ACCESSION No. 799

and one which, if persisted in, must prove fatal to its attainment of that position amongst scientific bodies to which the professional standing of its members justly entitles it, and under present circumstances we should not be doing our duty if we neglected to bring prominently before the notice of all members the importance of the present crisis in the affairs of the society.

It is, we think, undeniable that the Institution of Mechanical Engineers is at present far from holding the position to which its composition entitles it, and the cause of this is not difficult to discover. In order that any scientific society may possess material influence, it is in the first place necessary that it should be composed of men of greater or less eminence in their profession, and secondly, that it should take a prominent part in the discussion and settlement of questions of importance to the profession to which it relates. Now, we do not hesitate to say that as far as this latter qualification is concerned the Institution of Mechanical Engineers fails utterly. Let any one who doubts this examine the volumes of *Proceedings* for the last few years, and compare the papers and discussions which they contain, with those of the Institution of Civil Engineers or of the Iron and Steel Institute for the same period. In the first-mentioned case he will find many carefully prepared papers containing valuable data mingled with many others which are little more than descriptions of patented inventions which had previously been fully described in the professional journals, while in but few cases will he find any discussion worthy of the name. In the Proceedings of the two other Institutions named, on the other hand it will be found that the discussions occupy a most important place, and this because the matters brought forward are of general professional interest, and because when an important question is at issue ample time is allowed for its discussion. That this difference is not in any way due to an absence of subjects which the Institution of Mechanical Engineers could profitably discuss is amply proved by the fact that subjects of a strictly mechanical nature are brought before the Institution of Civil Engineers, and lead to extended discussions, maintained largely by men who are also members of the Birmingham Institution. Mr. J. Robinson's paper on the construction of locomotives, Mr. Culley and Mr. Sabine's paper on the pneumatic transmission of telegrams, Mr. W. R. Browne's and Mr. W. A. Adam's papers on the construction of railway wagons, Mr. Head's paper on traction engines, and many others, are instances in support of what we say.

That the above-described state of affairs should exist is only a natural consequence of the policy so far adhered to by the Institution of Mechanical Engineers. Holding the bulk of its meetings, and having its head-quarters at a provincial town, it has come to be regarded widely has a provincial and not a national body, while the miserable attendance at the majority of its Birmingham meetings has deterred members from the trouble and cost of preparing papers which run the chance of being read to two or three dozen people, and then passed over almost without notice. The first step for remedying this state of things is, as we have said before, that the head-quarters of the Institution should be shifted to London, and that we hope most earnestly the present movement with that object in view will meet with the success it deserves. That the feeling of the great bulk of the members is decidedly in favour of the change is proved by a memorial before us, this memorial asking the President and Council of the Institution "to consider the question of removing the head-quarters of the Institution to London, and, if necessary, to ascertain, in such manner as they think best, the opinion of each member on the question." This memorial is signed by 558 members out of a total of 943 on the books, while eight have declared themselves neutral, and but 22 are opposed to the memorial. From 246 members no answer has been received, while 31 are entered as belonging to the Council, and 109 as dead, resigned, or too far off to communicate with. At the meeting next Thursday the question will have to be decided by personal vote, the convenient practice of voting by proxy not being provided for by the rules of the Institution, and hence it behoves all members who value the interests of the Institution to be present on the occasion, and for once not to let themselves be deterred by the inconveniences of a visit to Birmingham.* It would be very greatly to be regretted if a step so vital to the future position of the Institution was to be indefinitely postponed in opposition to the wishes of the bulk of the members, simply because there happened to be at the ensuing meeting an insufficient attendance to nullify local influence.

* We may state that for the convenience of members resident in London, a special train on the Midland Railway has been secured for Thursday next. This train will leave the St. Pancras Station at 10.5 a.m., calling at Bedford at 11.20 a.m., and Wigston at 12.35, arriving at Birmingham at 1.20 p.m. The return train will leave Birmingham at 8.5 p.m., and arrive in London at 11.18 p.m., calling on its way at Nuneaton and Bedford. The train will be composed of Pullman cars, which have been kindly placed at the disposal of the members by the Pullman Palace Car Company. Another special train of Pullman cars will leave Manchester for Birmingham at 2 p.m.

ALEXANDER BAIN.

ANOTHER of the early telegraphic worthies has passed away. The newspapers of last week chronicled the death of Alexander Bain, at the Home for Incurables, Broomhill, near Glasgow. To English and American electricians everywhere the name of Bain has long been "familiar as a household word." His remarkable native genius for invention, and the melancholy story of his life, have given rise to a great deal of kindly interest in him and his welfare. In some respects Bain may be considered the Burns of invention. He was born of poor parents at the small town of Thurso, in the extreme North of Scotland, and he was wont to relate how one night, when he was a boy of twelve, he went to hear a penny lecture on science. This set him a thinking, and proved the impulse which determined his whole future career.

Bain learned the trade of clock-making, and went to Edinburgh. Here in trying to apply an electric current as a motive power for clocks, in place of weights and springs, he was led to the invention of the electro-magnetic pendulum, which moves the clock instead of being moved by it as in ordinary clocks. To yield the very weak current necessary for this Bain hit upon the plan of sinking plates of copper and zinc in the ground, relying on the moisture as an exciting liquid. But this earth battery proved unsteady from drought and polarisation, so the clock was not generally successful. His electrically-moved pendulum, however, suggested to Wheatstone the idea of an electrically controlled pendulum, which has been successfully worked out by Mr. Jones, of Chester, and by which means the standard clock in Greenwich Observatory controls the public clocks throughout the country.

Bain then went to London, and here between the years 1841 and 1846 in the short space of five years he produced a series of elaborate patents containing all his great improvements; an instance of power and fertility of genius perhaps unparalleled in the history of invention. In 1838 Steinheil, of Munich, had made his great discovery of using the earth as the "return" wire in a telegraphic circuit. Bain independently invented the use of "bodies of natural waters" for the same purpose, and published it in 1841 in a patent for "improvements in applying electricity to control railway engines and carriages, to mark time, to give signals, and to print intelligence at different papers." In 1843 he published his reinvention of the "earth-battery" which Steinheil had also anticipated him in. In 1844 he patented a log for measuring the speed of ships by revolving vanes and an ingenious method of electrical registration of its results on board. The same patent describes the fire alarm thermometer now so commonly used, in which the mercury rising to a certain point closes an electric circuit and rings a bell.

Others of Bain's patents relate to his electric clocks. He had also a method of playing organs and other keyed instruments at a distance by means of electricity; and it is in one of his patents that we first find a coil of wire freely suspended in a magnetic field employed as the moving body of a telegraphic receiving instrument. This principle has been admirably turned to account of late years in Sir William Thomson's siphon recorder.

But the greatest, or at least the best known and most valuable invention of Bain, is his electro-chemical telegraph, now temporarily discarded in this country for the Morse ink-marker, but coming rapidly into favour in America, where it is doing some astonishing work. In Bain's chemical marker the current from the line passes down a steel stylus, then through the strip of travelling paper to earth. The paper is soaked in a solution of nitrate of ammonia and prussiate of potash, which the electricity decomposes, leaving a blue stain. The marks differ from the Morse only in being thus chemically produced. But the merit of the Bain over the Morse lies in their being no mechanism to move, so that time is saved, and a very high speed of working admitted of. Owing to the motion of the marking wheel by electro-magnetism in the Morse its speed of recording is limited to about 40 words per minute. We heard from Sir William Thomson at the Glasgow meeting of the British Association in September last that he had seen in America "Edison's automatic instrument telelegraph 1057 words in 57 seconds, this done by the electro-chemical method of Bain." It is generally believed by electricians here and in America that there is a great future still before this hitherto neglected system.

Another striking novelty of Bain's, which has been turned to excellent account in other hands than his own, is the automatic sending of messages by means of a strip of perforated paper. The message is first punched out in a series of holes in the paper, which is then passed through the transmitter at the speed required. The paper, rendered discontinuous by the holes, makes and breaks the circuit, allowing or stopping the current from entering the line. This plan has been utilised by the late Sir Charles Wheatstone in his automatic transmitter for land lines, and also by Sir William Thomson and Professor Jenkin in their automatic curb sender for submarine cables.

After this splendid outburst of invention, Bain seems to have done little. We believe that he about this time realised a considerable fortune by his inventions. He went to America, but soon returned again. He was ever afterwards in poor circumstances. Latterly his health gave way, and those who saw him a few years ago in Glasgow, could not but remark the apparent wreck to which the massive forehead and the sturdy frame had come. It ultimately became necessary to afford him money help. The Royal Society granted him 150*l*. Through the agency of Sir William Thomson, Dr. C. W. Siemens, Mr. Latimer Clark, and others, a pension of 80*l*. a year was secured for him under the Civil List in December, 1873. It was some time after this before they were able to find the beneficiary out, he was living so retired. Quite recently he was stricken with paralysis of the legs and removed to the Home, where he died at the age of 66. Mr. Bain was a widower, and left two children,—a son now in America and a daughter now on the Continent.

It has been said that Bain came before his time, and lived unrewarded while the world benefited by his works. But we believe it may be said of him as Carlyle said of Burns, it was not wholly his outward but in part his inward misfortunes that kept him poor.

TORPEDOES AND THE CENTENNIAL.

IT was natural to expect that a mode of warfare which played no unimportant *rôle* in the American civil war should find a suitable place in the late Centennial Exhibition; and, accordingly, among the various objects that filled the Government Building, few formed a more conspicuous collection than these engines of destruction. To facilitate description, we may divide these exhibits into three groups, namely, the towing, the spar, and the automatic torpedoes.

The towing torpedoes exhibited were chiefly constructed on Captain Harvey's type. Two of these were shown with their ropes and buoys in order to give some idea of how they are placed and secured in position. As they are to be fired by contact, they must be maintained near the surface of the water. When they strike against an obstacle, one or more projecting levers are released, and drop with a sudden blow upon an underlying bolt. The percussion is thence transmitted to the charge, which instantly explodes, shattering the object encountered.

The Barber torpedo is modelled on the Harvey, and claims to be an improvement on its prototype. The long lever-arms are suppressed, and are replaced by six fuzes projecting at various angles from the surface of the powder chamber. The explosion is effected either mechanically by collision, or electrically through the conducting wires forming the core of the towing rope. The torpedo is kept at the required level by means of fins adjusted in the rear of the shell. Buoys are thus dispensed with, and the torpedo is in consequence less easily observed by the enemy.

The spar torpedo consists of a strong iron chamber, enclosing the explosive, and is carried at the extremity of a long thick spar from which it derives its name. This torpedo necessitates the use of a steam launch provided with special fittings for

ACCESSION
No. 759
2/2

the rapid protrusion and withdrawal of the spar. When driven against the enemy, the torpedo explodes mechanically, and at the same moment snaps its connexion with the spar, which is immediately drawn in and prepared for subsequent use. In order to facilitate the rupture, the short metal plate which proceeds from the proximate end of the casing and is lashed to the spar, is made of cast iron and sufficiently thin to yield to the concussion without offering any considerable resistance. Four of these torpedoes were exhibited, two carrying a charge of 75 lb. of powder each, and two others of 100 lb. This interesting collection also included a model of a steam launch with its special appliances, and a spar 45 ft. long which did good service in the late civil war.

We have now come to the third and most important group of torpedoes, viz., the automatic, or self-propelling, of which there were three specimens. The most conspicuous, by its bulk, was that called after its inventor, the Lay torpedo. The shell is somewhat spindle-shaped, 28 ft. 3 in. long and made of boiler iron. It is divided into four compartments. The forward one, technically known as the nose, contains the charge of explosive material, viz. 300 lb. of powder, or 75 lb. of dynamite. The second in order contains the motive power, which consists of carbonic acid gas generated in the usual way by the outpouring of sulphuric acid (from three flasks) on a carbonate. The gas, which has an initial pressure of forty atmospheres, is conducted from the generating apparatus through iron tubes to the engine, which is filled up in the fourth compartment. The third section contains a roll of ten miles of insulated wire, which is paid out from the reel itself and serves to keep up electrical connexion with the firing station. The torpedo is entirely under the control of the electrician, who, by means of a series of contacts, opens or closes certain valves and thus increases or diminishes the speed and stops or steers the torpedo as circumstances may require. The torpedo is submerged to about four-fifths of its volume, and cleaves its way through the water at an average rate of ten and a half knots an hour. It may be fired either by contact or by closing the electric circuit. Its position is always known by the slender guide-poles, which project from its upper surface. In recent experimental trials made at Newport, Rhode Island, the American torpedo station, it was sent out a distance of a mile and a half, thus proving its superiority over other machines tried of the same class.

The next in size was the Ericsson torpedo, 13 ft. in. long, with a shell made up partly of wood and partly of iron. It is propelled by pneumatic pressure produced by strong condensing air-pumps erected at the firing stations. The air is led through a stout hose, which is gradually paid out, to the engine situated within the body of the torpedo. This is connected with a double screw whose rotation produces the necessary propulsion. The driving power consists in reality of two screws revolving in opposite directions. This contrivance was adopted in order to neutralise the effect of the water, backlash, on the rudder. The depth of immersion varies from 6 ft. to 15 ft., and is attained by setting the "diving pins" at an appropriate angle. The charge consists of 200 lb. of powder; it is lodged in the nose and fired mechanically. Some ingenious mechanism has been devised by means of which the movements of this machine may be regulated, so that, applying different pressures, the speed may be varied, and the torpedo may be stopped or directed at pleasure. The secret of the arrangements necessary to effect this, has not been inspired. Owing to the weight and length of the gear, it has not been found practicable to send this torpedo to a distance exceeding a few hundred yards. In the frequent experiments made by the United States Navy, but little success was obtained in steering this torpedo.

The last was the "fish" torpedo, so called from the resemblance of its general outline to a typical fish. The motive power is air condensed in a strong chamber within the shell to thirty atmospheres. From this chamber, the air is conducted through strong tubes to the screw. The depth of immersion is regulated by lateral pins. This torpedo explodes on contact. It is not steered, but launched forward in the direction of the enemy. Should it fail to strike, it will continue on its onward course until the air is exhausted and then it will sink.

The collection also included several pieces of apparatus used in connexion with torpedo warfare. The most important of these were fuzes, showing the various modifications required in their construction, according as they were to be fired by frictional electricity, by a galvanic battery, or by a dynamo-electric machine. There were several detonators of various types, the predominating consisting of mercury fulminate surrounding a small charge of gun-cotton, the whole being enclosed in a powder chamber of small dimensions. In addition to these was a number of circuit-closers of the well-known kind, in which, when the torpedo is slightly tilted to one side, the displaced mercury completes the electric circuit. The dynamo machine universally used is that patented by Moses G. Farmer, the Government electrician at the torpedo station. The current produced by this instrument is said to be more powerful than that produced by Siemens and others, while the apparatus itself is supposed to be more reliable in practice.

This collection attracted a large share of public attention, partly by the novelty of the numerous exhibits, and partly, too, by the facility with which information could be obtained from Lieutenant Thomas, who had the superintendence of this section of the Exhibition.

PATENTS.—No. XII.

NOTES FOR THE GUIDANCE OF INVENTORS.

By W. LLOYD WISE, A.I.C.E.

BELGIUM—*continued.*

Laws, &c., relating to Patents.—The Belgian Patent Law is dated May 24, 1854. A law was passed dated March 27, 1857, which slightly modified that of 1854, by allowing a delay of six months for the payment of the annual tax with the addition of a fine of ten francs. The practice of the Patent Office is governed by a royal decree, dated May 24, 1854. By the provisions of the law of 1854 patents are granted without previous examination either of the novelty or of the merit of the invention, and at the risk and peril of the inventor. This is the substitution of the repressive for the preventive system which formed the basis of the old law of January 25, 1817, which law caused great dissatisfaction owing to the unjust manner in which it operated, as the arbitrary decision of one man or a few men decided on the fate of an application for Letters Patent.

Grantee of Patent.—There is no preliminary inquiry as to the right of any applicant to receive the patent he seeks. Hence it would seem that any person or persons making application in due form may obtain a patent. A patent, however, so granted is not necessarily valid. The law does not distinctly specify who may and who may not be grantees of such a privilege. But this may be inferred from the stipulation contained in the law relative to the validity of a patent; the invention must not have been commercially worked in Belgium by others previously to the application being filed, it must not have been published in a printed work, and it must not have been patented in Belgium or elsewhere, and though there are exceptions to the two last points, it may be taken that the patentee must either be himself the inventor or the possessor of an invention unknown in Belgium, which has not been published (except in an official publication) and which has not been patented at home or abroad, unless the Belgian patentee be also the foreign patentee or his assign.

A patent may issue to several persons jointly, whether they be joint inventors or otherwise. Leading authorities have expressed the opinion that minors, married women, and even lunatics and persons under interdiction or privation of the exercise of civil rights, may obtain valid patents. Resident foreigners and non-residents, natives of foreign countries, may also obtain good patents in Belgium. It does not appear that a patent could be invalidated on the ground that the subject matter was the invention of another person, and had been appropriated by the grantee in fraud of the actual inventor. Notwithstanding that (as hereafter appears) a patentee is required to put his invention into practice within a certain period, a valid patent may be obtained by a person legally unqualified to work it, as, for example, a patent for a chemical process or combination might be granted to a person not a qualified chemist licensed to conduct chemical operations.

The right of an employé to hold a patent for an invention made by him during working hours will depend upon circumstances.

Should it appear that the main general idea emanated from his principal, and that the method of carrying it into practical effect was devised by the employé acting under the order of his principal, the employé might be disentitled to the patent, notwithstanding that the invention in its workable condition might be said to have emanated from him.

But it seems that if the employé has been ordered to produce a certain thing, and in the process of so doing has conceived an improvement in the method of producing the required article, he may be entitled to a patent for his invention, the thing ordered of him and which he has been engaged in producing being the property of his principal, and the improved method of production not constituting in reality any part of or feature in the thing produced, although the invention may have been exercised in producing the article.

Belgian Government officials are interdicted from holding patents for inventions relating to objects such as are produced or used in their own departments of the public service. For example, an employé of the Belgian War Department is disqualified from holding a patent for any instrument of war.

But it does not seem that this prohibition would extend to a military man holding no Government appointment save his post in the army. Invention of a patentable nature by such a person is work of a class clearly beyond the pale of his obligation to the public service.

Subject Matter.—The law does not enumerate the features essential to the patentability of an invention. It simply says that exclusive rights shall be granted for all discoveries or improvements that may be worked as articles of industry and commerce. It is, however, evident that new or improved processes, new or improved machines, instruments or apparatus, as well as such applications of known means producing novel results in a manufacturing sense, may be patented.

Abstract philosophical principles, natural substances (even though newly discovered), natural phenomena, scientific theories, systems, notions, or methods, and abstract rules or formulæ *per se*, are not patentable. But their application and adaptation to industrial purposes are in some instances patentable. The law does not even require that the subject matter of a patent shall be useful. But it does require that the invention shall be new. In other words, it provides that the patent shall not be valid if the patented invention proves to have been used, executed, or worked by other parties in the kingdom for commercial purposes, prior to the legal date of the invention, importation, or improvement, or if the complete specification and the correct drawings of the invention are proved to have been produced previous to the date of the deposit in a printed and published work or collection, except when, as regards patents of importation, such publication shall have been merely made according to legal prescription. Hence, where an invention has been previously patented in another country, say the United Kingdom or the United States of America, the fact of the officially printed specification having been on view to the Belgian public prior to the application for a patent there would not in itself render the Belgian patent invalid. But the effect of a full disclosure of the invention and of the mode of performing it in a scientific or other newspaper, or publication, would be fatal.

Under these circumstances it is dangerous to delay the application for a Belgian patent for any considerable length of time, after having patented the invention in any other country, where the authorities publish the specifications of the patents they grant or allow them to be inspected by the general public.

Searches, Official Publications, &c.—As will appear from what has been already stated, the intending patentee must himself take all responsibility as to the novelty of his invention, there being no official preliminary examination on the subject. All documents relating to applications for patents are forwarded to the Ministry of the Interior within four days of the filing thereof, and on arrival at the Ministry the applications are entered in a special register which the public may consult every day, Sundays and holidays excepted, from 10 A.M. till 2 P.M.

The usual holidays are New Year's Day, Christmas Day, Easter Monday, Whit Monday, Ascension Day, the 15th of August, the 1st of November, and the 15th of November.

The specifications of patents granted are published in full or in substance by the administration in a