

THE MANUFACTURE OF EDISON PHONOGRAPH RECORDS.

The Edison phonograph has become such a familiar object in our modern home life, and its mechanism, in spite of its marvelous ingenuity, is so straightforward and easily understood, that it is difficult, in giving a description of this prince of toys, to tell the multitudinous possessors of them anything that they did not know before. If one were asked to name the particular part of the phonograph which possesses the greatest interest and which is the most essential to its success, he would have to mention the cylinder of wax upon which the waves of sound are cut by the dainty little sapphire turning-tool known as the stylus.

The great growth in popularity of the phonograph, and the necessity for keeping the owners supplied with fresh "literature," has caused the mere work of manufacturing the records to assume truly enormous proportions. Evidence of this is shown in the storage room of the Edison Phonograph Works, in which are to be found tier upon tier of storage "bins," whose contents represent records of 3,000 distinct subjects, or nearly half a million wax cylinders in all.

The first process in the manufacture of records takes place in the melting room, where the proper constituents to form the special grade of wax employed in making the records are brought together and melted in several large vats, each of which contains about 1,000 pounds. There are three meltings in all, and between each the fluid is carefully strained to remove any hard or gritty impurities which it might contain; for it is evident that the presence of foreign substances, even a few particles of fine dust, might easily produce fatal irregularities in the grooves of the record. The first two meltings take place in the melting room, and the third in the moulding and shaping room, of which we present an illustration. On entering this room, the most conspicuous feature is several large, circular, rotating tables, set around the periphery of which is a number of round, iron pins which form the core of the mould. Concentrically around each of these pins is placed a brass sleeve. The wax is taken from the melting vats in a can and poured into the moulds in the manner shown in our illustration. The tables are constantly rotated, thus bringing the moulds, which cool very rapidly, round to the workers on the opposite side of the table, where the wax cylinders are removed. The moving table brings the empty moulds back to the starting point, where they are again filled from the pouring can. The cylinders are cast with an interior spiral thread, which adds somewhat to the strength of the cylinder, and forms the bearing surface when the wax cylinder is placed on the mandrel of the phonograph. After they have cooled, the cylinders are first reamed out to gage, then edged and rough-turned, and finally given a finishing cut, the finish turning being done with a fine sapphire knife. The records are then given a final inspection, in which those that show the least sign of imperfection, such as a hair crack, or a failure to meet the gage test, are rejected. The cylinders are now ready for the important work of making the records.

It should be mentioned just here that in addition to the standard size of records, measuring about $2\frac{1}{4}$ by 4 inches, with which the public is more familiar, the Edison Company manufacture a larger size, known as the concert record, which is about 5 inches in diameter. The advantage of the larger size is that the grooves are longer and the curves of the depressions are of longer radius, with the result that the ball-point of the reproducer is able to follow the grooves more closely and give a more perfect reproduction of the sound waves.

One of the upper floors of a large building in the record department is divided into a number of rooms, in which the specialists who are employed by the Edison Phonograph Works are kept steadily at work speaking, playing or singing into the recording machines. One of our illustrations shows the methods adopted in producing solo records, whether instrumental or vocal. In this case the violinist stands with his instrument immediately and closely in front of three converging horns, each of which connects with a recording phonograph. The only difference between a recording and a reproducing phonograph is in the nature of the little sapphire tool by which the diaphragm rests upon the wax record. In making the record, the "recording stylus" is used, and in reproducing the record, the "reproducing ball" is substituted. The difference between the stylus and the ball is that the point of the stylus is cup-shaped and ground to a fine cutting edge, which, as it travels over the surface of the wax cylinder, is driven more or less deeply into the material, and turns off a shaving which varies in thickness, according to the quality of the sound waves which fall upon the diaphragm. It is extremely interesting to watch the endless stream of fine hair-like turnings which falls from the little tool while the record is being made. One of the first things that strikes a visitor to the record room is the rapidity with which the artists sing, the speed being much greater than that to which one is accustomed in a music hall or opera house. Moreover, the songs are

sung with the full power which would be used before a public audience. As soon as the record is made, it is taken off the mandrel and placed in a phonograph and reproduced to test its quality. If there is the slightest defect, it is, of course, rejected.

Among the most popular records are those of band music, and for making these the company maintains a full instrumental band, which is occupied steadily, under the baton of a conductor, in playing popular airs, marches, waltzes, etc. The musicians are so grouped around the phonographs that the volume of sound from each instrument strikes full upon the horns, the front row of the performers being seated on ordinary chairs and those behind on raised seats. On the occasion of our visit there were no less than sixteen phonographs on the racks in front of the band, each with its horn pointing toward the musicians. In this case, as in the case of solos, the music is performed at full power.

The testing of the phonograph records is done in a separate room by a corps of experts, who are careful to throw out every record that gives the slightest suggestion of a defect. Long training in this work has made them sensitive to irregularities in tone and quality which would scarcely be noticed by the average listener. It is to this searching examination that the uniformly high quality of the Edison records is largely to be attributed.

Our last illustration shows the phonograph testing room. This test is just as important as, and perhaps more so than, the testing of the wax records themselves. The work done in this department is really a matter of testing the testers, for during the construction of the machines every part of the phonograph, as it is completed, is subjected to close inspection. It may happen, however, that in the assembling, or in the frequent handling, a trifling injury may have resulted to some part; there may be a slight lack of adjustment, or the bearings may be clogged with oil, and it is the part of the final inspector to detect such faults and see that the machine works with the absolute smoothness necessary to good phonographic results.

The phonographs themselves, after passing this test, are put in cabinets and sent to the shipping department; the phonograph records, after the final inspection, are each carefully wrapped in cotton, then in paraffine paper, and finally placed in cardboard boxes on which are printed the catalogue numbers of the records. The boxed records are then stored in numbered bins, and on the receipt of an order, it is a simple matter to select the records, pack them in cases or barrels and wheel them to the cars, which are brought by a switch to the doors of the shipping department.

In closing we would make mention of the really admirable system of shop management which is displayed throughout the whole of the works—a system which displays very markedly that characteristically American arrangement of the shops themselves, and of the machines with which they are crowded, which aims at minimizing the amount of handling and transportation to which each individual piece is subjected in its transformation from the crude material to the finished article. There are, as this journal has often pointed out, several elements which conduce to the commercial supremacy of the country; and to nothing is the cheapness of our products more directly traceable than to that carefully-thought-out distribution of the work and orderly and consecutive arrangement of the machines, of which these works are a striking example.

Automobile News.

A prominent firm of cycle manufacturers in Coventry (England) have devised a lady's motor bicycle. The machine is of the conventional design, with the open frame, and the motor, which is a two horse power oil engine, is compactly attached to the rear wheel. The cycle is started in the usual manner by pedaling, and the speed of the motor is controlled by a small lever fixed to the handle-bar.

Next year the Automobile Club of England proposes a more exacting motor car test than the 1,000-mile trial of 1900. The experiment will continue over a period of three weeks, commencing, as at present arranged, on August 12, 1901. The cars will leave London en route for Shaftesbury and Plymouth, to cover which distance will occupy two days. From Plymouth they will proceed to the North of England through the western counties to Carlisle. This journey will include a series of hill-climbing competitions on the two steep sharp gradients Dunmail Raise and Shap Fell. Glasgow will be the next destination, where the cars will be placed on show in the Manufacturers' section of the Exhibition. A short independent tour for five days is then projected through the Highlands, the cars reassembling at Glasgow on August 26. The return to London will be made via York, Lincoln, Norfolk and Welbeck Park, at which latter place the speed trials will be made, as on the last occasion. It is contemplated that the cars will travel 100 miles per day, with an aggregate distance for the tour of 1300 miles, independent of the five days traveling in the Highlands.

Science Notes.

Mr. Marshall H. Saville, of the American Museum of Natural History, has started for his winter work in southern Mexico, where he will continue his excavations in the territory formerly occupied by the Zapotecs.

An institution was opened in Belgium for the alleged cure of tuberculosis by the exclusive raw meat diet. After a trial of a few months, the experiment was abandoned, as it was found that there was no efficacy in the Richet cure.

The various scientific departments in England recently held a conference in which they sought to obtain government powers for protecting the delicate instruments in the Kew and Greenwich observatories from any magnetic disturbances that arise from the working of electric tramways and railways in their vicinity.

The Duke of Abruzzi on his recent Arctic expedition carried with him a small balloon, similar in construction to those employed in the Italian army, for the purpose of pushing farther north when the vessel became blocked by the ice. It, however, proved useless. The duke is now busily engaged upon the design of a new balloon, specially adapted for such an object, which he will take with him upon his next expedition.

There is to be a ceramic exhibition in St. Petersburg in December. Its aim is to show the public the progress made by Russia and other countries in artistic and industrial ceramics. Only works of artistic excellence will be admitted to the exposition, but also those which, lacking the preceding condition, are yet distinguished by the originality of their design, form or mode of manufacture.

The city budget of New York city for 1901 calls for the expenditure of \$98,100,413.43, an increase of \$8,321,440.95 over the budget for 1900. The largest sums are for education, \$18,512,817.69; interest on city debt, \$12,100,206.05; police, \$11,983,343.42; the redemption of the city debt, \$10,332,173.18. It is curious to note that The City Record, in which various advertisements relating to the city are printed, has \$563,200 appropriated for it, an enormous sum, exceeding that appropriated for buildings.

Sir George Newnes, who financed Mr. Borchgrevink's recent expedition to the Antarctic zone, has placed the whole of the scientific spoils collected by the late Nikolai Hansen, the scientist to the expedition, at the disposal of the Natural History Museum at South Kensington. The collection comprises birds, beasts, fishes, and an assortment of other innumerable curiosities. The authorities at the museum will select all that they require, and transfer them to the experts in the respective departments, to be duly examined and annotated.

At a recent congress of German anthropologists, which was held at Halle, Professor Dr. Klaatsch, of Heidelberg, read a paper in which he contended that the hypothesis of the direct descent of man from apes was no longer tenable. His conclusions were based upon the biceps muscle of the thigh. He stated that it was a mistake to regard man as the most perfectly developed mammal in all respects. His limbs and teeth do not show any high degree of development, and he is superior to other animals only in his brain development.

The Rev. J. M. Bacon, F.R.S., proposes to make a balloon ascent during one of the thick, impenetrable fogs which visit London during the winter months. He proposes to ascend to the higher limits of the fog and to explore scientifically its constitution. He also proposes to discharge small cartridges of gun-cotton at great heights, in order to ascertain whether the concussion will dislodge or disperse the fog in any way. He has already carried out several experiments with similar cartridges for acoustical purposes, at varying altitudes.

Arrangements are being made among the various scientific and mechanical institutions in London to hold an engineering congress at the Glasgow Exhibition next summer. The congress will consist of nine sections, with Lord Kelvin as Honorary President. The President of the Institution of Civil Engineers will preside over the first section, while other sections will be presided over by Sir Benjamin Baker, F.R.S., and Sir John Wolfe-Barry, F.R.S. Already a sum of over \$16,000 has been collected as a guarantee fund for defraying the expenses of the scheme.

The latest development of the automatic machine is an apparatus in which letters and telegrams may be placed to await the call of the addressee. The communications are inserted in the machine in such a manner that the name and address is plainly visible through a small window. To obtain possession of a missive, one places a penny in the slot. Should a reply be necessary, the insertion of another penny into the instrument will insure the delivery of an envelope and sheet of note paper, and the reply may be written upon a small desk attached to the machine. It is stated that the English postal authorities have consented to place letters and telegrams in these automatic "postes restantes" if the address of the particular machine is supplied.

Engineering Notes.

A subway scheme is proposed for Chicago, every other street in the business section being involved in the project.

It is said that the Krupps are negotiating with Spanish capitalists for the organization of a company in Spain to build ironclads and manufacture ordnance.

The increasing importation of American steel into Great Britain is interfering with the trade of Swansea, as the revenue obtained from the importation of raw material used in making bars, and the industry itself, was threatened with extinction.

The à la carte system of dining cars of the Pennsylvania Line west of Pittsburgh has been abandoned in favor of the table d'hôte plan, ballots having been given to passengers for several months in order that they might vote as to their preference.

The Lake Shore and Michigan Southern Railway has instituted a house to house canvass in Chicago with a view to causing the people to test the facilities of their suburban service, and free tickets are left at the houses which entitle the holder to one free ride in either direction.

Probably the most valuable stock in the world is that of the London New River Company, of London. There are only 72 original shares, of which 36 are "adventurers' shares" and 36 "king's shares," the former commanding higher prices than the latter. A share sold recently for \$625,000.

Preparations are being made to move the Columbus monument at the circle at Fifty-ninth Street and Eighth Avenue, New York, on account of the underground railroad. The foundations were so deep that it was considered cheaper and safer to move it temporarily, and then return it to its present location.

Experiments are being carried out in Germany as to the perforating capacity of the latest Mauser model, and the latest field guns, and as targets several hundreds of pauper corpses are being used. The bullets, when fired at a comparatively short distance, tear asunder the soft inner organs and finally mangle the bodies.

A new light system has been introduced into the village of Stunzheim in Würtemberg. From a large central petroleum reservoir, the oil from which the light is produced is distributed to the different lamps through copper tubes; the petroleum is then vaporized by special apparatus and burner. A large lighting plant of this system is to be put in the railroad shops at Stuttgart.

The American red gum wood is now being largely employed in London for street paving purposes. Regent Street, Piccadilly, and the Haymarket have recently been paved with this wood, and it is to be employed extensively in other parts of the metropolis. Although the wood is not so hard as the red woods of Australia, it is more durable than deal or any other timber, while it affords the best foothold for horses. A prominent feature of the wood is that it neither shrinks nor expands under the influence of dry or wet weather, which are great recommendations for its utilization for paving purposes.

An American hydraulic engineer, Linden W. Bates, has been asked to undertake the widening of the Suez Canal. The corporation is desirous of rendering the canal available for the passage of ships of greater draught than can now be accommodated. It is to be carried on by a colossal dredging process. Mr. Bates has just completed three very large dredging ships for the Queensland government. The largest of them is about to leave the Armstrong-Whitworth yards at Newcastle-on-Tyne, and the Australian colony has consented to have the machinery stopped en route and test its efficacy for the purpose. Mr. Bates has had great experience in matters of this kind, as he helped to lay out the Chicago Drainage Canal and designed the big Mississippi works at Memphis for the War Department.

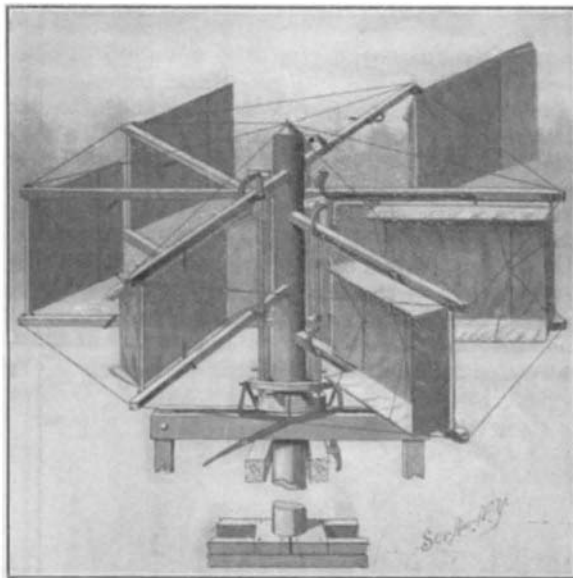
The Midland Railway Company, of England, have recently purchased four Pullman sleeping cars for use on their system. Each car measures 59 feet 10¾ inches over the buffer beams, and 13 feet 1 inch in height from the rail level to the top of the roof. The bogies upon which the car is built were constructed by the Midland Railway Company at their own shops, so that they differ somewhat from the prevalent American pattern. The fittings for the vacuum brake were also supplied by the railway company. The car was dispatched to England in sections, and the parts re-assembled at the railway works. The car is divided, one portion of it being provided with five staterooms, each of which is supplied with bed, folding washstand and usual appurtenances. The remaining portion of the car is a general saloon, and is only converted into a sleeping apartment at night by making up the berth between the two seats. All the berths are on the same level, the company having abandoned the idea of placing one berth over the other. A smoking saloon and buffet are attached. A charge of \$1.25 is made for the use of this saloon in addition to the railway saloon.

A NOVEL WIND OR WATER MOTOR.

We present herewith an illustration of a novel motor, patented by Marcin Puszkar, 18 Greenwich Street, New York city.

From a central driving shaft, a number of arms radiate, which serve to carry vanes. Of these vanes, each has one end pivotally attached to the outer end of one of the arms, so that it can swing freely. Stops are movably secured to the arms and arranged to project into the path of the vanes to bring them into driving connection with the arms. Bars are slidable transversely on the arms and are operatively connected with the stops. A collar or ring normally engages the ends of the bars, the ring being provided with alternating elevations and depressions. The collar is locked by means of a lever. A stop-lever is arranged to engage the projecting portion of the lock-lever to unlock the collar whenever desired. By means of this lever mechanism, the collar can be made to rotate with the arms, or it can be thrown out of gear, so that the bars will sink into the depressions, thereby stopping the motor.

The vanes, as our illustration shows, are of peculiar construction. Each vane consists of a rectangular frame to which a cover is secured. To this rectangular frame canvas-covered side frames are pivoted so that they can fold inwardly. At the pivotal or outer end of the vanes a folding canvas-covered end frame is attached, and is opposed by a balancing-frame likewise covered with canvas. The vanes are pressed by the current against the stops. When the vanes approach a position directly in line with the wind, they are swung around on their pivots, partially by the action of the wind on the end frames. This action is counter-balanced by the balancing frame, thereby preventing the vanes from swinging around too soon. The vanes range in the direction of the wind, the several frames folding against the main frame. Against the current



THE PUSZKAR CURRENT MOTOR.

the vanes present a narrow edge, and therefore offer little resistance, automatically preserving a direction parallel with the current until they strike the stops again.

Strike Insurance in Austria.

A number of Austrian manufacturers have recently formed an association for insurance against strikes, says a United States consul. It is the object of the association to indemnify its several members for all losses sustained by them from unjust strikes which may break out in their respective establishments, whether voluntary, sympathetic, or forced. Each member is to pay a weekly premium equal to from 3 to 4 per cent of the amount of his pay-roll. The indemnity to be paid to him in case of a strike is to be, tentatively, 50 per cent of the wages paid to his employes for the week next preceding the suspension of work. It is provided, however, that no indemnity shall be paid if a committee of confidential agents appointed by the association shall, after a full investigation of all the circumstances, find the strike a justifiable one.

It is worthy of note that a report upon and discussion of the subject "Insurance against strikes" formed a prominent feature of the programme of the national convention of Austrian manufacturers.

It appears that this movement of industrial employers is not confined to Austria. It is reported that a similar insurance association, though on a smaller scale, has been organized in Leipzig. Both the Austrian and German associations, it appears, recognize in principle the justness of strikes; which is, at least in this country, an important concession to labor. Whether this recognition will have any practical result, remains for the present a matter of conjecture.

THE French roller boat built by M. Bazin has been broken up at Preston, England, after being exhibited for some time as a curiosity. Her construction was most intricate, and the amount of metal used enormous.

Electrical Notes.

Telephonic communication has been established between St. Michael and Nome by means of a temporary submarine cable. The toll is \$2 for ten words.

A Russian medical man has decided that the electric light is least injurious to the eyes. He says that the oftener the lids are closed the greater the fatigue, and consequent injury. By experiments he finds that the lids would close with different illuminations per minute: Candle light, 6.8; gas, 2.8; sun, 2.2; electric light, 1.8.

The single-phase system is rapidly being supplanted in England. The Sheffield corporation have arranged with the Electrical Construction Company, Limited, of Wolverhampton, for the conversion of their existing plant into the two-phase system. They have also ordered two new two-phase alternators and engines to work in connection with the same at a cost of \$69,200.

The new electric railway at Paris has proved a great success, despite the mishaps that have occurred thereon from time to time. From the date of its opening on July 19 until October 31, 13,000,000, passengers were carried. Occasionally the daily number of passengers carried amounted to 170,000. It was originally intended to run only 270 trains per day, but this number has been considerably increased, and further trains are to be added.

An accident occurred on October 19, on the Paris Underground Railway, in which twenty-nine persons were injured, and two were fatally hurt. The accident occurred near the Exposition grounds. A train entered the station at the Place de la Concorde, and then backed out again. The train which followed it misunderstood its signal, and the result was a collision. As both trains were moving slowly, the damage to the train was not very great. Traffic, however, was delayed for several hours.

The French government have decided to establish their own service of submarine cable communications. This decision has been arrived at as a result of the Transvaal and Chinese campaigns, when the majority of the messages from France had to be dispatched over lines under British control. Even the communications that pass between the home government and the various ministers abroad have to pass through English hands. It is proposed to establish four cable lines interconnecting the colonies and the home country.

In the fire which destroyed the telegraph department of the Manchester post office a short time ago, the whole of the 250 instruments, which comprised one of the finest and most modern installations in the English postal service, were lost, the damage representing some thousands of dollars. For the past twelve months the work of substituting the accumulator system in place of the old battery system has been in progress, and now the obsolete system will have to be used for another year until the accumulators can be restored.

The Russian authorities are displaying remarkable energy in connection with the utilization of Popoff's wireless telegraphic system. All the lighthouses in the Black Sea are to be provided with this apparatus, and several stations are to be erected on the shore, so that communication may be maintained between the shore, lighthouses, and the warships within the radius of the electric waves. Two hundred complete installations of the apparatus were recently dispatched to Vladivostock and Port Arthur, and the work of fitting out the Russian warships in the Pacific is to be carried on with all possible celerity. The two ports are also to be connected by the establishment of intermediate stations along the Korean coast.

Mr. K. W. Hedges, of London, has recently patented some improvements in connection with lightning conductors. By his process, all the joints in the conductors are effected by a fusible or plastic metal, poured into a mould which has been placed around the parts to be joined. To insure perfect contact between the joints, he recommends that the mould should constitute a kind of clamp, thus forcing the plastic metal upon the parts of the conductor joints. He also fixes a lead protecting sheath round the conductor at the approximate point at which it enters the earth. Earthing is attained by a plate, or in the event of the ground being dry, by a tube driven deeply into it, and closely packed with carbonaceous material.

A new electricity meter has been patented in London in which the conventional balance spring is substituted by an electro-magnetic device to bring the escapement wheel to the central position. This wheel has a number of wires diametrically attached to it, and is surrounded by a coil through which passes the current to be measured. The rapidity of the oscillation of the balance wheel to a certain extent is proportional to the current. Should an extra powerful current happen to traverse the coil, or should the current be suddenly increased in voltage, auxiliary devices are provided to prevent the balance wheel when near the central position remaining stationary at that point. These secondary appurtenances also serve to set the balance wheel in motion with a small current. In other respects the appliance resembles the ordinary type of meter.