THE HESLOP STEAM ENGINE.

The South Kensington Museum has just received an important addition to its collection of primitive engines, in the sole remaining specimen of the type of steam engines invented by Adam Heslop and patented by him in 1790—a class of engines, by the way, which has been entirely overlooked by those who have attempted to trace the origin and development of the modern steam engine. This oversight is all the more remarkable, since the Heslop engine has been, in the Cumberland coal field, a somewhat successful competitor of the improved engine of Watts; and is furthermore important in that it contains the germ of the compound engine of the present day.

The Heslop engine (now honorably retired, in company with the Soho "sun and planet" engine, and the locomotives "Rocket," "Sanspareil," and "Puffing Billy") was built about 1795, and has been in use ever since in the colliery of the Earls of Lonsdale, at Whitehaven. As described by Mr. H. A. Fletcher, of that place, before a meeting of the Royal Institution of Mechanical Engineers, this engine is furnished with two open-topped cylinders, on each side of the main center of the beams, and both of them single acting, although their pistons are acting in the same direction. These cylinders are described respectively as the "receiving cylinder" and the "working cylinder," the latter being possibly so-called lest Boulton and Watt should contend it was only a condenser with a piston in it; but in actual practice they were known, and perhaps more correctly, as the hot cylinder and the cold cylinder. The steam, on being admitted into the first or hot cylinder, helps to raise the piston by its pressure underneath; the return stroke is then made by the weight of the pump rods, etc., in the pit, suspended by a chain working over an arched beam head. During the down stroke of the pump rods, the eduction valve being opened, the steam passes from this cylinder to the second or cold cylinder by means of the connecting pipe, constantly immersed in a trough of cold water, which produces sufficient condensation to "kill" or reduce it to atmospheric pressure as it enters and fills the cold cylinder. The cold piston having arrived at the top of its stroke, and its cylinder being thus filled with steam, the injection valve is opened, admitting a jet of water beneath the piston, and thus bringing a vacuum into play. In the case of rotative engines the return stroke was made by the weight of the connecting rod, crank, and a heavy pair of links attaching the hot piston to the beam, assisted by the momentum of the flywheel. The two pistons are heavily weighted in equilibrium, and the action of the steam in the hot cylinder is simply to take off the weight of the hot piston, and allow that of the cold piston to come into play. This arrangement is necessitated by the arched head and chain connection, which, though proper to receive a pull, will not admit of a thrust. In order to prevent the possibility of injection water passing from the cold cylinder to the hot one, the latter is elevated above the level of the former.

By this arrangement of two cylinders Heslop obtained advantages closely approaching those of the separate condenser, and effected a signal superiority over the atmospheric engine of Newcomen, even as it then existed with all the structural improvements introduced by Smeaton; who was compelled to admit that, in its best state, 50 per cent of the steam was wasted by the alternate heating and cooling of the cylinder.

Mr. Heslop does not appear to have been guided by any fixed rule in the relative proportionate capacity of the two cylinders. In the specification drawing they appear to be practically equal in contents, while in five instances in which the dimensions have been ascertained, the hot cylinder is invariably the larger, being respectively 8, 53, 75, 78, and 87 per cent larger in capacity than the cold one. Doubtless he found sufficient reasons for gradually decreasing the proportions of the cold cylinder, but with higher pressures of steam than were then in use, there seems no cause why these proportions might not be reversed.

In the engine described by Mr. Fletcher the hot cylinder is 34 inches diameter, with 2 feet 10 inches stroke, and the cold cylinder 25½ inches diameter, with 3 feet 3 inches stroke. The wooden beam has been frequently renewed, and a symptom of fracture in the present one is met by two pieces of old boiler plate patched over the middle portion; the present hog-backed shaped is modern, the original beam having been parallel in form. The air pump of 12 inches diameter has been an after-addition; and the shifting valve in the cold piston is plugged up, being apparently no longer necessary. A drawing, made about the year 1823, shows an air pump placed outside the cold cylinder, and worked through a double radius parallel motion, by means of a small beam attached to the end of the main beam by a long connecting link. Nevertheless the cold piston still did its work through a chain and arch head, and it was probably not till 1837 that the now existing links and cross-head guides were substituted. The original cast iron flywheel shaft has been replaced by a wrought iron one of the same dimensions. The winding gear is on a second motion shaft, which is not parallel to the first, and is driven from it by a bevel pinion on the flywheel shaft, working into an ordinary spur wheel with parallel teeth upon the winding shaft. The curiously bent connecting rod was a common feature in all Heslop's rotative engines; and though its obvious intention is to clear the hot cylinder, he contended that it gave a certain amount of elasticity which was beneficial and desirable. The cold water pump discharges itself on the top of the cold piston, from which it overflows on the up stroke into the cistern on which the cylinder is placed. This engine also pumps, by means of a cast iron beam added about forty years ago, and placed some 4 or 5 feet above the level of the main beam, to which it is connected by links.

Fifteen engines on the Heslop principle have been thoroughly authenticated. The inventor, Adam Heslop, was the son of a blacksmith, settled at Workington, and said to be a Scotchman. In company with his brothers, Adam followed the same craft, which then included what little was known or requisite in the fitting of machinery and the use of the latter. In very early life he removed to Coalbrookdale, for the purpose of improvement and experience in the neighboring iron district. When his engine was patented he was living at Kelby, near Wellington, in Shropshire. In 1798, or the following year, he founded the Lowea iron works, near Whitehaven; and so far as known, his engines were used exclusively in that region.

Effect of Boiling upon Milk.

It is well known that boiled milk has a totally different taste as well as different physiological effects from unboiled milk. According to Schreiner the peculiar odor and taste of boiled milk are due to sulphureted hydrogen, as can be easily proven. If milk is placed in a flask fitted with an upright cooler, and then boiled, sulphureted hydrogen gas escapes from the tube and will blacken lead paper. After the milk has been poured out of the flask enough sulphureted hydrogen gas will remain in it to give the reaction as well as smell. Milk that has been boiled, on standing, will not curdle as soon as that which is not boiled, as every housewife knows. But Schreiner says that it curdles sooner than unboiled milk if acids are added. He placed 10 c.c. of milk, diluted with 25 c.c. of distilled water, in a flask, and added dilute sulphuric acid containing one half gramme acid to the liter. A certain definite quantity of acid was always required to produce a visible coagulation. Fresh milk which had been boiled always took 10 to 12 per cent less of this acid than it did before boiling.

The action of rennet upon milk is also affected by boiling. He found in numerous experiments that were made with the milk of different animals, that ten times the quantity of rennet required to curdle raw milk was insufficient to produce this effect upon boiled milk of the same kind and at the same temperature (95° F.), in ten times as long a space of time. The quantity of acid or of rennet necessary to curdle a given volume of fresh milk was found to depend upon the quality of the milk, *i. e.*, the amount of dry substance, or total solids. The milk of different kind of cows kept upon the same food required different amounts of acid. If equal quantities of rennet were added to different samples of milk, the time required for coagulation at a given temperature increased with the amount of dry substance in the milk. The quantity of acid required to coagulate milk from the same cow at different periods increased regularly from calving to the time of drying up, corresponding to the constant increase of solids in the milk during the period of lactation. The total increase of solids for the whole period was 11 to 13 per cent in the Frieslander breed of cows, 12 to 16 per cent in those of Simmenthaler breed.—*Chem. Centralblatt.*

Executive Ability.

Very few men are blessed with the talent of doing more than one thing well. In the economy of nature our gifts, as a rule, are few. One may be able to plan but cannot execute, while his neighbor's executive ability is his strong point. This man is good at the wheel, but lacks financial ability; another one can design china and earthenware of superior style, but falls short of success as a business manager. Similar experiences are met with in every trade. Men may succeed in the routine of designing, and in other departments of potting, but when their success in any one of these encourages them to essay manufacturing, they are all at sea, simply because the latter position calls for the exercise of entirely different qualifications. Now and again we find notable exceptions to this rule. We meet occasionally with men who possess a combination of different and varied excellences, superior wherever they are placed; but, on the whole, such instances are rare—so rare, in fact, that the exception only proves the rule. Such men are successful. They must be, for they possess every requisite in the whole range of mechanical and executive ability. Other men, who know nothing, practically, about the details of construction and qualities of materials, sometimes succeed, but they have an executive power well developed, and, supported by a clear judgment trained by experience, they master all difficulties.

One class of men may not know how to draw the simplest pattern, but, on the other hand, they may possess good taste, which will enable them to decide whether a design is good or bad, and their discernment foretells its reception with the trade. Give them a basis and a plan, and they will complete the structure. On the other hand, those who have the practical routine thoroughly by heart, but lack the executive power, generally fail in their attempt to do business. What we wish to impress is the importance of executive talent. It is the all-powerful lever. It is not always a gift. In nearly every man there is a germ, which, with proper cultivation, will develop this train to a certain degree. Young men learning the business should study it in all its bearings, and afford it every opportunity for growth. With it success is possible, even if mechanical genius and practical apprenticeship are wanting, but without it the best workman is unfitted for independent business operations. We do not urge this point to the exclusion of others, but we know its possession is imperative. Too much knowledge concerning the details of a business cannot be had, and whatever else you lack, do not fail to cultivate the executive faculty.—*Pottery Gazette.*

AGRICULTURAL INVENTIONS.

An improved plant digger, patented by Mr. Andrew Kreider, of Annville, Pa., has a blade like that of an ordinary spade, at the upper end of which there is an eye or loop for receiving the foot. There is a socket at the top of the eye for receiving the handle.

In an improved harrow, patented by Mr. John H. Yager, of Jacksonborough, O., the harrow sections may be jointed by hinge straps of different lengths to change the angle of the sections in relation to the central axis of the harrow. Handles are applied, which may be arranged as runners upon which to draw the harrow from one place to another.

An improved machine for rolling and pulverizing plowed ground has been patented by Mr. Earl D. Fink, of Columbus, O. It consists in a roller having a surface of rods or bars which cut the clods of earth. Spiral flights or conveyors are placed inside the roller to assist in leveling the ground and to convey to the end of the roller the earth which enters through the bars.

Mr. James P. Karr, of Monticello, Ind., has patented a beehive having a broad chamber with an inclined bottom and hinged detachable frames. The honey box is supported on pins, and provided with detachable frames with intermediate glass covers. The object of the invention is to render every part of the hive accessible and to facilitate cleaning.

A Shower of Pollen.

An uncommonly heavy fall of pollen occurred in the Lehigh Valley of Pennsylvania, March 16, in connection with snow. As usual, the circumstance was widely telegraphed as a shower of sulphur—a fair illustration of the persistence of error in the popular mind. Not a year passes without one, perhaps many, such falls of pollen in various parts of the country; and every year the mistake of calling it sulphur is corrected in the more intelligent newspapers; but the delusion will not down. Under the microscope the yellow dust which fell in such abundance at Allentown and Reading proved to be pollen of the Southern pine, probably brought by the storm from the pine forests of Virginia, perhaps the Carolinas or Georgia. The blossoms of the Pennsylvania pines were probably not far enough advanced at that date to furnish the quantity of pollen observed. These minute particles are carried by the wind sometimes hundreds of miles.

Reproduction of Ancient Glass.

Within the last two years the secrets so vainly sought for of the glass-blowers of antiquity have been found out by the modern representatives of perhaps the oldest industry in Europe, and the celebrated "murrhine" of Pliny and other objects of veneration to connoisseurs are now reproduced (not imitated) by the deft and learned workmen of the Venetian Isles. So great is the gain to science, that the heads of the most famous glass manufactories in Europe (as well as most of the different *musées*) have bought at very high prices samples of these revived arts of the ancients, and the Cross of the Legion of Honor has been awarded to M. Giovanni Castellani, the Director of the Royal Society of Murano, by the French Government, for the discoveries of the society in this department of art, and for its services in connection with the recent Exhibition at Paris.

Conditions of Idiocy.

In the annual report of the Pennsylvania Training School for feeble-minded children, for 1878, two interesting facts are noted. The statistics of the institution show that a larger proportion of males than females are admitted, the ratio being greater than can be explained except on the presumption that idiocy, like other infirmities, strikes with most severity the male; also that in the order of birth nearly half the idiots are first-born children, a fact strongly suggestive of a special line of ills to which the first-born are peculiarly liable, and to which they so often succumb either in death or in chronic disease. These disadvantages, the superintendent remarks, are often a sad recountal of the young mother's unfitness either for the genesis, nourishment, or intelligent care of her offspring. It is also noted that of the whole number (288) present in the institution at this date, 150 are half orphans and 74 whole orphans. This startling fact would seem to prove the assumption of some writers, that idiocy is one of the results of a degeneracy of race, by which, after a long exposure to debilitating influences and excesses, it ends in premature death, in scrofula, idiocy, or sterility.

Success of Wood Pavements in London.

The asphaltum pavements, which were being extensively laid in London six years ago, have been mostly taken up in the business sections and wood pavements substituted. The greater portion of the Strand is now laid in wood, and it is being laid at various points of Cheapside, Fleet street, up toward the Bank of England. Some of the suburban streets are also paved with wood. A bed of asphaltum is at first laid and allowed to harden, and on this the blocks are laid. They are of hard seasoned wood and are first kyanized. After being laid, coal tar is poured in all the crevices, and when opened for travel it presents a very solid and enduring appearance. It has been in use for a couple of years in the neighborhood of Charing Cross, and it is solid and perfect as when first laid. The asphaltum caused great injury to horses, as it became very slippery in wet weather, and for this reason was removed and abandoned.