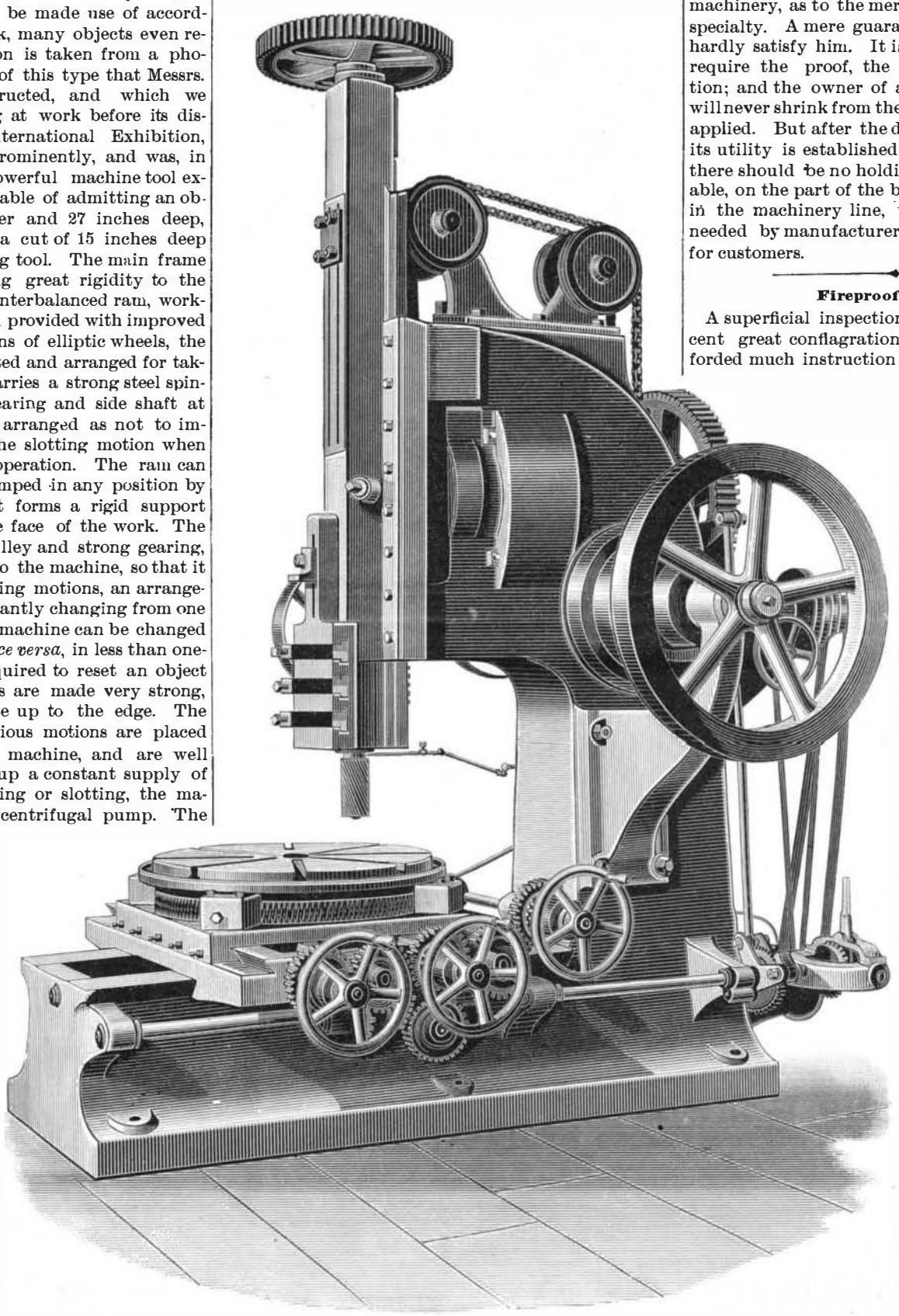
COMBINED MILLING AND SLOTTING MACHINE.

This is a new machine patented by Mr. Dixon, one of the partners in the firm of Kendal & Gent, Manchester, and it has been designed, says the *Engineer*, to combine in one machine the operations of roughing out objects with the slotting tool and afterward finishing them complete with the milling cutter, without the loss of time and, what is of still more importance, the risk of inaccuracy, due to the necessity, as hitherto, of changing and resetting work from one machine to another. A further advantage secured by the combination is that in medium sized works, where it is often difficult to find sufficient employment for a large machine adapted for slotting only, the addition of the milling motion gives so much more scope for the constant running of the machine; and, in fact, in any engineering works a combined tool of this class is more than doubly serviceable, as either operation can be made use of according to the nature of the work, many objects even requiring both. Our illustration is taken from a photograph of the first machine of this type that Messrs. Kendal & Gent have constructed, and which we had an opportunity of seeing at work before its dispatch to the Antwerp International Exhibition, where it has figured very prominently, and was, in fact, the largest and most powerful machine tool exhibited. The machine is capable of admitting an object 6 feet 2 inches in diameter and 27 inches deep, and it is adapted for taking a cut of 15 inches deep with either slotting or milling tool. The main frame is exceptionally strong, giving great rigidity to the whole, and carries a long counterbalanced ram, working in rectangular slides, and provided with improved quick return motion by means of elliptic wheels, the disk plate being well supported and arranged for taking up all wear. The ram carries a strong steel spindle for milling, driven by gearing and side shaft at the top, the whole being so arranged as not to impede in the slightest degree the slotting motion when this is required to be put in operation. The ram can be raised and lowered or clamped in any position by screw, so that when milling it forms a rigid support for the cutter quite up to the face of the work. The driving is by a large cone pulley and strong gearing, and is arranged transversely to the machine, so that it serves both milling and slotting motions, an arrangement being provided for instantly changing from one operation to the other. The machine can be changed from slotting to milling, or *vice versa*, in less than one-tenth of the time usually required to reset an object on another tool. The tables are made very strong, and are well supported quite up to the edge. The handles for working the various motions are placed together at the side of the machine, and are well under control. For keeping up a constant supply of lubrication when either milling or slotting, the machine is fitted with a small centrifugal pump. The total weight of the machine is about 11 tons.



COMBINED MILLING AND SLOTTING MACHINE.

The Panama Canal.

Dr. Arthur Gore returned recently from a trip through the United States of Colombia. Referring to the Panama Canal, he says that since the failure of the company to receive a new loan a spirit of demoralization seems to have settled down upon the whole enterprise. Nothing of any consequence is being accomplished at present.

Workmen are being discharged right and left, and auction sales of mules, carts, and other property are of frequent occurrence. It is said the sub-director-general intends to remove his headquarters to Colon, and that the Grand Hotel, built by the canal company, is to be sold. Nearly all the merchants of Panama hold "canal paper," as it is called, and the large owners are feeling very blue over the prospect in store for the enterprise. Dr. Gore is satisfied that the whole proceeding has been worked by egregious frauds from the beginning, and for the $120,000,000 already expended there is nothing to show in the way of a canal but a superficial scratch in the hard mass of volcanic rock through which it was proposed to cut a passage. Large sums of money have been spent in the construction of residences for officers, houses for workmen, hospitals, shops, tool houses, etc., nearly all of which were built by contractors who have bled the country most unmercifully. Some very handsome buildings and grounds now mark the line of the canal at the various points where it was thought best to begin operations. Gazing on these palpable evidences of extravagance, the French residents remark, "*C'est magnifique, mais ce n'est pas le canal*" [it is magnificent, but it is not the canal]. The surveyors' stakes were supplied under contract for $25 apiece, and all the other preliminary arrangements have been made on a scale and at a cost that would bankrupt a company with anything less than the "wealth of Ormus and of Ind" at its back.—*N. Y. Sun.*

Manufacturers and Machinery.

Men who conduct great business enterprises, says the *Manufacturers' Gazette*, are naturally conservative and averse to innovations and experiments. And yet it is through experimental knowledge, acquired by reducing theory to practice, that all progress in the useful arts is made. But it is not the business of the purely practical man to theorize; he is concerned only with actual results, and is satisfied to leave "well enough alone."

There are hundreds of fossilized mill owners who dread the appearance of the inventor with his new machine as the sick man dreads the potion of physic or the surgeon's knife which is to cure his infirmities and give him a new lease of life. He would rather be let alone and plod along in the same old beaten track which leads to no progress, provided his contemporaries in the same line of business are content to do the same. Even if it can be demonstrated that the new invention is one in the interest of true economy, and will pay for itself ten times over in the course of a few months, he is reluctant to investigate its merits, and don't care to experiment with it. He can only be interested on compulsion. Especially if its adoption would involve any considerable immediate outlay, he can't see any good in it, and won't touch it until compelled to do so by the action of some more enterprising and progressive rival, who "knows a good thing when he sees it," and who believes that "the best is the cheapest" in the long run.

It is undoubtedly true that the continual improvements in machinery involve frequent changes, which are sometimes expensive and burdensome to manufacturers.

Of course, we do not recommend the practical manufacturer to grab at every new patented machine which comes along, regardless of merit. While open to conviction and ready to investigate, he also needs to be cautious, deliberate, and discriminating in his action, in order that he may be sure to get the best, and not throw away his money on mere pretentious and catchpenny devices. There is no danger of his being deceived or imposed upon if his investigation is properly conducted. He is not called upon to take the word of any man, however well known or expert in machinery, as to the merits or capabilities of any new specialty. A mere guarantee of certain results should hardly satisfy him. It is not unreasonable for him to require the proof, the practical ocular demonstration; and the owner of any really meritorious patent will never shrink from the real test, however rigorously applied. But after the demonstration is complete and its utility is established beyond doubt or question, there should be no holding back, if terms a rereasonable, on the part of the buyer. A new and good thing in the machinery line, which is really wanted and needed by manufacturers, will not long go a-begging for customers.

Fireproof Construction.

A superficial inspection of the ruins left by the recent great conflagration in Clerkenwell, London, afforded much instruction as to the behavior of different kinds of building materials in resisting the action of a fierce fire. The buildings destroyed upon this occasion were mostly filled with wares of a highly inflammable character—such as toys, furs, clothing, paper, etc. In some places where the fire raged fiercest, and whence it extended in all directions, as from a center, everything had disappeared from the site except a heap of crumbling bricks—not even the mortar remained. Some brick walls continued standing near these places; but they were split and shaken from top to bottom. Further off were brick party walls, standing firmly enough themselves, but inclosing areas open from basement to sky, and destitute of front and back walls. Beyond these came the shells of houses, from which all the interior had been burnt out. It appeared from this scene that there is in conflagrations a point of intensity at which the best brickwork fails, although this is a point far beyond the durability of stone, concrete, or ironwork structures. Fireproof construction is, in fact, a term which can only be used in a comparative sense. At the same time, there are degrees in the capacity of materials to resist fire which do not always appear from a cursory appreciation of the nature of the material. Thus, among the ruins at Clerkenwell, there were many specimens of timber brest-summers which had failed and fallen rather from the yielding of their supports than from their own ignition. Provided that it is in sufficiently solid pieces, and shielded from air currents, timber is, for all structural purposes, more reliable in a fire than either stone or iron. Wrought iron girders fail at a comparatively early stage; and it is a question whether, for the support of shop and warehouse fronts, etc., solid timber posts, properly shielded, would not be preferable to iron or stone.—*Journal of Gas Lighting.*

IN a case of alleged epithelioma involving the facial bones, with extensive infiltration of the tissues, where an operation was not deemed desirable, Dr. Antonio, of Mazzara del Vallo Maggio, applied an ointment consisting of 15 parts of resorcine to 20 parts of vaseline twice a day, with the result, it is said, of completely curing the disease; nothing remaining but a white scar a centimeter in diameter.—*British Medical Journal.*

Honors to Professor Hughes.—An Interesting Speech by Him.

The anniversary meeting of the Royal Society was held at their rooms, Burlington House, on the 30th of November. Students of electricity will welcome the announcement that a royal medal was awarded to Professor D. E. Hughes, F.R.S. At the anniversary dinner, the president, Professor Stokes, mentioned the presentation of the royal medal to Professor Hughes, and proposed a toast to the recipient, to which Professor Hughes replied as follows:

Mr. President, my Lords, and Gentlemen: I cannot hope to find suitable words to express my thanks for the kind manner in which you have responded to the toast proposed by our president, Professor Stokes, nor sufficiently thank him for the flattering terms in which he has mentioned my researches. The numerous experiments which led me to the invention of the microphone are based upon the discovery I made of the remarkable property of loose electrical contacts. If we make a bad joint or loose contact in an electric conductor, we find that not only do these disjointed conductors vibrate in unison with the atmosphere, but in vibrating they produce an enormous variation in the strength of the electrical current. And if we join a telephone in circuit, we find that every word spoken to the loose contact is repeated with absolute perfection. An equally remarkable fact is the reversibility of the effect, so that a loose electric contact will repeat in sound any variation of current passing through it; consequently, we may speak to one loose contact and listen to a second, when every word spoken to the first will be clearly heard. The greatest power of sound, however, is obtained when used with a telephone, and the augmentation of sound is greatest when the original sound is most feeble. In order to study the effects of feeble sounds, I at first listened to the ticking of a watch; and after making the microphone more sensitive, I was desirous of listening to sounds below the power of the human ear, such as those produced by the walking of a fly. This succeeded perfectly, but, unfortunately, flies were scarce at the time I was experimenting. I then studied sounds still more feeble, such as the sounds produced in a copper wire at each passage of an electric current—sounds which no human ear has heard direct, but which, by the aid of the microphone, are heard as a clear, ringing sound, due, I believe, to molecular motion in the wire itself. The microphone not only augments feeble sounds, but it will transmit the most complicated sounds of speech and music with absolute perfection. It has also been employed in physical, medical, and mechanical researches, and in France it has been of service to humanity in listening through the rocks to the sounds made by entombed miners, and by its indications encouraged the aid which finally saved them. The molecular sounds which the microphone revealed led me to invent an instrument which should penetrate inside of a metallic body, and reveal any change in its structure. This I accomplished in my induction balance. In this instrument induced currents from two separate coils are opposed and balanced with each other; but this balance of current is so sensitive that the slightest disturbance or reaction produced by the introduction of a piece of metal in one of the coils destroys the equilibrium. The amount of disturbance can be measured and the balance restored by the introduction into the second coil of a similar piece of metal or by an equal reaction. If we could find two equal pieces of metal, such as coins, they would balance each other; but in practice the instrument is so sensitive that it points out differences in two similar coins fresh from the mint, or in two pieces of equal weight cut off the same bar, due either to a slight chemical or molecular difference in the structure of the metal. Any physical or mechanical change, such as that produced by heat, magnetism, or strains, is at once declared; and it is particularly sensitive to such changes in iron or steel. A curious example of its sensitiveness to iron occurred at the Paris Electrical Exhibition. Elisha Gray, the inventor of the harmonic telegraph, told me that fifteen years ago a small iron filing had penetrated his finger, giving at first some pain, but the filing and pain soon disappeared. He was anxious to know if the filing was still in his finger. I told him to place each finger successively in the induction balance, which he did, and all fingers gave perfect silence except one. This finger, however, immediately acted on the balance. producing loud sounds, and this finger proved to be the one which had been injured by the filing. So there could be no doubt that the filing still remained after a period of fifteen years. If we place an iron bar or rod in the coils of the balance, we find that no two portions of the bar are exactly the same, and the slightest flaw, strain, or crystallization of the iron is at once detected. Now, if we could apply this method to locomotive axles, we should be able to detect, in advance, any defect, and thus prevent the numerous accidents which occur on our railways from this cause. At present we cannot do this without first detaching the axle from the locomotive, but I hope some day of finding a modification of the balance which will overcome this difficulty. The electric sonometer aids the induction balance by comparing sounds from an absolute zero to any desirable extent, and it has been found most useful for measuring the power of hearing in those partially deaf. To cite a single example: Dr. Richardson, F.R.S., lately published an account of a youth who had been very deaf for many years. On being observed by the aid of the sonometer, the sonometer indicated that the cause of deafness was that of a solid obstruction, and upon operation a stone or pebble, was found in the ear, which had been there unsuspected since childhood. On the removal of the pebble, the hearing was immediately and permanently restored. I will not detain you by speaking of my researches in electricity and magnetism, nor of the many remarkable effects of the microphone and induction balance, but I am proud to say that all these instruments and researches were first presented to the world through the *Proceedings of the Royal Society*. I am deeply grateful to Dr. De la Rue for having on many occasions assisted me with his valuable advice, and allowing me to make use of his magnificent laboratory whenever the nature of my experiments needed such aid. Allow me to express my sincere thanks for the great honor conferred on me this day, and for the kind manner with which you have listened to my remarks.

[How to Construct a Microphone will be found fully illustrated and described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 163. How to Make the Induction Balance, in SUPPLEMENT, No. 196.]

Conditions of Success in Life.

In a recent address before the Georgia State Medical Association, Dr. Searcy stated that the physiological conditions of success in life depend mainly upon a vigorous, healthy action of the brain and nervous system. It follows, therefore, that the structural integrity and functional capacity of the brain are matters of the deepest importance, and their preservation and improvement are of vital moment. The author believes that much would be accomplished, could we discover the ways in which the brain capacity is increased and lowered. The problem is a most delicate one, for up to a certain point the receptivity of the brain is directly proportional to the strain already brought to bear upon its capacities. An even balance between the brain functions is an essential element. The superior man must have the ability, not only to comprehend, but, in an equal degree, to discriminate; he must be able to select for a purpose. Besides the ability to learn, a man, to be successful, needs the power to verify his learning, to deduce his own conclusions, and to execute his purposes with persistence.

A simply erudite man is not necessarily successful. On the contrary, he is often the reverse, a perfect failure, for lack of the saving virtue of common sense. The capacity to receive is of small value unless it be coupled with an ability to adjust, arrange, and impart. It frequently happens that a man who is simply a scholar and nothing else is at an absolute disadvantage in the presence of an unlettered man who is blessed with an inherent excellence of capacity in the three departments of brain action. One need not be educated to possess this trait, though it is the addition of education to such natural gifts that brings distinction. It is not an exaggeration to say that many a man of eminence has had occasion to envy his humbler associates the possession of those so-called commoner merits which would have given his own attainments a greater availability. Nature apparently requires a certain amount of the concrete to maintain a mental equipoise. The man who can learn, reason, and execute with equal facility possesses the elements of success, even though his qualities be of but an inferior order; while one who has any of these faculties abnormally developed at the expense of the others will always be crippled by the absence of the essential features of a successful life.

Telephoning from Lightships.

An experiment of the greatest importance to the commercial world is now being made on the east coast of England by the Telegraph Construction and Maintenance Company. For the last eight months the company has had several of its best operatives located in the neighborhood of the Naze, off which the most dangerous sands round England are to be found. These gentlemen are hourly in communication by telephone with a lightship which is anchored ten miles out, in the vicinity of the Swin passage. An ordinary telegraph cable has been laid from Walton-on-the-Naze to the Sunk Lightship, and telephone and telegraphic apparatus have been affixed to both ends.

It was considered improbable that the human voice would be conducted ten miles, especially in rough weather; but this has been now proved to be thoroughly practicable. A conversation was carried on with Mr. Stevenson, one of the Telegraph Maintenance Company's officials (who was on board the Sunk Lightship), by telephone, for a considerable time. Mr. Stevenson had been a month upon the boat, and had experienced all kinds of weather, during which time he had kept Mr. Lewis and Mr. Pinkerton, his colleagues on shore, fully informed of the state of the weather, roughness of the sea, and passing craft, adding frequently forecasts of weather, which usually turned out to be correct.

A month upon the lightship is a trying ordeal; but Mr. Stevenson was so satisfied with the success that attended the experiment, and knowing, if the advantage of telephonic communication with lightships was understood and generally adopted, what a splendid boon it would be to mariners and merchants, that he spent his time busily in collecting information, and watching the working of his electrical machines. In a back room of the Walton post office are machines for utilizing magnetic currents of all descriptions. A button is touched which rings a bell in Mr. Stevenson's cabin upon the Sunk Lightship, ten miles away; then a voice, that of Mr. Stevenson, is heard inquiring what is wanted. "How is the wind?" "How is the tide?" "Have you seen such and such a ship pass?" "How much water is there in the Swin passage?" These questions can be answered at once. Or the following is transmitted: "Signal such and such a ship that she is to put in at Harwich."

Every ship passing is duly signaled, and her name and description telephoned to the Walton post office. On an average, ninety ships pass in the day, and if it was known that messages could be sent ashore, no doubt the majority of these would avail themselves of the benefit. A considerable number of the ships passing have come great distances without passing one of Lloyd's signaling stations. The signaling of these passing the Sunk Lightship would be of great commercial value, as their time of arrival at any port they were bound for could be timed by the owners in London accurately, and everything could be made ready for the landing and the sale of the cargo.

Of much more importance is the use the telephone could be put to in a storm, or in the case of a ship getting on the sands. One night last year, in a rough sea, a ship did get on a sand bank, and instantly her exact position was telephoned to Walton from the lightship. The gentlemen at Walton awoke the lifeboat crew and telegraphed to Ramsgate and Harwich, where the lifeboats were got ready for launching. Just as all three lifeboats were about to start, a telephone message came from the lightship that the ship in distress had got safely off the sand bank, and that there was no need for the lifeboats to start. The boats were stopped, and if it had not been for the telephone they would have been out on the rough sea all night searching for the ship that sent up distress signals. If all the lightships around the coasts of Europe had this means of communication to point out the exact position of a ship in distress, a great number of lives would be saved, as the position of many ships foundering cannot be indicated with any certainty by the ordinary rocket signals. Besides the above uses of the telephone with lightships, all passing ships in quest of a pilot to navigate them through dangerous channels could without difficulty telephone their desires to shore.

The Sunk Lightship is only 150 tons, and yet only once in the stormiest sea, when she had been tossed about in a gale of wind, has the telegraph wire been broken. The two ends at the break were picked up and rejoined within twenty-four hours. She is moored in ten fathoms of water, and is manned by a captain and six to eight men, all of whom express their most earnest approval of the intercommunication with the shore, whereby they can make known, at once, their own and the wants of others. During the night, communication is as open as in the day. The Trinity Board is showing considerable interest in the experiment, and it is hoped that it will see the great importance of at once putting, by this means, the chief lightships in communication with the shore. It is stated by the gentlemen engaged at Walton that the telephone will act over twice ten miles; and there is no reason why some day it should not act over much greater distances.—*London Times.*

Manufacture of Writing Materials.

At a meeting of the Academie des Sciences, M. De Boutarel read an essay upon "Paper and the Industries connected with it," in the course of which he quoted some statistics as to the rapid increase in the quantity of pens, paper, pencils, etc., which are manufactured in Europe and the United States alone. M. De Boutarel says that the manufacture of paper, which at the beginning of the century was practically *nil* in the United States, now amounts to 500,000 tons per annum, and that it is just double this figure in Europe; the value of the straw, rags, and other materials used in the manufacture of the paper being £20,000,000. M. De Boutarel estimates the value of these 1,500,000 tons of paper, when manufactured, at £40,000,000; the note paper being calculated at 120,000 tons, worth £6,400,000. M. De Boutarel estimates the value of the steel pens manufactured annually at £800,000; while the number of heliotype plates may be safely estimated at 3,000,000—thirty Paris houses alone turning out 900,000.