Machinery and Tools as they are.---The Steam Engine.

(Continued from page 83.)

DIRECT-ACTION ENGINES—This class of engines derives its appellation from the manner in which the motion of the piston is transmitted to the crank, which is placed directly over the cylinder and connected to the piston rod either by the agency of a connecting-rod or even, in some instances, the latter is dispensed with, and the piston-rod itself connected to the crank pin. Attempts are frequently made to classify direct-action engines into three or four varieties; some arranging them according as they are made with a parallel motion, or from using, instead, a guide motion, but these small minutiæ are features not sufficiently distinctive to constitute different varieties. Other modes of classification are equally objectionable, for the truth is, when this form of machinery became popular, almost every maker had some peculiar arrangement or modification of his own. From this circumstance there has arisen an endless variety of direct-action engines, many of which have already fallen into oblivion, leaving only the better sorts still in use. We shall therefore briefly sketch the outlines of a few that stand conspicuous, but before doing so, will make a few remarks on the benefits and disadvantages which result from this substitution for the beam or side-lever engine. We have stated whence they derived their name, but the position of the crank directly over the cylinder, is itself a great evil, compelling the constructor, in the most simple forms of this class, to a choice of two evils—either to have a short stroke and short connecting-rod, or to place the paddle shaft excessively high, to which evils there must be added great friction and consequent wear. Their chief recommendations are, that they allow the length of the engine-room to be diminished by one-third, and the weight of the machinery to be at least two-fifths less than heretofore. There is an important difference between the naval and mercantile marine, which should not be lost sight of; in vessels of war it is of the first importance to keep as much of the machinery as possible beneath the water-line, so as to be secure from injury during an engagement, hence a good engine might be rejected for the government service, although well adapted for a merchant vessel, and on the contrary an engine adapted for the navy might not be advisable for the latter purpose. The engine of this kind which ranks first in estimation at present, and not without reason, is the Oscillating Engine. On this account, and because there are several peculiarities about it, we shall describe this sort of engine rather more fully; it must, however, be premised that the oscillating principle has lately been applied to machinery differing much in form, but in the following we shall more particularly refer to the engine most generally used. Its peculiar feature, and from which it derives the name, is, the swaying or rather oscillation of the cylinder:—the piston-rod is provided with a head and strap, so as to connect directly with the crank-pin, without the intervention of a connecting-rod, but it is evident that, as the piston moves up and down in a straight line, an arrangement is necessary to allow of the rotary movement of the crank, this is effected by the cylinder having two gudgeons or trunnions on it, midway between the top and bottom, so that when placed in bearings it can oscillate freely, and will yield to the motion of the crank as the latter is impelled by the piston-rod. The bed-plate is formed with plummer-blocks for the reception of the cylinder gudgeons, and there are firmly attached to it eight wrought-iron columns, which support the top frame or entablature, this latter having on it the main plummer blocks in which the shaft revolves. We have mentioned that the cylinder moves to-and-fro on its central bearings, but here a difficulty occurs,—how to supply it with steam; this is accomplished by making the gudgeons or trunnions hollow, one being for the reception of the steam, and the other to convey the exhaust steam to the condenser. The communication between the slide-valve casing and these hollow gudgeons, is by two passages that are carried around the cylinder, and form part of the same casting. The slide casing oscillates with the cylinder, and the manner in which the valve is worked is also peculiar, for it is evident that the distance between the eccentric and the weigh-shaft which moves the valve is continually changing. This is arranged by means of a frame, which moves up and down when the notch in the eccentric rod is made to grasp a stud in the centre of the above frame. There is a curved slot in the lower part of the frame, in which moves a roller giving motion to the weigh-shaft, so that as the frame moves up and down the slide-valve partakes of the motion, and when it is requisite to reverse the engine, the operation is effected by moving the frame with a lever suitably attached. Between the two cylinders are placed the condensers, air and feed pumps, &c.; frequently only one condenser and air-pump are used for the two cylinders, which arrangement is liable to the objection that if the air-pump gets out of order the whole machinery is disabled. An intermediate crank shaft is employed to work the pumps.

Some modifications have lately been introduced, affecting chiefly the condensing apparatus, the mode of admitting the steam, and the use of two light separate slide valves instead of the heavy single valve casing, so as to improve the balance of the cylinders. Oscillating cylinders have also been applied to that kind of framing which is formed with two inclined planes, on which the cylinders are placed so that they incline to each other and as regards the vessel are fore-and-aft to it, or in other words, stand in a line with the keel, a position which causes less strain on the vessel. With this arrangement only two cranks are required, which can be connected by a drag-link, and there is a considerable diminution of weight and friction,—the same framing is also often used for fixed cylinders.

The Trunk Engine is another variety which after being neglected for some time, has lately been placed in several large vessels and found peculiarly well adapted for giving motion to the screw propeller. Its peculiarity consists in connecting the piston-rod to the piston by a joint, so that it works freely instead of being keyed on tight. A rectangular trunk or casing, bolted on the piston, encloses the rod and passes steam-tight through the cylinder cover, so that the upper end of the piston-rod, being attached to the crank-pin, is able to sway to-and-fro within its casing, whilst it impels the crank.

The Gorgon Engine is another form, absurdly deriving its name from the vessel in which this form of engine was first used. For several years it was highly esteemed, but is now receding in favor, and with reason, for the other direct-action engines already described are far superior. Its main characteristic is in attaching the piston-rod to the crank overhead by a short connecting-rod, which entails the evil of a short stroke and other disadvantages.

Two cylinders to each engine is another variety, in which case the two piston rods are connected by an arm (called a T-piece from its shape), and the connecting-rod is attached to the lower part of the T-piece, thus allowing it to be very long; this engine is, however, expensive and bulky. The long connecting-rod, which is so great a desideratum, is obtained by other makers in another way, who fashion the lower part in a forked-shaped so as to extend over a cross-head and side rods, to which latter it is attached. Before leaving this subject we think it right to mention that the employment of the double cylinder expansive engine, for steam vessels, has lately attracted considerable attention.

While discussing the economy of the marine engine, we shall make a few brief remarks on the rule adopted by some writers, for finding the capacity of the air-pump, which, according to them, should bear a fixed ratio to that of the cylinder, that ratio being usually as one to eight, this has been already mentioned, except that the word "capacity" must be substituted for "diameter." This ratio, it can be shown, is only an approximation for the quantity of water required for condensing varies, of course, according to the temperature of the exhaust steam. Another element to be taken into account, is the normal state of the injection water, for the temperature of the ocean differs greatly in various parts of the world. Again, if surface condensation is employed, the size of the air-pump can be very much reduced, as its sole office is that of removing the condensed steam and the uncondensed vapor, but not the injection water.

(To be Continued.)

Anastatic Printing, &c.

MESSRS. EDITORS.—On page 59, No. 8, this Vol., Scientific American, there is an account of Randolph Appel's process of producing copies of printed books, &c. The said process has been known to me for at least twenty years, and during that time I have made many experiments upon various kinds of substances, such as leather, horn, ivory, brass, copper, iron, zinc, silver, &c., I also claim part of the honor for reproducing printed matter without the re-setting of type, making new engravings, &c. I am in possession of a large number of impressions on paper taken from printed books, papers, engravings, &c., which were taken directly from the paper surface without transferring them to metal surfaces; any amount of impressions may be taken in this way without injury to the original.

The following is a description of a process by which any desirable impression may be etched upon common *tin plate*:—Take a piece of tin plate (or tinned iron) which is new, clean, and free from spots and marks, cut it somewhat larger than the original subject from which it is desirable to make the etching or engraving, next take hold of the plate by one corner with a pair of pliers, and subject it to the heat of a spirit lamp, holding it in a horizontal position and continue the heat by moving the plate over the flame until the tin thereupon has thoroughly melted, when it must be withdrawn and held in the same position until the metal hardens again; it may now be cooled in water and polished with flour of emery or the like. All kinds of grease must be avoided; when thoroughly polished moisten the design with a solution of the nitrate of silver prepared in the following manner:—Take a half dollar (American coin) and dissolve it into an ounce and a half of strong nitric acid, diluted slightly with water to quicken the operation (the water should be hot), when the silver coin is found to be entirely dissolved place the contents into a half pint glass and fill up the remainder with pure cold water; the solution is now ready for use, and must be placed into a separate vessel in small quantities and applied with a soft brush to the paper; care must be taken never to immerse the brush into the larger portion of the liquid, for in case there should be more than one impression required or taken from the same design, the second would be apt to precipitate the silver in solution and it would require the hand of a practical chemist to restore it to its former condition.

When the paper of the design has been thoroughly moistened with the above solution, place it between folds of blotting paper to free it from all superfluous moisture, now place the plate in a press face upward, and the design upon it face downwards, and lay two or three folds of cotton, flannel, or woolen cloth upon the same, and then apply pressure by screw or otherwise, and then remove the paper quickly from the plate by taking hold of it by one corner. If the whole has been properly conducted, it will be found on examination that the plate has acquired a beautiful and uniform etching over the whole surface, and oftentimes it will require no further etching, but should it happen that the process is incomplete or unsuccessful, heat the plate and repeat the process as before, and if it is required to deepen the impression, heat the plate slightly, face upward, so as to harden the surface, then, when cold, moisten the surface by pouring pure water thereupon, holding it in a horizontal position so as to retain a quantity of the water, and next pour upon the surface nitric acid diluted in the proportion of one part of acid to eight of water. This being an extremely delicate operation, it requires to be conducted with the utmost care, or the whole design will be destroyed.

DAVID BALDWIN,
Godwinville, N. J.

[We have received a number of impressions—rather copies—of pictures, printed matter, &c., from our correspondent, the said copies having been taken without being transferred to metal. We have never seen any anastatic proofs which we considered equal to the originals.

For the Scientific American.
American Entomology.

While this branch of zoology is making wonderful progress in the hands of our transatlantic neighbors, there is no science, perhaps, in America, which meets with so many enemies who calumniate and try to degrade it, denying its utility, and representing it as a puerile and barren pursuit. There are some individuals who, if an immediate answer is not given to their query, *cui bono?* at once conclude it unanswerable. Such utilitarians consider what is beyond their own limited vision superfluous. The Creator has stamped everything good, and if this age would be called scientific, it must, like the mind of Bacon, in sweeping over the field of universal science, examine every rivulet as well as the imposing cataract.

The numerous family, coming in the province of entomology, comprise both foes and friends to man. They are capable of producing famine, pestilence, and disease. The productions of the earth, domestic animals, and even man himself are often a prey to this formidable enemy. The lion may destroy an individual, but the weavil may depopulate a city. Now to successfully oppose we must know the character of an enemy. Practically considered, therefore, it is for our interest to acquaint ourselves with this science. To some insects, on the other hand, we are under the weightiest obligations. To the bee we owe our most delicious sweet; to the silkworm our most beautiful apparel; to the cochineal our richest dye. They consume animal and vegetable matter suffering decomposition; they are agents in the fructification of plants, whose organization and transformation offer an extensive field to the physiologist.—Vaccination is also indebted to entomology. Aside from usefulnes, it has beauty and elevation. No part of creation exhibits so much perfection in so small a space. Their variety of action and consummate adaptation of parts bespeak the wisdom and power of Deity; to the ant and the bee we turn for examples of industry and economy, of harmony and order. Comparatively little is known of the insects of the United States, although we have motions to actuate us beyond those of any other nation, and it is the duty of scientific journals to display its advantages and diffuse a more liberal knowledge of those myriad beings which, of themselves, constitute a living world. A wide field for discovery is opened to the amateur of strong mind and persevering research.

J. O.

Gun Explosion at Gibraltar.

The Gibraltar Chronicle of the 22nd Oct. gives an account of a gun explosion while a portion of the garrison were carrying on gun practice with red hot shot. A 32 pounder, 9 feet 6 inches long, and weighing 56 cwt., charged with 10 lbs. of powder, a dry wad and a wet one, and 32 lbs. iron hot shot, having mis-fired, was reprimed and fired by percussion-hammer and tube. On the charge being ignited, the gun burst, scattering the carriage to atoms, the splinters of which knocked down six of the unfortunate gun detachment on the spot, wounding two of them.

The metal parted into a dozen pieces; four immense masses of several hundred weight each, were hurled nearly a hundred feet into the air and carried to a distance of nearly 300 yards from the platform on which the gun was standing; and the breech thrown to the rear, across the battery and public road, killed an ass on which a little boy—who miraculously escaped unhurt—was mounted. The whole battery was for an instant enveloped in smoke, and the panic which ensued during its clearing away was one of such intense anxiety as to baffle description. When we consider what a vast number of the military were at the guns, and the concourse of spectators, among whom were some Moors of distinction, it is passing wonderful that so few were hurt; and, above all, that only two cases may be deemed dangerous.

A New Metal.

Dr. Owen, of England, has discovered a new metal, of the earthy class, holding an intermediate position between magnesia and manganese; the name given to it is "Thalium." Its oxide, dissolved in hydrochloric acid is of a beautiful pea-green color.