There are several varieties of steel in the Exhibition. Specimens of wootz or oriental steel, in the form of little conical ingots, are in the Indian collection. They are made from wrought iron fused with twigs of wood and charcoal on a small hearth. There are also specimens of steel called "homogeneous metal," which is very mallcable and tough, and contains a low per centage of carbon. It occupies a position between wrought iron and ordinary steel. The barrels of Whitworth's rifles are made of this metal. Very strong tubes for boilers are also made of it. Although recently revived in England, it was invented and patented as claimed by M. Mushet in 1800, and is thus described :—"When iron is presented in fusion to 1-140th or 1-150th part of its weight of charcoal, the resulting product occupies a kind of middle state betwixt malleable iron and steel. It then welds with facility, and may be joined either to iron or steel at a very high welding heat. Thus combined with carbon it is still susceptible of hardening a little, but without any great alteration in the fracture. It possesses an uncommon degree of strength and tenacity, and is capable of an exquisite degree of polish, arising from its complete solidity and the purity of fracture conveyed to it by fusion."

Many samples of steel made by the process of cementations are in the English, French and some other departments of the Exhibition. In England, large quantities of Swedish iron are used in making steel, and different varieties of iron yield different qualities of steel. A knowledge of these differences is generally regarded as a trade secret. The iron for steel is all selected and arranged by experienced persons. They examine its grain, and are very careful in their selections. There were 170 English applicants for space to exhibit steel. Only one-half of this number has been accommodated. The largest Sheffield steel manufacturers have not sent specimens.

In articles of cutlery the English manufacturers believed they were unequaled in their wares, but in the most common articles of pen knives and table cutlery, the French beat them altogether ; and with imported English steel, the French makers of surgical instruments have also surpassed the best in Sheffield. Messrs. Naylor & Vickers, of Sheffield, however, display cast-steel railway wheels and steel tires ; also cast-steel bells, piston rods and axles, which in their classes are unequaled. Bessemer makes a great display of articles made of his steel, such as rails, tubes, wires and shafts. In the French department, Jackson, Son & Co., exhibit articles of steel made by the Bessemer process, and the Swedes have also sent both iron and steel treated by this system. The German steel is coarse ; all the very finest specimens exhibited, excepting the wootz, were made at Sheffield.

TRIAL OF STEAM PLOWS.

An interesting trial with steam plows took place on the 5th of August, at York, England, before the County Agricultural Society. The furrows drawn were 330 yards in length ; three steam engines were on the ground, stationed at the end of the field, and ropes and windlasses were employed to drag the plows. About one acre per hour was plowed by two of the plows, and the work was executed in a superior manner to plowing by horses, while the entire cost per acre was about thirty-three per cent less. The weight of the plows ranged from 500 to 700 lbs. in the furrows. One engine used was 8-horse power ; it had a single cylinder of 9-inch diameter, and a stroke of 12 inches. It carried steam of 70-lbs. pressure, and the speed was 130 revolutions per minute. The second engine had two cylinders, each of 7-inch diameter, a stroke of 12 inches, steam pressure 70 lbs., speed 130 revolutions per minute, and the power was ten horse. The third engine was of fourteen horse power ; it carried 75 lbs. of steam pressure, its two cylinders were 7¾ inches in diameter each, and the stroke 12 inches. Its speed was 180 revolutions per minute, and it plowed 1 acre, 1 rood and 5½ perches per hour, making four furrows, six inches in depth, at once. The smallest engine and plow required six attendants, the next ten-horse power engine, seven, and the largest only three men and two boys. Mr. J. C. Morton, from the Committee of the Yorkshire Agricultural Society, has made a report on the trial, and the following is given by him as the prices of the apparatus employed :—

	£	s.	d.
1. Fowler's 3-furrow plow, 800 yards of rope, 5-tined grubber, and rope porters, two anchors	295	0	0
8-horse power engine	235	0	0
2. Fowler's 14-horse power engine, 4-furrow plow, rope porters, 800 yards of rope, and anchors	875	0	0
7-tined cultivator	70	0	0
3. Howard's double windlass, 1,400 yards of rope and cultivator	220	0	0
3-furrow plow	50	0	0
10-horse power engine	295	0	0

These figures multiplied by 5 give us the prices in dollars.

VALUABLE RECEIPTS.

To Gild Steel.—Make a neutral solution of gold in nitro-muriatic acid (aqua regia) and pour into it a quantity of sulphuric ether ; the ether will take up the gold and float upon the denser acid. The article is then to be washed with this auriferous ether (with a hair pencil) ; the ether flies off and the gold adheres.

To Silver Brass.—Take 1 part chloride of silver (the white precipitate which falls when a solution of common salt is poured into a solution of nitrate of silver or lunar caustic), 3 parts of pearlash, 1 of whiting and 1½ of common salt, or 1 part chloride of silver and 10 parts of cream of tartar, and rub the brass with a moistened piece of cork dipped in the powder.

Piercing a Hole in Glass.—The most simple method of making a hole in glass is, if possible, to pick out a place where there is a bubble in the glass. A very hard steel point is then taken, and worked round in the place, where it generally soon makes a hole down to the bubble, and by a repetition of the process the hole is completed, which is then enlarged at pleasure by a rat-tail file. Care must be taken that the file is smaller than the hole, for if it should stick in the hole the endeavor to disengage it would certainly crack the glass.

To Stain Pine Black.—The pine should be perfectly free from knots (as they will not color), and a strong solution of hot logwood rubbed carefully all over the board and then it is allowed to dry. Another coat may be given, or a number, according to the shade wanted. After the logwood is dried a solution of copperas should be applied in the same way as the logwood.

Poison Balls for Rats and Roaches.—Put a drachm of phosphorus in a bottle along with 2 ounces of water ; cork it and plunge it into a vessel of boiling water till the phosphorus is dissolved, then pour it into a mortar along with 3 ounces of lard, and rub it briskly, adding some water, about half a pound of flour and 2 ounces of sugar. The whole is made into a paste and divided into balls about the size of marbles. This is laid down on the floor or shelves for rats, cockroaches or other vermin, who eat and are destroyed. For rats cheese is better than sugar, and tallow better than lard. The cockroaches are fond of anything sweet, hence sugar is a bait for them. Potatoes will answer as well as the flour. These balls should be laid down at night and carefully lifted in the morning, taking care not to let any be touched by a child. They should be locked up through the day.

To Remove Foul Air from Wells.—It is well known that many accidents occur to persons going down into wells to clean them, owing to the noxious gas in such places. To remove the gas before descent is made into any well a quantity of burned but unslacked lime should be thrown down. This, when it comes in contact with whatever water is below, sets free a great amount of heat in the water and lime, which rushes upward, carrying all the deleterious gases with it ; after which descent may be made with perfect safety. The lime also absorbs carbonic acid in the well.

Permanent Ink.—Shell-lac, 2 ounces ; borax, 1 ounce, distilled or rain water, 18 ounces ; boil the whole in a closely covered tin vessel, stirring it occasionally with a glass rod or small stick, until the mixture has become homogeneous ; filter, when cold, through a single sheet of blotting paper ; mix the filtered solution, which will be about nineteen fluid ounces, with one ounce of mucilage of gum arabic, prepared by dissolving 1 ounce of water, and add pulverized indigo and lampblack, *ad libitum*. Boil the whole again in a covered vessel, and stir the fluid well to effect the complete solution and admixture of the gum arabic ; stirring it occasionally while it is cooling, and after it has remained undisturbed for two or three hours that the excess of indigo and lampblack may subside, bottle it for use. The above ink for documentary purposes is invaluable, being, under all ordinary circumstances, indestructible ; it is also particularly well adapted for the use of the laboratory. Five drops of kreosote added to a pint of ordinary ink will effectually prevent its becoming moldy.

Honey Comb Pudding.—6 cups of flour ; 2 cups of beef suet chopped fine ; 2 cups of milk ; 2 cups of molasses ; 2 cups of raisins ; 1 cup of currants ; 3 teaspoonfuls of soda and six of cream of tartar, a little salt. Boil three hours. Serve with wine or brandy sauce.

[This receipt was sent to us by one of our female subscribers.

Systematized Cattle Feeding.

The *American Stock Journal* states that there is no established system of cattle feeding in New England, but in Old England there is ; and the following table of provender with the cost of fattening one bullock during winter is given by Mr. Blundell, who is an extensive English cattle feeder :—

Debtor.	s.	d.
To 4 lbs. of oilcake meal per day, or 28 lbs. per week at £12 per tun	3	0
To 1 lb. of bean meal per day, at £12 per tun	0	9
To 64 lbs. of mangold per day, or 448 lbs. per week at 10s. per tun	2	0
To 20 lbs. of oat-straw fodder per day, or 140 lbs. per week, at 30s. per tun	1	10
To 20 lbs. of straw litter per day, at 15s. per tun	0	11
To attendance per week	0	6
To interest on capital and gain	3	0
Total	12	0
Creditor.	**s.**	**d.**
By increased value of bullock per week	10	8
By value of manure per week	1	4
Total	12	0

The fattening of cattle has been a subject of experiment with Mr. Blundell for many years. The mangold which he feeds is but little known in America as a crop, yet Mr. Blundell states that can raise 30 tuns of mangold where he can raise only 20 tuns of Swedish turnips ; and 64 pounds of mangold are equal to 75 pounds of swedes for feed. With respect to hay he says : "As to the 20 pounds of oat straw which he had put down for fodder, he had never yet seen one instance in which a bullock throve on hay. Observation had taught him that hay did not answer ; first, because it cloyed the stomach, and next, because the animal did not continue to eat his food so well as when it had straw, and this was especially the case where a large quantity of roots was grown. During the summer months he cut up his clover and fed his beasts under cover, believing it was in that way they would prove most profitable. A ruminating animal required a large amount of straw to distend the stomachand keep up the process of digestion. He thought that the best age to commence fattening was from 18 to 20 months.

Mr. Hedley, in an article in the English *Agricultural Gazette* on the selection of cattle, says : "In my close identification with fat cattle for several years I have always found that the best animals have the most massive heads, the most capacious chests, and the strongest spines." American cattle-feeders have a great advantage over those in England in having such quantities of cheap Indian corn for feed, but this very abundance, we believe, has led them to become careless and unsystematic in feeding. There is nothing lost by adopting a good system, and while the above method of Mr. Blundell cannot be carried out in America as in England, a useful lesson may be derived from his remarks about hay for feed. In the Northern States and Canada hay is the great crop of the farmer for feeding his cattle during winter. According to Mr. Blundell it is very inferior food for cattle. Our farmers should make experiments to settle this question for themselves as it is one of very great importance.

A Praying Machine.—In the Indian department of the great exhibition is a red praying wheel from Thibet. The prayer is written on a piece of paper and fixed to the wheel, which revolves on a spindle held in the hand. The idea of the worshipper is that every time the wheel turns the prayer is made. Frequently the wheel is fitted to be turned by a small stream. In the mountains of Thibet travelers see considerable numbers of these praying machines thus driven by water power.

Frictional Grooved Gearing.

We have recently published several interesting articles on the above named subject, from American correspondents who had made and used the frictional gearing. The following is from *The Engineer*, and it throws considerable new light on the application and utility of such gearing in Great Britain. It says :—

In the western passage of the western annexe will be found a steam winch, exhibited by the Patent Frictional Gearing Company, of Glasgow, which will well repay inspection. As most of our readers are probably aware, the frictional gearing is intended as a substitute for toothed wheels of every description, a few, we think, who examine the working of the wheels can doubt that the improvement is very great. The mode by which the motion is communicated is extremely simple ; the peripheries of the wheels are provided with continuous and endless Λ-shaped grooves, the extreme points of the Λ being removed to insure a good bite, and each Λ fitting into the recess formed between two W on the other wheel ; the smallest possible pressure is thus made to give a very large amount of force. It is calculated that the adhesion or driving hold of the surfaces of these grooved wheels is about nine times that of plain surface frictional wheels. When working at 1,000 circumferential feet per minute the contact pressure requisite for transmitting a standard horse power is 22 lbs. ; at double that circumferential speed, 11 lbs. ; and in the same relative proportions at other speeds ; a wheel 8 feet in diameter, working at forty revolutions per minute, gearing with a pinion, requiring about 1 tun of contact pressure to transmit 100 indicated horse power. This system of gearing seems to be thoroughly adapted both to heavy and light machinery ; and wherever there is liability to sudden concussion or strain they are invaluable, since, from their very principle, it is evident that they cannot be damaged ; for, in case of a sudden jerk, a slight and immaterial slip is the sole inconvenience, the wheels being left in quite as good order after the jerk as they were before, instead of, as would be the case with ordinary teeth gearing in use, broken teeth having to be repaired before the working could be continued. The smoothness with which the frictional gearing works is remarkable. Some of the wheels upon this system have been in use more than four years, and continue to give the greatest possible satisfaction ; and it is considered that where the wheels are properly proportioned to the work to be done they are more durable, and transmit power with less waste by friction than is incurred by using toothed gear. As an evidence of the advantages derived being really of a practical character, it will suffice to state that this system of gearing has been adopted by many of the principal ironmasters, manufacturers, and others in Scotland and South Wales, and with such satisfactory results that many of them have given permission for the gearing to be examined at their works in operation. Even for such heavy work as the rolling of iron the grooved wheels have been found applicable ; and in their application to heavy and light rolling purposes they may be seen in use at the works of Messrs. Sharp and Brown, Birmingham ; of the Dundyvan Iron Company, Coatbridge ; of Messrs. William Baird and Co., Muirkirk ; of Messrs. Strang and Hamilton, Glasgow ; of the late Mr. Anthony Hill, Merthyr Tydvil ; and at several other places. The wheels have also been employed as screwing rolls for straightening bars and tubes, for winding engines, for steam cranes, as well as for driving fans, circular saws, rotary pumps, &c.

Sponges.

Sponges belong to the lowest class of animals ; a creature which may be said to form the first link in the great chain of life which ends with man. This microscopic protozoon is by no means unfrequently to be met with in stagnant waters and vegetable infusions. It is a minute semi-fluid mass, presenting scarcely any evidence of distinct organization, even of the simplest kind. When the creature, in the course of its progress, meets with a particle capable of affording it nutriment, its gelatinous body spreads itself over and around the precious morsel so as to envelop it completely. The substance thus taken into this extemporized stomach undergoes a sort of digestion, the nutritive material being extracted, and the indigestible part being, as it were, squeezed out of the body. Of the mode of its reproduction nothing yet is known, save that it undergoes multiplication by self-division, and that portions separated from the mass, either by cutting or tearing, can develope themselves into independent beings. This living speck of jelly, which can get along without legs, and which can convert any portion of its substance into a stomach, may be regarded as the type of the Protozoa.

In the living sponge the skeleton, usually composed of a fibrous network, strengthened by spicules of mineral matter, is clothed with a soft flesh. Most sponges are strengthened by calcareous or siliceous spicules, and the variety of forms presented by these bodies is almost endless. In the ordinary sponge, *spongia officinalis*, the fibrous skeleton is almost entirely destitute of spicules ; but in the curious and beautiful sponge of Barbadoes the entire network of fibers is composesed of silex, and is so transparent that it looks as if composed of spun glass.

With the exception of those that belong to the genus *Spongilla*, all known sponges are marine, but they differ very much in habit of growth ; some are only found at considerable depths, others live near the surface, and many attach themselves to rocks and shells between the tide-marks. The average depth at which the best Turkey sponges are found is thirty fathoms ; those of an inferior quality are found at lesser depths.

All the finer descriptions of sponges are obtained from Islands in the Mediterranean, and the coarser descriptions from the Bahama banks and the coast of Florida. About one thousand bales, each weighing 300 lbs., are shipped annually from Nassau, New Providence. Sponge fishing is also carried on at Key West, in Florida, where about 100,000 lbs. are gathered annually. Our great source of sponges, however, is the Bahamas.

The Andros Islands and the Cays are the great sponging districts. The sponge is usually found in grassy and rocky patches near the shores of this group. Crawls for cleaning these may be seen, constructed with stakes about two inches thick, driven into the mud, and forming a square of twelve feet, sufficiently high to prevent the sponge washing out. In these the sponge is soaked and washed frequently, after having been buried in sand about a week or ten days, when it loses the black animal matter, which has an offensive smell. When first gathered the pieces are wrenched from the rocks with a strong two-pronged fork fixed to a long pole. The sponges are of four kinds—yellow, glove, velvet and mop. The first is the most valuable kind ; the second is the toughest, and much used in stables for its softness.

In 1859, 207,450 pounds of Bahama sponges were imported into the United States. At Nassau, New Providence, it may be seen in vast quantities on clear days spread on the roofs of houses, and hung upon fences to dry. All the sponges which are hawked around our streets for sale, either come from Key West or Nassau.

Trial Trip of the Black Prince.

[From Mitchell's Steam Shipping Journal, August 29.]

The official trial of the speed of the *Black Prince*, at full power, at her deep draught of water for sea service, commenced at Portsmouth on the 26th inst., under the most favorable circumstances of wind and weather. The two previous trials of the ship took place at light draught, and under somewhat exceptional circumstances, the first only being a trial of speed, made on the day after her arrival at Spithead from Greenock, on the 20th of November, 1861. The second was her trip outside the Wight, to test the action of her enlarged rudder, in April last. In her speed trial she made four runs at the measured mile, with the following results in knots :—First run, 15·859 ; second run, 12·950 ; third run, 15·319 ; and fourth run, 13·043. Some disappointment was felt by many at the time at this rate of speed, the *Warrior* having exceeded it on her trial at deep draught, when she averaged 14 354 knots. The ship's draught of water on the 20th of November was 24 feet 2 inches aft, and 21 feet 10 inches forward. The second trail (not of speed) took place in April last, to test the capabilities of her rudder, which had been enlarged from an area of 130 feet to 153 feet. On this occasion she had 12 men at her wheel, and, taking three of the circles completed by the ship as the average of the whole, they were made respectively in 8′ 5″, 9′ 49″ and 9′ 33″—the angle of the rudder being in each case 16°, 13° and 13°. The ship's draught of water was—forward, 22 feet ; aft, 23 feet 1 inch. The *Black Prince* is now, however, in commission, with her stores on board and ready for sea, and made her trial of speed on the 26th inst., on equal terms with her sister ship the *Warrior*, tried on the 17th of last October. An auxiliary engine has been fitted of 40-horse power for working the capstan, pumping water from the different compartments, washing decks, and also to act as a fire engine. A cupola furnace and fan has been erected for molten iron shell. Tramways in coal boxes and stoke holes, with engines for raising ashes, &c., and feed engine for the auxiliary boiler, have also been fitted. The ship's upper deck presents a fine roomy space to the eye. Here she carries two 110 pounder Armstrongs, four 40-pounders and two 20-pounders, also Armstrongs, besides rifled and smoothbore guns for boat service. On the main deck she carries, in the two compartments, forward and aft of her armor plating, eight 110-pounder Armstrongs—four in each compartment. Behind her armor plating all the guns are the 95 cwt., smoothbore, for 68 pound solid shot, mounted on carriages fitted with directing bars. Four runs were made with the following results :—

	Time. min.	sec.	Speed in knots.	Revols. of engines.	Steam	Vacuum for.	aft.
First run.....	4	21	13·846	47·5	20lb.	25	23
Second run.....	5	58	10·055	49	20lb.	25	23
Third run.....	4	9	14·457	49	20lb.	24	23
Fourth.....	5	50	10·286	59·5	20lb.	24	23

Mean speed of the four runs 12·209. This result was so unsatisfactory, as compared with the *Warrior's* trial, that ship having attained a mean speed of 14 354 knots, that it was resolved to abandon any further trial of speed, and to recommend to the Admiralty that the ship should be taken into Portsmouth harbor, and placed in dock to clean her bottom, and that the weight on her safety valve should be increased to a level with that given to the *Warrior* on her trial trip, the *Black Prince* having been worked with five pound less than the *Warrior*. The screws of both ships are precisely similar improved Griffith's, and set at the same pitch ; the draught of water of the two vessels was, however, different, and against the *Black Prince*, whose draught was 26 feet 10 inches aft, and 26 feet 2 inches forward, the *Warrior* drew 26 feet 5 inches aft, and 25 feet 6 inches forward.

Testing Butter.

Mr. John Horsley, analyst to the County of Gloucester, England, in an article in the *Chemical News*, recommends as a method to distinguish between pure butter, and that adulterated with lard and other substances, the following process :—

First satisfy yourself, by melting a portion of the suspected butter over a water bath, and observing if there be any insoluble admixture of farinaceous matter, such as wheat flour, potato starch, arrow root or turmeric (said to be sometimes used), which the microscope and chemical tests will prove ; then mix the melted butter in an evaporating dish with four or five times its bulk of hot water, and allow it to stand for two or three hours to collect on the surface and solidify. Detach the resulting cake of butter, and place it on a piece of blotting paper to dry, by the absorption of all adhering aqueous matter. If a piece of this prepared butter be introduced into a wide-mouth stoppered bottle, and surrounded with ether, at the temperature of 65° Fahr., it ought to entirely dissolve, forming a clear lemon-yellow colored liquid.

English Cupola Frigate.

The Board of British Admiralty has fully approved the model of an improved armor-plated cupola vessel by Mr. Turner, master shipwright at Woolwich Dockyard ; and one of these vessels is ordered to be constructed. The iron cupola will be fixed instead of movable, 200 feet long, 50 feet broad, and 10 feet deep. Guns will be placed round the vessel from fore to aft, and will be able to sweep the water at such a depression that no gun vessel can approach. She will be fitted with a ram 3 feet under the surface of the water, 8 feet long ; and her rudder tiller and propeller will be under the water. The ship will carry 26 guns ; and her dimensions will be as follows :—330 feet long, 64 feet broad. 25 feet draught, and 8,700 tuns displacement.