning both locks No. 2, the old and the new one, and swinging on a centre pier between the two; widening the "reach" between No. 2 lock and Wellington basins, constructing the Wellington basin, and making all for 19 feet depth of water.

This contract was awarded to Messrs. James Worthington and A.P. McDonald, and the work is estimated to cost some $1,900,000.

SECTION NO. 3.—The contract for this section was given to Messrs. McNamee, Gaherty and Fréchette, but was by them transferred to an American firm, Messrs. Loss and McRae, who are now working it.

The improvements on this section comprise the widening and deepening of the canal, building a dockwall on the inner slope, the rebuilding of the Wellington Bridge, where the canal will be widened, on the south side, more than 100 ft.; partially rebuilding the St. Gabriel lock, and constructing a new one on the northwest side of it, which will have a depth of fourteen feet of water on the mitre sill, while the depth of the old lock is not changed; removing the regulating weir and race-way on the north side of the canal, and constructing new ones; rebuilding the McGee Bridge, which will swing on a centre pier between the two locks. The new Wellington Bridge will swing on a square centre pier having two arched culverts running through it to prevent impeding the water, with a rest pier, and in a line with the centre pier. The swing bridge will thus span two navigable channels, each forty-six feet wide; and outside these will be another channel, on either side, each 30 feet wide and spanned by stationary bridges. The work on this section is estimated to cost from $600,000 to $700,000.

It has been proposed, for the safety and convenience of the public, to build two bridges instead of one, where Wellington street crosses the canal, one to be solely for the Grand Trunk Railway, and the other for vehicles and foot passengers.

SECTION NO. 4 extends from McGauvran's Island up to the Grand Trunk Railway's iron bridge, including it. The improvements consists of widening and deepening the canal, building slope walls of dry masonry—which, by the way, are suited to answer the purpose of dock walls and so intended—and rebuildind Brewster's and the Grand Trunk Railway bridges. The new Brewster's, or Napoleon Road bridge will swing on a centre pier, having a culvert running through it, and leaving a channel for navigation on either side, similiar to Wellington bridge. The iron railway bridge will be moved southward some fifteen feet, but will be of the same width, with two channels of navigation, as at present. There will, however, be a stationary bridge at each end of the drawbridge.

This work is in the hands of Messrs. Whitney and Boyd, and is estimated to cost about $330,000.

SECTION NO. 5 extends from the Grand Trunk Railway bridge to within some 500 feet of the Cote St. Paul lock. The only mechanical work, besides constructing the slope walls and a bywash, is the rebuilding of a culvert, but the rest of the job is a heavy one. The earth here is of a peculiar formation, the top to a depth of eight or ten feet, being black muck, under which is a bed of soft white clay or marl, and under it rock. The clay is so soft as to be nearly liquid, and therefore has to be removed and replaced by firm earth to afford a bottom upon which to build the canal walls. For a short distance, this marly bed is said to be sixteen feet in depth.

The contractors, Messrs. Charlebois and Mallette, state that in excavating for the wall on the north side, they took out some 15,000 cart loads of this clay, and many acres of land adjoining are covered with it, presenting a curious sight. Interest is added to this section from the fact that it is the scene of the so-called "Canal Land Ring Frauds," concerning which litigation is still pending. This land has the appearance of being utterly useless for agricultural purposes, being simply a barren bog; and it is not supposed that the top dressing of white clay which has just been spread upon it, will greatly increase its fertility. The following interesting extract from the report of the Chief Engineer of Public Works on the navigation of the St. Lawrence, last year, refers to this tract of land. He says:

"It was, however, soon ascertained that a great part of the land through which the new line would pass, was controlled by parties who, not only attach great importance to the position themselves, but had succeeded in impressing others with greatly exagerrated notions of its value. In fact land that, a few years ago, could have been bought for $120 per acre, and which at the time the canal survey commenced was not valued at more than three or four hundred dollars an acre, has been recently disposed of, at a credit sale, at the rate from eleven to eighteen thousand dollars per acre. These enormous prices are stated to have been "bid" for property situated on the north side of the canal and between the Grand Trunk Railway Swing Bridge and Côte St. Paul Road."

This section is little over a mile long, and the improvements on it are estimated to cost $350,000. The culvert to be rebuilt is for passing the waters of the River St. Pierre under the canal. The new culvert will be just above the present one, and will be much larger. It will be constructed upon the principle of an inverted syphon, and will have three arches, each six feet wide; is entire length will be 296 feet, and width 36 feet, and the bottom will be 14 feet below the bed of the canal.

SECTIONS NOS. 6 AND 7 are comprised in one contract, which was awarded to Messrs. Wm. Davis and Sons, and is approximately estimated at $900,000. The extent of these two sections is from about thirty rods below the Côte St. Paul locks to a mile and three quarters above, and the improvements on them consist of widening and deepening the canal; partially rebuilding the old Côte St. Paul lock, without disturbing the bottom; constructing a new lock on the north west side of the present one, with a depth of fourteen feet of water on the sill; rebuilding the Côte St. Paul road bridge, which will swing on a centre pier, similarly to the Brewster's bridge (always in speaking of rebuilding bridges the masonry only is meant, for although the building of the superstructure belongs to the canal improvements and has to be done by Government, this part of the work does not enter into the present contracts; and the same explanation is applicable to the building or rebuilding of the locks, in which the present contracts do not include the lock gates); rebuilding a waste weir or by-wash and a siphon culvert with one arch, to carry surface water under the canal, both a short distance above the lock; reconstructing the highway for a short distance below the bridge, moving it farther north. Here at the locks the wide channel of two hundred feet ends, and above the width will be one hundred and fifty feet. There is considerable rock cutting at the bottom of the canal on these sections. The widening of the canal is done altogether on the north-side on section No. 6, but on both sides on No. 7 section.

On SECTION No. 8, which is something over a mile and a third in extent, a considerable portion of the deepening will be rock cutting, on an average about four feet deep, but the upper portion of the section, for one thousand feet, averages about twelve feet; and a roadway has to be built along the south side, the whole length of the section. The contract is in the hands of Messrs. O'Brien and Sullivan, and is estimated to amount to about $400,000.

On these intervening sections, at a distance both from the suburbs of the city and from Lachine, boarding-houses are erected on the works for accommodation of the workmen.

Although the effects and results of drink among the canal laborers have a number of times been manifest since the commencement of operations, and although informed only the other day, that drinking and drunkenness were conspicuous on the works, we are happy to be informed that drunkenness is on the decrease.

SECTION No. 9 is a little over a mile in extent and reaches up to within about one thousand feet of the guard-lock at Lachine. The work of widening and deepening is pretty much all rock-cutting, but slope-walls have to be built on both sides on top the rock. The amount of the contract is estimated at $350,000. The immense amount of rock required to be removed on this section makes the job a heavy one, so far as labor is concerned. The contractors are Messrs. Lyons, Bros., and the amount of work accomplished is not small. The earth on top as well as the rock down to the water level, has been mostly all removed, on both sides of the canal. A curious sight is presented by the one thousand one hundred holes of three inches diameter and averaging eighteen feet in depth which have already been drilled in the rock on the sides, for blasting. It is said that this drilling, charged with dynamite, will be supposed to remove one hundred and twenty-five thousand yards of rock; but, fortunately, it will not be blasted all at one time, else the inhabitants of Lachine and vicinity might experience a little earthquake. The drilling is done by steam drill, peculiar looking machines, of which seven are used, and three steam-engines are required to operate them.

SECTION 10 commences at about seventy rods below the guard lock at Lachine, and includes the remainder of the canal proper. From the lower end of this section, the rest of the old canal is not interfered with at all, but a new, more capacious, and entirely distinct channel will be constructed, extending far out into the river. The work on section 10 comprises the opening of the new channel, which will be a 150 feet wide, a short distance below the guard lock, making the width of the canal, at the junction of the old and new channels, some 320 feet; constructing a new guard lock, 45 feet wide and with 14 feet of water on the sill; constructing a new swing bridge, similar to the present one over the old canal for the highway immediately above the lock. About two-thirds of the cutting is through solid rock. The section is only 1,400 feet long. This work is in the hands of Messrs. Rogers, Kelly & Co., and its estimated cost $270,000. Work on this section will not be subject to the inconveniences attending that on other sections, and the new channel being distinct from the old one, the work can be done either in summer or winter, and the contractors state that they will build the lock, bridge and slope walls next summer. The earth taken from the excavation has to be dumped into the river, forming an embankment outside the pier work of the new entrance. In the new guard-lock there will be submerged a gate, called a "guard gate," reserved for use in cases of emergency.

SECTION 11 comprises the new entrance channel, which will extend over a mile out into the river, to above the lighthouse, quiet a distance beyond the present entrance channel. To protect this channel on the outer side a continuous line of pier work, 6,200 feet in length, will be constructed, running nearly parallel to the present pier; and on the inner side, alongside the present pier, will be a single line of cribwork, and the space, six feet wide, between this and the old pier will be filled in with puddle. The outside pier consists of two lines of tight cribs filled in with stone, and the space, six feet wide, between the two, is to be filled with puddle; these cribs being built up to the level of low water, and a wall of rubble masonry being built on top of them. This, obviously, will make very secure work. The channel will be 200 feet wide, and 15 feet deep at low water. The bottom is rock, and from six to ten feet of it will require to be removed; to do this the channel will require to be unwatered, a section at a time, which can only be done after the crib work is built.

The contract for this work, which is expected to cost $700,000, was given to Messrs. Wm. Davis & Son, who have also sections 6 and 7, and the time for the completion of it does not expire till April, 1879, a year later than the other contracts.

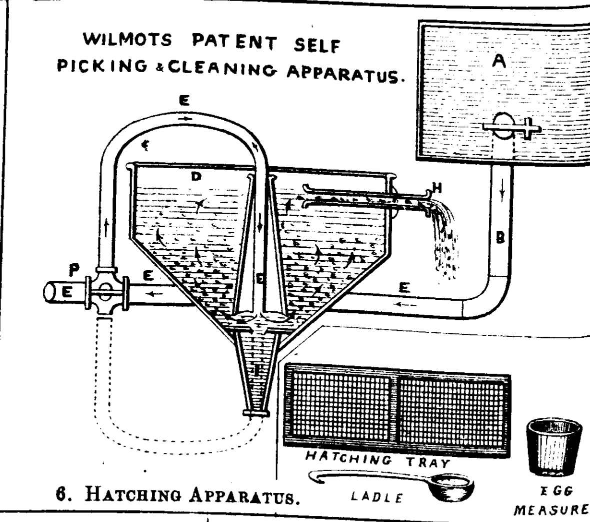
The reason for building a new entrance channel instead of enlarging the old one, was that great difficulties in doing the latter in winter, when the canal would not be in use, were anticipated. To drain the new channel for the purpose of excavating the rock bottom, coffer-dams will have to be built across the channel, and the section thus enclosed pumped dry.

DIFFERENT SCHEMES AND THEIR MERITS.—By referring to the report of Mr. John Page, Chief Engineer of Public works, on the navigation of the St. Lawrence, submitted to the Secretary of the Department last year, it is seen that several different schemes were proposed for the enlargment of the Lachine Canal. Mr. John G. Sippell, the Superintendent Engineer, having presented various schemes for enlarging portions of the old canal, and constructing a duplicate canal for the remainder of the distance, while the scheme at present being carried out is in the main that of Mr. Page. Mr. Sippell's arguments in favour of a new canal for a large portion, or nearly all the way, amounted to this: That a new canal could be built with comparative facility during the summer months without interfering with either the traffic on it or the manufactories along its banks which are dependent on the canal for water power; while the enlargement of the present canal would largely increase the cost of the work by its being forced in to the winter months, extending over three or four winters, and seriously interfering with the operations of the manufacturing interests, it being represented that there were 30, 000 people who derived a subsistance from the mills and factories on the canal, which of course would have to shut down in winter unless provided with steam power. Mr. Page while taking into full consideration these important and weighty arguments in favor of the new channel scheme, had still to regard the formidable objection of the enormous prices which it was likely would have to be paid for the land through which the new canal should pass, and presented the following arguments in favor of the enlargement of the old canal: "FIRST, there would be no uncertainty connected with the bottom, or formation of the banks, nor risk of damage to adjoining property from leakage. SECOND, the canal could be enlarged without the department being at the mercy of property-holders who entertain such extraordinary ideas of the value of land. THIRD, the principal part of the clay excavation could be advantageously done by machinery during the open season, and all the work over water-surface could be carried on at the most favorable time. FOURTH, the future outlay for working expenses, maintenance and management would doubtless be very much less for one large canal, than for two of lesser dimensions."

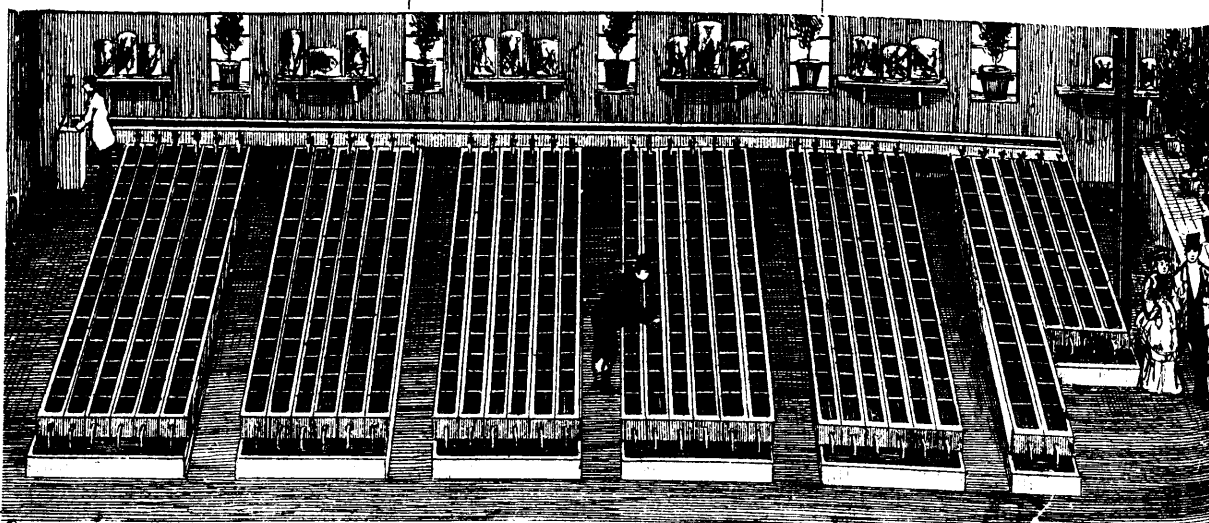
Although the depth of water in the canal when enlarged will be thirteen feet, it will only allow for the navigation of vessels drawing twelve feet of water; but the new locks will all have at least fourteen feet of water on the mitre sill, and the canal may be deepened to fifteen feet so as to accommodate vessels of 14 feet draft, which is equal to the capacity of the Welland Canal and greater than the present capacity, for navigation, of the River St. Lawrence.

A WATERPROOFING COMPOSITION.—Dr. Scherzer, an Austrian official at Pekin, has just sent to his government some specimens of a Chinese composition called "Schioicao," which has the property of making wood and other substances water-tight. He has seen in Pekin wooden chests which had been to St. Petersburg, and have come back uninjured, and that the Chinese use the composition for covering straw baskets which are afterwards employed in carrying oil for long distances. Cardboard, when covered with the composition, becomes as hard as wood; and most wooden buildings in Pekin have a coating of it. It consists of three parts of blood deprived of its fibrine, four of lime and a little alum.

5. Taking Ova from Fish and Impregnating them.



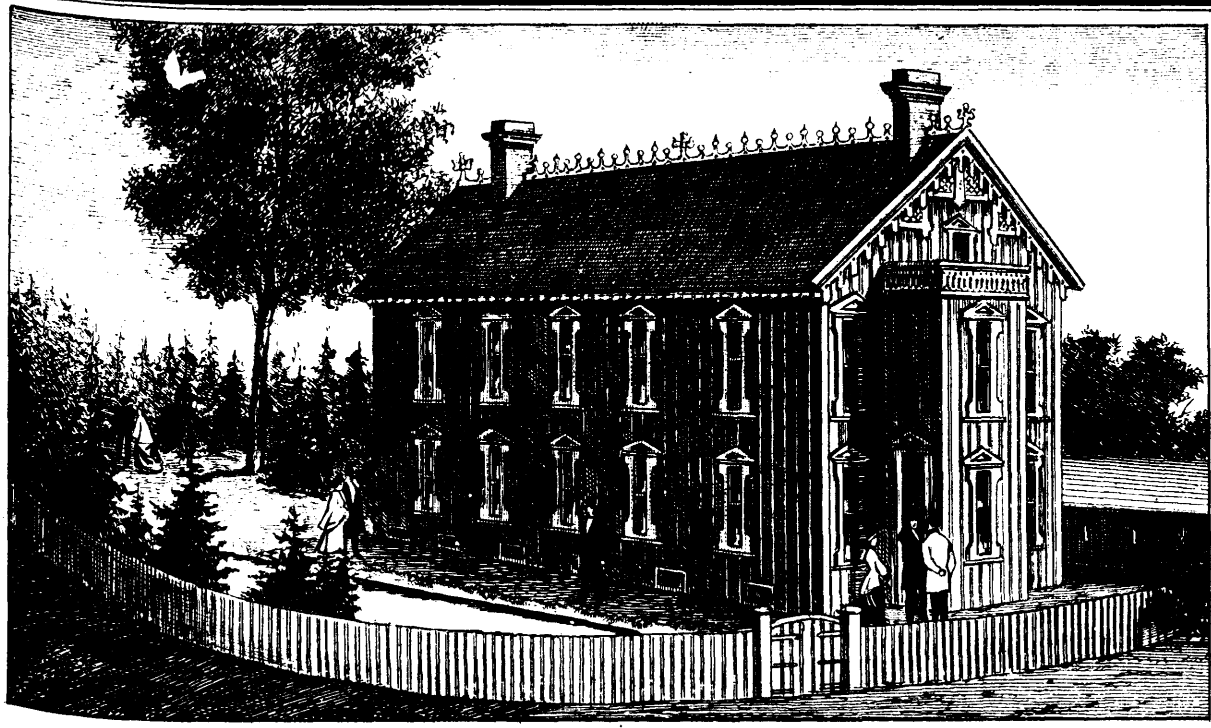
6. Hatching Apparatus.



7. Breeding-Room, Upper Flat.

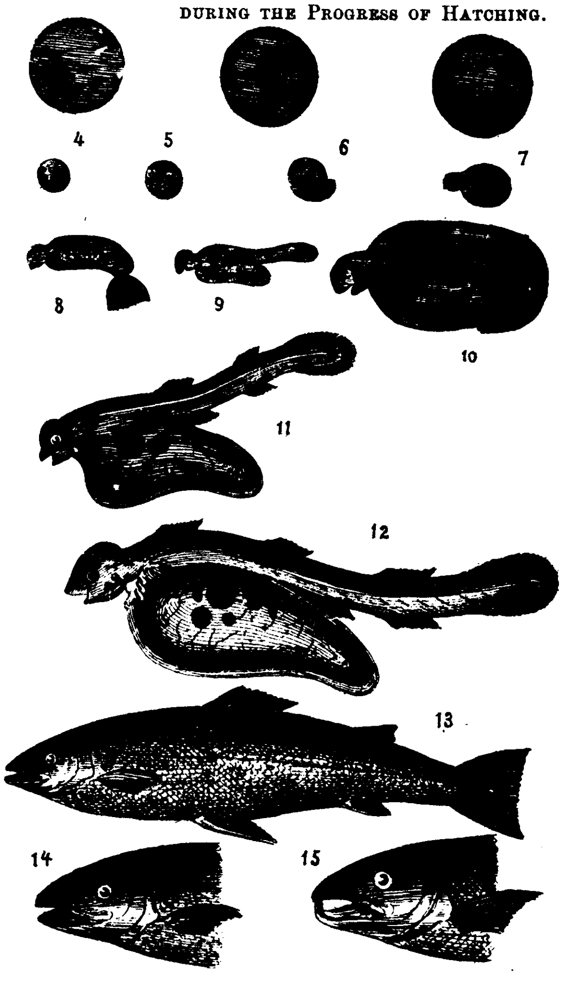
8. Museum.

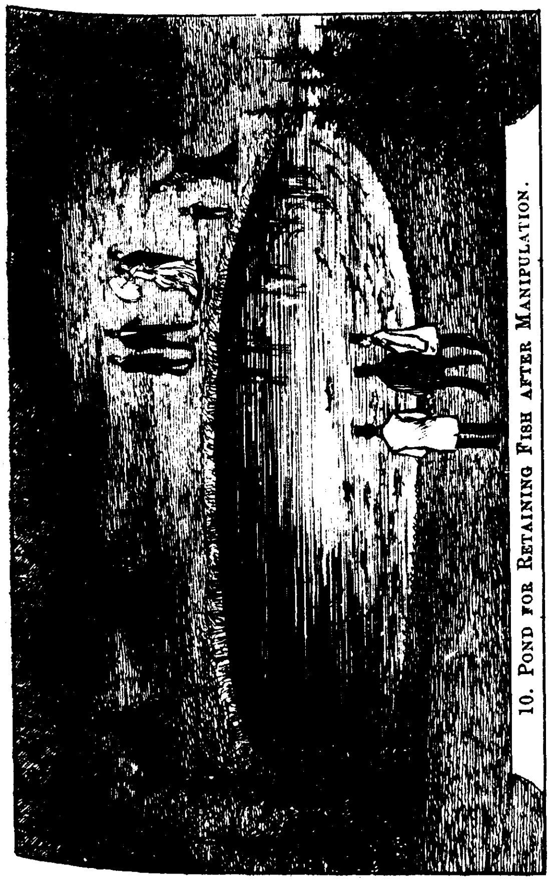
FISH CULTURE.



9. Outside View of Breeding-Room.

11. Different Stages of the Eggs during the Progress of Hatching.





10. Pond for Retaining Fish after Manipulation.

FISH CULTURE.

SCIENTIFIC NEWS.

At at recent meeting of the Dresdener Gewerbeverein, a communication was read by Mr. Herrmann, engineer for the Siemens Glass Factory, in which he explained that their celebrated hard glass was formed under hydraulic or other pressure which gave the desired hardness independent of any tempering. By means of this process larger glass panes can be formed than was possible before. The glass is stronger than the tempered glass in the proportion of 5 to 3. The fracture is fibrous, not crystalline like the ordinary glass. At an examination instituted by the "Gewerbeverein," a lead bullet weighing 120 grains was dropped upon plates of ordinary and pressed glass, supported at the four corners. The ordinary glass was fractured by a fall of the bullet from a height of 300 millimetres, while the pressed pane fractured at a height of 2000 millimetres. A second specimen of the latter was subjected to a fall of 3000 millimetres without breaking.

Eleven establishments were engaged in the production of Bessemer steel in the United States in 1876. The number of net tons of pig iron and spiegeleisen converted by the Bessemer process in 1876, was 539,475, against 395,956 tons in 1875, and 204,980 tons in 1874. Of spiegeleisen alone there were used 45,980 net tons in 1876, against 33,245 in 1875. The number of net tons of Bessemer steel ingots produced in 1876 was 525,996 against 375,517 tons in 1875, and 191,933 tons in 1874. The number of net tons of Bessemer steel rails produced in 1876, was 412,461, against 290,863 tons in 1875, 144,944 tons in 1874, 129,015 tons in 1873, 94,070 tons in 1872, 38,250 tons in 1871, 34,000 tons in 1870, 9,650 tons in 1869, 7,225 tons in 1868, and 2,550 tons in 1867—a total production of 1,163,028 net tons in the ten years during which the Bessemer steel industry of this country may properly be said to have had an existence. It has really had a slow growth until within the last few years. The number of net tons of spiegeleisen produced in this country in 1876, was 6,616, against 7,832 in 1875. One firm in Georgia made 100 net tons of ferro-manganese in 1876. The average prices of Bessemer steel rails in the United States during 1876 ranged from $65 at the mill in January, to $50 in December. It is said that not a single steel rail was imported into that country in 1876. In 1873, 159,571 net tons were imported.

One of the most curious but insufficiently substantiated inferences drawn by some of the geologists who have devoted attention to the chemical metamorphoses which the rocks composing the crust of the earth are subject to, is the conclusion that the earth is gradually losing its water, or drying up. It is generally assumed that the evaporation of the water from the surfaces of our oceans, lakes, rivers, &c., is practically balanced by the various forms of precipitation, rain, snow, hail, &c., from the clouds, by which it finds its way again to the earth. This is strictly true in the sense that not a particle of water passes beyond the limits of our atmosphere, and that all that finds its way into the atmosphere by evaporation, sooner or later is returned again. Nevertheless, the water supply of our earth is slowly but steadily diminishing. It is not destroyed, but is so modified as to be no longer available for the sustenance of animal or vegetable life, since it is absorbed and bound up in the rocks. This disappearance of water is to be accounted for partly by mechanical absorption, partly by the hydration, or binding of water, which is generally one of the phenomena attending the superficial weathering of the rocks, and partly by the crystallation and recrystallation of the constituents of many of the rocks, and the extensive chemical changes going on at unknown depths within the bowels of the earth, as manifested in the phenomena of volcanoes. In the course of time, though, happily, many ages from the present, the combined result of these several causes of dissiccation must be the complete absorption of all the water, and its disappearance from the surface of the earth. According to the *Polytechnic Review*, the estimate has been made that about one-seventeenth of the original quantity of water the earth was provided with, has already been bound up in the rocks, or absorbed beyond the possible reach of the organisms living upon her surface.

Brass Lacquering.—If you want a good deep gold lacquer I would suggest that you should make up a small stock bottle, holding, say, half a pint, according to the following recipe. You can then add as much as may be required for the tint you wish to get:—Alcohol, ½pint: dragon's-blood, 1 dram; seed lac, 1½oz.; turmeric, ½oz. Shake up well for a week, at intervals of, say, a couple of hours, then allow to settle, and decant the clear lacquer, and if at all dirty filter through a tuft of cotton wool. Mix with the pale lacquer a day or two before you wish to use it.—*English Mechanic.*

A New California Industry.—A manufactory of a new kind of belting has been recently established at the Willows, North Oakland, in which the entrails of sheep are used in the production of an exceedingly strong and durable belt. Hitherto none has ever been manufactured for the purpose of putting it on the market, either here or in Europe, but in a few manufactories on the continent it has for years been made by the workmen themselves in quantities sufficient only for immediate use. Now a building has been erected close by the abattoir for the purpose of manufacturing this belting for the market.

The entrails of sheep, which will average about fifty-five feet in length, are first thoroughly cleaned and then placed in vats of brine, where they remain some days. When thus prepared they are not much thicker than a piece of common cotton twine, and will sustain a weight of about ten pounds. The next stage in the process of manufacture is to wind the prepared material upon bobbins, after which the process is the same as in making common rope. This method is used to produce a round belt, but where a wide, flat belt is to be made, a loom is employed, and the five strands are woven together, as in ribbon manufacture. The flat belts are made of any size, and the round are of sizes varying from one-sixteenth of an inch up to one inch and a half in diameter. The round belts are made either in the form of a smooth cord, or as ropes with from three to five large strands.

The three-quarter inch rope is said to stand a strain of seven tons, and is guaranteed to last ten years. Hemp rope will last on an average not over three years. The three-eighths round cord, containing one hundred and fifty strands, will endure a strain of about four tons. A one and one-eighth inch belt was recently put in position in the Safe Deposit building. The manufactory at "The Willows" was started about three months ago, and now employs nine hands. New looms for weaving flat belts have been bought, and in a short time the production will be increased. The North Oakland abattoir does not furnish material enough to supply the demand, and a large proportion has to be procured from Butchertown. A large quantity is shipped from Butchertown to the East, where it is manufactured into violin strings, but now all this promises to be used nearer home for a more useful purpose. With the exception of the entrails of cats and dogs, those of the sheep are only fit to be used in this manner, as in other animals they are both too large and too short.—*San Francisco Bulletin.*

Painless Death.—In a lecture at the Royal Institution, Prof. Tyndall, speaking of the painless death by electricity, remarked that Franklin was twice struck. He afterward sent the discharge of two large jars through six robust men, who fell to the ground and got up again without knowing what had happened, neither hearing nor feeling the discharge; and Priestly, too, who made many valuable contributions to electricity, received the charge of two jars, but did not find it painful. Prof. Tyndall said that this experience agreed with his own, that in the theatre of the Royal Institution, and in the presence of an audience, he once received the discharge of a battery of fifteen Leyden jars. Unlike Franklin's six men, he did not fall, but, like them, he felt nothing; he was simply extinguished for a sensible interval. This may be regarded as an experimental proof that people killed by lightning suffer no pain. Now, the measured velocity of electricity is many thousand times greater than the measured velocity of sensation in the nerves. Hence, the electrical concussion reaches the centre of life without any possible announcement by eye, or ear, or sense of feeling. There is abundant evidence that death by a rifle ball traversing the brain is for the same reason entirely without consciousness or pain. A rifle ball, however, is a tortoise compared with the electric flash.

Artificial Ivory.—Natural ivory has been investigated as to its composition, and the proportions of the materials found *in natura* has been adopted for the manufacture of artificial ivory. Two parts of indiarubber are dissolved in 36 of chloroform, and the solution saturated with pure phosphate of lime, or pulverised carbonate of zinc, pressed in moulds and dried. When phosphate of lime is used, the artificial product resembles natural ivory very closely. The matters for which no substitute is provided are of small importance. In Paris M. Dupré makes artificial ivory with papier mâché and gelatine. Billiard balls made of this substance cost only a third the price of ivory, while they possess all its hardness and elasticity. Used for other purposes, this pasty compound takes the name of Paris marble, and is worked up for mouldings, capitals of columns and architectural ornamentation generally.

AMERICAN INVENTIVE PROGRESS.

Under the above heading the *Scientific American* of May 7th has a long and interesting article, from which we make the following extracts:

"To show with what rapidity inventors made improvements on inventions embodying original principles, says the writer, it may be noted that in the early days of the sewing machine 116 patents were granted for improvements thereon in a single year; and out of the 2 910 patents issued in the year 1857, 152 were for improved cotton-gins and presses, 164 for improvements on the steam engine, and 198 for novel devices relating to railroads and improvements in the rolling stock. In the year 1848, three years after the publication of this paper was commenced, but 660 patents were granted; but under the stimulus of publishing those inventions as they were patented, ten years later, in 1858, the number had increased sixfold, reaching 3,710, while up to January 1, 1850, as already stated, the aggregate of patents issued amounted to 17,467; since that time and up to this date the total is 181,015.

"And curiosity here leads us (adds the editor) to review our own work, extending back, say, twenty years, or to 1857, a period during which 170,745 patents have been issued. We find, by actual count, that 62,062 applications have been made through the Scientific American Patent Agency for Patents in the United States and abroad. This averages almost ten applications per day, Sundays excluded, over the entire period, and bears the relation of more than one quarter to the total number of patents issued in this country up to the time of writing."

AMERICAN MEAT PRESERVATION.

The precautions taken for the preservation of meat for export across the Atlantic, and eventually into metropolitan shops and stores, are merging into the scientific. The history of 100 sides offered for retail sale at the Cold Storage Wharf, Upper Thames Street, is a good sample of this. The animals were slaughtered in New York a fortnight ago, and on arriving at Liverpool in due course, the carcases were transferred to two vans specially constructed by Mr. Acklom. In these vehicles, per North-Western Railway, they reached their destination in London. Mr. Acklom's van is a dust-proof chamber, always perfectly ventilated. The walls or sides are composed of double panels of felt, the exterior panel being lipped into a cylinder, the water from which, after percolating it, returns to a tank, whence it was originally pumped by an automatic windmill worked through the action of the train. On monday morning last the thermometer registered in the van 45°; and such is the effect of the construction, the hotter the weather is the lower is the temperature, as the result of evaporation. After it reached the market hall, Monday's supply was placed in a refrigerating room, which forms part of a vast space beneath the Cannon Street Railway Station. The whole area available being equal to about an acre and a quarter, it is calculated that about 20,000 tons of meat might be stored there. A vault close to the river is to form the icehouse of the establishment, being spacious enough to hold 500 tons, and thence cold air will be diffused to the rooms used for storage, the walls of which will be covered with canvas and paper, so as to exclude the ordinary atmosphere. Besides the basement there is a story above, which is designed for the reception of game, fruit, butter, and other importations; and there are three or four landing-places for the disembarkation of meat and other foreign provisions. The meat met with a ready sale, realising from 6½d. to 8d. per lb.—*Iron.*

GREEN VARNISH FOR METALS.—Green transparent varnish; Grind a small quantity of Chinese blue with double the quantity of finely-powdered chromate of potassa (it requires the most elaborate grinding); add a sufficient quantity of copal varnish, thinned with turpentine. The tone may be altered by more or less of one or the other ingredients. Green bronze liquid: One quart of strong vinegar, ½oz. of mineral green, ½oz. raw umber, ½oz. sal-ammoniac, ½oz. gum arabic, 2oz. French berries, ½oz. copperas; dissolve the whole in a pipkin over a gentle fire, allow to cool, and then filter.

PAPER VARNISH.—All varnished gums composing the same, and dissolved in turpentine, have a greasy nature. Paper must be first sized, or if dissolved by any other spirit, 8oz. of gum sandarach, 2oz. of Venice turpentine, 32oz. of alcohol. Dissolve by gentle heat. Or a harder varnish, reddish cast, 5oz. of shellac, and 1oz. of turpentine, 32oz. of alcohol, or Canada balsam dissolved in turps.

BRITISH PATENT DOCUMENTS.

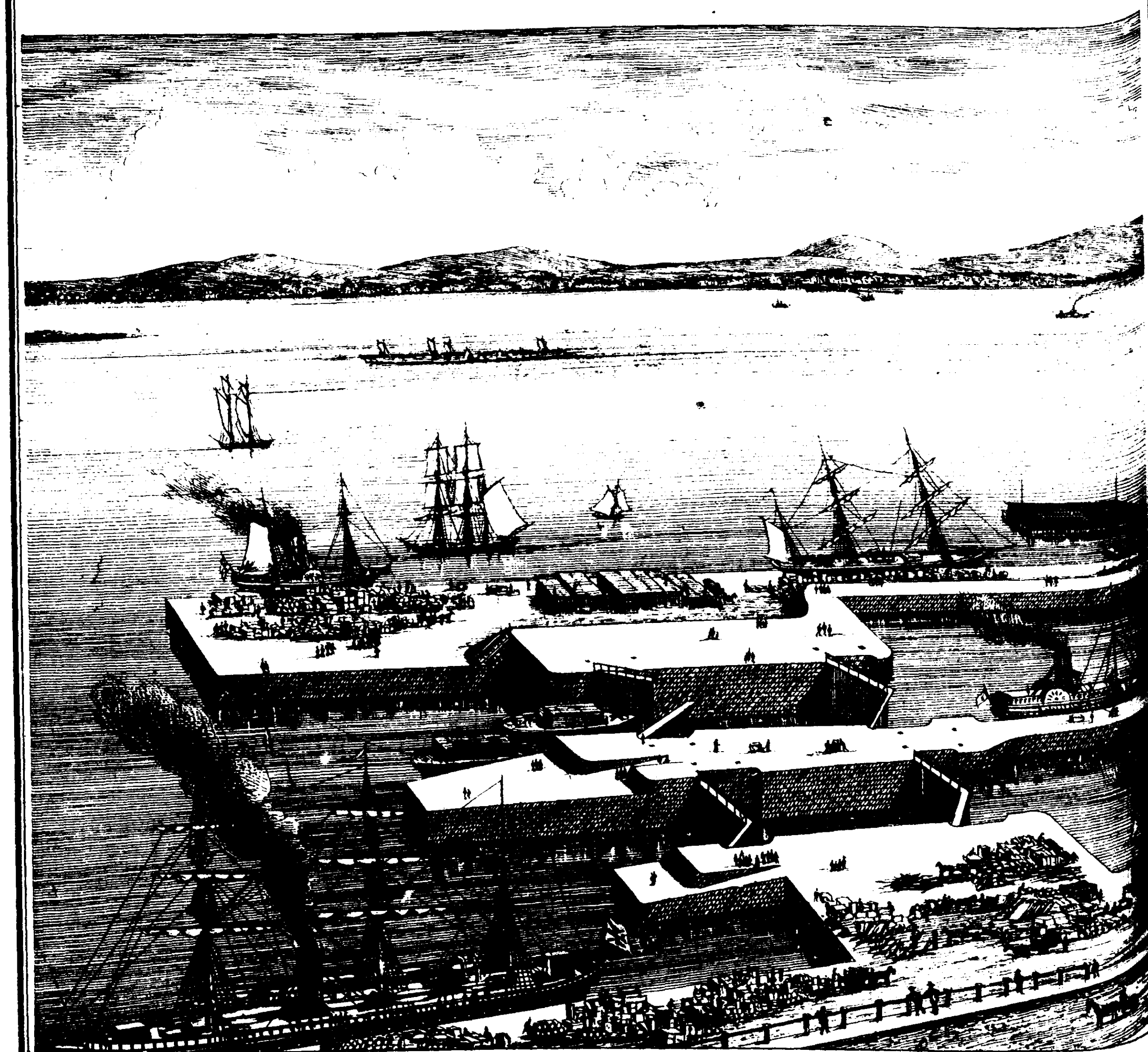
The *Scientific American* has the following remarks on British Patent Documents:

"The clumsiness of the British Patent Office is exemplified in the form of its patent documents and the ponderosity of its printed copies. Although other nations discarded years ago the feudal method of sheepskins and dangling seals, the Britishers still adhere to it. A British patent document consists of an animal skin, 2½ feet long and 2 feet wide, filled with a long rigmarole reciting the titles of Her Majesty, and what she hath done by these presents. Scattered here and there on the margin of the skin are certain scrawls, supposed to be the official signatures of my lord this or his highness that, each of whom receives from twenty to fifty thousand dollars a year for such like exhaustive labor. The skin is further authenticated by the royal seal, consisting of a large disk of wax, bearing an embossed effigy of Her Majesty, seated on horseback, carrying a club or sceptre. This beeswax seal is six inches in diameter, one inch thick, set in a round tin box, and attached to the skin by cords. The weight of the document, with seal and appurtenances, is two pounds four ounces avoirdupois. The object of this formidable affair is to let the common people know that the government has granted a patent to Smith for a birdcage or a flat iron.

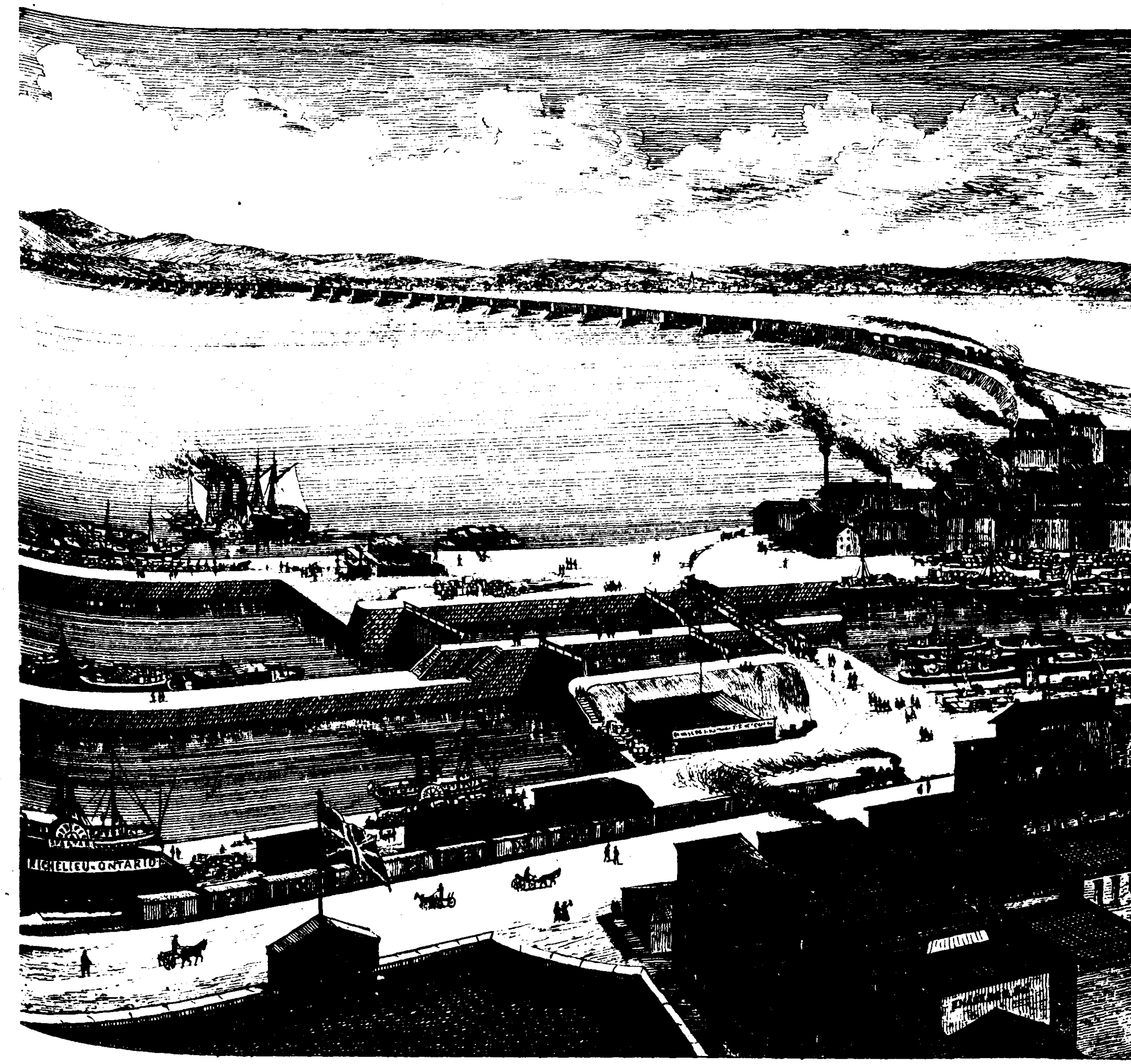
In addition to the patent, the government also prints the drawings and specifications of each patent; and these are also unnecessarily spread out, covering a large area of paper. So bulky is the large majority of these copies that the government has been compelled to curtail; a smaller and more compact style of printing has lately been adopted. An order has also recently been given to destroy nearly all the copies of printed specifications of expired patents: 250 tons of these valuable documents have already been carted away, and the process of destruction still continues. The only reason given for this is that it is difficult to find storage room, and it has, therefore, been determined to reduce the stock of copies to five apiece. The amount which these have cost to print is over $3,500,000, more than that sum having been spent in this way since 1852, when the Patent Law Reform Act authorized the printing of specifications. Large numbers have, of course, been given away from time to time, and still greater numbers have been sold; but the stock which still remains is a very large one, and by far the greater part of it is in constant demand. This wholesale destruction of public property is causing bitter complaints among the patent agents and consulting engineers who have been informed of it, as it will give much additional trouble to those employed in patent cases. The usual practice has been to purchase copies of the specification required for such purposes, and the agents were then able to work in their own offices. It will now be necessary for them to do much of their work at the Patent Office Library. It is also stated that the library of the Patent Offices to be "weeded" in order to give more space.

A CANAL STEAMER.—A steam tug invented by Hugh Stevenson, of Oshkosh, Wisconsin, is exciting attention among those interested in canal navigation. The boat is 55ft. long, 16ft. beam, and 4½ft. deep. Attached to the main shaft, in the centre of the boat, are two large shafts, 14ft. long, incased in beams 15in. in diameter, which shafts connect with shafts which turn driving wheels. These driving wheels, 2ft. 4in. in diameter, double flanged and very heavy, run on an iron laid along the bank and propel the boat by traction. Half a mile of the track has been laid where the trials are being made, and the tests thus far have been very successful. The invention, it is claimed, does away with all wash in the canal. A tug will cost from 3000 dols. to 3500 dols.—*Hydraulic Engineer.*

TISSUE GLASS.—In German and Austrian laboratories there has come into use an invaluable filter made of a fine-spun glass, presumable different from that which may now and then be seen used in ornamental toys. It has the appearance and most of the mechanical peculiarities of cotton or silk thread, and is stated to be very valuable as a filter where the solution would be affected by the ordinary filter, or as a collector for precipitates. If we wish to calcine an insoluble compound, on the filter used for its separation, we find in the crucibles, with the residue, without ash, a crystal globule, which represents the original filter. An alliet use is found for it in the preparation of brushes used in solution which attack those made of organic material, and safe, therefore, when used in such matters as chromic acid, nitrate of silver, iodine, &c. The German name for it is *glaswolle;* the French *coton de verre.*



LACHINE CANAL IMPROVEMENTS, MONTREAL.



LACHINE CANAL IMPROVEMENTS, MONTREAL.

IMPORTANT IMPROVEMENT IN BRICK MACHINES.

(See page 148)

We are always pleased to announce decided progressive inventions, and therefore it is with satisfaction that we lay before our readers an account of the performances of a new brick machine, of which the adjoined engraving is a representation. It is by the fruit that we judge of the tree, and it is the productions of a machine which determine its value; that in the present case the productions are of an extremely high and unique value will appear presently.

The great advantage of bricks made from clay over cut stone is that it takes so much less labor to shape a given form from clay than to cut it from natural rock, while the labor and expense of baking is far less than would be the blasting, cutting, and shaping of stone, hence why brick walls are cheaper than stone walls; but their great advantage is their greater stability, from the reason that the bricks are all correctly square, which is not attainable with stone, except by special great labor. Such brick partition walls as are often set up in cities like New York, about a hundred feet high, could not possibly be built of stone, unless the walls were made very thick, by which much valuable space would be lost.

It is very natural that, considering the great amount of mechanical labor required for brick-making, many attempts should have been made to dispense with this labor and substitute machine labor. The result has been the construction of various brick machines, of which there are three types:

1st. *Dry or Untempered Clay Machines.*—These use the clay directly from the bank, and in some cases require artificial means to reduce the clay to natural moisture. It is claimed that the objection to these machines are overcome in the burning; but the quality of the bricks offered in the market is a sufficient refutation of the claim, as they are not desirable for building purposes.

2d. *Mud Machines.*—These use the clay so wet and soft that the bricks must be dried on floors before they can be handled, and therefore possess no advantages in point of economy over hand-labor.

3d. *Machines which Thoroughly Temper the Clay.*—These avoid the extremes of the first and second classes. The clay is properly tempered in the pug-mill, and when moulded, is so firm and compact as to be handled and hacked without injury. Upon this principle alone can machines be constructed combining all the qualities necessary and desirable to produce cheaply first-class marketable bricks. To perfect such a machine has been the ambition and aim of many inventors, and the great hope of brick-makers.

It is to this (3d.) class that the machine here described belongs, and it is claimed to be the very head and front of it, having no peer or equal. By the use of this machine the cost of manufacturing is considerably reduced, and so superior in quality are the bricks that they may at once come in competition, even as a matter in economy, with wood and other building material. The admitted superiority of bricks for permanent structures, proven through all ages, and notably so by the late disastrous fires in several of our large cities, has increased their use to such an extent, even in the erection of the most costly and elegant buildings, that it will require all the improvements which science and art can suggest, to meet the great demand.

As the shaping of the clay into any form is so easy, it is indeed strange that variously shaped bricks have not been produced before. The manufacturers are prepared to produce bricks in various shapes for ornamental as well as architectural purposes. We have before us a set of more than forty diagrams of different forms of bricks made by this company; some are for various forms of moldings, some for string courses, some with bevelled corners, etc. These diagrams are presented to professional architects, with the expectation of their support in carrying out the intentions of the company working this machine, to develop the growing taste for ornamental brick structures, and to furnish such bricks where needed, both as to shapes and various colors, such as white, buff, black, gray, etc.

The machine can make 30,000 bricks per day. Its framework and bed-plate are constructed of iron, and occupy a space of about 8 feet square. There is an upright cylinder or pug-mill 2 feet in diameter and 4 feet high; this cylinder is cast in sections and bolted together, and has a vertical shaft passing through its center, provided with a series of knives for cutting and tempering the clay, and forcing or feeding it downward to and below a segmental false bottom secured in the lower part thereof. In the space between the false bottom and the bottom of the pug-mill, works a pusher attached to the shaft, the front of said pusher being made convex or curved. This pusher forces the clay from the pug-mill through a die or mouth-piece into moulds, and acts in connection with a pivoted stop, which also works under the false bottom. As the clay is forced by the pusher under the false bottom the stop prevents it from going around, and causes it to pass through the die or mouth-piece into the moulds. By the use of the pusher and stop the clay is forced direct from the pug-mill, obviating the use of any other machinery for that purpose. These parts also, from their regulation and motion, produce a safety-valve at the proper time, enabling any excess of clay fed down by the knives in the pug-mill to be returned for the next charge, thereby avoiding any undue pressure in the moulds.

The moulds are attached to each end of a carriage, which has a reciprocating motion, and stops each set of moulds at the proper time, immediately in front of and flush with the mouth of the die. These moulds have grooves or cuts, through which pass knives placed upon a revolving shaft above, separating and dividing the clay into bricks. The outer end of the moulds has a solid abutment against which the clay is forced sufficiently to press out any flaw, crack, or imperfection. After the knives have cut the clay, the carriage is moved, bringing the other set of moulds in front of the die, and while this set is being filled the others are being discharged. The bricks are discharged by the raising of the bottom of the moulds (which are styled followers) on a level with the sides. A sweep or push-bar then removes them on to boards or a stationary table, from which they are taken by a boy and placed on drying cars or barrows. This operation is the same alternately at each end of the machine. All the motions of the machine are positive and regular, the only belting required being that necessary to transmit the power from the engine. An engine of 20 horse-power is sufficient for one machine.

In machines using a pug-mill for tempering purposes there has been a failure to obtain regularity of feeding. This difficulty is overcome in this machine by the use of the safety-valve previously described, thus securing all the advantages of manufacturing bricks from thoroughly tempered clay. The clay may be dug in winter and exposed to the action of the weather, is is generally done in making bricks by hand, or taken directly from the bank. A sufficient quantity of water is conducted to the clay in the pug-mill to assist in thoroughly tempering it before it is forced into the moulds. The bricks, when discharged from the moulds, are compact and of such consistency as to be handled without marking or injury.

In estimating the cost of making bricks by this machine, (which is less by one-half than the old method,) it is only necessary to say that the only labor required is to bring the clay to the machine and take the bricks therefrom. Where drying cars are used, the bricks are placed direct thereon at the machine, and are not again handled until delivered at the kiln; so that the expense of handling is greatly diminished. The bricks made by this machine are claimed to be "perfect bricks," and to bear the closest examination; they may be cut the same as those made by hand, and in appearance compare favorably with the justly celebrated Philadelphia and Baltimore bricks. They are admirably adapted for all building purposes, having good angles, while they are of uniform size.

For simplicity of construction, durability, strength, regular movement, and non-liability to derangement of parts, this machine is "Peerless," and a marvel of mechanical skill. We recommend, in connection with this machine, the use of crushing rollers, by means of which all lumps of clay and small stones are pulverized, and larger stones thrown out.

As a recapitulation of the merits of this machine, we may say that it is simple, strong and durable; thoroughly and properly tempers the clay, and presses the bricks so firm that they can be handled as they come from the machine without injuring or defacing them; it requires little or no skilled labor to work it; is economical, of great capacity, and comparatively inexpensive; the bricks are uniform in quality, size and appearance, with sharp angles, and fully equal to any made by hand; and it is capable of moulding bricks from any kind of clay.

Those especially interested in a machine of this kind may receive further information by addressing the Peerless Brick Company of Philadelphia, at their office, N. E. corner of Fifth and Chesnut streets.—*Manufacturer and Builder.*

Discovery of Apatite in Canada.—Mr. Miller has struck a wonderfully rich mine of apatite, native phosphate of lime, in the rear of Templeton, near Ottawa. He has been taking it out at the rate of three tons per day of picked blue phosphate.

BIRD-HOUSE THAT ANY BOY CAN MAKE.

(See page 160.)

Now that Summer has come, we have no doubt but that many of our young readers would like to encourage around them some of our pretty singing birds, which not only delight us with their warbling at early morn, but do good by eating the numerous insects, which otherwise would destroy our fruit trees. We borrow, therefore, from that valuable journal the *American Agriculturist*, a few illustrations of bird-houses of a simple form which any handy boy can make, and which we have no doubt would be more congenial to feathered taste than houses of a more costly and elaborate style. The *American Agriculturist* says :—

We have, in former years, given a number of engravings of bird-houses of various kinds, some very simple and others ornamental. It is a mistake to have the bird-houses too showy and too much exposed. Most birds naturally choose a retired place for their nests and slip into it quietly, so that no enemy can find out where they live. All that is needed in a bird-house is, a hiding-place, with an opening just large enough for the bird, and a water-tight roof, and there are so many ways in which these may be provided, that any boy can contrive to make all the bird-houses that may be needed. A correspondent once wrote us that he had seen an old hat, with a hole for a door, tacked by the rim against a shed, as in figure 1, and occupied by birds sooner than a showy bird-house. Several years ago a friend told us that an old tin oil-feeder (such as is used in filling lamps), which had been hung upon a fence picket, had been occupied by birds, who reared a brood in it. European sparrows and martins do not seem to care how much they are exposed, or how many neighbors they have, hence large bird-houses upon poles, with several tenements in them, will answer for these, while others prefer a more retired place. Gourd shells, fruit-cans, and boxes of various kinds, may be securely fastened in the trees and at other places near the house, where they will soon be found by the birds. The neat little kegs in which oysters are sent to inland cities, are capital ready-made bird-houses, needing only to be washed out, and placed so that the opening in one head will answer for the floor. Figure 2 shows how six of these kegs may be put together to go upon a pole. The kegs are fastened to the boards by screws put in from beneath. Figure 3 shows how a two-storied house may be made from two shallow boxes, each divided inside into four tenements ; each box has a bottom board, projecting two inches all around, to answer as a landing place ; the roof should be tight, and the whole so strongly nailed that it will not warp, and it should be painted. The remaining engravings show how small boxes, of different kinds, such as may be found at any store, may be turned into bird-boxes. These are much better to be fastened to sheds and out-buildings and to the branches and trunks of trees, than to stand out upon poles. In figure 4, the covering is of thin strips of chestnut or other easy splitting wood ; figure 5 is covered with the bark of the Paper or Canoe Birch, which is not rare in northern woods, and ornamented with Laurel or other crooked twigs. In the absence of Birch, any other bark will answer, no matter how rough, as seen in figure 6. In putting up bird-houses, keep two things in mind : place them where cats cannot catch the birds as they pass in and out, and be sure to fasten them so securely that no wind, or shaking of the trees will throw them down, and thus break up the family.

MEASURED LANGUAGE.—In a recent publication, Mr. Ruskin says, — "Your present system of education is to get a rascal of an architect to order a rascal of a clerk of the works to order a parcel of rascally bricklayers to build you a bestially stupid building in the middle of the town, poisoned with gas, and with an iron floor which will drop you all through it some frosty evening ; wherein you will bring a puppet of a Cockney lecturer in a dress-coat and a white tie, to tell you smugly there is no God, and how many messes he can make of a lump of sugar. Much the better you are for all that when you get home again —aren't you ? " A correspondent, signing himself " R. A." wishes to know whether he is "to infer from this, as Mr. Ruskin is understood to be a respectable man, that all architects, clerks of works, and bricklayers are rascals ? "

THE "DUILIO."

(See page 148)

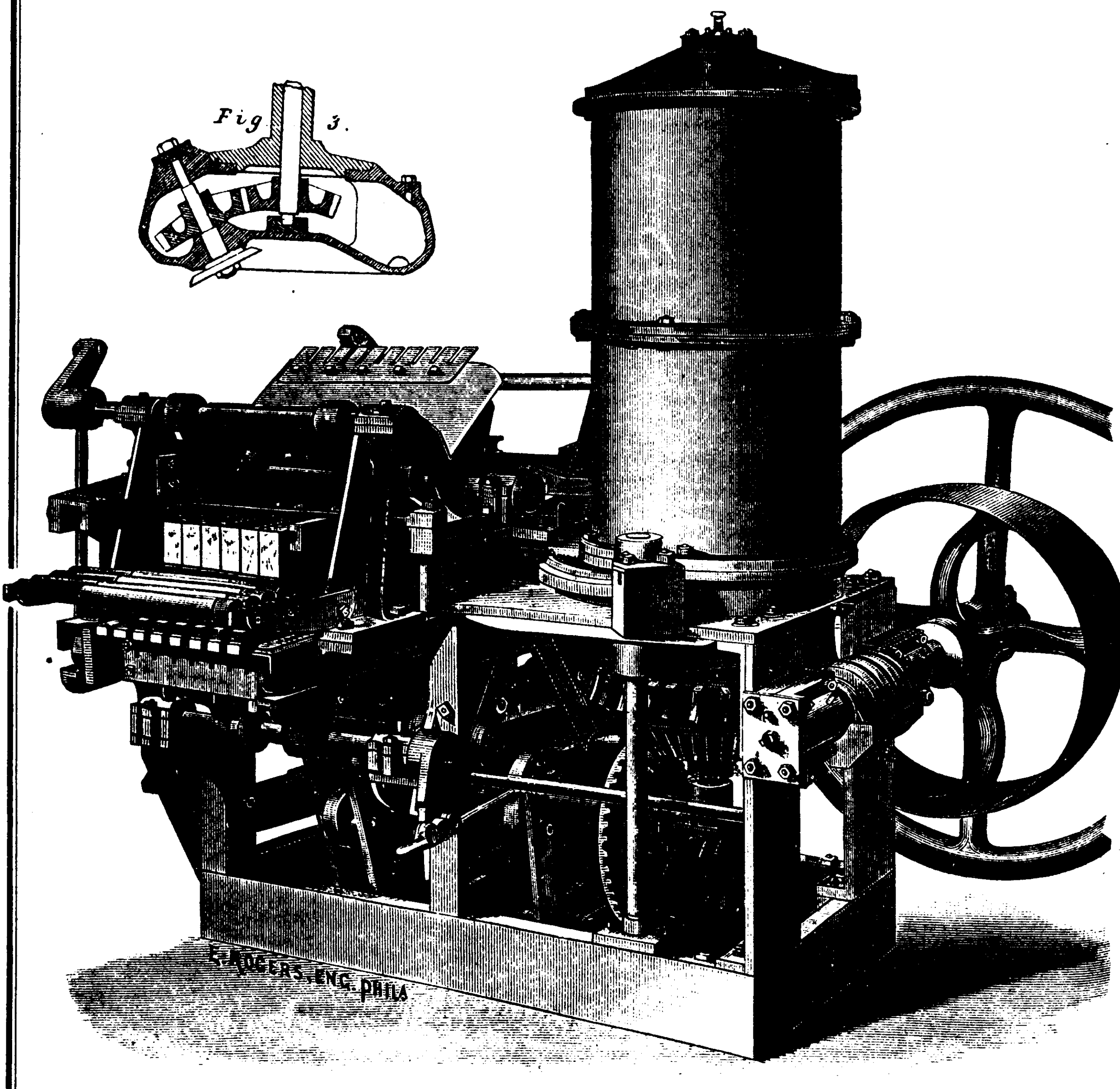
THE Duilio constructed by the Italian Government is perhaps the most powerful ironclad vessel at present in existence. She is not yet completed, and but one of the four 100-ton Armstrong guns has been delivered. The general design of the vessel will be understood from the accompanying engraving, for which we are indepted to the *Scientific American*. Her length is 331·2ft., breadth at water line 58·4ft., and depth of hold 25·2ft. She has two turrets, which, instead of being in the centre line of the ship, are placed towards the sides, so as to get a clear fore and aft fire from each turret. The inside diameter of each is about 26ft., and the outside 32½ft., while the two turrets, with the armour-plating and the two guns, will weigh about 6720 tons. Each turret makes one complete revolution in a minute, and when in position for firing is stopped by hydraulic locking bolts. The vessel is built in compartments, and is provided with a system of pumps, which discharge water from her in case her skin is pierced by a shot. The Duilio carries no masts, and all the machinery and the rudder are entirely under water, so that no vulnerable portion of the vessel is exposed.

Various trials were made with different sized powder cubes and weights of shot, to notice especially the initial velocities of the shot, and the pressure on the powder-chamber after each successive enlargement of the bore. This was followed up by a brief account of the range experiments, and those made against the Shannon targets. He compared the results of the 100-ton gun at Spezia with those of the 81-ton gun at Shoeburyness, and concluded with a detailed account of the recent trials against the armour-plated target, and the effect produced thereon by the shots. His paper was illustrated by diagrams of the targets employed on these occasions. Messrs. Pollock, Guiness, Crompton, and Douglass took part in discussing the several questions which have been brought under notice, and a discussion was raised upon the question of economy in private workshops as compared with the Government arsenals.

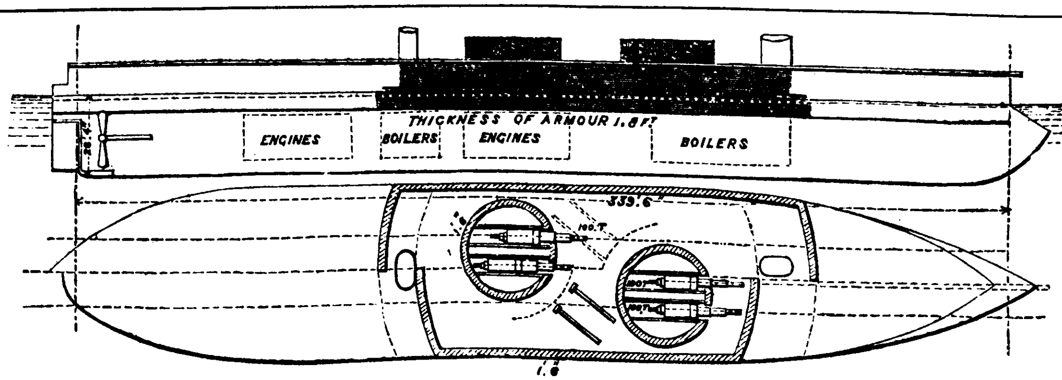
SAWDUST IN MORTAR.—M. Siehr recommends very highly the use of sawdust in mortar as superior even to hair for the prevention of cracking and subsequent peeling off of rough casting under the action of storms and frost. His own house, exposed to prolonged storms on the sea-coast, had patches of mortar to be renewed each Spring, and after trying without effect a number of substances to prevent it, he found sawdust perfectly satisfactory. It was first thoroughly dried and sifted through an ordinary grain seive to remove the larger particles. The mortar was made by mixing one part cement, two lime, two sawdust, and five sharp sand, the sawdust being first well mixed dry with the cement and sand.

TO RENDER PLASTER-CASTS WATER-PROOF.—Mr. R. Jacobsen gives the following method for preparing gypsum moulds so that they will permit being washed. A neutral soap of stearic acid and caustic soda is prepared and dissolved in about ten times its weight of hot water. The moulds or objects are either coated with, or immersed in this solution. By this procedure the color of the object is not affected, it is rendered impervious to moisture, and permits the object to be washed, even with lukewarm soap water, since stearate of potassium is only soluble in hot water. Soap water is entirely superfluous for washing gypsum casts ; warm water is all that is requisite. Ordinarily, moulds, etc., are cleaned of dust and dirt by means of soap water. This removes the dirt, but leaves, in its place, a film of soap, which most readily collects and retains dust. This same difficulty is presented by gypsum that has been impregnated with a solution of alum and stearine. A coating made with a solution of stearate of alumina in benzole behaves in a similar manner. The gypsum can also be made impermeable to water by saturating it with a solution of oleic acid in benzine ; this should be but slightly colored and oxidized. This solution is to be applied to the object when cold, and in such quantity as to completely saturate the gypsum. These objects are not to be cleaned with soap water, since this would take up the oleic acid, but should be wiped with a cloth, moistened with the acid. The first described method gives the best results, and is especially to be recommended in voluminous castings.—*D. Ind. Zeitung, ix,* 82.

WEAKNESS OF OLD AGE.—Men of age object too much, consult too long, adventure too little, repent too soon, and seldom drive business home to the full period, but content themselves with a mediocrity of success.—*Lord Bacon.*



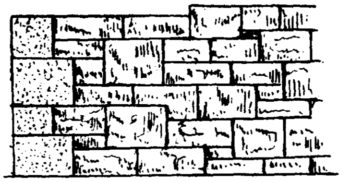
IMPORTANT IMPROVEMENT IN BRICK MACHINES.



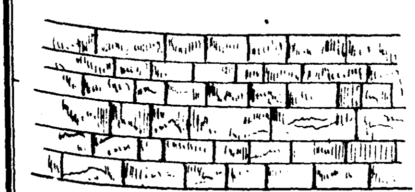
THE DUILIO.

1. Random Rubble (Uncoursed.)

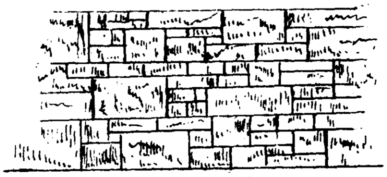
2. Random Rubble (Built in courses.)



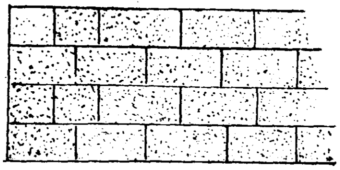
3. Squared Rubble (Uncoursed) with Ashlar Quoins.



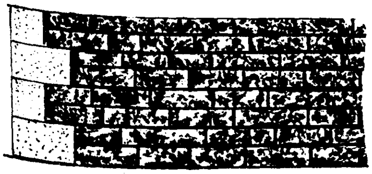
4. Squared Rubble in Courses.



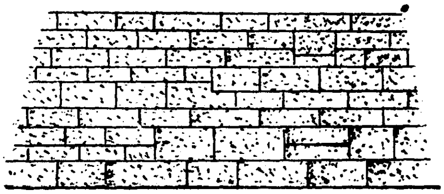
5. Regular Coursed Rubble.



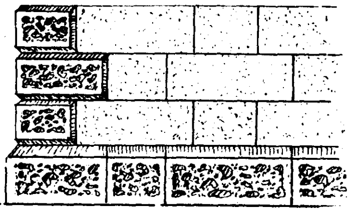
6. Coursed Ashlar Masonry.



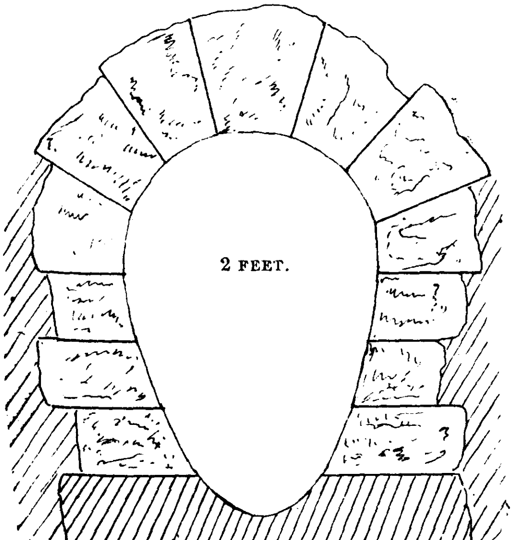
7. Small rock-face Ashlar.



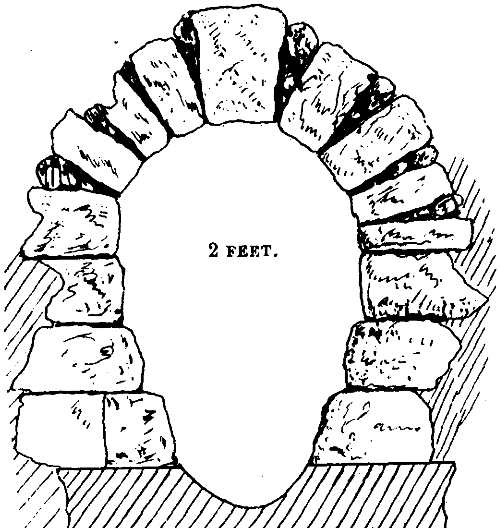
Rough Hammer-Picked Ashlar (in regular or random courses.)



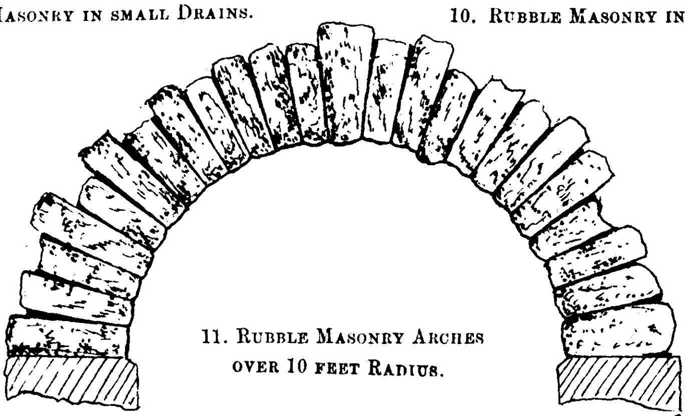
8. Plane Ashlar, (with Chamfered and Rusticated Quoins and Plinths.)



9. Ashlar Masonry in small Drains.



10. Rubble Masonry in small Drains.



11. Rubble Masonry Arches over 10 feet Radius.

RUBBLE AND ASHLAR MASONRY.—See Page 129.

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 the boys and girls, NEEDLE WORK, AMATEUR MECHANICAL PURSUITS, and all the elements of a *practical domestic education*; also GARDENING and ARCHITECTURAL NOTES.

THE UNITED STATES TORPEDO STEAMER ALARM.

While, in preparing for the wars of the future, foreign nations have bestowed chief attention upon immensely costly experiments on guns and armor, here, in the United States, the principal aim has been the perfection of the torpedo system. An admirably organized and thoroughly equipped torpedo school for the navy has for several years been in existence in Newport, R. I. The work which there is done is not published, but many of its results are of great importance. There is also an army torpedo station at Willet's Point, L. I. We have also constructed one torpedo vessel which is probably the most formidable craft afloat (not excepting the Italian ironclads with their 100-ton guns), and in time of war will form the model for a fleet of like steamers. This vessel is the Alarm; and in the annexed engravings we represent all that we are permitted to make publicly known relative to her contruction.

The Alarm, we should premise by explaining, does not fight according to any established rules of naval tactics. Having sighted an enemy—say at night—her compound engines drive her head-long at him at the rate of 15 knots per hour. As she nears him, the immense electric light on her bow flashes out its glare, blinding her adversary to her own hull (which is already sunk so low that her deck is but three feet above the sea), while displaying his every proportion. The roar of her 10-inch gun, as it hurls its huge shot or shell into the attacked vessel, is followed by the crash of the bow spar torpedo striking the doomed craft thirteen feet below the water line. Then, perhaps after a momentary check due to the torpedo recoil, the Alarm plunges forward, driving her immense ram into her adversary's crushed side. As she swings broadside on to her foe, another torpedo spar shoots out from her side, and another torpedo is exploded under the unguarded bottom of the enemy; while the machine guns on the torpedo boat's rail keep up a deadly fire of thousands of bullets per minute, sweeping her opponent's decks. We need scarcely add that the Alarm is a disagreeable craft for a heavy ironclad (one like the Vanguard, for instance, which went down like a shot on being slightly rammed) to encounter. She is well provided with defensive means, but of these we shall write further on.

An excellent idea of the shape of the Alarm may be obtained from the large illustration, Fig. 1. Her length is 172 feet, of which 32 feet is snout or ram; her beam is 27 feet 6 inches, and she draws 11 feet of water, displacing about 700 tons. She is built of thoroughly tested charcoal iron, and on the English bracket plate system: that is to say, she has really a double hull, one shell being constructed inside the other. Within the outside shell three longitudinals of great strength run the entire length of the vessel, and are connected with bars running in a horizontal direction by brackets. The different sections can be entered through man-holes so that a person can pass from stem to stern between the inner and outer vessels. These compartments are all watertight, so that, in event of a leak, only one section could fill. The whole interior of the vessel is also built in compartments which may be hermetically closed, so that, in case of rupture of both shells at any point, it would still be impossible to fill the entire ship with water. The side plating is not thick, as it is not intended as armor, the vessel, as already explained, being almost wholly submerged while in action.

In order to attack an enemy suddenly, and to pursue him in case of flight with success, and also to be possessed of a very necessary mode of self-protection, it is evident that a vessel such as the Alarm requires not only the means of speed, but of handling her with the utmost readiness. The theory is that she is always to meet her adversary bows on; and as her most formidable enemy is the ram, she must be able to turn in so small a space and so quickly that it would be impossible for her to receive a fair broadside blow. This is effected by the total abolition of a rudder, and by steering her with the same apparatus which propels her, the Fowler wheel, which is represented in Fig. 5. The wheel turns on a vertical shaft; and its paddles are feathered by an eccentric cam in such a manner that, at one part of their revolution, they have a pushing and drawing action on the water, while at another part they present only their edges. The device, in fact, is simply a feathering paddle wheel, turned horizontally instead of vertically. By suitably turning the cam wheel, which is done from the helm, the feathering of the paddles is caused to occur at different points; and in this way the ship may be turned, or rather her stern twisted, around as if on a pivot. At the same time, by suitably adjusting the paddles, the vessel goes ahead or backs, the engine meanwhile running always in the same direction.

The steering is accomplished from the wheel house located aft on the deck, an interior view of which is given in Fig. 2. By means of the hand lever, shown beneath the wheel, steam is admitted to the little engine which works the cam that adjusts the paddles. Then, by turning the horizontal hand wheel in either direction, the helmsman controls the movement of the cam as desired. Just above the wheel is a dial with a pointer, which enables him to note the exact position of the paddles, and so to place them as ordered. This contrivance shocks the feelings of ancient tars; for with the advent of the machinery the time-honored hand wheel and the yells of "starboard," "port," "steady," etc., to the helmsman, disappeared; and in lieu of the latter orders, the pilot quietly remarks "sixteen," "ten," "two," or other proper numbers on the dial, in accordance with which the man at the wheel places his paddles.

Inside the wheel house (which may or may not be used in action as desired, as all its appliances are duplicated below deck) are devices for communicating with the men working the big gun in the bow, Fig. 3, or those managing the torpedoes. For instance, on nearing an enemy, the captain would press a certain button. A signal sounds as the gun, meaning "get ready;" a bell then rings in the wheel house, meaning that the order is understood. At another signal, the gun is fired. Then another button pressed sounds a bell in the portion of the ship where the torpedo spars are located; and at once those in charge run out the designated spar. Fig. 6 shows the spar, which is a long hollow iron cylinder lying on its supports between decks. Its outboard end rests in a kind of an electric fuse, also shown in Fig. 6, is adjusted, so that its platinum wire will become white hot, and so fire the torpedo when the current passes. To the cradle in which the torpedo spar lies are attached heavy tackles hooked to the beams overhead, so that the spar can be tilted to different angles in order that its extremity, when pushed out, may be at a greater or less depth under water. The valve through which the spar passes through the side of the vessel is so constructed that no water can enter during the protruding of the spar. The latter operation is effected by a tackle brought to a steam winch provided for the purpose. The side spars are 18 feet and the bow spar 35 feet in length. On receiving the signal above noted, the men below affix the torpedo and run out the spar. If the vessel to be attacked has torpedo guards out (heavy nettings of rope sunk down to keep torpedoes at a safe distance from the bottom), an ingenious mechanical contrivance on the torpedo signals that fact, and the person stationed at the exploding wire does not press the key. The Alarm then tries to break or push through the obstruction, and her success is announced by the same signalling arrangement. Then the impact of the torpedo with the vessel's hull is announced, and then the captain, in the wheel house, touches the key, and the explosion follows.

The firing may be done either below decks at the place where the torpedoes are pushed out, or from the wheel house. In both places, electric machines are located which may be set in action by the ship's engines. Fig. 4 represents the firing keys in the wheel house; and in Fig. 2 the electric machine is indicated. By pressing one of the keys in Fig. 4, connection between the torpedo with which it communicatesand the electric apparatus is at once established. The gun in the bow, Fig. 3, is mounted on an ordinary naval carriage, and is manœuvred by its tackles being carried to a steam capstan, which is also used for hoisting anchor. Shot and cartridges are whipped up from below by a tackle attached to a carriage which travels on the horizontal bar across from rail to rail, so that the charge can be easily swung directly in view of the muzzle. The gun, when run out, points directly ahead, as the large engraving indicates.

The engines of the Alarm, a diagram of which we give in Fig. 8, are of the compound variety, with four cylinders, the condenser, A, being placed between them. There are two high pressure cylinders, B, diameter 20 inches, stroke 30 inches, and two low pressure cylinders, C, 38 by 30 inches. The low pressure cylinders are jacketed. Short connecting rods from the cross-heads are attached to two bell crank levers, E, which have a throw of 27 inches. The crank connecting rods, F, are attached to the other ends of these bell crank levers and to a common pin in the driving crank, G, which latter crank has a throw of 15 inches. The valves (not shown in the engraving) are on top of the cylinders, and are operated by eccentrics working on an intermediate shaft, which is actuated by levers from the cross-heads. No links are fitted to the valve gear of these engines, for the reason, already stated, that the engine need never be reversed. The propeller shaft, H, is, of course, vertical.

The air and circulating pumps for the condenser are independent. There are four cylindrical tubular boilers, with an aggregate heating surface of 4,600 square feet.

The question of how the Alarm herself would fare against the heavy guns of a modern ironclad at close quarters is really of little moment. As we have shown, it would require several hard hits delivered in a number of different places to cause her to sink. All her vulnerable parts are entirely submerged, and any injury to her engines, etc., must come through her steel-plated deck, at which no projectile can be fired other than at a sharp and consequently disadvantageous angle. Probably a second torpedo from the Alarm would not be necessary to insure the destruction of any war vessel now afloat. At the distance under water at which she explodes her mines, no plating is ever affixed to vesels; and the crushing-in of their timbers must inevitably follow the explosion. If the torpedo boat should become fastened in her enemy and go down with her, or succumb to a near fire, the loss would not be on our side. Lives are to be lost in war in any event; and if, by the sacrifice of a torpedo vessel costing a couple of hundred thousand dollars, we ever sink a great iron-clad worth a million, the life mission of the former craft may well be deemed as fulfilled.

The Alarm was built according to designs prepared by Admiral David D. Porter. She is an admirable sea boat, rising lightly and buoyantly to the largest waves. Her ventilating arrangements are excellent, and the quarters of both officers and men remarkably large and commodious. Her present commander is Lieutenant Frederick H. Paine, U. S. N., to whom we are indebted for the greater part of the facts here presented.

—*Scientific American.*

A NEW industry, extracting tannin from sweet fern, has been started in Hancock, County Maine. From a ton of sweet fern it is said that a barrel of extract tannin is made, worth $22, and also a barrel of second quality, worth $7.50 per barrel. From the alder, one cord will make one barrel, worth $20; while from the hemlock bark one cord will make a barrel of first-class extract, worth $20.

BLACKING FURNITURE.—Boil ½lb. of chip logwood in two quarts of water, add 1oz. of pearl ash, and apply it hot to the work with a brush. Then take ½lb. logwood, boil it as before in two quarts of water, and add ½oz. of verdigris and ½oz. of copperas. Strain it off, and put in ½lb. of rusty steel filings; with this go over the work a second time. Oil of vitriol diluted with water, and applied with a brush, makes a good black stain.

ALUMINIUM.—In a paper on the uses of this metal, Dr. R. Biedermann states that aluminium bronze is used in this country for making the large preserving pans used by wholesale confectioners; and that aluminium is recommended as an alloy in type metal. Lange, in Glashütte (Saxony), employs an aliminium alloy in the manufacture of watch springs. The new springs have the advantage over the old in not being subject to rust, in not being magnetic, and in possessing greater hardness and elasticity. An alloy of an 100 parts aluminium and five silver can be worked like pure aluminium, but is harder, and takes a beautiful polish. An alloy of five parts aluminium and 100 silver is almost as hard as ordinary silver, but has the advantage over it of containing no metal which is of a poisonous nature, or which can effect a discoloration of the silver.

SAWS FOR HOT IRON.

(Se page 153.)

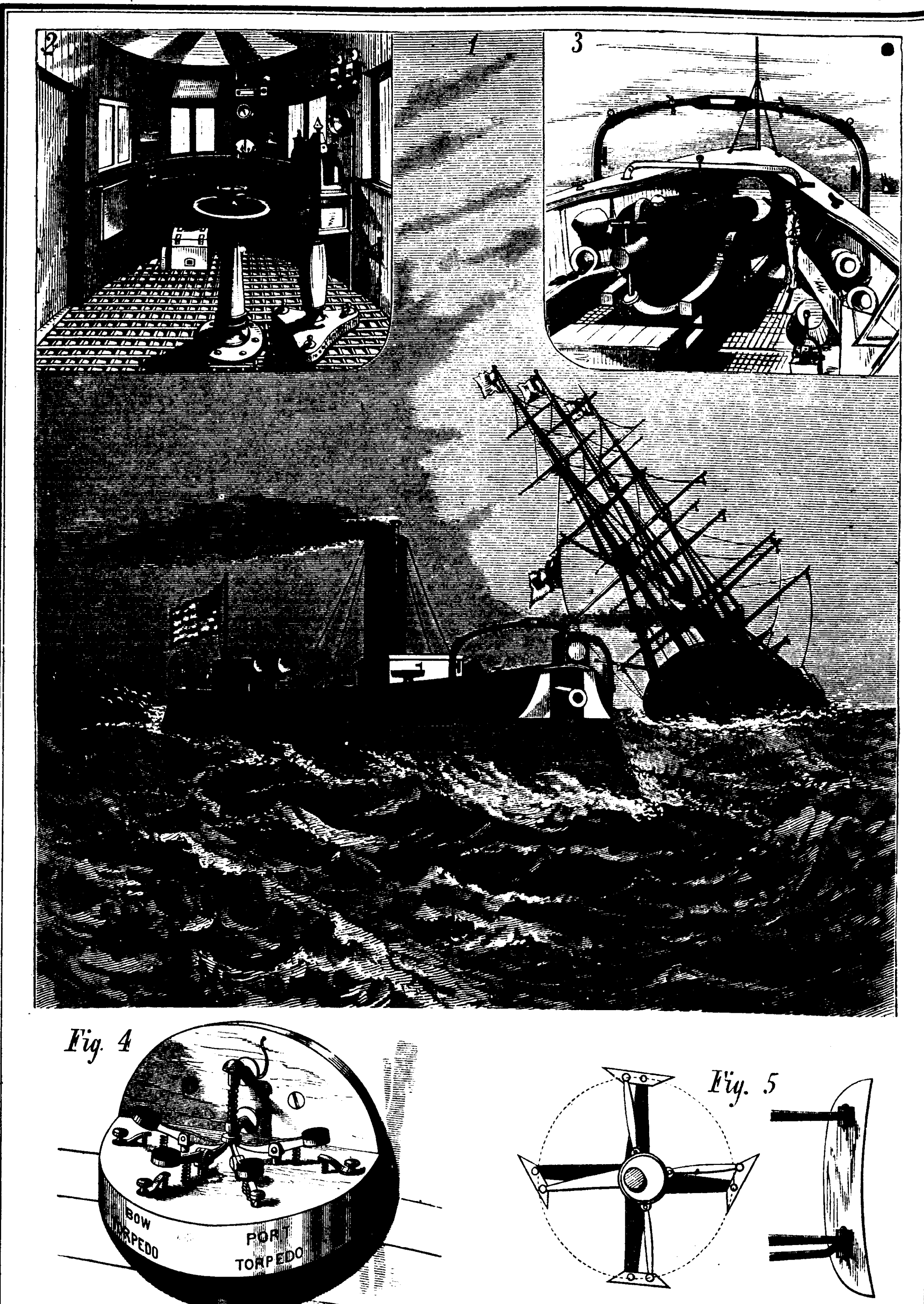
In the ready working of iron and steel, and to reduce the manipulation of these metals to simplicity as well as expedition, it has long been found necessary to adopt some system of cutting, apart from the slower processes with hammers and sets. To obtain this desideratum various expedients have been tried, the most modern and generally accepted being the circular saw, and this has proved successful. The operation of cutting, say a bar of iron or steel, now much resembles in outward appearance the same process as applied to wood, but in the construction of the machine for this purpose it is requisite particularly to ensure accurate balance and steadiness, combined with simplicity, strength and speed. Of recent improvements in this branch of tool-making we believe the saw manufactured by Messrs. B. & S. Masiey, of Manchester, presents a good sample, and it appears to be eminently fitted to fulfil in a high degree all the requirements which could be expected from such an aid.

We give an illustration of the saw for hot iron supplied by this firm, from which the nature of the implement will be at once seen. It is claimed for this saw that a red-hot bar of iron or steel of ordinary thickness can be severed nearly as quickly as wood, and with almost equal ease, any bar up to a diameter of 6 inches, and of any form, being cut at a considerable saving of time, material and labour. The piece of metal to be operated upon is laid upon three bearers, seen at the left of the above illustration, and the table containing them is moved to or from the saw by means of a quick-threaded screw. The construction of the whole machine is strong, and, as may be seen, exceedingly simple, and one of the self-recommendatory features is that skilled labor is not required to take charge of the work. To an engineer or smith such an adjunct would occupy a convenient place in the work-shop, and the saw is well worthy of attention.

WHOLE OX SOUP.

In Australia, where the horned stock has increased of late in a more rapid ratio than the population, the supply of meat is much greater than the demand; and at the present time the price of cattle is commonly quoted "at boiling rate;" that is, the animals will fetch no more from the butchers than can be realized for their hides, horns, hoofs, tallow, etc., for exportation. In large establisments devoted to preparing these utilizable portions of the bullock, there was of course an immense waste when the ox went into the melting pot; but this loss is now in a great measure avoided by boiling the animal at once into soup, or concentrated extract of beef. After the head, horns, hoofs, etc., are removed, the meat is cut into convenient sized pieces and conveyed to immense steam-tight double cylinders capable of holding upwards of fifty bullocks at a time. In seven hours, during which they are subjected to a pressure of steam of 15 lbs. per square inch, the bones and meat are reduced to a pulp. The steam is then condensed, and the tallow, which floats on the surface, drawn off. The pulp is removed and placed in a powerful press, which squeezes out the soup. The latter is, however, not yet sufficiently concentrated; and to render it so, it is placed in a peculiarly constructed boiler, there reduced by evaporation, and finally run off into bladders. When cold, the essence is semi-transparent, of a rich reddish brown color, and sweet to the smell and taste, almost like confectionery. A whole bullock, after being thus treated, yields but 20 lbs. of soup.

BEEF-TEA.—Dr. Christian says that "every one will be struck with the readiness with which certain classes of patients will often take diluted meat-juice and beef-tea repeatedly, when they refuse all other kinds of food." This is particularly remarkable in "cases of gastric fever, in which," he says, "little or nothing else besides beef-tea or diluted meat-juice" has been taken for weeks or even months, "and yet a pint of beef-tea contains scarcely one-fourth of an ounce of anything but water." The result is so striking that he asks, "What is its mode of action? Not simply nutrient; one-fourth of an ounce of the most nutritive material cannot nearly replace the daily wear and tear of the tissues in any circumstances. Possibly," he says, "it belongs to a new denomination of remedies." It has been observed that a small quantity of beef-tea, added to other articles of nutrition, augments their power out of all proportion to the additional amount of solid matter. The reason why jelly should be innutritious and beef-tea nutritious to the sick is a secret yet undiscovered, but it clearly shows that careful observation of the sick is the only clue to the best dietary.



ADMIRAL PORTER'S SYSTEM OF TORPEDO WARFARE.

ADMIRAL PORTER'S SYSTEM OF TORPEDO WARFARE.

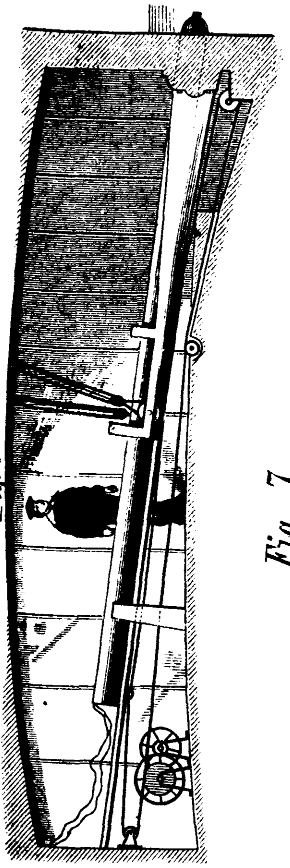


Fig. 6

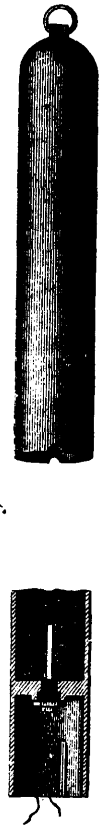
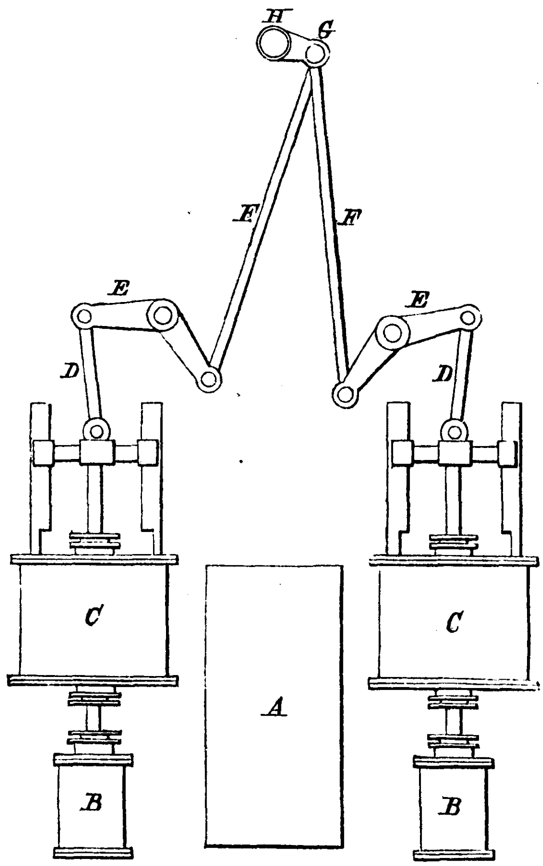
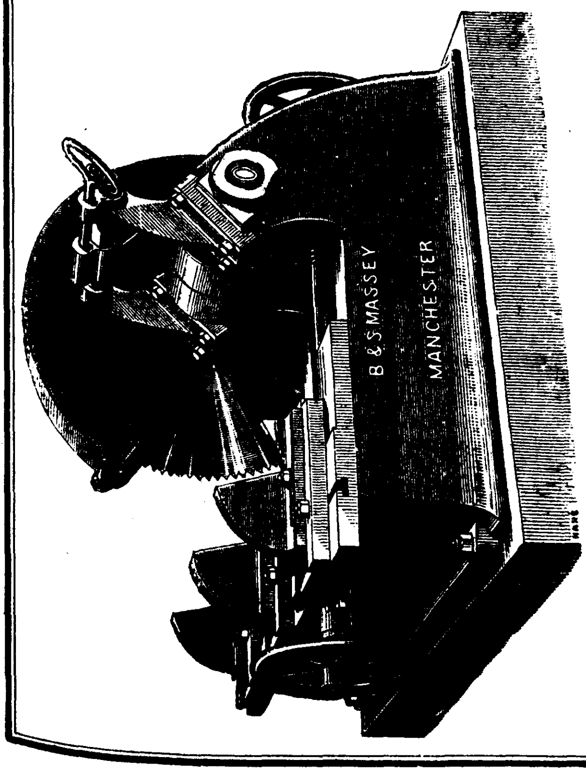


Fig. 7

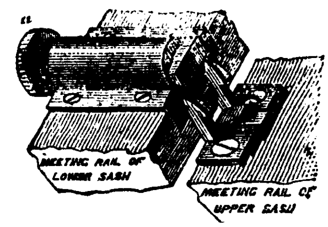
ADMIRAL PORTER'S TORPEDO SPAR.

Fig. 8.





SAW FOR HOT IRON.



EDWARDS' PATENT SASH FASTENER.

(See page 153.)

The accompanying illustration shows an ingenious device for securing window-sashes. The barrel fixed upon the lower sash contains a spiral spring acting upon the rod carrying the thumb-nut *a* and the T-piece at the opposite end, which, in closing the window, slides over the pointed parts of the hook, catches on the upper sash meeting rail, and prevents the opening of the window, except by pushing the thumb-nut *a*, which can only be done from the inside. When the window is closed the nut *a* may be screwed up, and the two meeting rails brought into firm contact, so as to prevent shaking and draughts. The little hinged piece shown between the two vertical hooks is a very neat device for holding the T-piece out of the hooks while the sash is being lifted. The nut *a* is unscrewed, and the bar carrying it and the T-piece pushed forward, when the latter catches over the hinged flap, and moving upwards with the raising of the sash holds the T-piece until it has passed the hooks.—*Iron.*

THE "CHALLENGER" EXPEDITION.

At the Literary Institute, Edinburgh, Mr. John Murray, of the "Challenger," gave, last week, a lecture on the results of the cruise of that vessel. After explaining the objects of the expedition, and describing the elaborate apparatus with which the observations were carried out, the lecturer gave a picturesque narrative of the cruise, with notes, historical, physical, biological, of many places visited. He then proceeded to give an epitome of results obtained from the observations. It was, he said, a curious coincidence that the highest mountain was just about the same as the greatest depth of the ocean. The average depth of the sea was, however, very much greater than the average height of the land above its level. Through the Atlantic there ran a great submarine ridge at an average height of two miles, while on each side the trough was from three to four miles deep. The Pacific, instead of being a shallow ocean, as had been supposed, was very much deeper than the Atlantic, and great depths were found round coral islands, which previously were believed to rise from shallow water. The greater part of the bed of the ocean was filled with water below 40°, and although the surface of tropical and sub-tropical seas was warm, the bottom, even at the equator, was ice-cold. This cold water came from the Arctic and Ant-arctic Seas, but chiefly from the latter—wholly so in the case of the Pacific. The cold water slowly flowed northwards to supply the place of that carried away by evaporation and strong currents produced on the surface by prevailing winds. The saltness or specific gravity of the ocean was found to be greatest in regions where winds were constantly blowing over its surfaces ; the water became less salt where coasts or accumulations of ice were approached. Naturalists had long recognised a strong similarity of the animals of the coast of Africa and the West Indies, and supposed that at one time a great continent had existed between those points. He thought an explanation would be found in the equatorial stream carrying larvæ, &c., across from Africa to the American coasts. Everywhere they found life in the greatest abundance and variety, the kind being determined in any locality by the physical conditions of the ocean. For instance, where they had warm and salt water, organisms which secreted carbonate of lime abounded, such as the foraminifera ; where the specific gravity of the water was low, they had organisms which secreted silica, as radiolaria and diatoms. There were no barren regions, as the older naturalists supposed. When they sank their tow-nets a mile beneath the surface they frequently found creatures which before the expedition were unknown to science. Having described several of the new silicious sponges, corals, shrimps, crustaceans, and crinoids, Mr. Murray directed special attention to three new forms of fish. The first was a salmon-like creature, with long pectoral rays or filaments which arched over the head, presenting a curious resemblance to corals and crinoids. The second was a black fish, got in the Atlantic at a depth of three miles, with a long filament arching over the head, the extremity being highly phosphorescent. The third was long and eel-like, with no eyes, but a large phosphorescent organ on the head. The lecturer next described the floor of the ocean, and the deposits now forming there. Along the shores of great islands and continents the detritus from rivers and coast lines was forming deposits closely resembling the sedimentary rocks of geology. But when they passed 200 miles out into the open sea, they found a different state of things. In depths less than 2½ miles, in temperate and tropical regions, the bottom consisted of the shells of foraminifera and molluses, which had lived on the surface and sunk when dead to the bottom. Far south in the Antartic Ocean, where the specific gravity of the water was low, the foraminifera were largely replaced by organisms which secreted silicious skeletons such as diatoms. In the middle and western Pacific there were large areas where the bottom was composed of radiolaria. By far the largest deposit, however, was that of red clay, composed of pumice stones disintegrated by the carbonic acid in the sea water. This clay was always found in depths over 2½ miles. Little spherules of native iron were also got from the bottom, and these were believed to be the remains of meteors. The observations went to show that the present great ocean basins had ever been great ocean basins, and, he thought, also that the great continental areas had always been the areas on which continents existed. In conclusion, Mr. Murray referred to philosophical theories which the observations of the expedition had exploded, and remarked that a foundation had been laid from which all future expeditions must start.

AN ANACONDA.

An illustrious visitor from South America has arrived at the Zoological Society's Gardens. He is one of the largest of the *Boaidæ* family known to our generation. He is an anaconda (*Eunectes murinur*). This immense snake is now safely housed in the snake-house under the parental.care of Holland, who has for many years so ably managed the snakes, poisonous and non-poisonous. Our visitor, says Mr. F. Buckland, arrived at Liverpool in a large box. Intelligence was given to M. Bartlett, who proceeded to Liverpool to inspect him—a matter of considerable difficulty. It will not do to buy an expensive snake of this kind without a warranty. Snakes are very liable to canker in the mouth. The gums get swollen and flabby and completely conceal the teeth, so that the beast cannot feed. Again, if snakes are injured in the capture they frequently die in consequence. It was necessary to examine the snake as to these two points. Having been shut up for several months without food and in the dark, the anaconda was not in a good temqer. When the lid was opened Mr. Bartlett caught him tight round the neck with both hands ; it was not necessary to open the mouth, as the savage snake did that soon enough of himself, in true anger. A moment's inspection showed he had no disease of the gums. It was with some difficulty that Mr. Bartlett got his head back into the box without letting out more than a foot or two of his body. The anaconda has not poisonous teeth, but has great powers of crushing. The box with the snake weighed over 2cwt. It was with much dodging that the anaconda was conducted by two keepers to his new quarters, where he at once retreated into a bath of warm water from which as yet he has only emerged once or twice. It is difficult to give the exact length of the snake, as he is not to be measured with as much facility as a fathom of rope. He is now lying in three parallel folds in his bath ; we know the length of the bath, and we calculate his length to be between 18 and 20 ft.—a tremendous fellow. It was impossibe to get a tape measure round him ; but having measured his diameter in his thickest part, we conclude that he is over 2ft. round the body. At present he is thin, and his skin fits him very loosely. It is hoped that he will soon begin to feed. Mr. Bartlett has ascertained that the last meal this snake had consisted of a young peccary, the horny part of the hoofs having been discovered in the stones at the bottom of the cage ; there are also the hair of another animal which has to be diagnosed by microscopists. This tropical American snake is also called the aboma. The provincial name is *El traga venado* or the deer-swallower. He never interferes with men, although of course he will take his own part if attacked. It is greatly to be hoped that this magnificent snake will in time get an appetite and recover from his travel-worn appearance. His color may be described as buff, with very dark markings on the upper parts. His companion in the cage is a magnificent reticulated python (*Ular sawa*), caught at Penang. He has been at the gardens since August, 1876, and has not eaten anything since he arrived. He shed his skin on Sunady, February 25th, and is now most lovely to behold. It would be impossible to described the tints of the new skin (a splendid lacing of bronze, blue, gold, and black) except by saying that they are quite as gorgeous as a peacock's plumage.—*English Mechanic.*

A SILK-SPINNING FISH.

There is a mollusk—the *pinna* of the Mediterranean—which has the curious power of spinning a viscid silk which is made in Sicily into a textile fabric. The operation of the mollusk is rather like the work of a wire-drawer, the substance being first cast in a mould formed by a sort of slit in the tongue, and then drawn out as may be required, The mechanism is exceedingly curious. A considerable number of the bivalves possess what is called a *byssus*, that is, a bundle of more or less delicate filaments, issuing from the base of the foot, and by means of which the animal fixes itself to foreign bodies. It employs the foot to guide the filaments to the proper place and to glue them there ; and it can reproduce them when cut away. The extremity of the thread is attached by means of its adhesive quality to some stone ; and this done, the *pinna*, receding, draws out the thread through the perforation of the extensile member. The material when gathered is washed in soap and water, dried, straightened, and carded—1 lb. of coarse filament yielding about 3 ozs. of fine thread, which when made into a web, is of burnished golden brown color. A large manufactory for this material exists in Palermo.

A GOOD waterproof cement may be made by mixing glue 5, rosin 4, red ochre 2 parts, with a little water.

CENTRAL AFRICAN HABITATIONS.

(See page 156)

Commander Cameron, R. N., whose famous journey across Africa has proved so rich in valuable additions to our geographical knowledge of a little-known portion of that continent, gives, in the record of his travels, the sketches from which the annexed illustrations are made. Both represent discoveries which will afford an excellent idea of the ethnological importance of a study of the people of Central Africa and their habits.

Fig. 1 represents the curious village of Manyuema, where the explorer found the houses arranged in regular streets, and the latter kept scrupulously neat and clean. The inhabitants, although cannibals, are much more civilized than their neighbors, and appear to be a conquering race which has enslaved the tribes of the vicinity. They are skillful iron workers, and erect furnaces which show considerable inventive ability.

It is well known that, in pre-historic times, whole villages were often constructed on piles, above lakes. Relics of these dwellings have been abundantly found, belonging to extinct peoples representing all stages of civilization, from the age of stone down to the dawn of the iron age. It is not understood why the ancients adopted this form of habitation. Protection from hostile tribes, safety from wild beasts, and convenience in fishing, have all been suggested; but there are reasons which go to show that none of these explanations are entirely satisfactory. Commander Cameron has found the same species of dwellings in use on Lake Mohyra, in Central Africa, and in Fig. 2 one of the huts is represented. The inhabitants are excellent swimmers, and, although provided with boats, frequently take to the water in preference to using them.

The lake dwellings of which our engraving gives a specimen are to be found in all parts of the world. The oldest known are in Switzerland, and in that country they have been thoroughly explored. They are of two kinds, those built of fascines and those built on piles. Those of fascines were commonly used on the smaller lakes of Switzerland, and wherever the bottom was too soft to hold a mass of piles firmly; those of piles were built in deeper water, where the waves would sweep away a foundation of fascines. Lake dwellings as old as the stone age are found in some parts of Russia, and in Borneo and the Malay archipelago, as well as in Africa. Herodotus mentions them on Lake Prasias, in Thrace; and as these were connected with the shore only by a single narrow bridge, the inhabitants were enabled to defy the troops of Darius. Each family occupied one hut, and caught fish by letting a basket down through a trap door.—*Scientific American.*

MIGRATION OF BIRDS—WHAT GUIDES THEM?

Now, the question will be asked, "How are birds guided upon their journey?" It is hard to answer. Naturalists know something about it, but very little indeed. We know that many birds, the geese for instance, put themselves under the direction of a leader, and we know that this leader is an old bird which has made the journey often before. Many birds are hatched so late in the season that they are too young and feeble to make the journey at the time their friends start for the south. Therefore, they are left behind, and, although they soon grow up and become strong enough to migrate, they do not know the way, and, as there is no old bird to show them the path, they are compelled to stay through the winter, and live upon such food they are able to find. We see from this that the journey is not directed merely by instinct, but that some experience is also necessary; for, if it were not, young birds could find their way as well as old ones. Then we can not understand how it is that geese become confused and lost in stormy weather, unless we believe that they find their way by memory of the landmarks. No one who watches a troop of swallows, when they are preparing to leave us in the fall, can doubt that the knowledge of the older birds is very important. As the time for migration draws near, these birds gather in large flocks and spend several days in preparing for the journey. They keep up an incessant twittering, and often start off for a short flight in order to try their wings; when at last they have learned the surrounding country so well that they will have no difficulty in recognizing it when they return, they mount into the air together, at a signal from a leader, and begin their long voyage to the south.

These noisy consultations and preliminary flights would not be necessary if the migration were entirely due to instinct; and those who examined the subject the most carefully, conclude that both instinct and experience have part in it.—*St. Nicholas.*

MUSHROOMS.

(See page 156)

To those living in the neighborhood of forests in Europe, especially in France, mushrooms form an important item in domestic economy. Being among the most nitrogenous articles of diet, they well deserve the name of "vegetable meat," which has been bestowed on them. We publish herewith engravings of three kinds of edible mushrooms, all well known in France, and which might be more generally introduced here to the great satisfaction of American epicures. The first is the *morille comestible*, the botanical name of which is *Morchella Esculenta*; the second is the plant. The stalk and the upper part correspond to the fruit, as their function is simply to carry the spores.

There is one fact which should be remembered by the lovers of mushrooms, which is that locality has much to do with the flavor of these *fungi*, and even with their fitness for food. The *Agaricus Campestris*, the common mushroom of this country and England, is rejected in the markets of Italy as unwholesome; while the chantarelle, a highly prized rarity in England and a favorite species in France, which is represented in Fig. 3, was not relished when found in North Carolina by Mr. Curtis. This writer states that he ate of 40 different species of *fungi* gathered within two miles of his house, and that he found 111 kinds in the State.

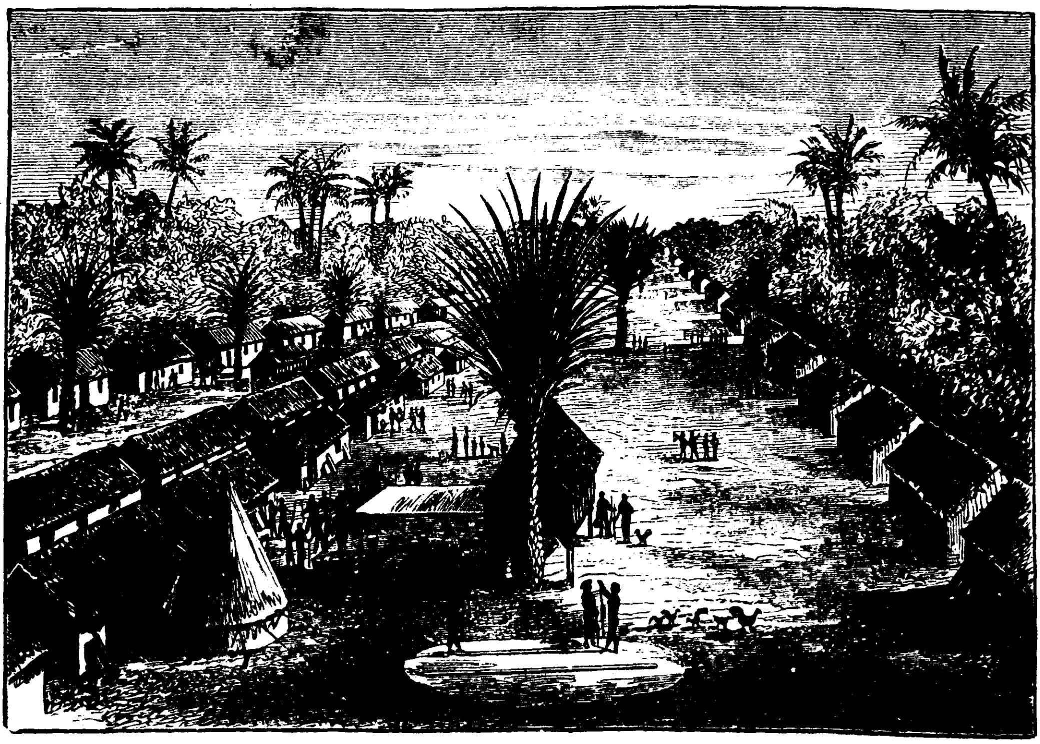
HEALTH AND MARRIAGE.

The *Sanitarian* takes strong ground that marriage, at the proper time, is favorable to health and long life. By the statistics of M. Bertelon and others, in a discussion of the subject before the French Academy of Medicine in 1871, from 25 to 30 years of age, married men die at the rate of 6; the unmarried 10; and widowers at 22 per 1,000 annually. From 30 to 35 years, the deaths among the same classes respectively are 7, 11 and 19½; from 35 to 40, 7½, 13 and 17½ per 1,000, and the same favorable conditions to the married continue at greater ages. But married men aged from 18 to 20 die as fast as men from 65 to 70.

Among women marriage is not quite so favorable as among men. From 30 to 35, wives die at the rate of 9 and spinsters 11 per 1,000. Under 25 the mortality of wives is a little greater than among single women. After 40 years of age, the longevity of married women is much greater than that of the unmarried.

The probabilities of life in this connection are — a man of 25 who marries has an expectation of 40 years' married life; if he does not marry, his expectation at that age is only 35. A woman who marries at 25 may expect to live until she is 65; if she remains single, to 56 years of age. Widowers and widows are nearly as badly off as those who do not marry.

Rapid System of Plastering.—By the use of this system, the lathing and two coats of plastering, with lime and hair, give lace to large slabs fixed to the joists, which form the body of the ceiling at once. The edges of these slabs are bevelled reverse ways, and fit into each other so that the stopping cannot be shaken out. The faces of the slabs are made rough, and the whole receives a thin finishing coat of cement or stucco, which effectually conceals the joints, and produces ceilings of good appearance. By this means no time is lost in waiting for drying; and the annoyance of dirt and rubbish caused by mixing and using lime and hair is entirely avoided. The manufacture of the slabs may be briefly described. A sufficient quantity of plaster and fiber is mixed with glue-water; half of this, while in a plastic state, is spread evenly upon a plate-glass bench, with edges raised three-eighths of an inch, beveled. A sheet of strong open canvas is then stretched tight across, and wrapt round two laths which are embedded in the two edges of the slab. The object of having these laths is to tighten the canvas, and to stiffen the edges of the slabs in their span from joist to joist. The remaining portion of the plaster and fiber is spread evenly upon the canvas, which then remains firmly embedded through the centre of the slab. A bass broom is then passed over the face of the slabs to form a "key" for a finishing coat. When sufficiently set, the slabs are removed from the bench, and exposed to the air to dry. These slabs are two feet six inches wide, of sufficient length to reach across four joists, and are secured to the joists by driving 1½ in. zinc nails through the laths before mentioned, and about four inches apart, along wherever the joists come. The joints are then roughly stopped with cement, and the whole receives a thin "setting" or finishing coat of cement or "stucco," as in the ordinary way. The system certainly has its advantages.—*Builder.*



CENTRAL AFRICAN HABITATIONS.

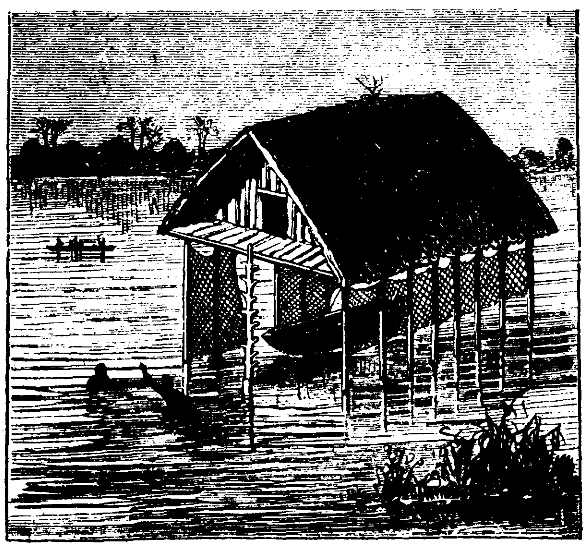


Fig. 2.—AFRICAN LAKE DWELLING.

Fig. 2.

FIG. 1. FIG. 2.

MUSHROOMS.

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 the boys and girls, NEEDLE WORK, AMATEUR MECHANICAL PURSUITS, and all the elements of a *practical domestic education;* also GARDENING and ARCHITECTURAL NOTES.

FLORAL CULTURE.

BOCCONIA.—Nat. Ord. Papaveraceæ. *Linn.—Dodecandria Monogynia.*—Ornamental foliage plants for single specimens or groups on lawns. Bocconia Japonica, a Japanese variety, nearly hardy, forms a bush-like growth from four to six feet in height, producing racemes of bloom from two to three feet in length; very effective during late Summer and Autumn months.

VISCARIA.—Nat. Ord. Caryophyllaceæ. *Linn.—Decandria Pentagynia.*—A genus of remarkably pretty, profuse-flowering plants, producing a striking effect in beds, ribbons, or mixed borders, grow freely in good garden soil. *Hardy annuals.*

WALL-FLOWER (Cheiranthus Cheiri.)—Nat. Ord. Cruciferæ. *Linn.—Tetradynamia Siliquosa.*—The flowers of the Wall-flower are deliciously fragrant, and greatly prized for bouquets. In the Spring garden they are indispensable for filling beds, making groups, and forming ribbons; the large massive conspicuous spikes of the double German varieties have a charming effect in beds and lines; while the more bushy, compact growth and profuse blooming of the single Wall-flowers render them exceedingly attractive, and most valuable for Spring gardening. They require the same treatment as German stocks. *Half-hardy perennials.*

BRIZA MAXIMA (Quaking Grass.)—Large, a most beautiful variety; one of the best. *Hardy annual.*

STIPA PINNATA (Feather Grass.)—One of the finest of the ornamental grasses; the seed, being slow to vegetate, should be started in a hotbed. *Hardy perennial.*

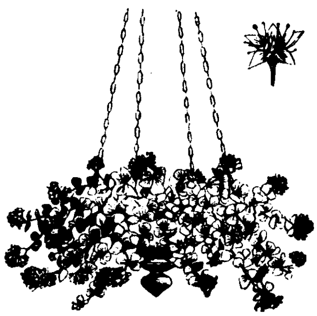
BOCCONIA JAPONICA.

VERBENA VENOSA.

SAPONARIA

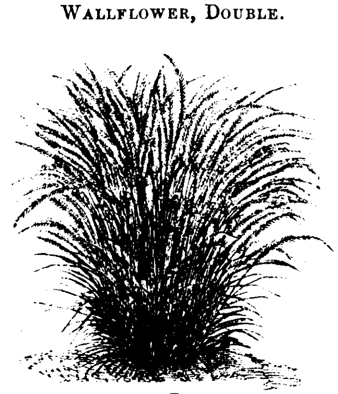
VISCARIA OCULATA.

WALLFLOWER, DOUBLE.



SEDUM.

BRIZA MAXIMA.



STIPA PINNATA.

SANVITALIA

MISCELLANEA.

New Fish.—An ichthyological discovery of the utmost importance has lately been communicated by Prof. W. Peters to the Royal Academy of Science of Berlin. This is a second genus and species of the wonderful order of *Leptocardii*, or brainless fishes, the so-called invertebrated vertebrates. This order, which some naturalists rank as one of the primary divisions of vertebrata, has hitherto been known to be represented by the single genus *Amphioxus*, which comprehends the various supposed species of lancelets. The new animal is closely related to the *Amphioxus*, but wants both caudal and anal fins, and has, instead, a high dorsal fin. The *Epigomethys cultellus*, as the creature is called, was dredged in eight fathoms, near Peale island, Moreton bay, Australia.

Insect Nerves.—The nervous system of the *Hymenoptera* (bees, wasps, ants, sawflies, etc.,) has been studied by E. Brandt. He describes certain pedunculate bodies whose development, as originally discovered by Dujardin, corresponds with the degree of development of the instincts and intelligence in the different species. Brandt's researches now enable him to prove that this is the case also for the different sexes of the same species. Thus in the worker of the honey bee they are of immense size, while they are slightly developed in the queen and in the males.

Weight of an Atom.—On the absolute weight of atoms, a lecture experiment by J. Annaheim, is as follows :—Dilute solutions of fuchsine were examined, and it was found that 0.00000002 gram. of the substance can be detected by the naked eye. If we assume that in a drop of the solution there is one molecule of fuchsine, and at least this amount must be present, the weight of an atom of hydrogen would be 0.00000000059 gram. A similar experiment with cyanine gave similar results.

Cement for Joining Amber.—A solution of hard copal in pure ether, of the consistency of castor oil, is suggested by Ph. Rust for cementing amber. The carefully-cleaned surfaces of fracture, coated with the solution, should be pressed together, and retained in contact by means of a string wound around the object, or in some other suitable way. The operation should be performed as rapidly as possible, since the evaporation of the ether impairs the adhesiveness of the cement ; so that all arrangements for compressing the object should be made before laying on the cement. A few days are required for the complete hardening of it. In repairing tubes, as for pipes, any of the solution happening to pass into the interior should be carefully removed at once with a slender feather.

It is said that in Tasmania there is an insectivorous plant which eclipses anything of the kind known in this country. The plant grows in the crevices of rocky ground, is about 6in. in height, with a single vertical stem from which project one or two dozen small foot-stalks, carrying small discs about ½in. in circumference, fringed with tentacles. A sticky substance exudes from the ends of the tentacles and filaments, which effectually retain a fly and at once convey it to the centre of the flower, which closes tightly over it, and, according to the report, the fly is " digested."

A company has been formed to raise the " Vanguard," and in the event of success they are to pay the Government about £30,000, as the latter will probably decline to exercise their option of purchase, for though a fine vessel she is of an obsolete type. An improved diving dress, capable of withstanding a pressure of 130ft. of water, has been devised, and the company confidently predict the success of their operations.

A bull butted a train off the track of the Richmond and Danville railroad, last Monday, near a bridge. The engine, tender and six cars went through the bridge and the engineer was killed. Shortly after, the locomotive boiler exploded, and the bridge and cars caught fire. The bridge was 600 feet and was totally consumed.

The mid-day meal should be light or delayed till the work is done. Intense brain work cannot go on at the same time the stomach is strongly taxed in digesting food.

Composition for Mirrors.—The glass is first covered with a deposit of silver, platinum, antimony, or other metal, and then coated with gum varnish ; on this the following composition is poured : ¾oz. cyanide of potassium ; one quart water, nitrate of mercury—to saturation ; and sufficient acetic acid to give an acid reaction ; and the whole diluted with five quarts of water. After the lapse of half an hour the mercury has penetrated to the surface of the glass, and by forming an amalgam with the metal, gives a beautiful white lustre.—*Ber. d. D. Chem. Gessellsch, per D. A. Poly. Ztg.*, v, 146.

DOMESTIC RECEIPTS.

Mechanical Power of Water. — Water is a purifier, a cleanser, a dissolver and a mechanical power, and will run along down an incline the solid ingredients of town sewage, with road detritus—such as grit and silt—the moving power of water being in proportion to the volume, the vertical depth and the gradient down which the flow is directed. Flushing by volume and head, artificially formed, will remove detritus from sewers of low gradients, where accumulation may have taken place. A velocity in the sewage of two feet six inches per second will remove any solids likely to be passed into drains and sewers.

Worth Knowing.—We are assured that one pound of green copperas, dissolved in one quart of water and poured down a water-closet, will effectually concentrate and destroy the foulest smells. On board ships and steamboats, about hotels and other public places, there is nothing so nice to purify the air. Simple green copperas, dissolved in anything under the bed, will render a hospital, or other place for the sick, free from unpleasant smells. In fish-markets, slaughter houses, sinks and wherever there are offensive gases, dissolve copperas and sprinkle it about, and in a few days the smell will pass away. If a cat, rat or mouse dies about the house and sends forth an offensive gas, place some dissolved copperas in an open vessel near the place where the nuisance is, and it will purify the atmosphere.

Poisons.—For any poison, the most speedy, certain and most frequently efficacious remedy in the world, if immediately taken, is a heaping teaspoonful of ground mustard, stirred rapidly in a glass of cold water, and drank down at a draft, causing instantaneous vomiting. As soon as the vomiting ceases, swallow two tablespoonfuls or more of sweet-oil, or any other mild oil. If no ground mustard is at hand, drink a teacupful or more of sweet-oil or any other pure-mild oil, melted hog's lard, melted butter, train oil, cod-liver oil, any of which protect the coats of the stomach from the disorganizing effects of the poison ; and, to a certain extent, by filling up the pores of the stomach (the mouths of the absorbents) prevent the poison being taken up in the circulation of the blood. Persons bitten by rattlesnakes have drank oil freely and recovered. These are things to be done while a physician is being sent for.

Coffee as an Invigorator.—A correspondent of the London *Lancet*, who owns a water-power mill, says : I am frequently compelled, at this season of the year, to have men working in water even in frosty weather. I find the following allowance gives great satisfaction to the men, and we never have a case of cold or injury to the men in any way : Kettle of coffee, made with half sweet milk, half water, three or four eggs, whipped, poured into it when off the boil ; hot toasted bread with plenty of butter of finest quality. Serve up this every two and a half hours. The expense is much less than the usual allowance of whiskey, and the men work far better, and if care is taken to have the coffee, milk (cream is still better), bread and butter, and especially the butter, of the very finest quality, the men are delighted with it. I am persuaded it would be worth while to try this allowance instead of grog. Giving extra grog gives the men a notion that it is good for them, and perpetuates the belief in stimulants among workmen.

Beauty Like Summer Fruit.—Beauty is as summer fruits, which are easy to corrupt, and cannot last ; and, for the most part, it makes a dissolute youth, and an age a little out of countenance ; but yet, certainly, again, if it light well, it maketh virtues shine, and vices blush.—*Lord Bacon.*

Righteous Vengeance.—Some one having urged Tasso to avenge himself upon a man who had done him many injuries, he said, " I wish to take from him neither his property nor his life nor his honor, but only his ill-will towards me."

Antiseptic Properties of Bi-Chromate of Potassa.—M. Langeroy finds that by simply submerging vegetable and animal products in a solution of 1-1000 parts bi-chromate of potassa in water, they are effectually preserved. If the meat be kept in the bath for several months it assumes a gutta-percha like appearance, is so hard that medals can be struck therefrom.—*La Nature*, v, 142.

A New Galvanic Element.—Dr. Robert Newmann has constructed a new galvanic element whose electrodos are respectively of zinc and gilded lead. The liquid employed is not mentioned by the *Journal Télégraphique*. According to the opinion of the constructor, the electromotive force of this element is twenty-five per cent. greater than that of Bunsen. The latter, according to Waltenhofen, equals 1.67 Daniel.—*D. A. Poly. Ztg.*, v, 142.

French Bread.—Take nice rice, ¾ lb.; tie it up in a thick linen bag, giving it enough room for it to swell: boil from three to four hours till it becomes a perfect paste; mix while warm with 7 lbs. flour; adding the usual quantities of yeast, salt, and water. Allow the dough to work a proper time near the fire, then divide into loaves, dust them in, and knead vigorously.

Paris Baker's White Bread.—On 80 lbs. of the dough left from the previous day's baking, as much luke-warm water is poured as will make 320 lbs. flour into a rather thin dough. As this has risen, 80 lbs. are taken out and reserved in a warm place for next day's baking. One pound of *dry yeast* dissolved in warm water is then added to the remaining portion, and the whole lightly kneaded. As soon as it is sufficiently "risen," it is made into loaves being placed in the oven without touching each other, so that they may be "crusted" all around.

Dyspepsia Bread.—The following receipt for making bread has proved highly salutary to persons afflicted with dyspepsia, viz.:—3 quarts unbolted wheat meal; 1 quart soft water, warm but not hot; 1 gill of fresh yeast; 1 gill molasses, or not, as may suit the taste; 1 teaspoonful of saleratus.

For the sake of the industrious housewife, and not for bakers, as they are supposed to know already, it may be well to state that 30 minutes' baking will suffice for 1 lb. loaves and cakes; and 15 minutes additional for every lb. after the first for larger ones. Thus a 1 lb. loaf requires ½ hour, a 2 lb. loaf ½ hour, and a 4 lb. loaf 1¼ hour.

The Secrets of Vienna Bread.—The proportions of Vienna bread, confessedly inferior to none in the world, are: Flour 100 lbs.; water and milk, 9 gals.; salt, 6 lbs. 4 ozs.; pressed yeast, 18 lbs. 12 ozs. According to Prof. Horsford, good fresh middlings flour will compare favorably with the average Hungarian flour used in Vienna. The fresh pressed yeast is obtained by skimming the froth from beer mash in active fermentation. This contains the upper yeast, which must be repeatedly washed with cold water until only the pure white yeast settles clear from the water. This soft, tenacious mass, after the water has been drawn off, is gathered into bags and subjected to hydraulic pressure, until there remains a semi-solid, somewhat brittle, dough-like substance, still containing considerable water. This is the pressed yeast, which will keep for eighty days in summer, and much longer on ice. For use it should be fresh and sweet.

The mixing is commenced by emptying the flour sacks into a zinc-lined trough about 2½ feet wide and 8 feet long, half round in form. Then with a pail holding about 5 gals., equal parts of milk and water are poured, and left to stand until the mixture attains the temperature of the room, between 70° and 80° Fahr. It is then poured into one end of the trough and mixed with the bare hand with a small portion of the flour to form a thin emulsion. The pressed yeast is next crumbled finely in the hands, and added in the proportion of 3½ ozs. to every 3 qt. of liquid, and then 1 oz. of salt in same proportion is intermingled through the mass. The trough is now covered and left undisturbed for ¾ of an hour, and after this the rest of the flour is incorporated with the mass in the above-named proportions.

The mass of dough, being allowed to rest for 2½ hours, becomes a smooth, tenacious, puffed mass of yellowish color, which yields to indentation without rupture and is elastic. It is now weighed into pound masses, and each lump is cut by machinery into 12 small pieces, each ¾ inch in thickness. Of each one of these, the corners are brought together in the centre and pinched to secure them. Then the lump is reversed and placed on a long dough board for further fermentation, until the whole batch is ready for the oven. Before being introduced into the latter, the rolls are again reversed and restored to their original position having considerably increased in volume, to be still farther enlarged in the oven to at least twice the size of the original dough. In the oven they do not touch each other, and the baking occupies about 15 minutes. To glaze the surface they are touched in the process of baking with a sponge dipped in milk, which besides imparting to them a smooth surface, increases the brilliancy of the slighty reddish cinnamon color and adds to the grateful aroma of the crust.

Triumph of Application.—Few things are impracticable in themselves; and it is for want of application, rather than of means, that men fail of success.—*Rochefoucault.*

The Beautiful and Useful.—The useful encourages itself; for the multitude produce it, and no one can dispense with it; the beautiful must be encouraged; for few can set it forth, and many need it.—*Goethe.*

A NORWEGIAN TIMBER CHURCH.

(See page 160)

There exists in Norway, says the *Building News*, a series of wooden churches of great interest to the antiquary. The subject of our engraving is, perhaps, the most curious of them all. Situated in the neighborhood of some of the wildest and most romantic scenery in the country, it is of strange and fantastic design, and the carved pinnacles at its angles give it the appearance of a Chinese pagoda rather than a Christian church. The building is entirely of pine, the roof and walls being covered with tooth-shaped shingles, protected from the weather by layers of pitch. It possesses nave, chancel, and apse, the roof of the latter forming a most curious feature—resembling a large beehive. A covered way, about 3 feet wide, runs all round the church. It is believed to have been erected in the 11th or 12th century, and the resemblance which the mouldings and capitals bear to English architecture of that date fully bears this out.

ABOUT KEROSENE OIL.

All explosions of petroleum lamps are caused by the vapor or gas that collects in the space above the oil. When full of oil, of course, a lamp contains no gas; but immediately on lighting the lamp, consumption of oil begins, soon leaving a space for gas, wheih commences to form as the lamp warms up, and after burning a short time sufficient gas will accumulate to create an explosion. The gas in a lamp will explode only when ignited. In this respect it is like gunpowder. Cheap or inferior oil is always most dangerous.

"The flame is communicated to the gas in the following manner:—The wick-tube in all lamp-burners is made larger than the wick which is to pass through it. It would not do to have the wick work tightly in the burner. On the contrary, it is essential that it move up and down with perfect ease. In this way it is unavoidable that space in the tuble is left along the sides of the wick sufficient for the flame from the burner to pass down into the lamp and explode the gas.

"Many things occur to cause the flame to pass down the wick and explode the lamp.

"1. A lamp may be standing on a table or mantel, and a slight puff of air from the open window or door may cause an explosion.

"2. A lamp may be taken up quickly from a table or mantel and instantly explode.

"3. A lamp is taken into an entry where there is a draught, or out-of-doors, and an explosion ensues.

"4. A lighted lamp is taken up a flight of stairs, or is raised quickly to place it on the mantel, resulting in an explosion. In these cases the mischief is done by the air movement—either by suddenly checking the draught, or by forcing air down the chimney against the flame.

"5. Blowing down the chimney to extinguish the light is a frequent cause of explosion.

"6. Lamp explosions have been caused by using a chimney broken off at the top, or one that has a piece broken out, whereby the draught is variable and the flame unsteady.

"7. Sometimes a thoughtless person put a small-sized wick in a large burner, thus leaving considerable space along the edges of the wick.

"8. An old burner, with its air-draughts slogged up, which rightfully should be thrown away, is sometimes continued in use, and the final result is an explosion."

The following is the United States standard for test of kerosene, as set forth in the law of 1867:—

"That no person shall mix for sale naphta and illuminating oils, or shall knowingly sell or keep for sale oil made from petroleum for illuminating purposes inflammable at less temperature of fire-test than 110 degrees Fahrenheit; and any person so doing shall be held to be guilty of a misdemeanor, and on conviction thereof by indictment or presentment in any Court of the United States, shall be punished by a fine of not less than $100 or more than $500, and by imprisonment for a term of not less than six months nor more than three years.—*Scientific American.*

Buckwheat Cakes.—"Mrs. B. S." is troubled because her cakes will not brown. The addition of a little molasses will remedy the trouble—try a table-spoonful to a quart of batter. Much depends upon the cooking. Many have the griddle too cool, and the cakes are dried rather than cooked. It is useless to expect light and good cakes unless the griddle is hot enough to puff them up at once.

BIRD-HOUSES THAT ANY BOY CAN MAKE.

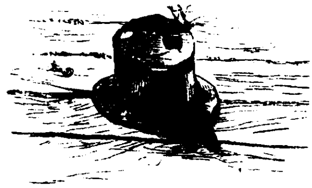


FIG. 1.

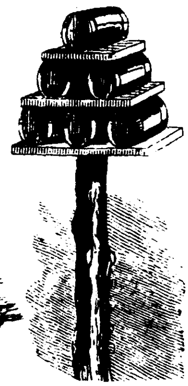


FIG. 2.

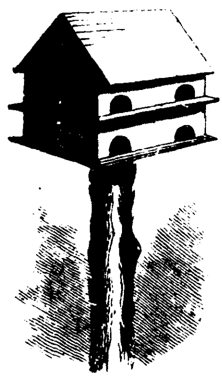


FIG. 3.

Fig. 4.—HOUSE OF SPLIT STICKS.

Fig. 5.—HOUSE WITH BIRCH BARK.

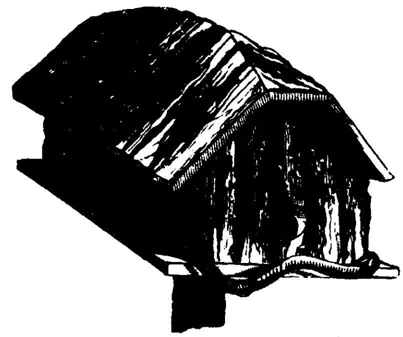


Fig. 6.—HOUSE WITH ROUGH BARK.

A NORWEGIAN TIMBER CHURCH.