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MAGNETIC CAR TO TRAVEL 600 M.P.H.
(see page 910)

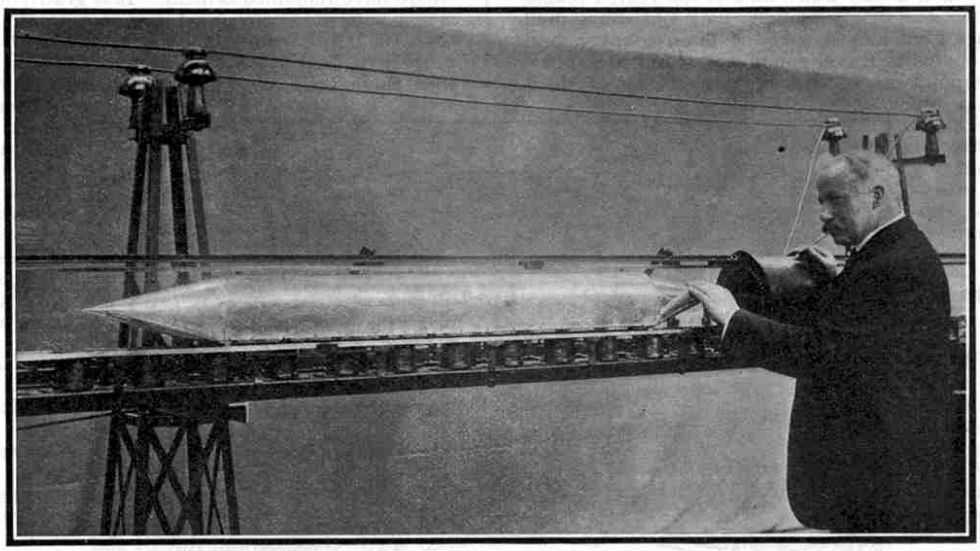
High Speed Trackless Railways

Electro-Magnetic Propulsion at 600 m.p.h.

By H. F. Kutschbach

ONE of the greatest enemies of the transport engineer is friction, for this opposes the movement of all vehicles supported on wheels, whether they run on rails or on road surfaces, and reduces their speeds very considerably. If this friction could be abolished, less powerful engines than those employed to-day could be used to give greater speeds than are now possible, and there would be considerable saving in the cost of repairs as well as in constructional expenses.

The desire to abolish friction has led to the invention of many interesting forms of locomotion. Early in the present century the mono-rail car was introduced by Mr. Louis Brennan. This was a coach of the ordinary type, driven electrically, but it differed from the vehicles employed on ordinary electric railways in running on a single rail instead of on two. The car was balanced on its single line of wheels by means of two gyroscopes. The heavy flywheels of these gyroscopes rotated extremely rapidly, and their property of keeping their axes pointed in a given direction enabled them to restore instantly the level of the car when this was tilted. Very high speeds were attained with perfect safety on this railway, and wear and tear was reduced considerably by the abolition of the second rail.



M. Bachelet with a working model of the electro-magnetic train he invented. The car is resting on the poles of the electro-magnets and one of the solenoids is shown on the right. Our photograph is reproduced from "Electricity," by W. H. McCormick, by permission of the publishers, T. Nelson and Sons Ltd.

Other inventors have tried to eliminate friction and to avoid other defects of ordinary locomotion by using cars suspended from overhead rails. A striking instance is the well-known electric railway that runs between Elberfeld and Barmen, in Germany. This is an overhead system that for part of the distance covered is constructed above a river, and it may be described as a large scale development of the electric telpher dealt with on page 834 of the "*M.M.*" for November, 1929. The cars are suspended from trolleys that run on a single rail, the driving motors being carried by the trolleys; and the reduction of frictional resistance enables high speeds to be attained on this remarkable transport system with the use of comparatively low power.

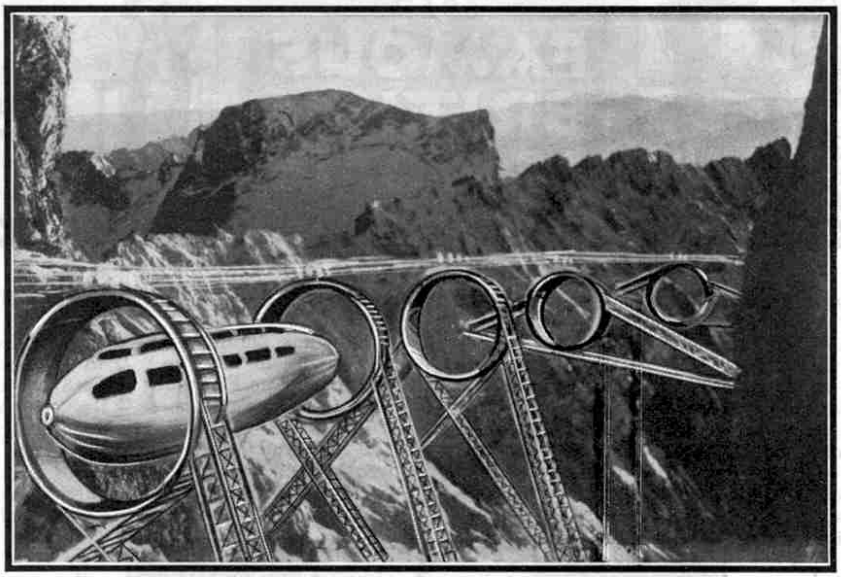
An overhead railway of more than special interest is the Bennie "Railplane," which was fully described and illustrated in an article on page 594 of the "*M.M.*" for August, 1930. The long cigar-shaped vehicles designed by Mr. Bennie are suspended from two-wheeled bogies running on an overhead rail carried on trestles or columns, but differ from those of previous overhead railways in the use of airscrews to drive them. These airscrews are actuated by electric motors, carried in the cars themselves, that are supplied with current from a conductor rail. Thus the wheels on the overhead rail merely act as supports.

At the speeds at which the cars of the Bennie "Railplane" are driven a lifting action similar to that of an aeroplane is brought into operation, and this has the effect of diminishing frictional losses by reducing pressure on the rail. Ball and roller bearing devices also are freely used, and Mr. Bennie claims that on the "Railplane" friction could be reduced to 5 lb. per ton of load. With an average horse-power of 120, a speed of 120 m.p.h. could be attained on the level.

The adoption of the Bennie "Railplane" would greatly reduce the initial cost of railway building, and there would be little difficulty in bridging wide estuaries and other stretches of water by means of the system, for all that would be necessary would be a series of trestles to support the single rail from which the cars are suspended. A further advantage is that undulations of the ground could be followed, for the cars are capable of ascending or descending gradients much more severe than those met with on ordinary railways.

An interesting effort to overcome difficulties due to friction was made immediately before the Great War by a French inventor named Bachelet, whose system differed entirely in principle from those already described. Bachelet made use of the discovery, due to Professor

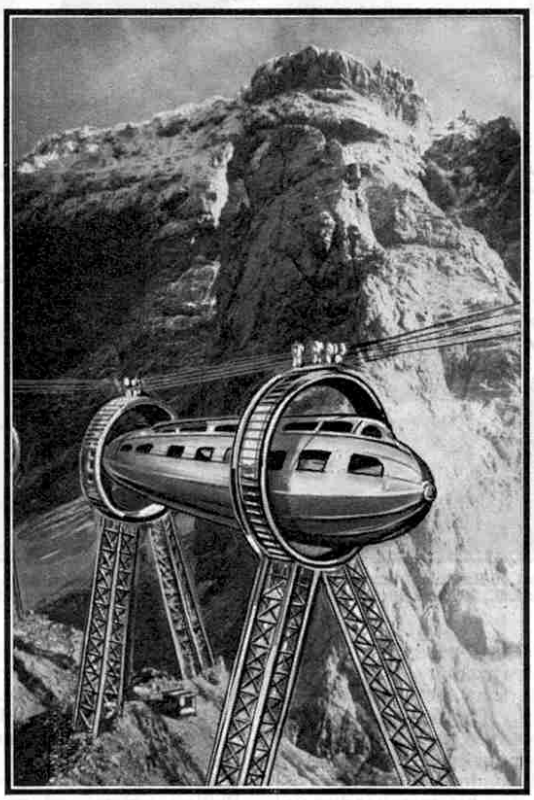
Elihu Thompson, a famous American scientist, that a plate of copper, brass or aluminium was momentarily repelled by an electro-magnet when the current was turned on, and attracted when the current was stopped. These metals are not magnetic, and the attraction and repulsion are not ordinary magnetic effects but are due to currents induced in the plates at the instant of producing or destroying the electro-magnetism. The effects are shown equally well if the magnet is excited by means of alternating current, for this changes its direction very rapidly, and thus changes the magnetism also. The repulsive force is much more powerful than the attraction, and when a powerful and rapidly alternating current is used the plate is repelled so strongly that it remains supported in mid-air above the pole of the electro-magnet.



A trackless electro-magnetic railway in mountainous country. The cars of this suggested railway of the future would attain speeds of 600 m.p.h.

Bachelet employed a track made up of a continuous series of electro-magnets actuated by alternating current. The car, which was roughly cigar-shaped, had a floor of aluminium and contained an iron cylinder. It ran along the line of magnets and was kept in position by means of three channel guide rails, one at each side of the track and a third overhead, in which ran brushes fitted with guide pieces. These guide rails also acted as conductors for the current.

So long as the electro-magnets remained unexcited the car rested on the track, but the repulsive action produced on the aluminium floor when the current was switched on raised it clear of the track and kept it suspended. While in this mid-air position the car was pulled forward by powerful solenoids energised by direct current. These solenoids act like magnets, and when the car entered one of them the iron cylinder was attracted by it, and thus the car was given a forward movement that was sufficient to carry it along to the next solenoid. There the pull was repeated, and so the car was drawn forward from one solenoid to another to the end of the line.



Another view of the proposed trackless railway described in this article.

A model of Bachelet's invention was constructed on such a scale that a child could be seated in the car, and the trials that followed were successful. It was unnecessary to energise all the electro-magnets and solenoids at once, and they were divided into sections, the alternating and direct currents employed being automatically switched on as the car approached the beginning of a section, and cut off as it left. Extraordinary speeds were attained, and the inventor looked forward to reaching speeds of more than 300 m.p.h. in actual practice.

Since the trials of Bachelet's invention the aeroplane and the airship have become familiar means of travel. Friction is of comparatively small importance in air transport. The machines employed must be self-contained power units, however, and the provision of reliable engines for them not only involves heavy expense, but also complicates matters by adding considerably to the weight to be carried, and thus to the power necessary. A further difficulty is that repairs and replacements are impossible during travel, and this adds to the risk of accident. In these respects a railway built on the principles employed by Bachelet would be more satisfactory. The power necessary could be supplied from large central power stations, and instead of engines the cars would only need to be equipped with iron cylinders and plates of aluminium or some other non-magnetic metal, which could be incorporated in the constructional details. The electro-magnets and solenoids that support the car in the air and pull it forward respectively would be stationary, and therefore easy to reach for adjustment or repair. A further advantage of a line of this kind would be the ability to work on gradients more severe than those of ordinary railways, so that it would be unnecessary to build embankments or excavate cuttings and tunnels in its construction.

The ease with which electric railways employing the Bachelet system may be built, and the great speeds possible on them, have led to a revival of the idea in Germany. The engineers responsible for this revival think that the electro-magnets actuated by means of alternating current may be dispensed with, and that the pull of the solenoid would supply the power necessary to maintain the cars in position above the ground as well as to draw them forward through the air. Thus the new lines would have no track. It would be necessary to

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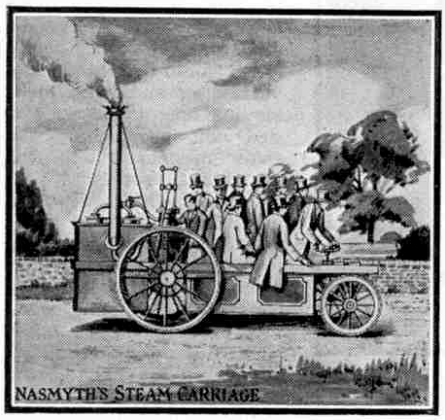
Trackless Railways—(*Continued from page 911*)

provide means of support for the cars at stations, of course, and platforms on which these would stop would be erected at intervals. The cars themselves would be carefully streamlined in order to reduce air resistance.

As was the case on Bachelet's electric railway, current would only be switched on in each solenoid as a car approached it. In Bachelet's model this was effected by means of trip gear on the guide rails, but relays brought into action by the interruption of a beam of infra-red rays may now be used, the cars themselves momentarily cutting off the beam by passing between its source and the photo-electric cell on which it falls. A similar switching arrangement may be introduced for the purpose of cutting off the current in each solenoid in turn when it is no longer needed. If this plan were adopted there would always be an active solenoid ring ahead of each car, and the constant forward pull thus exerted on it would cause it to move like a rocket or a projectile with a speed that might reach 600 m.p.h.



A steam-driven road carriage built about 1827 by James Nasmyth, the famous engineer. It was capable of conveying eight persons.

In order to stop a car it would be necessary to cut off the current in the solenoid immediately ahead of it. Radio would be employed to keep drivers of cars in touch with the power station, and a signal to stop the current could easily be given to the engineer in charge. Cars also could be stopped automatically, the beam of invisible light and the photo-electric cell concerned being placed at such a distance from the stopping place that the car would come to rest exactly on the platform provided. If for any reason a stop were not to be made at a certain station, a wireless-message would instruct the engineer to make the automatic cut-out inoperative.

Experimental work on a large scale will be necessary before an electro-magnetic line of this kind can become a reality. If the system is successful, however, the long and heavy trains that now grind their way at comparatively low speeds over costly steel tracks will be replaced by cars built of light alloys shooting through a succession of giant solenoids. These units will be supported on trestles, and since it will be unnecessary to provide a level route, the line will run over hills and even over mountain passes. Rivers and roadways will no longer be obstacles to be overcome by the construction of expensive bridges, for the trestles supporting the solenoid rings will be of standard design and easy to build in suitable positions.

Travel on the electro-magnetic air lines of the future will be luxurious as well as safe, for the use of light alloys in building the cars, and the absence of heavy machinery, will give the designer more scope than he has at present. The motion of the cars will be smooth and easy, and they will be warmed and heated by means of current picked up from wires along the track.

The advantages of the system will be greatest in cold regions or mountainous countries, for the solenoid rings will be heated by the passage of current through their windings, and thus will be unaffected by ice and snow, two dreaded enemies of railwaymen in many parts of the world. A great network of electro-magnetic lines may thus be built up, crossing Arctic lands, deserts and mountain ranges when necessary to shorten routes.

A Useful Toilet Fitting

The makers of Brylcreem have placed on the market a special pump to simplify the dressing of the hair. By pressing the plunger fitted to the pump a supply of Brylcreem is automatically delivered into the hand. There is no need to remove the cap and shake the cream out; the pump does it in an instant.

The pump is chromium-plated and is easily transferable from one bottle to another of the same size and will last a lifetime. The low price is 1/6.

Romance of Whaling—(*Continued from page 925*)

in the vessel. The blubber yields the finest quality of oil, that from the other parts of the carcase varying in quality.

When the floating factory has obtained a full cargo, and in any case before the ice sets in, she returns to her home port, but the whale catchers do not come further north than Buenos Aires, lying up in this or some other South American port until it is time to return to the Antarctic for the next whaling season. The floating factory again goes south in time to meet the catchers, taking with her sufficient fuel and provisions to supply her own and the catchers' needs for the season.

Whaling is carried on in the Antarctic regions on an enormous scale, and during the past few years about 20,000 whales have been killed annually, British, Norwegian, South African, Australian and American whaling ships participating in this terrific slaughter. It is impossible to say how long the supply of whales will enable this high rate of killing to be kept up, but certain interested countries are already investigating the subject with a view to taking steps to avert extermination of the whales in this region.

Life Story of Meccano—(*Cont. from page 951*)

involve the complete rejection of the locomotive, which is replaced on the belt with a report attached to it stating the reason for rejection. Locomotives that pass satisfactorily are ticketed accordingly and travel along for wrapping and packing.

While the assembly of the locomotive has been going on, the assembly of the train set with which it is to be packed has been in hand simultaneously on another conveyor. In this operation the box, containing only the set of assembled rails, is placed on the convevor with the components for the rolling stock. The assembly is carried out stage by stage in the manner I have described, and after the individual rolling stock has been inspected, wrapped and placed in the box, it is fed on to a cross convevor that passes the end of the conveyor on which the locomotive has been assembled. At this point the locomotive is packed in the box, the necessary literature and guarantee forms are placed in the lid, and the box is wrapped and replaced on the belt to travel to the Stores.

In this description of the assembly of a train set I have necessarily had to confine myself to a brief outline, but it will be seen that there is an amazing amount of work accomplished. Actually in the making of a No. 2 Special Train Set there are 2,732 operations involved! In the next part of my story I will deal with the packing of Meccano Outfits and the final despatch of the goods, in addition to discussing the activities of some of the departments that are engaged otherwise than on the actual production of Meccano and Hornby Trains.

For Dundee Readers

An interesting Meccano Model-building Competition is being run by Messrs. Smith Brothers of 3–15, Murraygate, Dundee. There are three sections, for boys from 7 to 9, 9 to 12, and 12 to 15 respectively; there are no restrictions as to the type of model, and there is no entrance fee. Models must reach Smiths not later than 8th December, and entry forms may be obtained from the firm.

What Shall I Be?—(*Continued rom page 927*)

age limits of 18 years and 23 years, or by competition limited to officers already in the service of the Post Office, with age limits of 18 years and 30 years. Competitions are usually held each year in the spring, and the subjects of the examination are English composition, general knowledge, lower mathematics, electricity and two more technical subjects. As usual, the personal qualities of candidates are tested by means of interviews.

Successful candidates in these competitions are appointed Assistant Superintendents of Traffic in London or Assistant Traffic Superintendents in the provinces for a probationary period of two years. The appointments involve liability to transfer from one part of the country to another in accordance with the requirements of the service and night duty is occasionally required.

The minimum pay is £184/12/– a year in London and £172/6/– a year in the provinces. Promotion to higher grades of service is by selection, and the posts of Assistant-Controller in London and Superintendent in the Provinces carry maximum salaries of £939/14/– and £564 a year respectively. Civil Service wages and salaries have been stabilised with bonus for about two years ahead, subject to certain conditions. All the figures given above represent the stabilised rates, but it should be understood that they are liable to review.

Those who are interested in any of the Post Office careers dealt with in this article may obtain leaflets giving details of the necessary open competitive examinations on application to the Secretary, The Civil Service Commission, Burlington Gardens, London, W. Further information on special points also may be obtained by writing to the Editor of the "*M.M.*," who is always pleased to give advice and assistance in individual cases.

Fun for Christmas—(*Continued from page 955*)

figure to be drawn inside, and then snaps back into place. A Cranked Bent Strip is bolted at the back of the figure and rests against the edge of the Sector Plate.

The model we have named "Professor Strongarm" is so simple that detailed instructions are not necessary. Washers are placed between the 1" Pulleys and the Angle Brackets representing the "Professor's" hands, and if these are adjusted so as to press lightly against the Pulleys, the "Professor" will describe complete revolutions as the Pulleys move along the "bars." The model should be tilted at one end in order to make the figure move. In the illustration the "Professor" is held captive by means of small elastic bands.

Result of October Competition Kay Sports Company

The names of the prize-winners in the Kay Sports Company's Competition announced in our October issue, are as follows:—First Prizes: Master Eric Fennell, 72, St. Ann's Road, Barking, Essex; Master Alfred Welland, 8, Heathfield Road, Plymouth, Devon. Second Prizes: Master John Langridge, 6, Priory Crescent, Lewes, Sussex; Master Frank Cullis, 228, Lichfield Road, Aston, Birmingham. Third Prizes: Master J. Forth, 3, Neale Street, Roker, Sunderland; Master Charles Bramfitt, 9, Lancaster Grove, Kirkstall, Leeds.