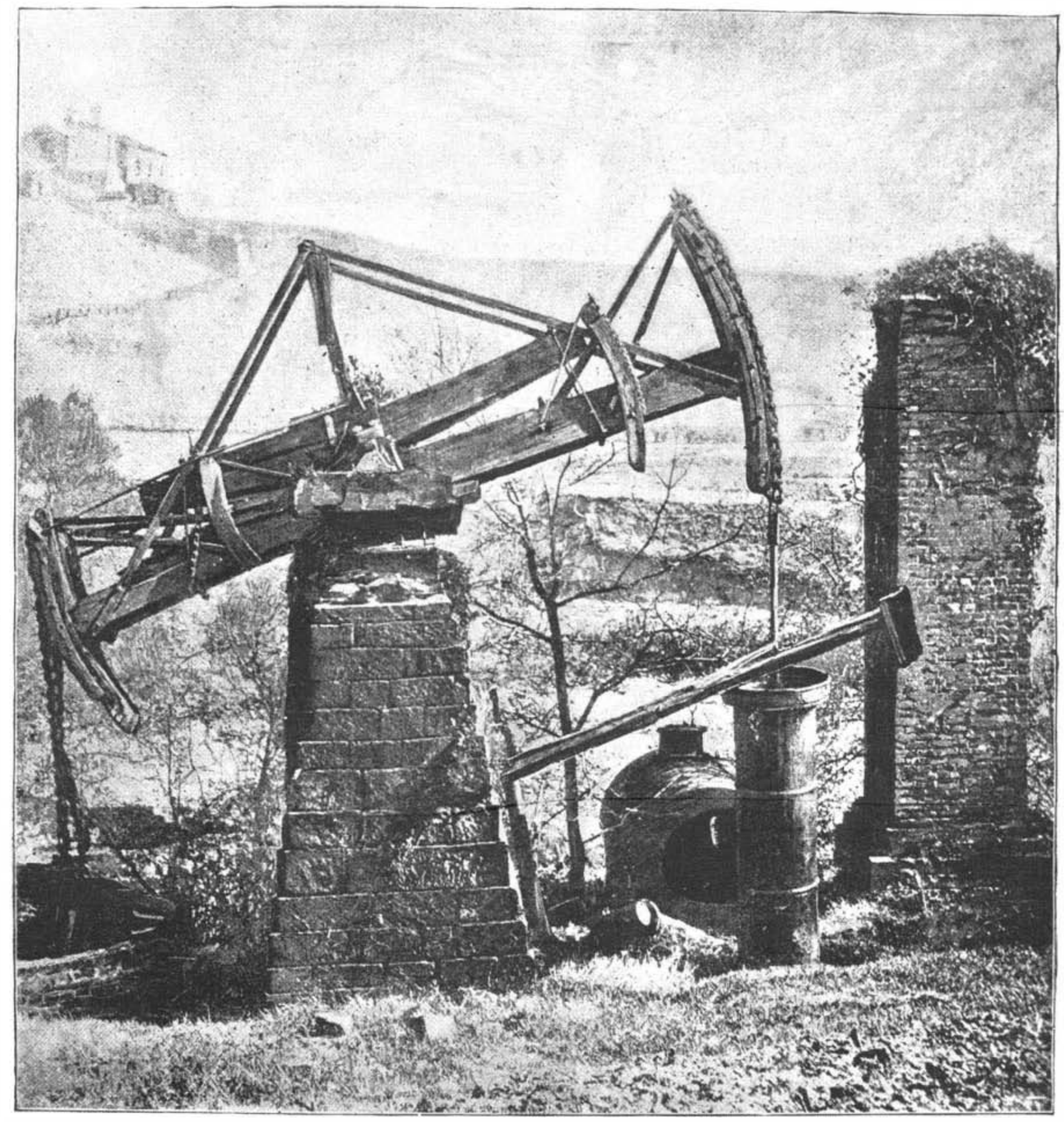
[FROM ENGINEERING.]

A NEWCOMEN STEAM ENGINE.

The steam engine long ago attained the dignity of having a history, and, indeed, an ancient history. It is to be found in museums and collections, and already many controversies have been waged over most points in its early construction. Attempts have been made, by aid of engravings and drawings, to reconstruct some of the earlier examples, so as to give the present generation a vivid idea of the triumphs of some of the great mechanical minds long passed away. Valuable as these full-sized models are, they, nevertheless, lack actuality, and there is always a doubt in the mind of the spectator of their literal accuracy. Far better it is when an actual example can be secured, and preserved for posterity. At the present moment there is a specimen of an engine built by Newcomen, of Dartmouth, in 1705, rusting away in the open air for want of a friendly hand being put forth for its preservation. It was brought to our notice by Mr. Bryan Donkin, to whom its existence was disclosed by Mr. Samuel Fletcher, of Ashton-under-Lyne, and we have pleasure in presenting our readers with an engraving showing its condition a year ago (since then the beam has fallen over). For years the engine was looked upon as one of James Watt's first productions, but recent inquiries leave no doubt that it is a steam motor of the Newcomen pumping type, single-acting. Nothing is known at all trustworthy as to its history. There are a few old residents in the neighborhood who remember its being occasionally, though not regularly, worked some 60 or 70 years ago (1834) for pumping a mine, about which time it seems to have been allowed to fall into disuse. The date of its erection in Fairbottom Valley, half way between Ashton-under-Lyne and Oldham, is uncertain, but it was probably toward the end of last century. It is still on the original site. The engine consists of a solid masonry pillar, 14 ft. 6 in. by 7 ft. 3 in. at the bottom, carrying the beam, which is made of oak, 12 in. by 14 in., braced together with iron, and has segmental ends with the balance weight at one extremity and the piston at the other. The beam, about 20 ft. long, rocks on two trunnions resting on the central masonry pillar, and the piston and pump rods are attached to it by chains. The cylinder, of cast iron, is about 27⅜ in. in diameter and about 6 ft. stroke, the steam entering only at the bottom. It is cast in one piece, 8 ft. 9 in. from flange to flange, and about 1¼ in. thick. As there was no separate condenser, condensation was effected by injecting water into the cylinder by a motion from the beam. It is impossible to say whether there were any rings round the piston, as it has not been taken apart, but probably there were none. A method often employed for keeping the joint of the piston good was to place horse dung on the top, but other materials that retained moisture, such as turf or tow, were also used. The valve gear was off a few years ago, and the pieces were lying about, but they probably could be collected. The wrought iron boiler, of the wagon type, is in a very bad condition; it is believed to be of a more recent date than the engine, and that the original was a haystack generator.

The width of the boiler is 6 ft. 3 in. at the widest part, and 5 ft. 7 in. at the narrowest, the height being 7 ft. There is a steam dome 18 in. in diameter by 14 in. deep, with an 8 in. steam pipe leading vertically out of it. There are five plates in the circumference of the boiler, and 12 rings of plates in its length, the average size of plate being 19 in. by 3 ft. 6 in. The present thickness of the plates varies from $\frac{5}{8}$ in. to zero. The pitch of the rivets is 1½ in. to 2 in.

It appears probable that this is the oldest engine in existence, but it is in a most dilapidated state. Having been so long exposed uncovered to all weathers, the beam has nearly fallen on its side, and the boiler is worn away till it is no thicker than paper in parts, with many holes. The grievous condition of neglect and disrepair into which the engine has fallen is an object of much concern to the people in the neighborhood, who would gladly co-operate in efforts to save it from rot, rust, and total destruction. The engine is the property of the trustees of the late Earl of Stamford and Warrington.



AN OLD NEWCOMEN STEAM ENGINE.

Peach Culture in Belgium.

The United States consul at Liege, in his last report, says that the kingdom of Belgium, after supplying a population of 500 to the square mile, exports 105,000,000 lb. of fruit. Last year the markets were glutted, and the value of foreign shipments rose to about £600,000. A very large proportion of the fruit shipped consisted of peaches, and of the finest varieties. In fine soil, and in situations protected from the north and northeast winds, peach trees, grown from the seed, have occasionally borne fruit; but to ascertain the best stock upon which to bud, a long series of experiments were tried and tried again upon all the varieties of prune, apricot, sweet and bitter almonds--every tree, indeed, of a kindred nature--till the conclusion was reached that the best stem for grafting is the red plum. This hardy plant, whose roots spread wide and strike deep, imparts much of its own vitality to its foster scions. Grafting or budding is done out of doors, so as not to soften the young tree by accustoming it to unnatural conditions. The next question to be considered was that of soil. In sandy and dry earth it was found that neither the plant nor the peach flourished, the one being spindling and the other small; while in rich and moist alluvial soil the tree prospered at the expense of the fruit. A calcareous soil, neither wet nor dry, is preferred by the peach, the young trees requiring a great deal of lime. As it is impossible to tell, without chemical analysis, the exact amount of this element contained in any given quantity of earth, its application must be more or less experimental. The rule in Belgium is to first thoroughly fertilize the soil with manure, and then, after planting the tree, to add a peck of lime to every cubic yard of earth, placing it near the surface. As it is necessary to loosen the earth for at least six feet square and three feet deep, this quantity—a bushel to a tree—may seem large, but the authorities are all agreed that more rather than less would be better. The application should be repeated every three years. Turning from the standard tree, which too often failed to be profitable, Belgian agriculturists experimented with espaliers, or wooden railings, but these were found to be so open and exposed that the young trees fared very little better upon them than in the orchard. They next tried the wall, not as in some countries where mural inclosures are built at great expense for the special protection of delicate fruit, but the sunny sides of their houses, and this met with such astonishing success that there are few houses to-day in Belgium upon whose southern exposed sides trees are not trained. No chateau is too grand, and no cottage too humble, to furnish them protection and support. Consul Smith says that last summer he saw ripening upon the gable end of a town house, a surface of about thirty feet square, over 2,300 peaches, and every one of them larger than a hen's egg. There were four trees, two of them with dwarf stems, not more than 12 inches high, and branches 6 feet long, radiating like the ribs of a fan, and two "riders," or bushes grafted upon tall stocks, whose boughs began to spread where the others terminated. At the time of flowering, it is always necessary to shield the buds from the action of frost, and this is done by various methods, the best of which experience has shown to be the placing, among the upper boughs of the trees, of branches cut from other green trees. This plan has been attended by good results, though it should be employed with great caution, as too much shade is apt to stifle the germs, by excluding the rays of the sun. Another method, until recently very much in vogue, and always effective, is the employment of mosquito netting, or other cheap material with meshes large enough to admit the free passage of light and air. The old custom of using closely woven cloth, like table or bed linen, at night, and removing it in the morning, is said to be more dangerous than the frost itself, as the trees at this season cannot be deprived of air without serious injury. In addition, this artificial heat at night, succeeded by the warmth of the sun, hastens their blowing, when the object is to delay it as long as possible. Shading at noon is sometimes as essential as covering at night. The poor succeed very well in protecting their fruit, by placing a number of horizontal poles about 18 inches apart, and from 4 to 6 inches from the trees, and covering them with light wisps of straw. In good situations, penthouses will sometimes suffice to protect the fruit; in any case, they are extremely useful in checking the flow of sap. Since 1876, the following addition to this method has made assurance doubly sure: A fringe, made of unthrashed rye straw, by tying the cut ends of the stalk together with twine or cord, six or eight in a loop, with spaces of about 3 inches between the wisps, is attached to a pole and suspended under the eaves of the penthouse and in front of the trees. The texture being open, it does not prevent the light and air from reaching the buds. These shields are usually placed in position about the 1st of March, and are not removed, except in cloudy weather, until all danger from frost has passed.

The Advantages of a Fad.

The man who undertakes to cultivate some fad like the growing of plants, the raising of fish, photography, entomology, boating, bicycle riding, athletic sports, microscopy, painting, drawing, music, fishing, hunting, and a thousand and one other things which may come under the head of personal recreation, has always something within his reach which makes him independent of the outside world. The boating man is forever "feeding" his canoe or yacht with paint or varnish and fittings of his own invention. The mineralogist has an endless pleasure in arranging his specimens and in obtaining those which are new. The sportsman fights his battles o'er again, and the fisherman attends to his tackle and invents "facts" to illustrate his next year's exploits. All harmless amusements, but more valuable than gold, because they take a man away from himself.—Business.

New Railway to London.

The Manchester, Sheffield, and Lincolnshire Railway Company is proceeding to work on the varioussections of their new extension to London. The contracts have all been let, and the work of clearing the large area scheduled for the London terminus in St. John's Wood will be put in hand immediately. This particular portion of the new enterprise will be one of the most extensive London clearances of recent years, no less than sixty acres being set apart for passenger station, goods yards, and approaches in Marylebone.

Coming from Finchley Road and Marlborough Hill, the new railway will run, chiefly in tunnel, beside the Wellington Road, and so underneath a corner of Lord's Cricket Ground and the Clergy Orphan Schools, across the Regent's Canal. Here the width of 124 feet, which the new line will occupy from Finchley Road downward, will spread out over an extensive tract bounded on the west by Grove Road, on the north by North Bank, on the south by Broadley Terrace and Boston Street, and to the eastward approximately by the Park Road. An offshoot will spring from the west side, running up to Carlisle Street. Here will be situated a coal station which, it is anticipated, will absorb a great deal of the London coal traffic which nowadays centers so largely at King's Cross. The company looks forward with much satisfaction to the future of these new coal sidings; a satisfaction, it is scarcely necessary to say, not at all shared by the inhabitants of this shortly to be metamorphosed neighborhood. To any one who is acquainted with the grimy purlieus of King's Cross and Battle Bridge, the alarm felt by these folk will not seem uncalled for.

Another offshoot springs from the southern side of this large area, and runs in a long and narrow strip through Blandford and Harewood Squares to the Marylebone Road. This is the site of the passenger terminus, which it is intended shall be fronted by a large hotel, after the manner of Euston and St. Pancras Stations. Alpha Road, South Bank, Boscobel Gardens, Princess Street, Omega Place, Blandford Square, Harewood Square, and a number of smaller thoroughfares will be demolished; and a new road of the commendable breadth of 60 feet will be formed from the Park Road to Lisson Grove, through Boston Street and Broadley Terrace. Another new road will be formed on the next side of the passenger station, running from the Marylebone Road and joining the other new thoroughfare at the point where the goods yards will commence.

Snake Poison.

This is the subject of an interesting article in Science Progress, by Prof. W. Halliburton, from which we make extracts as follows:

The most important class of chemical substances with which the physiologist has to deal is that of the proteids. Their importance arises from the fact that they form the most essential of the constituents of a diet, and the most constant and abundant of the materials obtainable from protoplasm and living structures generally. In spite of this, however, we know practically nothing of their chemical constitution. The physical properties of the proteids, their identification by chemical tests, their subdivision into classes according to their solubilities, and the products of their decomposition have all been pretty thoroughly studied; there also exist various theories of the way in which their molecule is built up; but there is nothing certain at present.

Not the least strange of the many puzzling facts in connection with the proteids is that many of them are poisonous. The poisonous proteids are not distinguishable by any well-marked chemical or physical properties from the non-poisonous or food proteids. When the idea of a proteid poison was first mooted it was received with incredulity; and it was suggested that the real poison was something adherent to the proteid, and if the proteid had been prepared in a pure condition, it would be found to possess no toxic properties. This hypothesis may be correct, for the methods at present in vogue for obtaining pure proteids leave much to be desired. These methods, however, improve year by year; but as they improve, the toxic power of the poisonous members of the albuminous group does not diminish, and it appears more and more certain that it is the proteid itself which is the poisonous agent.

Proteid poisons have been obtained from both the vegetable and animal kingdoms. Thus among those obtained from plants, one may mention the proteids obtained from jequirity seeds, the proteid associated with or identical with the ferment papain of the papaw plant, and lupino-toxin from the yellow lupin.

The most important of the animal proteid poisons are snake poisons; the proteids in the serum of the conger eel and other fish; and proteid poisons found in certain spiders.

Poisonous proteids are also formed during ordinary digestive processes in the alimentary canal of every one of us from the proteids taken in as food. The peptones and the proteoses or albumoses (intermediate products in the process of hydration of which the terminal product is peptone) are fairly powerful poisons; 0·3 gramme per kilogramme of body weight injected into the blood will kill a dog, producing a loss of coagulability of the blood, a fall of blood pressure, a stoppage of secretions, and ultimately death by cessation of respiratory activity. Normally animals are protected from this poison by the lining membrane of the alimentary canal, so that no proteose or peptone is found in blood or lymph even during the most active periods of digestion. The cells of this membrane possess many remarkable properties, but one of the most important is this power of regenerating albumen from peptone.

Allied to the albumoses of ordinary gastric activity are the similar products produced by bacteria. The way in which bacteria produce disease has long been a matter of dispute, but the problem appears to be approaching solution. Pathologists have at last turned their attention to the chemical side of the question, and shown that whereas in some cases the poisons produced by the growth of micro-organisms are alkaloidal in nature, in by far the greater number the toxic product is a proteid. The one which is best known, or at least attracted most attention, is the toxalbumose contained in Koch's tuberculin.

The foregoing list is far from complete, but one cannot conclude it without mentioning another class of proteid poisons: these are the nucleo-albumens obtainable by suitable methods from most of the cellular organs of the body. Originally discovered by Wooldridge, they were named by him tissue-fibrinogens, because they possess the remarkable power of producing coagulation of the blood within the blood vessels of a living animal. A very small dose will kill a rabbit or a dog, and death is, as a rule, produced by extensive clotting within the vessels, especially in the veins. Under certain conditions, however, especially in the dog, they produce the opposite result, namely, a loss of coagulability similar to that produced by peptone. Wooldridge termed this the "negative phase of coagulation."

A practical outcome of all this work is the discovery of alexines or protective proteids. These appear to belong to the nucleo-albumen class also. In small doses they confer immunity on animals to larger doses of similar poisons, and thus the long hidden secret of the modus operandi of vaccination and other forms of protective inoculation is at last beginning to be unraveled.

I propose in the remainder of this paper to consider one class only of the poisonous proteids: those which are secreted by snakes.

Dr. C. J. Martin is to be congratulated on his results, especially as the investigation was fraught with difficulties. It was impossible to procure the services of a professional snake catcher, and so it was necessary for him to do all the work himself. As he puts it, it was also necessary to overcome that dislike and dread of the serpent which is instilled into the youthful intelligence at an early age in every Christian land.

The method of obtaining the poison was an ingenious modification of that adopted by the Indian snake men. The yield of poison per bite was very small, and so considerable time and patience were consumed in getting enough material to work with.

The small quantity secreted is apparently amply atoned for by quality, the minimal fatal dose per pound weight being considerably less than that given by the Indian Snake Commission for the cobra. Some idea of this virulence may be gathered from the fact that one-thousandth part of a grain invariably kills a rabbit of five pounds weight in about a hundred seconds.

This extraordinary toxicity becomes more astounding still when we consider that the poison is a proteid undistinguishable by chemical methods from those daily used as food by all of us.

The first investigation into the chemistry of the snake poison of any importance was by Prince Lucien Bonaparte on the poison of an adder in 1843. He found that the activity of the poison was associated with that portion precipitated by alcohol; and he gave the name "viperine" to this precipitate. Dr. Weir Mitchell next turned his attention to the subject about 1860; and he is essentially the founder of our present knowledge concerning snake poison. Crude as were the methods of animal chemistry in his day, they nevertheless led him to the right conclusion that the toxic principle of the venom is albuminoid in nature. He termed it "croatalin" in the case of the rattlesnake. From that time till 1886, in conjunction with Reichert, he continued his work, and confirmed his general conclusion in the case of other North American snakes. About 1871 the Indian snakes received their share of attention; and the names of Sir Joseph Fayrer and Dr. Lauder Brunton are associated with valuable researches concerning the venom of the cobra, kraits and the Indian viper.

In the researches on the venom of the Australian black snake, Martin and Smith found it necessary to exclude various classes of poisons, as well as to determine positively the nature of the venom. They excluded in the first place by appropriate experiments the presence of micro-organisms, ferments, alkaloids, ptomaines, and crystalline acids. In the second place they showed that the poison was a proteid. The methods for the separation of proteids from one another are highly technical. It will therefore be sufficient to say that the manipulations were of the most recent and perfect kind, and pass to the results obtained. In the proteid mixture three proteids were obtained: one an albumen, and the other two albumoses. The albumen is not virulent, but the two albumoses (corresponding to proto and hetero albumoses of Kuhne) are extremely poisonous. They each have the same physiological action, and this is the same as that produced by the venom itself.

The most marked of the local effects is œdema; the general symptoms consist of twitching and convulsions in non-lethal doses. A fatal dose kills within a few seconds or minutes.

The conception put forward of the formation of these albumoses is the following:

The cells of the venom gland by a vital process exercise a hydrating influence on the albumens supplied to them by the blood, the results of which influence are the albumoses found in the venom. The difference between this process and digestion by pepsin or by anthrax bacilli is that the hydration stops short at the albumose stage, and is not continued so as to form peptone or simpler nitrogenous products like leucine, tyrosine or alkaloids. Gland epithelium is certainly capable of exercising such a hydrating influence; the conversion of glycogen into sugar by the liver cells is one of the best known examples.

Fontana, more than a hundred years ago, noticed that the blood remained fluid in animals dead of viper bite, and Brainard, writing forty years back, states that when death occurred immediately in animals bitten by rattlesnakes the blood was found at the post mortem examination to be clotted; but if some time elapsed before the animal succumbed, the blood remained fluid in the vessels. The continued fluidity of the blood has since then been noted by numerous observers in the case of various snakes.

This residue must then be examined for phosphorus. Snake venom contains no nucleo-albumen; and its action not only opens a novel aspect of the subject of snake poisoning, but also sheds light on the vexed problem of blood coagulation.

The smallness of the dose suggests that the injected material does not contribute itself to fibrin formation. Probably it acts by producing disintegration of the cells in proximity to the blood stream, such as the endothelial cells lining the vascular system. If it thus liberates nucleo-albumen from these, the conditions would be practically the same as if this toxic agent were injected from without. The venom is capable of playing havoc with the cells. This was originally shown by Weir Mitchell and Reichert.

Whether the venom causes any destruction of the white blood corpuscles is doubtful. These are massed together in such a way that their enumeration becomes a difficult matter.

The Origin of "Sprue."

Surgeon-Captain Dyson, while officiating for the Sanitary Commissioner of Bengal, has arrived at the conclusion, as the result of his investigations at Darjeeling, that hill diarrhœa is attributable to the mechanical irritation set up by small particles of mica in the water, which cannot be dissolved by any of the acids contained in the gastric juices. The Times of India adds that it thinks this explanation consistent with the symptoms of the disease, and that it may in all probability be accepted as the true one. Although it is, no doubt, true that minute particles of mica are found in the drinking water at Darjeeling, and that their presence may cause irritation and give rise to disease or diarrhœa, we can hardly believe that this explanation will apply to all the cases of this form of diarrhœa met with at different stations in India and in China, the Straits Settlements, and elsewhere. The disease has too wide a range of prevalence, its symptoms are too definite, and it continues too long after the subjects of it have left the places and climates where they contracted the disease for it to be accounted for in this way. It is not uncommon for persons, on first arriving on the hills from the plains of India, to suffer from diarrhœa and to recover without leaving their station; and it sometimes happens that others who have not been on the hills are attacked with a very similar if not identical complaint, and occasionally the symptoms of the disorder in question do not manifest themselves until after individuals have returned to this country. It can scarcely be that the geography of "sprue" is everywhere conterminous with the presence of mica.—Lancet.

A Gigantic Bird from the Eocene of New Jersey.

A very large extinct bird, about the size of an ostrich, and apparently allied to that group, is indicated by a few remains now deposited in the Yale Museum. These fossils are in good preservation, and were obtained by Dr. O. C. Marsh several years since in the upper marl beds, of Eocene age, near Squankum, N. J.