wrapped seven times around the iron core, having their termini soldered to bars on diametrically opposite sides of the commutator cylinder. The armature thus formed revolves between the poles of the field magnet, and its commutator cylinder is touched on opposite sides by brushes which take off the current. In the dynamo machine the armature and field magnets are in the same circuit. In the magneto machines which furnish the current to the lines the armatures are in the telegraphic circuit, while the wires of the field magnets are connected with the exciting dynamo.

The application of mechanical generators of electricity to telegraphy must be regarded as a great stride in the march of improvement, as it not only economizes space and means, but it supplies a known quantity in place of an unknown quantity. It replaces the subtile and variable acid and zinc, with the constant and positive power of steam. Without doubt the day is near when batteries will not be found in large telegraphic centers. They will probably be used in local circuits in small offices, but so far as working lines and large central offices are concerned there appears no reason why the machines should not speedily come into general use.

THE WORLD'S FAIR OF 1883.

A meeting to further the movement for a world's fair in this city in 1883, was held in Chickering Hall, January 14. A considerable number of capitalists and other influential gentlemen were present, and letters and telegrams of approval from many prominent statesmen, business men, and others, were read. Addresses were made by Hugh J. Jewett, President of the Erie R. R., Gen'l Joseph R. Hawley, of Connecticut, Senator Windom, of Minnesota, General Chas. E. Hooker, of Mississippi, and others. Considerable enthusiasm was manifest, but no positive action was taken further than to adopt a resolution asking Congress to take measures to give the proposed fair "official sanction and aid commensurate to its importance."

In the course of his remarks Gen'l Hawley said of our patent laws: "They may not be perfect, but they have done more than anything else perhaps to stimulate the ingenuity of the nation. In all the manufactories, a mechanic knows that if he invents something to save time and labor he can get a patent for it and be protected. Of course in carrying out these inventions a great many are shipwrecked, but on the other hand a great many are victorious, and this protection to ingenuity is making us an inventive nation. Another reason is that we are not cursed by the worst features of trades-unionism, which enslaves and cramps the mechanic himself. The unions forbid him to make anything more than his own particular part, and keep down the number of apprentices. These features weigh down with all their force upon enterprise and ingenuity. But you cannot control a Yankee shop in that fashion. If there be an invention the mechanic will be protected, and a manufacturer will run it in his shop if it breaks up all the other places in the land."

ELECTRIC MACHINES IN TELEGRAPHY.

The new and remarkable departure in the art of telegraphy, which we this week chronicle, to wit, the substitution of dynamo machines in place of galvanic cells for generating the electric current, is due to the genius and perseverance of Mr. Stephen D. Field, of San Francisco, Cal.

Various efforts have been made during past years to do away with the cells and their concomitant troubles and expense. Many of the most eminent electricians have turned their attention to the problem, but one and all have heretofore failed to attain the coveted success. The account we give this week of the great change which is now going on within the walls of that great palace of electrity, the Western Union Telegraph Building, shows that Mr. Field's discovery is one of vast importance, for which he is entitled to most generous rewards. His invention has made a complete revolution in the economies of telegraphy, and before a twelvemonth closes it will doubtless be in general use throughout the world. We heartily congratulate Mr. Field upon his splendid achievement. It is one of those brilliant discoveries that is far-reaching in its results and confers a direct, lasting benefit upon mankind.

Good Times for Mechanics.

The Baldwin Locomotive Works are now employing over a thousand more workmen than a year ago, though the last year's work showed the largest production of any year except 1873, when 423 locomotives were built. During 1879 there were built 398, of which 84 were for export, going to Australia, Brazil, Cuba, Norway, Mexico, Guatemala, Peru, Sandwich Islands, and West Indies. The large number of large orders now in hand keep the force employed full time. In every other line of mechanical production the same evidences of prosperity are observable.

Manganese Bronze.

In Prussia there has recently been introduced a new alloy of manganese and copper, which promises to be of considerable importance. "Mangankupfer," as the new bronze is called, consists of 70 per cent of copper and 30 of manganese, and is employed in small quantities to improve common brass, bronze, bell-metal, and the like, rendering them, it is stated, more compact, hard, and ductile.

THE late Leonard Case, of Cleveland, left property valued at $1,500,000 for a school of Applied Science in that city.

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NEW YORK, SATURDAY, JANUARY 31, 1880.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

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For the Week ending January 31, 1880.

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THE FUTURE OF ELECTRICITY.

Marvelous as have been the applications of electricity during recent years as a message bearer, light giver, health restorer, and otherwise, it requires no prophetic vision other than that which knowledge gives to foresee an extension of the uses of electricity in the immediate future infinitely beyond anything that the multitude now anticipate. The truth is, men have but barely begun to suspect the capacity of electricity to serve their kind. However numerous the means devised for harnessing the subtle power or great the social changes brought about by its employment, as in the telegraph and the telephone, the vast field for the application of electricity to human affairs has hardly been entered upon.

The best proof of this truth is seen in the varied lines of electric investigation and invention developed during the years just past, each with infinite possibilities, and all marked by surprising discoveries and practical utilizations at almost every step in advance. These lines of research point every way; and it is hard to name a direction of thought or a sphere of practical effort toward which, or into which, electrical investigation is not working or holding out promises of great reward to such as will enter boldly, intelligently, and perseveringly upon the quest.

Men of middle age have witnessed the more remarkable of the stages of social revolution which the utilization of steam has brought about during the past fifty years. Ten years ago it did not seem possible that any power could ever again enable men to repeat the giant strides of progress which steam, in our factories and on the highways of commerce, by sea and by land, had made possible. To-day even greater and more rapid revolutions are impending from the utilization of electricity, and men now living will probably see them brought about.

A few weeks ago we had occasion to speak of the great changes in social and business affairs already effected, and the greater in immediate prospect, through the development of the telephonic exchanges. In every important town such exchanges are in process of development, bringing into vocal communication not only the separate members of widely-extended communities, but also still more widely-separated communities.

Since then a novel and important improvement in a special field of telephonic use has been reported from London. Our readers are familiar with the principle of Mr. Edison's electromotograph or loud-speaking telephone. By employing his small electric motor to turn the chalk cylinder the telephone is made automatic. Instruments of this sort have been placed in, and a large number more are in preparation for, the London *Times* newspaper office; and the reporters of the paper, say in Parliament, instead of reading their shorthand notes to copyists, and transmitting the longhand copy to the printer, as heretofore, now read them directly to the telephone, thus saving the time of copying and carrying the report. In the printing office the compositor sits at a typesetting machine, and, as the report is delivered to him by the automotic telephone, he sets the type as one would play a tune upon a piano. Having no copy to decipher, his whole attention is given to the setting of the type, and another great saving of time is effected. The indications are that by the use of autographic and automatic telegraphy (in conjunction perhaps with stenographic typewriters) reports of public meetings will soon be almost instantly transmitted through long distances and at a fraction of expense which such work now involves. By the same process drawings as well as writings will be transmissible quickly and economically. Such inventions open up lines of progress too far reaching for the boldest imagination to follow.

In this issue of the SCIENTIFIC AMERICAN an account is given of an invention which, in quite a different direction, promises to work great changes in telegraphy. By substituting dynamo machines for batteries in developing the currents used in telegraphing, not only is a great economy effected in the working of the wires, but the larger part of the valuable space now occupied by the batteries is wholly saved. In the central building of the Western Union Telegraph Company in this city twelve tons of machinery take the place of seventy-two tons of battery cells.

The magnitude of the interests affected by an invention like this will be appreciated when we call to mind the fact that the Western Union Company alone requires something near 200,000 miles of wire for its connections in this country. The telegraph lines of all Europe will aggregate something like half a million miles. It must not be forgotten that for every mile of real wire employed in telegraphing the introduction of the quadruplex system gives three miles of "phantom" wire. In other words, the system makes every wire so used equivalent to four wires under the old system; and no one can say how far improvement in this direction is or is not possible.

The future of electricity in the sphere of light giving is daily becoming more apparent. The impossibilities of last year are the achievements of this year; and even if we were compelled to say that hitherto the electric light has not passed beyond the experimental stage, the positive gains made during the past few months are a guarantee that in several directions practical success is assured.

Our readers are already familiar with what Mr. Edison has accomplished. Many other more or less successful inventors are at work upon one or other of the various and very promising systems of electric lighting, both in this country and in Europe. In London a steady and remarkable progress is reported in the working of the Jablochkoff

candles employed at the Victoria station of the Metropolitan Railway and on Waterloo Bridge. A 20 horse power engine already sustains 60 lights (of from 500 to 700 candle power), and 80 lights are promised when another couple of Gramme machines are put down. The length of cable used is upward of a mile and a half, the length of the circuit over three and a quarter miles. It is claimed that the limit of the power of the engine has not been approached. The light already furnished exceeds 1,500 wax candles to the horse power; and yet the margin for improvement is enormous. The actual energy of the coal used is not less than eight times that really developed as light.

In still another direction—the development of thermo-electricity by direct solar radiation, by the utilization of the waste heat of our fires, and the like—the possibilities are incalculable and the work of invention but scarcely begun. In the near future, too, men will draw upon many now neglected sources of power, which will give them through the mediation of electricity a greater supply of motive force than is now derived from all our coal mines. In a recent issue of the SCIENTIFIC AMERICAN SUPPLEMENT the progress made in the utilization of electricity as a carrier of power economically developed in large engines operated by steam power, waterfalls, and the like, was described at great length by Professor Ayrton.

The transmission of power by electricity both for short and for long distances, is not only practicable but economical; and the sanitary and other advantages of drawing power from a distance, for small manufacturing and for operating domestic machinery, are so enormous that the new system is sure to work great changes in all branches of industrial affairs. In every department of life this most nimble and willing servant of humanity is becoming useful, or rather men are beginning to discover how infinite is his capacity for usefulness and the marvelous economies possible throughout his employment. He is as ready to work for us as to run our errands, or watch our property against thieves and fire. And it is no stretch of imagination to say that our children if not ourselves will see the small steam engine everywhere displaced by the electric motor, which will convert into motive power the subtle energy conveyed by wires from central sources of energy—huge furnaces constructed on the most approved scientific principles, out of the way waterfalls, tidal currents, even the sun himself. And doubtless this cleanly and trusty servant will serve humanity in ways we do not dream of now, and at a cost that will be, by comparison with the present cost of light and heat and working energy, almost nominal.

TWO MORE PATENT BILLS.

Two bills to amend the patent laws were introduced in the House of Representatives, December 18, and numbered respectively 3,039 and 3,041.

The first, by Mr. Vance, of North Carolina, provides that any one of the joint owners of any patent for an invention may grant a license to use the invention, but not exclusively, except under the following conditions: (1) When the conveyance or other instrument creating the joint ownership (recorded in the Patent Office before the execution of the license) provides that no license shall be valid unless executed by all the owners, or a specified portion of them in number or interest; or (2) when the joint owners have previously made an agreement limiting the power of the individual owners to grant licenses, and have had the agreement recorded in the Patent Office. The bill further provides for the recording of such powers of attorney, agreements, and the like in the Patent Office, and the use of certified copies of such papers in evidence, as is now done in the case of records of assignments. So far as appears the proposed amendment seems likely to be beneficial.

Not so much can be said of the bill introduced by Mr. Young (H. R. 3,041). Hitherto the American patent laws have wisely regarded inventors as the only parties entitled to the protection guaranteed by letters patent. Mr. Young proposes to extend the protection to those who introduce inventions from foreign countries; but (apparently) only under the curious condition that the art or process to be patented shall have been "used or practiced, unpatented, for the period of fifty years last past exclusively in the country where obtained."

Possibly this is the very thin end of a wedge designed to open our Patent Office to the class of operators known in Europe as "patent sharks," who watch the records of the patent offices of other countries for promising inventions which they immediately proceed to patent as introducers—a sort of industrial piracy which has not been and we trust never will be encouraged in this country.

It is more probable, however, that the parties for whom Mr. Young is working are interested in some art established in a country where patents are not granted—an art which they wish to introduce and monopolize here, or, what is quite as likely, one which they wish to keep from being practiced among us. Under a law such as he proposes any distinctively Asiatic, African, Swiss, Turkish, or South American art, and a wide range of arts which have been practiced too long in either of the several countries of Europe which issue patents to have ever been brought under the action of patent laws, could be patented here, either to work or to suppress. The propriety of granting such great privileges for nothing, or worse than nothing, is not obvious, to say nothing of the probable lack of constitutional authority for such a departure from the principle on which our patent laws are based.

THE TAY BRIDGE DISASTER.

The mails bring no conclusive explanation of the terrible railway disaster at the Frith of Tay. The hypothesis suggested as the most probable, in view of the meager telegraphic account of the disaster—namely, that the bridge was bodily blown away—still seems the most probable. The only point cleared up by the divers is that both the bridge and the train fell together, and that the train had entered upon the fourth span from the south end of the gap before the bridge was overturned. The disaster occurred where the sides of the iron lattice girders rose above the level of the track.

The hypothesis of the constructing engineer of the bridge, Sir Thomas Bouch, is that when the train reached the fatal spot it was tilted over against the girders by a sudden gust of wind, the girders gave way under the strain, and the whole structure broke down under the combined impact of train and storm. This is the best face that can be put upon the terrible affair; not a few engineers, however, are of opinion that the extreme height and narrow base of that portion of the bridge afford a sufficient explanation of its inability to withstand the pressure of the gale. It is certain that the stability of the bridge under the stress of high wind has more than once been seriously questioned. It is even said—though the evidence is not conclusive—that a leading firm, to whom the contract for the construction of the bridge was first offered, declined to undertake it on the ground that a bridge on the plan contemplated could not be made secure. The policy which dictated a single track, and therefore a high and narrow bridge, for such a crossing, proves to have been terribly the reverse of economical.

THE PAST YEAR'S WORK IN THE PATENT OFFICE.

For the first time, the year's work of the Patent Office shows a falling off, due undoubtedly to the attempt in Congress last winter to change the law to the injury of inventors. The determination expressed by inventors at the time to withhold applications for patents until assured that their rights would not be laid open to invasion by so doing, thus shows itself. The larger decrease in the number of patents issued may be due in part to the diminished means of the office through the reduction of the appropriations, which reduction, the Commissioner says, has been carried so far as to seriously cripple the office and injure the public interests. The completion and wide distribution of photolithographic copies of the drawings of American patents granted prior to November 20, 1866, and the distribution of English patents for reference in the Examiners' rooms, have aided to a considerable extent the Commissioner thinks, in reducing the number of patents issued.

The statistics of the office for the year ending June 30, 1879, are as follows:

The number of applications for patents was 19,300, being 357 less than the previous year. The number for design patents was 697; for reissue, 639; for registration of trade marks, 1,465; for registration of labels, 631; caveats filed, 2,674.

The number of patents granted, including reissues and designs, was 12,471, being 1,629 less than the previous year. The number of trade marks was 1,144; labels registered, 403; patents withheld for non-payment of final fee, 828.

The total receipts of the office were $703,146.79, being $31,741.19 less than those of the previous year.

The expenditures for the year were $548,651.47. This includes $5,000 appropriated for the repair of models damaged by the fire, and is not properly chargeable to the current expenses of the office.

The expenditures for the previous year were $665,906.02; $50,000 of this being for the repair of models. Excluding the amount appropriated for the repair of damaged models in both years, the current expenditures of the office were $72,254.55 less than those of the previous year. The excess of receipts over expenditures was $154,495.32.

This excess the Commissioner pronounces an unjust tax upon inventors, and favors its reduction either by exacting lower fees or by expending the surplus in improving the facilities for transacting the business of the office. He recommends the latter course. He calls attention to the inadequacy of the rooms provided for the use of the office, and, after insisting that the office needs and ought to have exclusive possession of the entire building, excepting the rooms of the Secretary of the Interior, he recommends that temporary accommodations be provided in that portion of the building now being reconstructed.

The Commissioner further asserts that the interest of the service demands an additional force of clerks and examiners, and to this end he recommends that provision be made by law for ten additional clerks of class one, three of class two, two of class three, one of class four, and fifteen assistant examiners. He suggests also that a portion of the surplus revenues of the office be used annually for the purpose of making additions to the technical library of the office, and for increasing the compensation of the clerks and employés, who, while forced to remain in the lower grade because of inadequate appropriations, are showing efficiency entitling them to higher pay.

Touching the present system of requiring and preserving models the Commissioner makes the pertinent remark that it cannot be permanent, and steps toward a change ought to be taken at once. At the present rate of accumulation there will be more than two million models to house before our second Centennial year, requiring fifty halls as spacious as those now used for storing models. In a few more centuries the entire Federal District would be inadequate to the storage of these evidences of American inventiveness. At the present time models are actually used in the examination of about 50 per cent of the cases in which models are filed. With proper scale drawings from working machines by far the larger part of the models now used might be dispensed with. The Commissioner, therefore, recommends as a first step toward getting rid of models that the following statutory provisions be enacted:

1. That no model shall be required or filed in any case, unless upon a written certificate filed in the case by the examiner in charge of the division to which the invention pertains that it will be useful in the examination of the application, or upon the special order of the Commissioner.

2. That the Commissioner shall not require the production of a model for the examination in any case in which the applicant shall furnish satisfactory scale drawings, made from a working machine, and shall produce for examination a working machine in operation in the city of Washington.

3. That upon the expiration of every patent the model pertaining thereto shall be sent by the Commissioner to one of the public institutions of science and art in the United States.

The only exception that can be taken to these recommendations is, perhaps, in connection with the third. The final disposition of the model might properly be left to the option of the inventor.

To obviate the risk of accidental or fraudulent alteration of models in the manufacture of copies of models for official certification, the Commissioner recommends the enactment of a law authorizing the employment for this purpose of skilled workmen, who shall take the oath of office and give bonds for the faithful performance of their duty.

The Commissioner further recommends that a law be passed authorizing the execution by United States commissioners, or other United States officers, of commissions issued by foreign governments to take testimony in the United States to be used before foreign patent offices and before all judicial, legislative, and executive departments of foreign governments, and to punish perjury committed in such testimony; the law to be operative only in favor of such governments as shall make like provision for taking testimony in foreign countries, to be used in like manner in the United States.

Also that the law relating to the payment of the final fee within six months of the allowance of a patent be so amended as to make the execution of the law possible in all cases. Under the present law, requiring a patent to be dated within six months of its allowance, the payment of the fee on the last day of the prescribed time makes it impossible to conform to the law without resorting to the fiction of a new allowance, made upon payment of the final fee too late to admit of the preparation of the patent before the expiration of the six months. The extension of the time, within which a patent may be dated, to seven months from the date of its allowance would obviate the present difficulty.

German Professors.

In the German universities the professors are men who have distinguished themselves by their contributions to science. They have usually begun their career as "privat docenten," or private teachers, a position unknown in America. If successful, they are made professors extraordinary, and of these a few only reach the distinction of professor ordinary. Any young man of promise, who has obtained the degree of doctor of philosophy (Ph.D.), with honors, can obtain permission to lecture in a given university, provided he passes a good examination in the subject that he intends to lecture on. The university gives him a room to lecture in, and if he succeeds in securing any listeners he gets their fees; beyond this he takes care of himself. His income depends entirely upon his popularity. If his lectures are good, and he proves his ability, his success is assured. In a few years he is called to a vacant chair in the same, or oftener in another, university, where he holds the position of extraordinary professor for years, often for life.

The following list of professors of chemistry in the principal German and Swiss universities embraces many distinguished men whose names are familiar in this country. The figures annexed give the ages of these men, and, as the *Journal of Applied Chemistry* says, they show that most of them are no longer "mere boys:" Berlin, A. W. Hofmann, *æt.* 61; Bonn, A. Kekulé, 50; Breslau, C. J. Loewig, 76; Erlangen, J. Volhard, 45; Giessen, H. Will, 67; Göttingen, F. Woehler, 79, H. Huebner, 42; Halle, W. Heintz, 62; Heidelberg, R. Bunsen, 67, H. Kopp, 62; Jena, G. A. Geuther, —; Königsberg, W. Lossen, 41; Leipsic, H. Kolbe, 61; Marburg, Th. Zincke, 39; Munich, A. Baeyer, 44; Strassburg, R. Fittig, 44; Tübingen, Lothar Meyer, 49; Würzburg, J. R. von Wagner, 57, J. Wislicenus, 44; Zürich, V. Merz, 42.

The oldest of these, Professor Woehler, no longer lectures. He will celebrate his eightieth birthday on the 31st of next July.

Dead at His Post.

A singular, but fortunately not a common, danger of travel was illustrated on the Fulton Ferry, between New York and Brooklyn the other day. A boat was in the slip on the Brooklyn side, and for a few minutes the deck-hands waited, wondering at the unusual delay in starting. Finally two of them mounted to the pilot-house and there found Wm. A. White, the pilot, on the floor, just dead. He had died of heart disease just as he was ready to sound the signal to start the engine. Had he fallen while the boat was in the middle of the crowded river, a very serious accident might have followed.