

VII.—By Frank Hornby

WHEN a boy takes up a hobby, whatever it may be, he feels a desire to meet other boys who have interests similar to his own, and to compare notes and talk things over with them. This is particularly the case with Meccano. No Meccano boy is content to play a "lone hand" for long; he soon wants to meet other Meccano boys, to see their models and to show them his own, and to discuss plans and schemes for other and bigger models.

It is more than 20 years since Meccano began to take its place as the greatest of all hobbies, and even in those early days Meccano boys were forming themselves into little clubs and societies. Presently we at Meccano Headquarters began to receive letters asking us to set up some form of central organisation to which all the individual clubs and societies might look for guidance and that would weld them all into one great body. We realised that the desire for a central organisation was a genuine and widespread and felt it our duty to do everything we could to satisfy this great demand.

It was in this manner that the Meccano Guild, the most remarkable brotherhood of boys in the world, came into being in 1919, and the announcement of its formation was received with the utmost enthusiasm throughout the great army of Meccano boys of all nations, and applications for membership began to pour in immediately in large numbers. To-day there is scarcely a civilised country in the world where members of the Guild cannot be found. More than 100,000 boys in every corner of the globe have undertaken to do their utmost to fulfil the chief aims of the Guild, and its constitution has caused it to be described as a "Junior League of Nations." With members of the Guild enthusiasm for their common hobby acts as a bond of union, and there is no doubt that the effect of the Guild on the actions of future generations will go far towards justifying this description.

We have been asked repeatedly why we chose the name "Guild" for the great Meccano organisation. The answer is that we wished our movement to be based upon the splendid ideals and traditions of the old Guilds—good fellowship and comradeship, and unselfish working for mutual benefit. The old Guilds are dead, but the spirit that animated them is as much alive to-day as ever, and we believe that that spirit animates the members of the Meccano Guild. So long as its members remain true to these ideals the Meccano Guild will live and prosper and become an ever-widening influence in the world of modern boyhood.

The three objects of the Guild, set forth in the form of application

for membership, are as follows:—(1) To make every boy's life brighter and happier. (2) To foster clean mindedness, truthfulness, ambition and initiative in boys. (3) To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

In order to join the Meccano Guild it is necessary for the form of application to be filled up, signed and witnessed. This form is then sent to the Secretary with a remittance of 7d. (1/- Overseas) to pay for a badge. The applicant is then duly enrolled as a member of the Guild and his badge and membership certificate are sent to him. The neat little triangular badge—its three corners representing the three objects of the Guild—and the handsome certificate are always received with enthusiasm.

The Guild originated for the benefit of Meccano Clubs, and to-day there are more than 400 of these organisations. Their world-wide distribution is remarkable. Strong and flourishing clubs exist not only in Great Britain, but also in the great Dominions, such as Canada, Australia, and New Zealand; and the movement is particularly strong in the Union of South Africa. It is not confined to boys of British race living within the boundaries of the Empire, for in addition the youth of India and Singapore have been wholeheartedly welcomed into

this world-wide brotherhood.

The Meccano Guild has spread northward to Iceland, eastward to China and Japan, and westward to the Pacific Coast of America. It recognises no international boundaries, and the boys of other nations are as keen to unite in order to derive the greatest enjoyment from their hobby as are the boys of British nationality. Many affiliated clubs having large numbers of members exist in Egypt. In France and Belgium the Guild has been specially successful and in those countries a large number of clubs are firmly established. Italy, Holland, Switzerland and Spain all add support to the movement; and recently considerable progress has been made in Northern Europe, the Guild having obtained many recruits in Norway, Sweden and Denmark, where promising clubs also have been established.

Across the Atlantic Ocean, the youth of the two Americas have learned to appreciate the spirit that animates the Guild. In South America in particular great progress is being made, and it has become necessary to print all Guild literature in Spanish. How rapidly the Meccano Guild is gaining ground in South America is shown by the fact that a Spanish edition of the "Meccano



The Meccano Guild is the common bond that unites more than 100,000 members. More than 400 strong Meccano Clubs have been founded in all parts of the world, and as the above portraits show, their Leaders and members are of many nationalities.

Magazine—the official organ of the Meccano Guild—has been introduced and is proving remarkably successful.

The organisers of the Guild have not overlooked the "lone" members. In many cases these live far away from the headquarters of a Meccano Club and often at a great distance from any other Meccano boy. For these members a Guild Correspondence Club has been formed, and this places boys living in the remotest parts of the world in touch with others of similar interests. The Guild Correspondence Club has brought into being many thousands of friendships that have endured for years. In the majority of cases the correspondents have never met, and it is unlikely that they will ever do so; but in a considerable number of instances holiday visits have been paid by members to each other's homes, and personal and enduring friendships have sprung up.

Many striking tributes have been paid by prominent people to the value of the Meccano Guild and clubs, and in this connection we are specially proud of the words of the Earl of Athlone, formerly Governor-General of South Africa. In opening an exhibition of models organised by the Association of the Peninsula Meccano Clubs at Capetown, the Earl of Athlone said:—

"We all want to acquire habits and qualities that will help ourselves and our fellow men—qualities such as perseverance, accuracy, conscientious method, interest and initiative. These are only some of the qualities that membership of this club helps to develop. Interest, I think, is one of the most important, for men and women who are consistently bored and without enthusiasms are not only a nuisance to themselves but to the world at large. No exhibitor who has shown himself capable of the painstaking work, intelligent curiosity, and determination to make good, indicated in the models, would be likely to fail in interest, or perseverance, or conscientious method in any walk of life."

Last month we described the origin and development of the Hornby Railway system. Soon after this system became thoroughly established there came about a repetition of what had occurred with Meccano: Hornby Railway owners were not satisfied to run their railways alone; they wished to meet other enthusiasts to compare notes and to carry out model railway operations on a bigger scale by combining their railway material. In this manner the demand arose for an organisation on similar lines to the Meccano Guild, but devoted primarily to Hornby railways. For some time we hesitated to inaugurate a second organisation of boys, but after a while we came to realise through correspondence that thousands of Hornby Railway owners were failing to secure the greatest possible fun and interest from their railways for lack of a little expert guidance. Ultimately we decided that something must be done, and in October, 1928, we were able to announce the formation of the Hornby Railway Company. Its immediate success was remarkable, and even with our experience of the rapid growth of the Meccano Guild, the rate of development of the new organisation has been a source of continual astonishment to us.

It was clear from the outset that miniature railway owners

all over the world had been in need of the assistance that we were now able to give them. The announcement that membership of the Hornby Railway Company carried with it the right to obtain expert advice on all matters concerning model railways and their operation

resulted in a flood of queries that still continues. The majority of these come from boys who are dissatisfied with their layouts, and who wish to extend and develop them on more railwaylike and realistic lines. All these queries are answered individually, and the various problems involved are dealt with as fully as possible. In many cases a diagram is specially prepared to show exactly how the layout is to be arranged.

This is almost invariably done where station layouts are concerned, in order that there shall be no misunderstandings in regard to the details of sidings, etc.

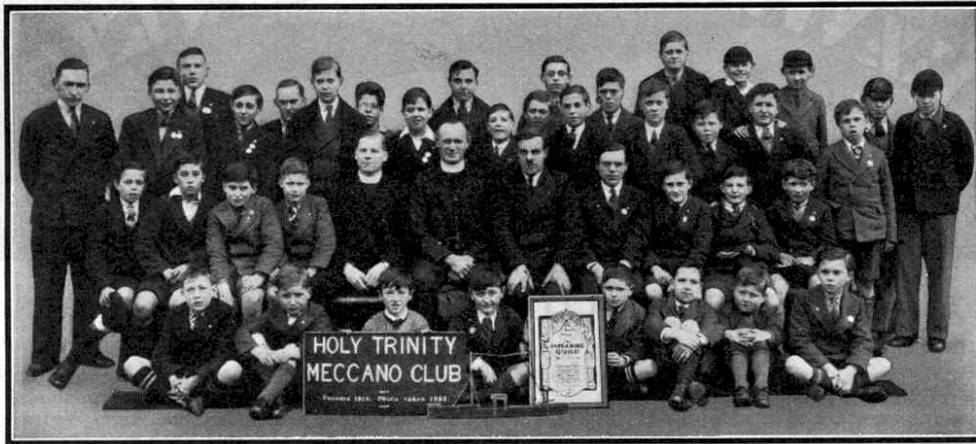
The formation of local Branches of the Hornby Railway Company, each with its own adult Chairman, has brought entirely new possibilities into the world of model railway enthusiasts. At the meetings of these Branches, usually held once a week, miniature railway operations are carried out on a most elaborate scale, made possible by the combining of members' railway material. Very often the material available is sufficient to enable the arrangements of a local station or goods yard to be reproduced almost in full. The planning of such a layout is always a source of the keenest interest, and its operation, when completed, arouses even more enthusiasm.

Another interesting development that has been brought about through the inauguration of local Branches of the H.R.C. is that of systematic visits to places of railway interest. Previously it was difficult for a "lone" model railway enthusiast to obtain permission to visit such places as engine sheds, marshalling yards, etc., but membership of an H.R.C. Branch solves the problem immediately.

From the inception of the Company, officials of all grades of the British railway groups have shown keen interest in the scheme, and have done their best to help it along. Local Branches now find no difficulty in obtaining permission to visit almost any places of railway interest under the guidance of their Chairman. Throughout the summer months we receive a succession of cheery letters from Branch secretaries describing visits that have been paid by the members, and the keen interest aroused as the result. In every case there are a few words of appreciation of the kindness and courtesy of the officials who supervised the visit.

The Hornby Railway Company has a Correspondence Club run on similar lines to that of the Guild, and it is an extremely popular feature. Membership of this club is open to any member of the Hornby Railway Company, whether he is a member of a local

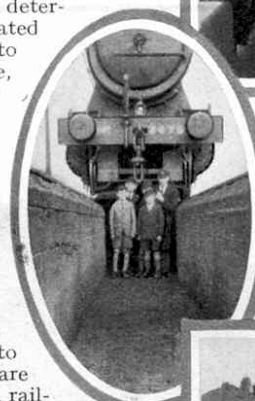
Branch or not. Through the medium of the Correspondence Club members may exchange railway news and thus learn about the many interesting things that are taking place on railways in far-off countries that it is unlikely they will ever visit. Another interesting feature made possible by the Club is the exchange of railway photographs either of miniature or real railways. It is impossible to over-estimate the value of being able to exchange such photographs with friends in different parts of the world.

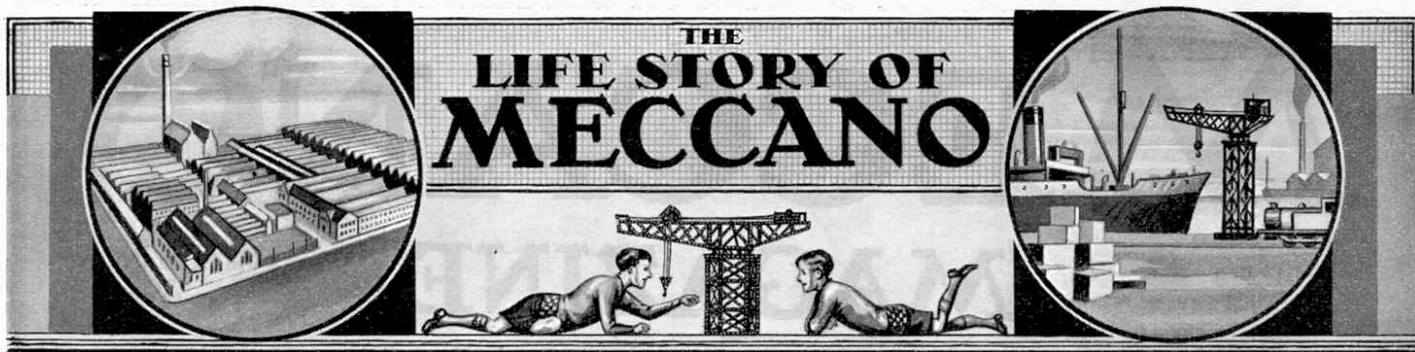


A group of members of the Holy Trinity (Barnsbury) M.C. This London club has the honour of being the first to be affiliated with the Guild, and is one of the most progressive Meccano clubs in the world.



Members of local Branches of the Hornby Railway Company have splendid opportunities of visiting engine sheds, goods yards, stations and other places of railway interest. These photographs show happy groups of members inspecting locomotives.





VIII.—By Frank Hornby

LAST month we told the story of the growth of the Meccano Guild, the first of the service organisations connected with the Meccano hobby, and of the development of the Hornby Railway Company, which brought together enthusiasts in all parts of the world in the same manner as the Guild united Meccano boys. The greatest of all service organisations, however, is the "Meccano Magazine," which made its first appearance in the modest form of a four-page leaflet that was distributed free, postage only being charged. Its expansion into a 6d. monthly with a net sale of more than 70,000 copies is one of the romances in the Life Story of Meccano.

The Magazine owes its wonderful success partly to its position as the organ in which Meccano boys and Hornby Train enthusiasts throughout the world find the connecting link between their hobbies and true engineering, and partly to the opportunities it affords its readers of discussing not only their models, but also their own aims and ambitions, with the Editor and his staff, whose interest in their lives has given the Magazine great social importance.

The beginnings of the Magazine can be traced to the letters that boys who possessed Meccano outfits were encouraged to write to Headquarters. These letters dealt with model-building problems and difficulties, and for some time readers showed little or no interest in the activities of others. Then gradually there came a change. Boys who had built models of particular machines began to show curiosity as to whether other boys had built such models, and how these compared with their own. This spirit developed rapidly, and there arose a widespread demand for the publication in some form of a series of photographs and descriptions of models of special interest for circulation among Meccano enthusiasts generally. It became evident that something had to be done to satisfy this demand, and eventually it was decided to publish experimentally a paper under the title of the "Meccano Magazine."

The first number appeared in September 1916, and consisted of four pages. Its success exceeded all expectations, and a second number was published two months later. From that time the Magazine appeared regularly every two months until July-August 1922, by which time it had grown to eight pages and had attained a steady circulation. It continued to be issued free, postage only being charged, until 1920, when a price of 1d. per copy was fixed. In September 1922, it was decided to publish the Magazine monthly and it has appeared monthly ever since.

By the end of 1923 the number of pages had increased to 28, and in January 1924, the price was raised to 2d. In May of that year the Magazine appeared in the first of the series of coloured covers that still continues. These three-colour covers, each representing some engineering feature of outstanding interest, are unique and they give the Magazine a strikingly individual appearance. A further increase in size

to 52 pages was made in January 1925, and at the same time the price was raised to 3d.

So far the increases in price had been gradual, but in January 1927, the bold step was taken of doubling it. It is always a risky proceeding to make so great a change in the price of a publication, and there have been instances where such a policy has proved disastrous. The position in regard to the "Meccano Magazine" was that there was an insistent demand on the part of readers for developments in various directions; that these demands could not be satisfied without the addition of a considerable number of pages; and that this necessitated an increase in price. It would have been possible, of course, to raise the price to 4d., but after consideration it was decided to make it 6d., and to give correspondingly increased value. This experiment proved fully justified. An immediate drop in circulation was expected and occurred, but after a few months the circulation rose steadily to its former level and then went beyond it. To-day, still at the price of 6d., the Magazine consists of a minimum of 80 pages, rising to over 100 pages for the December number; and its net sales are over 70,000 copies per issue. Some indication of what this means is obtained from the fact that for a December issue some 20 tons of paper are required; one month's issue, if stacked in one pile, would rise higher than the Eiffel Tower.

The early issues of the Magazine were devoted entirely to Meccano. New models were illustrated and described, suggestions from readers were commented upon, and brief extracts of general interest from readers' letters were published with suitable replies. These early issues were, in short, designed solely to show Meccano boys how to get more fun out of their hobby and to encourage them to build new models of their own invention.

Until 1921 the character of the Magazine remained practically unaltered, but in that year a change came about. Boys who had built models of large machines began to express a desire for information about their prototypes. They wanted photographs of these machines and descriptions of their construction and operation written in simple language. At that time information of this kind was not available. There were, of course, the engineering papers, but these were far too technical, and their general style was unattractive to boys. At the other extreme were articles on big engineering undertakings published from time to time in various popular papers. These were almost entirely devoted to picturesque descriptions of the spectacular side of such work, and gave no details of the machinery employed. It seemed

clear that here was a wide field for exploitation, and as an experiment an article was published giving a photograph and a brief description of a large pontoon crane belonging to the Admiralty. This article met with general approval, and it formed the starting point of the long process of development that has resulted in



The cover of the "M.M." when its price was 1d.



An early French issue.

the "Meccano Magazine" becoming recognised as the boy's Magazine of engineering—the only one of its kind in the world.

In comparing the "Meccano Magazine" with other boys' papers one is immediately struck by the entire absence of the familiar tales of adventure and school life. At one time well-wishers of the Magazine urged the inclusion of fiction, on the ground that no boy's paper had ever succeeded, or could succeed, without it. This view had been proved to be completely wrong for when one or two short stories were published with the object of ascertaining the views of readers, a deluge of letters arrived protesting strongly against valuable space being wasted on fiction. Nowadays the only fiction that is published is an occasional story with a strong engineering interest, or still less frequently, one with natural history interest.

A special feature of the Magazine is that every possible encouragement has been given to readers to write to the editor, and to regard him as a personal friend interested in their daily life. To-day the editorial correspondence is immense—the editor's average is over 200 letters a day all the year round—and unique in its intimate character. Correspondents are of all ages, living in all parts of the world. Many of them write monthly, or even weekly, and their letters make it clear that this correspondence plays an important part in their life. Naturally, many of the letters are written with the object of seeking definite information or advice on some particular matter; but a large proportion of the letters have no such practical purpose. They are written simply in the spirit in which one writes to a friend—that is, to tell of one's everyday doings, and of little personal incidents that may be of interest.

Many of these "correspondence friendships" have gone on for years; and some of them have been converted into personal friendships by a visit to the editorial office. The secret of this wonderful correspondence is simple—an individual reply to each letter. Each boy is replied to in the spirit in which he writes—and, equally important, in his own language—no matter whether it be to ask for advice in some difficult situation that has arisen, or merely to announce the arrival of a family of baby rabbits!

In addition to forming friendships between writers and editor this correspondence has the important result of indicating the views of readers upon the various contents of the Magazine. Many of the features that are now most popular have been introduced directly as the result of readers' suggestions, and other features that were less popular have been modified, or in some cases dropped altogether.

The secret of the success of the "Meccano Magazine" lies in the fact that it deals with subjects that are of interest to all intelligent boys, and deals with those subjects seriously. It provides articles that, whilst technically accurate, are at the same time written in an interesting style, free from all unnecessary complications and technicalities. Month by month it surveys the engineering undertakings in progress in different parts of the world, and gives detailed and fully illustrated descriptions of the most interesting of them. The history, construction and operation of machines of all kinds are dealt with, along with biographies of great engineers and inventors, past and present.

The value of the Magazine from an engineering point of view has been freely recognised by leading engineers, whose general attitude may be summed up in the following extract from a letter from Dorman Long & Co. Ltd., the famous engineering firm who undertook the colossal task of constructing the Sydney Harbour Bridge: "We know your Magazine well and appreciate its educational value to those who, as you rightly remark, will become the engineers of the next generation."

It may be said without hesitation that the influence of the "Meccano Magazine" on the next generation will go far beyond

this, however. The intimate contact that has been established between the editor and his readers provides countless opportunities of giving boys helpful advice and encouragement at important periods of their lives. Full advantage is taken of these opportunities, the most direct example being the introduction of a section under the heading: "What Shall I Be?" The articles in this section deal month by month with the different branches of various professions; the prospects in each are reviewed, and advice is given as to the best method of entering upon it as a career. This feature has been greeted with great enthusiasm, and of it Lord Baden-Powell wrote recently: "With your widespread influence on youth you have an unrivalled opportunity of giving sound advice to boys as to shaping their futures. I am therefore glad to see that you are doing this and cordially wish you a full measure of success."

As it is impossible to deal with individual cases in the course of a general article, it often happens that readers interested in any particular profession are in need of further details on some point. These may be obtained by simply writing to the editor, and the manner in which readers in all parts of the world have written to seek advice suited to their particular circumstances is the best evidence that the articles are really helpful. The correspondence arising from them is dealt with by members of the staff who, during the past three or four years

have been steadily accumulating information regarding occupations suitable for boys and are thus in a position to answer the many questions that are asked.

Although the Magazine circulates chiefly in the United Kingdom, many thousands of copies go overseas every month, in particular to Australia, New Zealand and South Africa. The Magazine has, in fact, readers in every civilised country in the world, even in such far away places as Siberia, Labrador, Fiji and Tierra del Fuego.

Naturally the early issues of the "M.M."—four pages devoted entirely to Meccano model-building—did not often attract "grown ups." Now, all that is changed and in many thousands of homes the "M.M." is welcomed and appreciated as much—sometimes even more!—by adults as by the most enthusiastic Meccano boy. Indeed, we receive many letters from boys complaining that father gets hold of the Magazine first, and keeps it until he has read it from cover to cover! Others complain that on the first of the month they notice they are always sent to bed early, so that father can have the "M.M."! In such cases we point out that as "Dad" usually pays the subscription he is entitled to "first whack"

at the Magazine and that in any case there is always a remedy for this state of affairs—to order two copies!

Almost from the first the "Meccano Magazine" had a small circulation in certain foreign countries. It was not long before many foreign readers began to clamour for a Magazine in their own language and the first step towards meeting their demands was taken when publication of a French Magazine was decided upon. This also began as a four page leaflet issued every two months. It progressed steadily and now it appears every month and consists of at least 24 pages, with a coloured cover on similar lines to that of the English issue. Later a further step forward was made by the publication of a "Meccano Magazine" in Spanish to circulate through Spain and South America. This has already achieved marked success, and gives every indication of becoming as popular in its own sphere as its English and French contemporaries are in theirs.

The development of the "Meccano Magazine" from a mere leaflet to a well-established sixpenny monthly added a new branch to the activities of Meccano Limited and next month we shall explain how the Magazine is prepared and printed, and finally despatched to its thousands of readers in all parts of the world.



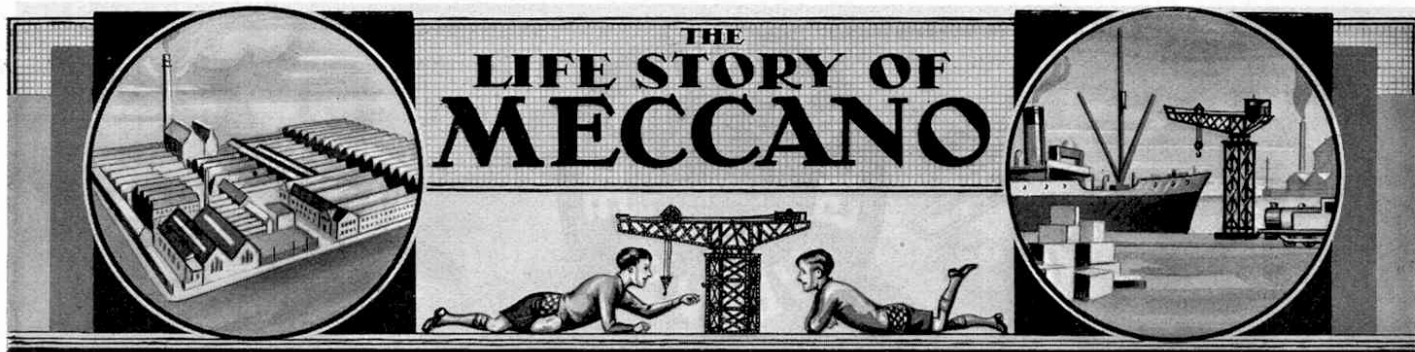
The first cover after the price became 2d.



A typical present-day "M.M." cover in three colours.



Meccano boys keenly interested in the special Christmas number of the "M.M."



IX.—By Frank Hornby

THIS month I commence my promised description of the Meccano Factory and the varied and interesting processes that are carried out in it. I am writing this particularly for readers who may be unable to visit the Factory, but at the same time I hope my account will come as a pleasant reminder to those who have already made a tour of the Factory with one of our special guides.

The plan reproduced on the next page, taken in conjunction with the little sketch reproduced in the heading above, will be helpful in making clear the layout of the Factory, which covers an area of nearly five acres, and gives employment to over 1,100 workers.

Perhaps the best way of explaining the work of the various departments of the Factory will be to describe the processes through which a new item added to the Meccano or Hornby Series must pass. First of all instructions are issued to our designers to prepare samples and estimates of manufacturing costs, and in due course these are presented to the Directors. They are considered in conjunction with the type and style of packing to be employed, and the quantity that may be expected to sell during the ensuing year. Finally, when a decision on these points is reached, orders are issued to the Works to manufacture, let us say, 50,000 of the new article.

Drawings of every part of the new product, schedules of the quantities of material required and of the operations involved and their sequence, are prepared. A set of blue prints from the drawings is sent through to the Tool Department for the designing and the making of the tools, with which the components of the new product will be manufactured. This work must be carried out within very fine limits and a high standard is rigidly maintained. The great popularity of Meccano and Hornby Trains is due in no small measure to the precision of the work of our Tool Department.

In its simplest form a press tool consists of a punch and a die, relative in shape, so that when a piece of metal is placed between them and pressure applied a desired form is produced. Typical simple tools of this type are those used for blanking metal shapes from sheets or coils of metal; piercing tools, the function of which is obvious, and forming tools that bend pieces of metal to desired shapes. A press tool can be carried into many stages of complication by the multiplication of the operations it is required to carry out at one stroke of the press. These are known as "compound" tools, and may actually carry out all the processes of blanking, piercing, and forming at one operation, and in addition assemble components at the same time. An instance of a simple

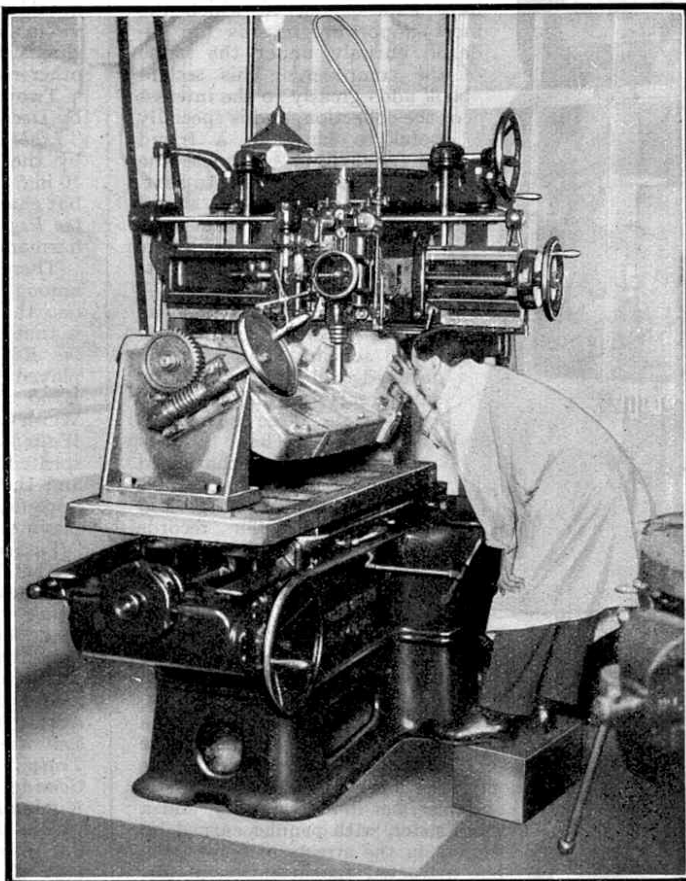
set of tools may be cited in those required to emboss a design on metal, say the window framing of a passenger coach. The lower part of the tool, clamped to the bed-plate of the press, has the actual design cut into its surface in reverse. The top tool, fixed to the ram of the press, bears the design in relief, allowances being made in this relief work for the thickness of the metal to be pressed between the two parts of the tool.

The production of a set of tools is a long job. In the case of the tools for one of our better classes of train sets—a No. 2 Special, for instance—the task may involve several months' work with an ultimate cost running into thousands of pounds. Every individual operation in the production of a train set calls for a specially designed tool, and in this particular instance more than 300 press tools are required.

On receipt of the prints for the new product the tool designer proceeds to lay out the design for the tools. A requisition showing the dimensions and specification of all the material required to make the tools is sent to the Stores, where the required material is prepared. Preparing the steel for issue to the tool-maker may involve cutting perhaps 20 pieces of steel from bars to stated sizes. This is done by a circular cold saw that in three minutes will cut through a bar of mild steel 6 in. in width and 2 in. in thickness. It takes rather longer to cut through the higher grades of steel such as a carbon tool steel, or a chromium alloy steel. Each part of the tool is made from the steel particularly suited to the work it will be called upon to perform. For instance, the base plate of a tool is invariably made from mild steel or cast iron, whereas the die will be of cast or alloy steel.

The first operation after receiving the tool steel in the Tool Department is to machine or grind the pieces on all surfaces. From this point the job is put into the hands of a tool-maker who will be held responsible for the production of this particular tool. He proceeds to outline the shape of the tool on the steel and to do all the preparatory work in readiness for machining the metal to shape. All machine work on the tools is done on special machines, such as turning, jig-boring, grinding, slotting, etc. This machining has to be done with great accuracy, but the degree of precision required will vary according to the particular job. For certain parts of the tool a limit of one-thousandth part of an inch is near enough; for others it may be necessary to work to the extreme fineness of one ten-thousandth part of an inch!

The tool-maker now fits all the parts together, after which they are ready to be heat-treated to give the steel its maximum



The complicated mechanism of the jig-boring machine, referred to in our description of the Tool Department, is excellently revealed in this illustration.

ability to resist the particular strains and stresses to which it will be subjected in operation. The heat treatment varies considerably, according to the grade of steel used in the tool and the result desired from the treatment. Carbon and alloy steel tools are hardened right through by raising them to a given degree of heat—780°C. for carbon steel, 1,000°C. for alloy steel—in either a gas, electric or salt bath furnace. Immediately the tools are brought from the furnace they are cooled rapidly by immersion in a water or oil bath. The tool is heated a second time to temper the steel to a given degree, the temperature employed in this operation being varied according to the degree of temper required. It is rare for any greater degree of temperature than 300°C. to be required in this process. The tempering process lowers the hardness of the steel to working requirements.

Mild steel cannot be hardened in this way, as the carbon content is too small; but the surface of the metal can be hardened if treated by a process known as "carbonisation." This process varies according to the size of the part and the depth of hardness required. Small parts are submerged in a bath furnace of cyanide with a working temperature of 1,000°C., and then quickly cooled in water. Large parts are packed in metal boxes with a carbonising mixture (bone and charcoal, etc.) and are raised to the required degree of heat in a furnace in which they remain for a time that will vary according to the depth of hardness required, six hours being a normal period to secure hardness to a depth of 1/16th of an inch. The cooling process, known as "quenching," is carried out by immersing the parts in water as in the case of small parts.

After hardening, all cutting parts of the tool are ground. The tool is completely re-assembled and is now ready for the necessary tests that must be carried out before the tools are passed to the Production Departments for use.

While the work of preparing the tools has been going on, the estimating staff have been busy ascertaining the quantities of materials required in the production of the order. These materials must be ordered from the makers and be in the Stores ready for issue to the Production Departments immediately the tools are completed. Another section orders the necessary packing materials and the cartons in which the articles are to be packed.

The Raw Material Stores provides the visitor with a vivid impression of the wide range of the activities of the Factory. From 200 to 300 tons of steel, brass and tinplate are maintained as a floating stock. The strip steel used for Meccano parts is stacked in coils weighing approximately $\frac{3}{4}$ cwt. each, and ranging in width from $\frac{1}{2}$ in. upward, according to the part to be made from them. The $\frac{1}{2}$ in. size is used for 12 $\frac{1}{2}$ in. Meccano Strips, which are stamped

from the strip longitudinally. The sizes from 5 $\frac{1}{2}$ in. downward are blanked from wider strips, the width of the strip varying according to the length of the part to be stamped from it.

Perhaps the most interesting material is the tin-plate used for Hornby products. This is packed in boxes and varies in thickness or gauge according to the job for which it is intended, the heaviest

sheets being those used for the boilers and framings of the No. 2 Special and No. 3 classes of locomotive. The greater part of the material is plain, the colouring and design being applied by spray-painting and transfers, processes that will be described in a later article.

When the tools are completed and the raw material is assembled, the processing passes into the hands of the Progress Department the work of which is to supervise the actual production. How involved this work is may be realised from the fact that there are 560 individual parts in a No. 2 Special Train Set. The production of all the parts required for any particular job must be kept running simultaneously so that they may reach the Progress Department Stores together in readiness for assembly. Any delay in regard to any one part would cause a serious hold-up of the whole product.

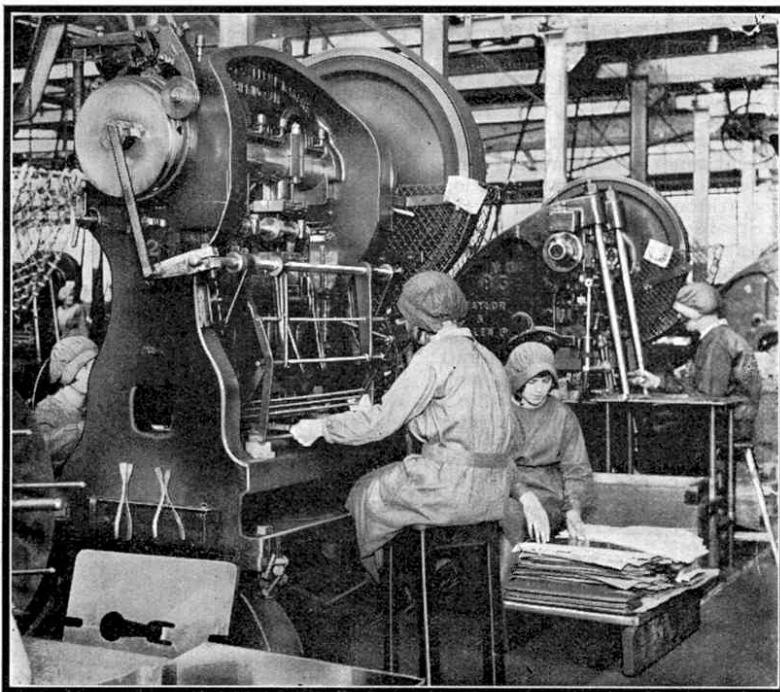
The first of the Production Departments is the Press Department, where

there is a range of presses. Hand-operated presses carry out the lighter classes of work, while the heavier power-driven machines perform the heavier and more complicated work. An interesting feature is that each machine can be adapted to perform any stamping job within the limits of its capacity, by the insertion of the appropriate tools. This interchangeability is an essential feature, for in the making of one simple Meccano part there may be as many as three or four different stamping operations. If each machine were capable of performing only one operation, a Press Department at least 10 times the size of the existing one, which covers approximately 10,000 sq. ft., would be necessary.

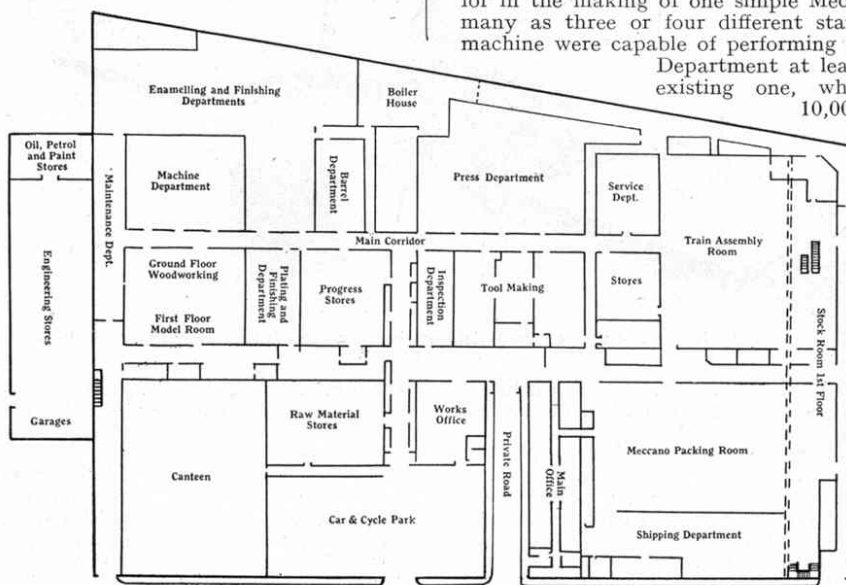
Not all the machines in the department are presses; other machines include a number of guillotines used for shearing tinplate sheets to required dimensions in readiness for blanking operations.

As a typical example of the working of the department we may take the making of a Flanged Plate. The blanking, piercing of the equidistant holes, and flanging, involves three operations in three power presses, working at a pressure of from 20 to 30 tons. In the first operation the plates are blanked from a coil of steel, the coil being placed on a coil holder, and its end fed into the

machine. The top or blanking tool is shaped like the plate, with its flanges laid flat. This part of the tool is fixed to the ram of the press. The bottom portion or die of the tool is of hardened alloy steel, and has a correspondingly-shaped hole cut out, so that the two parts of the tool fit exactly one into the other. The bottom part of the tool is fixed to the bed-plate

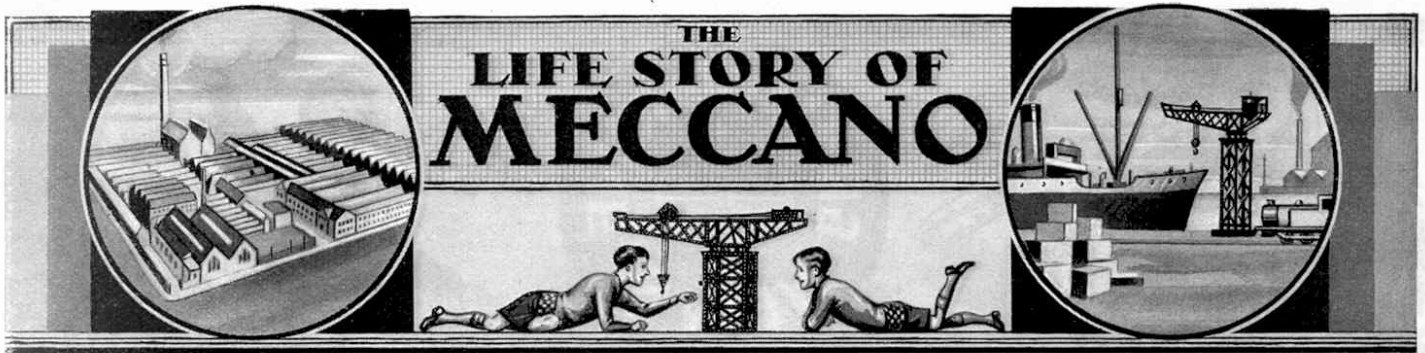


This illustration shows one of the larger presses described, a 70-ton double-crank power press, fitted with one of the latest safety devices to safeguard the operator's hands.



This plan of the Meccano Factory will help readers to follow the progress of a Meccano part in the course of manufacture, as revealed in this and the succeeding articles. The plan is interesting to study in conjunction with the aerial view published in the March "M.M."

(Continued on page 818)



X.—A Tour of the Factory. By Frank Hornby

LAST month we described the making of the tools for use in the Press and Machine Departments and dealt with the work of the Press Department where the blanking, piercing and forming of parts for Meccano and Hornby accessories are carried out. The next department to be reviewed is the Machine Department, located at the end of the main corridor shown in the plan of the Meccano factory reproduced in the October "M.M." This department has many machines of outstanding interest specially designed for particular types of work. Pride of place is taken by a large battery of various sized automatic screw machines and automatic screw threading machines used for turning all such parts as pinion blanks, pummels, solid pulleys, grub screws, etc. To watch pummels turned at the rate of 30 per minute on an automatic screw threading machine that feeds itself with rods from a magazine holding 20 rods, each 10 ft. in length, is a revelation.

The brass rod is automatically fed into the machine up to a swinging stop. It is then gripped by the collet in the spindle, which is revolving at a speed of 5,000 r.p.m. A front cross slide carrying a tool shaped to the desired form of the part to be produced is moved forward by cams and proceeds to turn the rod on the periphery. Simultaneously the drilling spindle, which is revolving at a speed of 2,500 r.p.m. in the reverse direction to the main spindle, moves forward to drill the axis hole of the pummel. It will thus be seen that the drill cuts at a speed of 7,500 r.p.m. On the completion of these operations the tools withdraw and the rear cross slide carrying the part-off tool moves forward and separates the pummel from the rod. The rod is now automatically fed forward again and the whole cycle of operations repeated once in every two seconds.

For more complicated work, the automatic screw machines are used. These machines are fitted with a turret at the rear end instead of a drill spindle, and have main spindles that can be reversed during operation. As many as six tools can be fitted into the turret, such as drills, reamers, taps, dies and box tools. Once the machine is set in operation it works fully automatically, every motion being controlled by cams.

Another battery of machines calling for particular attention are the gear cutting machines. These are of various types, but the most interesting are

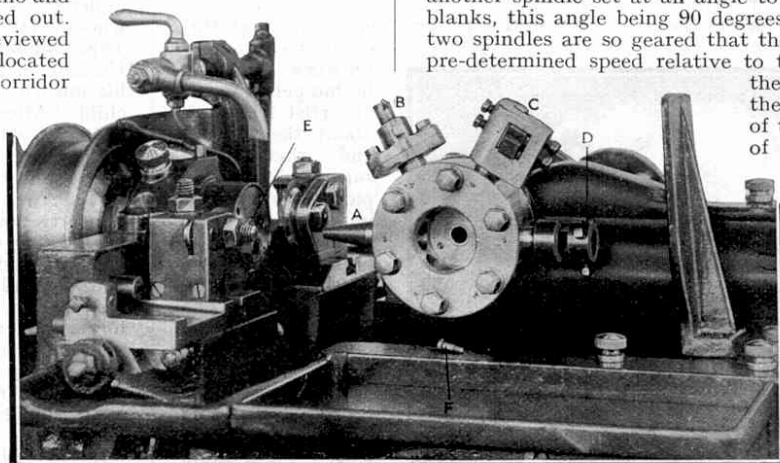
the gear hobbing machines. The blanks on which teeth are to be cut are placed between the centres of the machine and clamped in position. The cutting tool, known as the "hob," is carried on another spindle set at an angle to the work spindle carrying the blanks, this angle being 90 degrees, less the angle of helix. The two spindles are so geared that the cutting spindle revolves at a pre-determined speed relative to the work spindle according to the number of teeth to be cut on the blanks. The cutting teeth of the hob are placed in the form of a worm, that is, at an angle to its axis.

In the case of parts such as gear wheels for clockwork motors, the circular blanks—previously stamped from strips of brass or steel in the Press Department—are clamped together on the spindle until they resemble a short bar of solid metal. The cutting operation is carried out as already described, the length of time required for cutting the teeth on a batch of seventeen 57-toothed gear wheels being nine minutes.

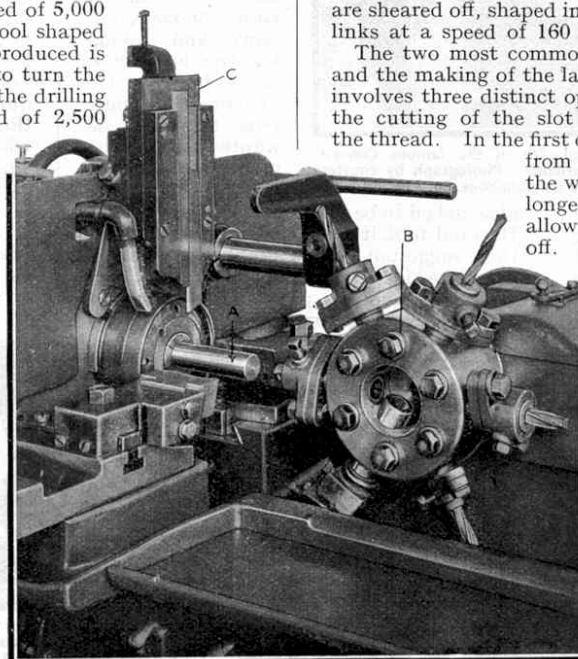
Another most interesting operation in this department is the making of sprocket chain. The chain-making machine works with a coil of fine steel wire that is rolled straight as it enters the machine. Short lengths of wire are sheared off, shaped into links, and linked up with the preceding links at a speed of 160 links per minute.

The two most common Meccano parts are the nuts and bolts, and the making of the latter is carried out in this department. It involves three distinct operations, the heading of the bolt blanks, the cutting of the slot for the screwdriver, and the rolling of the thread. In the first operation steel wire is fed into the machine from a coil, passed through rolls that straighten the wire, and the correct length of wire—rather longer than the length of the finished bolt, to allow for the heading up of the bolt—is sheared off. This length of wire is held in a die while the first operation heading tool gathers the material for the head, the second heading tool smashing it to the correct form. The bolt blank is then ejected out of the die and falls into a receptacle at the base of the machine.

The bolt blanks are taken to a second machine and placed in a hopper in which an arm moves up and down automatically, throwing the bolts on to a grooved chute in the front of the hopper. The shank of the bolt must lie inside the groove with the bolt head resting on the upper surface of the chute, so that the bolts travel down the chute and feed one by one into V-shaped notches on the edge of a wheel rotating at the bottom of the chute. This wheel passes under a circular saw that automatically feeds down and cuts the slots for the screwdriver. For



This illustration makes clear the operation of the turret of an automatic screw machine. A, B, C and D are tools in the turret; E is the point of feed of the rod, and F a finished part. The illustrations on this page are reproduced from the Editor's "Book of Remarkable Machinery," by permission of the publishers, Harrap & Co. Ltd.



A further illustration of the working of the turret. A is the rod of metal ready for working; B the turret, holding centring, drilling, reaming and box tools, about to advance on the rod; C a vertical slide holding the part-off tool. The swinging stop can be seen in the illustration immediately behind the first drilling tool.

the threading operation the bolts are placed in a similar hopper to that employed in the slotting process, and at the bottom of the chute they are forced into the space between the faces of the thread rolling dies. These are circular in form consisting of a centre drum and outer segments, both of which have the thread form on their faces, the outer segments being stationary, while the centre drum rotates rapidly. The bolt travels with the rotation of the drum, and the threading on the die cuts into the surface of the bolt as it rotates with the drum. The thread rolling machines that we employ now actually thread 240 bolts per minute.

In an annexe to the Machine Department we have a section where the casting of Hornby miniature figures, locomotive buffers, chimneys, wheels, signal finials, etc., is carried out. The casting machine on which the locomotive wheels are made consists essentially of a gas-fired cupola or "pot" in which the metal is melted, fitted with a cylinder and plunger. The cylinder and plunger form a pump that forces the molten metal through a nozzle into a mould or die, the latter carrying the form of the part to be cast. Some machines have manually operated pumps, these being used for the heavier classes of work, while other machines have mechanically operated pumps and are automatic. The dies on the heavy machines are water cooled, those on the others being cooled by air.

In the case of driving wheels for the larger classes of locomotives the casting consists of one complete set of four wheels; but other types of wheels are cast in sets of six, eight and sometimes twelve.

The miniature figures and farm stock recently introduced into the Hornby series are cast in hand moulds. After the parts of the mould have been clamped together, the lead is poured in from a small ladle filled from a cupola. The metal cools as it touches the side of the mould, and a rapid inversion of the mould syphons the surplus metal from inside the chilled skin back into the cupola. The mould is then separated and the hollow miniature figure removed.

Before the enamelling, plating or finishing processes can be undertaken, the parts must be freed from the oil and grease with which they have been in contact in the machine or press departments, and must be polished to remove any trace of roughness on the edges or surfaces. The polishing and cleaning work may be done in a variety of ways, according to the nature of the particular part.

The Barrelling Department is devoted particularly to preparing the parts for enamelling and plating, and must next be considered. I have heard this department colloquially described as the "Meccano Laundry," and indeed a casual glance suggests that the department is equipped with a series of washing machines! These are the barrels into which the parts are placed for the cleaning and smoothing process. The smaller types of barrel use sawdust, and the larger ones scrap leather, as polishing media. The parts are dumped into these barrels and rotated for periods varying from 30 minutes to three hours, and in some cases even longer, according to the nature of the parts. As the barrels rotate the parts tumble one over another,

the rubbing having the effect of burnishing them.

In the case of strips, flat plates, girders and similar parts, the bumping about in the barrels has the effect of bending the parts, and subsequently they must be straightened. This is achieved by passing the parts through rolling mills comprising a set of seven rollers mounted three upon four, the clearance between the rollers being adjustable, so that after the strip has passed through it comes out perfectly straight.

Although the primary purpose of the barrelling process is to smooth the parts, it does also remove oil and grease, although not to a degree sufficient to permit immediate plating or enamelling. Before either of these processes can be carried out the last traces of grease must be removed. This is done in a variety of ways. In the case of Meccano Strips that are to be enamelled, the parts are laid in mesh-bottomed trays in a vat

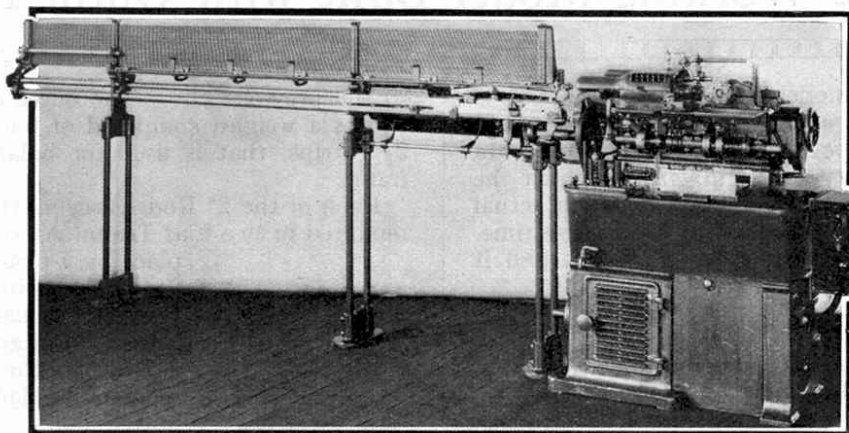
employing trichlorethylene as the solvent. At the bottom of this vat there is a sump containing the chemical, which is vaporised by heating with steam passed through a pipe in the sump. Immediately above the sump is a coil of steel tube through which cold water is circulated. Above this coil is a rack on which the mesh-bottomed trays are laid, and at the top of the tank is a further coil of steel tubing for the circulation of cold water. After the trays of parts are placed in the tank, it is closed, steam passed into the pipe in the sump, and cold water set in circulation through the coil at the top of the tank. As the vapour rises it acts upon the grease on the parts, loosening it. When the vapour reaches the top of the tank, contact with the cold water coil condenses it into vapour rain which, descending, washes the grease down into the sump. At the end of approximately ten minutes the steam is shut off and the cold water diverted from the upper to the lower coil. Condensation then takes place below the level of the frames containing the parts, and at the end of a further two minutes the tank is sufficiently clear of fumes to permit of its being opened and the trays removed. The parts are then clean and dry.

Certain types of parts to be enamelled, such as locomotive housings and speedboat hulls, are not suitable for cleansing in this manner, for they contain various corners that prevent the free circulation of the solvent. These parts are de-greased in sweating stoves, the working temperature of which is 280°F., the grease being evaporated away. Since the temperature to be encountered in the enamelling stoves, to which I shall refer later, does not attain a higher level than 220°F., there is no risk of free grease showing itself in any subsequent operation in the finishing processes.

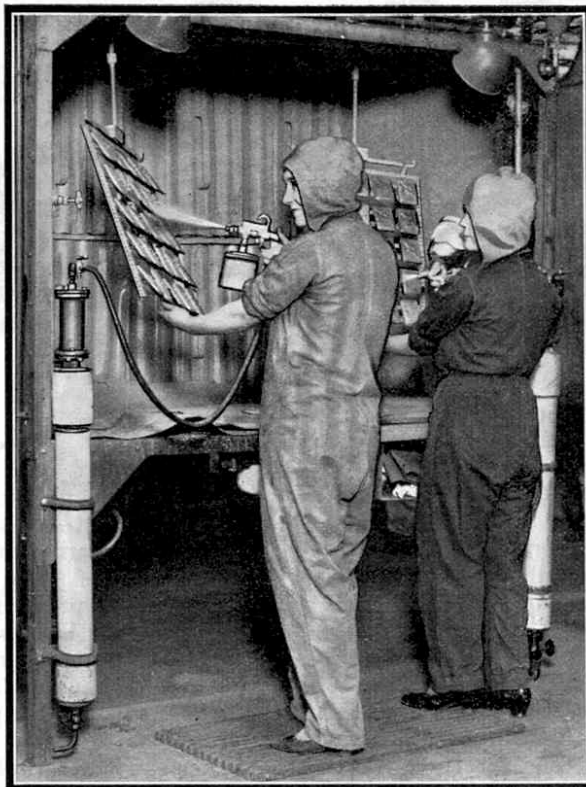
The de-greasing process employed for parts that are to be plated is carried out in the Plating Department

itself. In this case the parts are clipped on to frames or strung on copper wires and placed in a chemical bath containing a solution of caustic soda and cyanide of potassium. A current of electricity is passed through the bath from an iron anode, the frame of parts constituting the cathode, and this causes the chemicals to give off hydrogen gas at the cathode. The gas penetrates the film of grease on the parts and forces it off. The

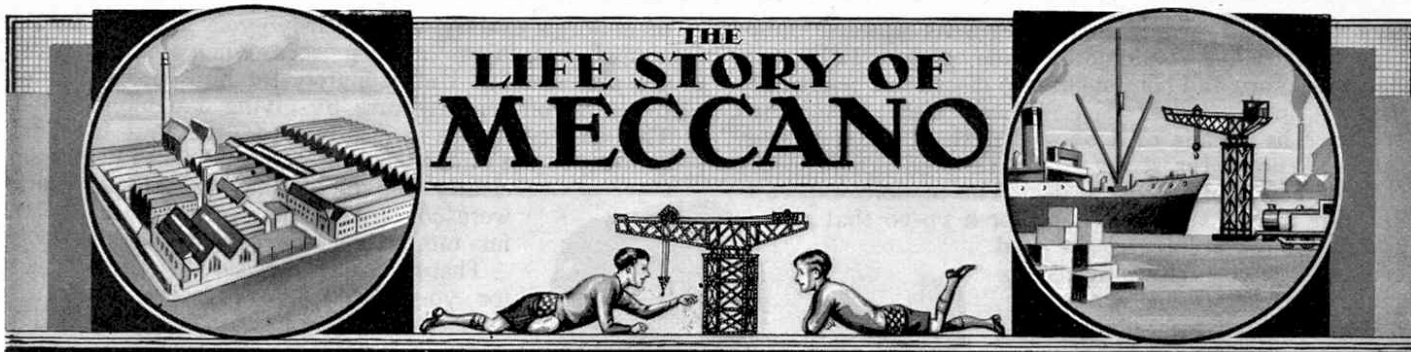
(Continued on page 860)



A high-speed screw machine complete with automatic feeding magazine, similar to that described in our article.



Spraying operations in progress in the No. 2 Enamelling Department, which will be described in the next article in this series. The enamel is contained in the reservoirs mounted below the spraying pistols, which are operated by compressed air.



XI.—A Tour of the Factory. By Frank Hornby

I CONCLUDED the previous instalment of my story by stating that the Enamelling Department might be considered the most interesting of the Finishing Departments. This department demonstrates most effectively the smooth organisation that is a feature of the Factory and, what is of equal importance, the fact that a "messy" job can be carried out without sacrifice of cleanliness and efficiency.

The Meccano parts treated here are spray enamelled, the enamel being forced from spraying "pistols" by means of compressed air. The enamel leaves the pistol in the form of a fine cloud, and it is this fineness that enables us to secure the even and smooth finish that is characteristic of our parts. For convenience of handling, the parts are spring clipped on to frames that are drawn by an endless chain through two spraying booths, placed side by side but facing in opposite directions. In the first booth one side only of the frame is sprayed, and the frame then travels on to the succeeding booth for the other side to be finished. After passing through the spraying booths the frames, complete with parts, are transferred from the spray conveyor on to the racks of the conveyor in the enamelling oven. These racks move through the oven on endless chains that completely circuit the interior of the oven, returning to their starting point in from two to 2½ hours, throughout which time the sprayed parts are subjected to varying temperatures ranging up to 220°F. On removal from the oven the parts are stripped from the frames and placed in trays and boxes to be taken to the Meccano Packing Room.

In the case of Hornby products the actual spraying operation is carried out in precisely the same manner, but the delivery to the operators is achieved in a different way, because these articles are not so suitable for the system of operation just described. The parts are placed on wire mesh frames and laid on travelling trays suspended from an endless overhead conveyor that completely circuits the department. The spraying booths are placed in two rows facing one another with the conveyor passing between. The operators working in the spraying booths take the frames of parts from the trays, completely spray them, and replace them on the next convenient passing tray. In its journey round the department each tray passes the operator engaged in loading and unloading the enamelling oven, and at this point the frame of parts is lifted off and placed on the chain conveyor in the oven. Any frame of stoved parts that has just left the oven is placed on the empty tray, which continues its journey to an unloading point for finished goods. As the tray travels along it is emptied, and then continues its journey round the department back to the point at which it was originally loaded with parts to be sprayed.

Two interesting automatic spraying machines are to be seen in this department. Parts to be sprayed on these machines are mounted on upright metal spindles, about 12 in. in length, located

on the outer edges of a turntable approximately 4 ft. in diameter. The spraying apparatus consists of three nozzles. As the turntable moves round, the spindles are successively brought into contact with a clutch and made to spin rapidly. Synchronous with this rotation jets of spray are forced through the nozzles, the path of the jets converging on the work. The spinning of the part presents its whole surface to the paint for a time sufficient to secure an even coating. As the turntable continues its circuit the sprayed parts are lifted from the spindles and placed on a wire mesh belt travelling endlessly through a tunnel over 83 ft. in length, through which the parts take approximately two hours to travel.

An interesting example of finishing work may be followed when the spraying of pulley wheels is in progress on these automatic machines. After the spraying and stoving the wheels pass on to a bench fitted with a belt conveyor, at which sit a number of operatives. In the first operation the boss is riveted into the pulley wheel and replaced on the belt, to be carried along for the second operation. In this the wheel is tested for concentricity and to ensure that the hole in the "boss" is of standard size. If the wheel is passed as true it is replaced on the belt and passes to the third operation, the fitting of a set screw into the boss. This is done with the aid of a mechanical screwdriver, a tiny machine consisting of a crossbar mounted over two springs, and a screwdriver turning rapidly in a slot cut in the edge of the crossbar. The set screw is dropped into this slot, head

downward, and the screwdriver engages with it. When the boss of the pulley wheel is placed over the slot and the crossbar forced down, the set screw is driven into position. Finally the wheel is tested a second time to ensure that the boss is firmly riveted, and after passing this test successfully it is packed in readiness for conveyance to the Stores, and subsequently the Packing Department.

All products of the Meccano Factory are guaranteed, and before they are packed they must be inspected to ensure, as far as is humanly possible, that nothing faulty leaves the Factory. In the preceding paragraph I have given an insight into our inspection system, but many parts do not lend themselves to inspection as part of the finishing process, and these are dealt with in a special inspection department. In this large numbers of trained operatives are employed to scrutinise and gauge the parts as they come from the production departments. The work involved is enormous, and a simple illustration will make this clear. Our average daily production of Nuts and Bolts is over 115,000, and every one of them has to pass an inspector. This is but one item in the department's daily work!

After passing satisfactorily all the tests applied in the Inspection Department, the parts are ready for assembly in the case of Hornby Train components, or packing in the case of Meccano Parts, and are sent to the Stores until required for those purposes.



The system of line conveyor work is made clear in this photograph. On the nearest belt a variety of articles are being assembled, including turntables, signal boxes, level crossings and locomotive tenders. The assembly of locomotives is in hand on the second belt. The test tracks referred to in the article are plainly shown.

The packing of Meccano Outfits is a matter that can be left until a subsequent stage of my story, and our tour of the Factory now leads us to the Train Room, a department some 16,000 sq. ft. in area divided by a main central gangway, running parallel with which are numerous work benches of the conveyor type. The conveyors on the south side of the main gangway are used for the assembly of rails, hand finishing of sprayed components—such as locomotive housings—and the assembly of units such as clockwork mechanisms. These parts of the locomotive subsequently pass to the conveyors on the north side of the gangway, where the final assembly is carried out.

The principle of operation is substantially the same in all the conveyor work. The components of the article to be assembled are placed on the conveyor at pre-determined time intervals and, as they travel along, the various assembly operations are carried out by the workpeople seated alongside the conveyor. Each operative concentrates on one operation—in some cases two—and gradually the article assumes its finished form and finally is examined, tested, wrapped, placed in its carton and laid on another conveyor to be carried to the Stores.

Some exceedingly interesting demonstrations of the care and skill that go to the making of Hornby Trains may be obtained in this department and as an example I select the finishing of a No. 1 Tank Locomotive.

Actually the preliminary assembly of the components of the locomotive housing, prior to enamelling, is not carried out in the Train Room. Obviously it would be wasteful administration to take the components from a Stores adjacent to the Enamelling Department to the Train Room for assembly, then to the Enamelling Department for spraying, and back to the Train Room for hand finishing. The assembly is therefore carried out in juxtaposition to the Enamelling Department.

The components of the locomotive are placed on the belt, and the assembly operations in sequence are as follows:—fixing the couplings; mounting the pillar bolts on the framings for the motors; fitting the wheel guards to cylinder boxes, the cab fronts to the cab sides, the cabs to the boilers and the wheel splashes to the cab and boiler sides; mounting the cabs and boilers on framings; pressing on the buffers, and finally inspection of the complete housing before passing it to the degreasing and enamelling processes.

These have been described in an earlier part of this series, and the locomotive may now be followed to the Train Room itself.

The locomotive is placed on the Handpainting and Transferring line conveyor, and as it travels along the transfers bearing the locomotive number and the railway company's identifying lettering are trimmed to shape, painted with gold size and laid on the belt alongside the locomotive. The first two operations are fixing the transfer and floating off its paper backing. These processes need not be described in detail, because the underlying principle is familiar to every boy who has stuck a transfer on the back of his hand.

The next operation is the lining of the boiler with its circular bands of colour, and then in succession the painting of the buffer beams, the steps to the footplates, the chimney, the smoke-box, steam pipes, cab roof, and the whistle or safety valve cover. These involve several different colours, each being applied by a different operator; and finally the locomotive travels into the Varnishing Department, where it is placed on a dwell conveyor that carries the parts slowly along while the recently applied paint dries out. The Varnishing Department is a small but important section located in the south west corner of the Train Room. An elaborate air-conditioning plant is employed to extract every particle of dust from the air in the room, for dust must not be allowed to come in contact with newly varnished goods, otherwise the highly glossy finish would be ruined. The varnishing and subsequent stoving operations are carried out in precisely the same manner as in the enamelling process.

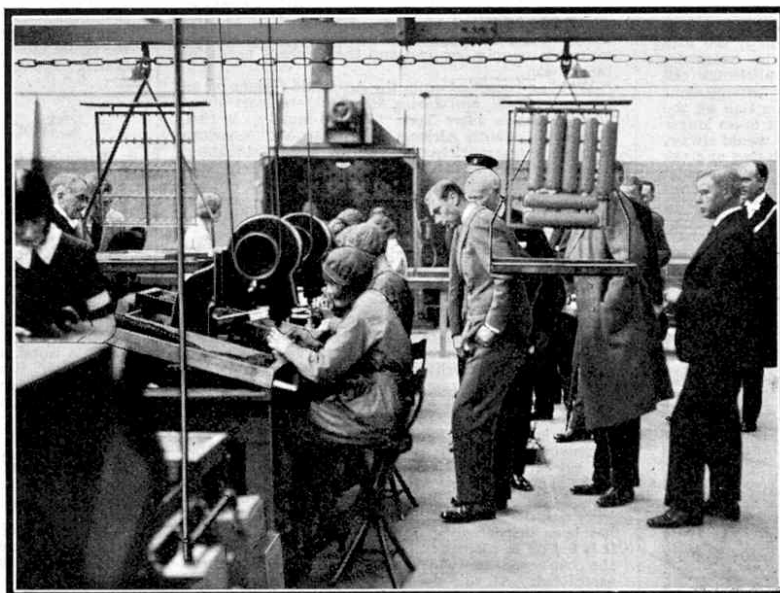
Simultaneously with the hand finishing of the housings the clockwork motors for the locomotives are assembled on an adjacent conveyor. In this work sets of components, other than the spring, are collected from bin racks located at the feeding end of the conveyor, placed in a metal cylinder, and laid on the conveyor. As the cylinders pass the operatives seated at the belt they are lifted off, and the whole of the mechanism of the motor is assembled by one operator. The mechanism and the locomotive driving wheels are replaced in the cylinder and laid on the belt to travel along to the operator responsible for winding in the springs. Owing to the cumbersome nature of the strips of spring steel these are laid in troughs over the winding machines, ready for use, and are not sent along the conveyor with the remainder of the components.

Finally the driving axles projecting from the side plates of the motor are stamped in a press to provide a keying for the wheels, which are pressed on in the next stage of the assembly. The finished motor now travels on to the end of the conveyor, where it is placed in a receptacle in readiness to be transferred to the conveyors on the north side of the Train Room. The empty cylinder is placed on a chute and runs back to the feeding point in readiness to re-start its journey.

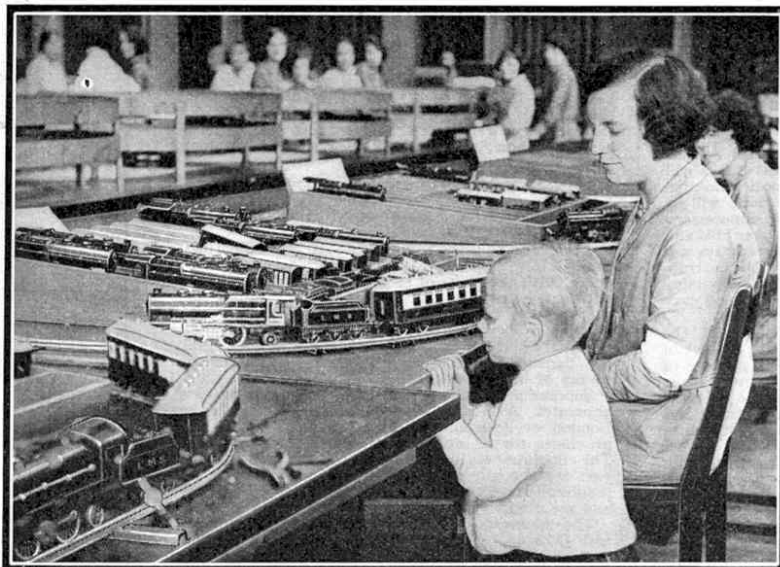
The assembly of the motor and housing involves further conveyor work. As the two units travel along, the reversing and brake

levers are fitted to the motor and the hand rails to the locomotive boiler, and finally the motor is bolted into the housing. The conveyor carries the locomotive to the test tracks, at which are seated a number of highly skilled operatives whose work it is to assure themselves that mechanically the locomotive is up to specification for performance. Naturally the standards specified vary according to the class of locomotive under test, but in all cases the test involves pulling a load of rolling stock equivalent to that with which the locomotive is packed for sale.

If any minor adjustment is found necessary the tester makes it immediately, but major adjustments

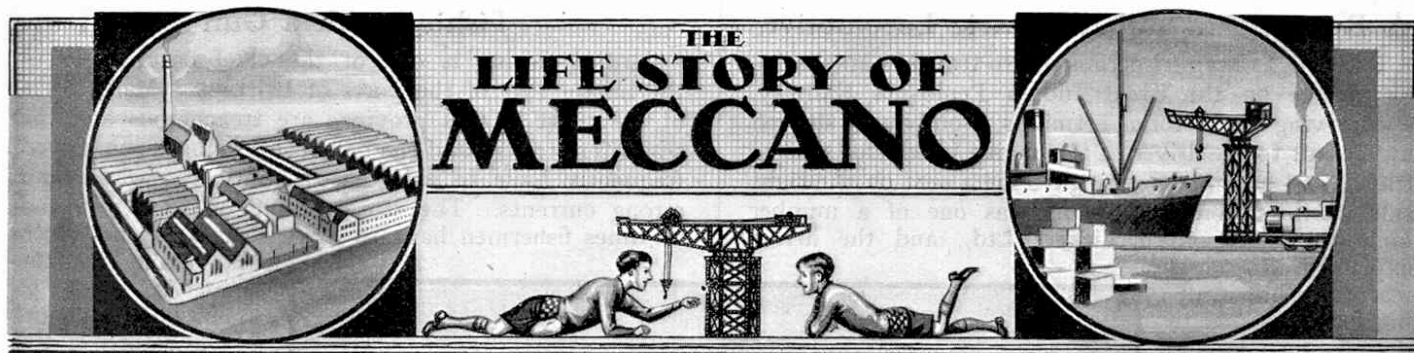


H.R.H. the Duke of York is here seen keenly watching the operation of riveting in the bosses to the pulley wheels after spraying, an operation described on the opposite page. Some of the travelling trays that circuit the Enamelling Department can also be seen in this illustration.



A young visitor to the Factory takes a close view of the testing of a No. 3 locomotive.

(Continued on page 952)



XII.—A Tour of the Factory. By Frank Hornby

IN last month's "M.M." I dealt with the finishing and packing of a Hornby Train Set. Before passing on to the packing of Meccano I would like to mention one interesting fact concerning the Train Room that will help my readers to understand the detailed study that has been applied to the organisation of this Department.

When any article is under production for immediate shipment, it is in continual motion from the moment of being placed on the Transfer and Handfinishing conveyor until it reaches the Shipping or Despatch Department. The journey from the Train Room is by way of an endless chain elevator and roller chute that carries the goods up to the Stock Room on the first floor, and deposits them on the upper band of a double conveyor running the full length—nearly 300 feet—of the Stock Room in each direction. The upper band travels towards the north end of the Store and the lower band towards the south. At the north end of this conveyor there is a spiral chute leading down to the Shipping Department, and goods reaching this chute automatically topple into it from the conveyor. It will thus be seen that goods brought up to the Stock Room by elevator and fed out on to the conveyor are automatically carried to the Shipping Department.

The conveyor is used primarily to distribute goods to the various bays in the Stock Room, however, and in normal practice an attendant is stationed at the head of the elevator to sort out goods going to stock bays south of the elevator from those going north. Material going north is allowed to transfer itself direct from the roller chute to the conveyor, while that going south is lifted from the chute and placed on the lower band of the conveyor to travel in the opposite direction. The storekeepers lift the goods from the conveyor as it passes the bays, and stack the parcels away in their correct places.

There is not space here to discuss the organisation of the Stock Room, but in order that the system under which the goods move through the factory may be made clear it is necessary to deal at this point with the actual despatch of finished goods. As the orders for despatch are received in the Stock Room they are split into sections, and issued to the storekeepers controlling the bays in which are stored the items included in those sections. The storekeepers collect the necessary goods and lay them on a rack immediately above the distribution conveyor just described. A system of coloured flags is employed—the same colour being allotted to all the sections of one order—to enable the storekeepers working at the different bays to identify the orders on which their colleagues are working. When the flags showing along the rack indicate that all the sections are collected and ready, the goods are laid on the conveyor and carried down to the Shipping Department. An advice note identifying the shipment passes

down the chute with the first package, in order that the articles following may be checked during packing.

Simultaneously with the processes just described, the assembly of Meccano Outfits has been going on in the Meccano Packing Department. This work also is carried out on conveyors, empty cartons being placed on the belt together with the loose parts, to be carried to girl packers seated alongside the conveyor. The packing process follows the general lines of the conveyor work described in other assembly processes, each packer in turn fixing

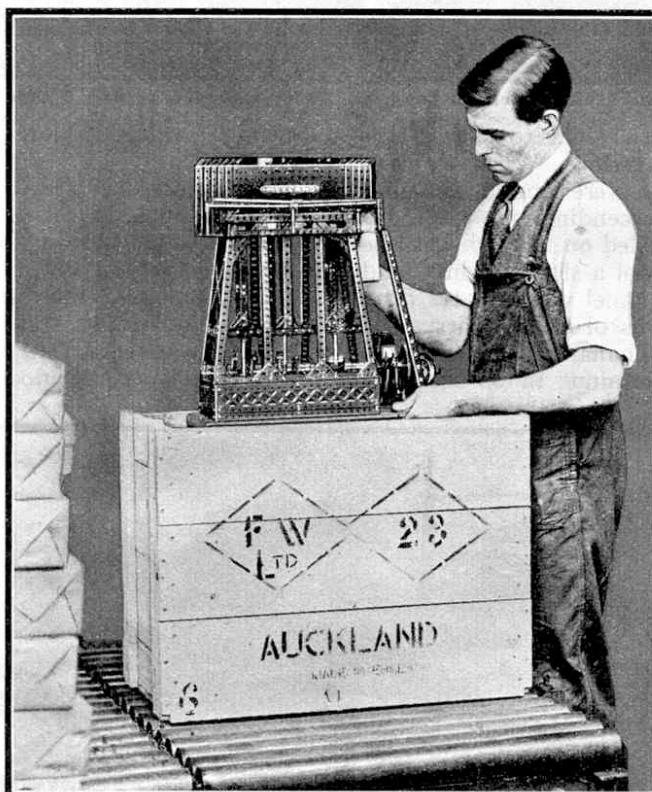
certain specified parts in position in the carton. There are two main assembly conveyors in operation in the Meccano Packing Department, each of them capable of handling 25,000 outfits a week with a normal complement of 26 operators per belt.

The wrapped outfits are carried away to the Meccano Stock Room by conveyors working across the heads of the assembly conveyors. This stockroom occupies a comparatively small space in the department, for the great bulk of Meccano parts are stored loose in specially designed bins and trays, in order that the stock of parts may be kept in a fluid state and available for packing into outfits of any size as desired.

A specially interesting feature of the Department is the method of counting the parts when they are taken into stock from the Production Departments, or in the course of packing. Obviously hand counting is out of the question—each year we make thirty millions of nuts alone! What is known as a Computation Scale is therefore employed for small parts in mass. This is a lever scale with a large centre pan and two small pans suspended from levers, giving a ratio of 10 to 1 on the first lever and 100 to 1 on the second. One part in the small pan at the end of the first lever balances 10 parts in the large centre pan and one part in the

pan of the second lever balances 100 parts in the large pan; so that it is a matter of seconds only to compute the number of parts in any consignment. For heavy parts such as Meccano Strips, where the consignment may weigh a quarter of a ton or more, a weight factor is used, and the total weight of the consignment in pounds is multiplied by this factor to give the number of parts in the consignment.

An interesting electrical counting machine is used to count bolts or nuts into boxes for packing with the outfits. The parts being packed are placed in a hopper and automatically fed out on to a small vibrating platform. As the platform oscillates it throws the parts one by one over its tilted lip into a small hopper mounted on one end of a scale lever arm. At the further end of this lever is a weight pan containing 12 bolts—assuming that bolts are being counted out in dozens—and the weight of this pan holds the small hopper in position until 12 bolts have been thrown into it. The equalisation of the weights then balances the lever arm and



A Marine Engine Model being packed for shipment to New Zealand. The roller packing "table" that makes the handling of heavy cases an effortless matter is a specially interesting feature of this illustration.



This illustration gives a comprehensive view of the Train Room with the locomotive test tracks a prominent feature in the foreground. The long conveyors used in the assembly of clockwork motors and for hand finishing can be seen in the background.

automatically breaks the electric circuit that has energised the oscillating mechanism. Simultaneously the floor of the small hopper opens to drop the bolts into the box waiting below. With the dropping of the bolts the weight pan pulls the hopper back into position, the contact is restored, and the process repeated.

And now the only operation intervening between the Meccano Outfit or Hornby Train Set and the outside world is the packing for despatch in the Shipping Department. The scene in the Shipping Department is possibly more colourful than any that has been encountered previously in my story. The great many-hued stacks of cartons awaiting attention from the packers strike a cheerful note that leaves a very vivid impression in the mind of the observer.

The goods awaiting despatch are trucked to the packers from the Meccano Stores, or the foot of the Stockroom chute. After surveying a consignment, the packer handling it is able to estimate within very fine limits the number and sizes of the cases required, and without any apparent "juggling" he fills every inch of space with goods! A roller conveyor running alongside the packing "tables" is used to carry the filled cases from the packers to the loading platform, and in the course of its journey each case is checked for a moment while bands of steel strip are fastened around it as a further measure to ensure safe transit. At this point the case is also labelled or marked with a stencilled shipping mark. Finally the case is carried over a weighing machine—an integral part of the conveyor—where its weight is registered, and thence it passes down a gently inclined roller chute leading out on to the shipping platform, to await its turn to be loaded for despatch.

Although our busiest season is concentrated around Christmas, the most interesting time of the year in the Shipping Department is from the beginning of August until the end of September, when the main Overseas consignments are being handled. At this season consignments are going out to all parts of the world, and names such as Hong Kong, Tokyo, Melbourne, Beira, Bombay, Sydney, Karachi, Singapore, Auckland, Lisbon, Genoa, Hamburg, Berlin, Toronto, New York, Valparaiso, Buenos Aires and Rio de Janeiro are commonly observed. It has been said that the sun never sets on the British Empire. The words "Meccano Boy" might be substituted for "British Empire"; indeed, I might go further and say "The sun always shines on Meccano boys!"

Up to this point I have confined my description of the Meccano

Factory to the departments engaged in the actual production of Meccano and Hornby Trains. There are, of course, several auxiliary departments of great importance, and without reference to these my story would be incomplete.

The most important of these departments are the Model Building, Printing and Service Departments. The function of the Model Building Department is apparent from its name. Here all the splendid models that are seen in Meccano dealers' displays during the winter season are constructed. Some idea of the extent of its work may be gauged from the fact that during the past year more than 730,000 bolts and over 750,000 nuts have been used in the department! Obviously the work calls for careful organisation, and although conveyor operation

is not feasible, the mass production principle is in use here as elsewhere throughout the factory.

I call to mind an occasion some years ago when it was found necessary to construct quickly several hundreds of motor car chassis models for use in a special advertising scheme. For a week or two the department resembled a motor car factory. Every member of the model building staff was called into service, some to build gear boxes, some differentials, others chassis framings, and so on until every stage of the building

and assembly had been portioned out. Never were motor cars constructed so quickly!

Our photographic work is carried out in the Model Department, a specially equipped studio and dark room being provided for the purpose. All the splendid reproductions of models and of realistic looking Hornby Railway scenes are from photographs produced here.

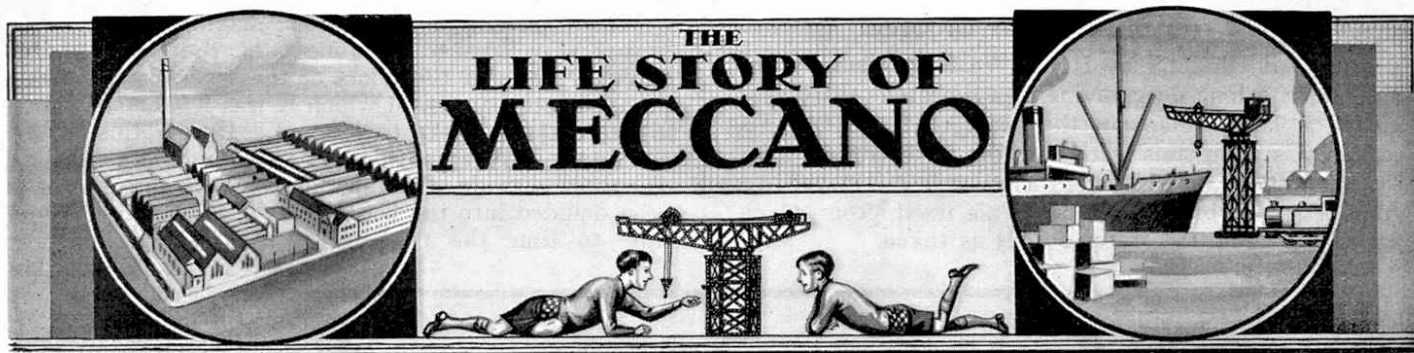
It is unnecessary to deal in detail with the work of the Printing Department, for only a year or two ago, in describing the production of the "M.M.," we devoted several articles to printing operations. There is much to interest the visitor in the Department, however, for although it is yet an "infant," it is growing rapidly, and during the past year it has produced many millions of small items in printed matter, principally leaflets, labels, and small folder catalogues.

Actually these represent but a small part of our yearly printing requirements, as will be obvious when I mention a few items in the list:—900,000 copies of the "M.M."; 130,000 copies of the Hornby Book of Trains; 1,500,000 Manuals of Instruction; and 500,000 Dealers' Catalogues. Huge orders

(Continued on page 85)

At the Meccano Factory

Number of pieces sprayed per day	120,000
Number of operations in making Hornby Train Sets:	
M1 Goods	726
No. 1 Goods	1,583
No. 1 Passenger	1,887
No. 2 Special Passenger	2,732
Shipping tonnage handled per day	25 tons
Timber used per week, $\frac{1}{2}$ in. and $\frac{3}{4}$ in. thickness	200,000 sq. ft.
Weight of metal handled per day	70 to 110 tons



XIII.—How Meccano is Made Known to the World. By Frank Hornby

IN the preceding chapters of the Life Story of Meccano I have told my readers of the invention of Meccano and the subsequent introduction of Hornby Trains. I have taken them on a tour of the Meccano factory in order that they may understand the amazing amount of skilled work that goes to the making of even the simplest accessory in the Meccano system; and I have recounted also something of the service side of our activities, explaining how the Magazine, the Meccano Guild and the Hornby Railway Company are conducted to help Meccano and Hornby Train enthusiasts to secure the greatest possible fun from their hobbies.

It is one thing to have created a wonderful toy, but quite another thing to ensure that the world shall know about it and recognise its merits. In this article, therefore, I propose to tell my readers something of the work of our Advertising Department, on which rests the responsibility of making known to boys in all parts of the world the latest developments in Meccano and Hornby Trains, and the enjoyment they may obtain from these wonderful toys.

The work of the Department covers an enormous range, but it may be divided roughly into three main sections. The first is concerned with the planning and preparation of our world-wide advertising in newspapers and periodicals. The second is occupied with the designing of catalogues and other printed lists that are issued in response to enquiries arising from the press advertising; and the third deals with the production of window display material, lantern slides and special printed matter to help Meccano dealers to create local interest in Meccano products. That is a bare outline of a task that keeps a staff of 50 working at high pressure throughout the year.

This planning ahead that is so essential to the smooth conduct of our present-day overseas campaigns is in striking contrast with the easy-going methods of the past. As early as March and April of each year the dates for the overseas Christmas campaigns have been finally settled and the preparation of the individual advertisements put in hand.

Before this advertising is ready for issue it has to be prepared in 16 different languages! An immense amount of painstaking work is involved, for the translation of the copy calls for not only a perfect knowledge of each country's language, but also for a sympathetic understanding of the characteristics of each country. For this reason the translations made by our Foreign Department, both for the advertisements, and for the catalogues to which I shall refer later, are submitted to our agents in the various countries for consideration in the light of their close local knowledge.

The "heavy artillery" of our press advertising campaigns is of course concentrated on the Christmas season. In the British Isles, during the two months preceding last Christmas, we used for our announcements some 80 newspapers, magazines and periodicals, covering a reader population of from 11 to 12 millions. The campaign increased in intensity until the peak was reached about 10 days before Christmas, when the buying season was at its height. Simultaneously similar advertising was appearing in

more than 200 publications throughout the Empire overseas and in foreign countries. In Belgium and Holland, where the principal festival of the year is St. Nicholas, falling on 6th December, the main advertising campaign is conducted during November.

These strenuous activities are the culminating points of many months of hard work. In the early part of the year, at conferences held between our advertising agents and ourselves, the broad lines of the campaigns are settled, the illustrations to be used in the advertisements are selected, the special selling points to be stressed are discussed, and the total amount of money to be spent is decided.

After the conference decisions have been made there is an immense amount of routine work to be put in hand. The actual sums to be spent in individual publications, the size of the spaces, and the positions and dates of appearance of the advertisements have to be settled. Then follows the designing and preparing of the actual advertisements, a task of many complications. An advertisement issued to the public reading a high-class monthly magazine must be different from one designed to appeal to the readers of a boy's weekly "thriller." The outlook of a Swiss boy living among mountains and snow is different from that of a boy living in the backwoods of Australia; and in framing our advertisements we must provide for all these differing characteristics. The fact

that we are able to do this without having to resort to elaborate variations provides an interesting demonstration of the universal appeal of Meccano products. Working models and moving trains have a language that is understood throughout the whole world of boyhood.

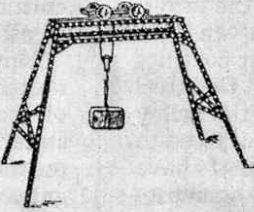
Each succeeding advertisement that appears in the daily press or in magazines presents an interesting aspect of the particular product dealt with, and thus there is unfolded gradually a complete picture of the delights of Meccano and Hornby Trains. Every publication is used several times, some of them more frequently than others, in order to drive home our points. The national daily papers, with their huge circulations but short reading life, must be used most frequently to ensure that our message shall live in their readers' minds.

While the details of the reading matter, known as the "copy," are being settled, the art work for the illustrations is in hand. Photographs of all the items to be featured are made; and from these are produced half-tone and line blocks in a wide range of sizes. When these are ready it is possible to proceed with the preparation of the "layouts," which are representations of the finished advertisements specially drawn up for the guidance of the printers, showing the positions of the illustrations and of the "copy," and the sizes and styles of type to be used.

It is exceedingly interesting to look back on the remarkable expansion of our advertising. In the early days of Meccano when, as "Mechanics Made Easy," the product was struggling to secure a foothold, I considered a quarter-page advertisement in the "Strand Magazine" to be the height of speculation. I had faith

MECHANICS MADE EASY.

**A Patent
Adaptable**



**Mechanical
Toy.**

With which boys may exercise their ingenuity in constructing Waggon, Shafting, less Variety of Mod-els. The Metal Strips being perforated with holes, equi-distant, enables them to be formed into the shapes (among others) enumerated. No expense for tools. Charming occupation, and Toy indestructible. Price, 7s. 6d. Wholesale from—

GEORGE PHILIP & SON, Ltd., 32 Fleet Street, LONDON.
PHILIP, SON & NEPHEW, South Castle Street, LIVERPOOL, and STOKE-ON-TRENT.

MANUFACTURERS—
FRANK HORNBY, 18, James Street, LIVERPOOL.

This is a reproduction of one of the earliest advertisements issued by Mr. Hornby for "Mechanics Made Easy," under which name Meccano first appeared.

in the future of Meccano, however, and I made a point of allocating each year a definite percentage of the sales revenue for the purpose of advertising. That policy has never been abandoned, and thus as sales have increased the volume of advertising has grown accordingly. The great spaces we use to-day, the half and whole pages in the daily and Sunday newspapers, costing up to £1,700 for a single insertion, are in fact less a speculation than the early two-inch single column and quarter-page spaces, costing perhaps £5 each.

The growth in the size of the spaces occupied has been accompanied by remarkable developments in the style of presentation. In the early days, as the winter season approached and we thought it desirable to prepare some advertising, we searched our stock of blocks for those most suited to the size of space in mind, placed the illustration in the middle of the space, strung together a few explanatory words, added a price or two and the name and address, and hoped for the best! To-day every illustration in our advertising is specially planned to bring out clearly the special point to be made in the advertisement; and every word is considered to make sure that it is the best to use in that place to secure the effective presentation of our message.

The bulk of our advertising in each country is standardised, and thus it is only necessary to make one type-setting of each advertisement, from which a series of matrices is prepared for distribution among the various publishers. A matrix is a papier-mache impression obtained direct from the blocks and type under heavy pressure, and is supplied in place of copy and blocks. The despatch of a set of matrices for the series of advertisements to each of the 200-odd publications employed is an easier and less expensive operation than the forwarding of a similar number of sets of blocks and copy. Apart from the saving in blockmaking and postal costs, there is the important advantage that the possibility is eliminated of mistakes creeping into the advertisements when set.

On arrival at the publishers' printing offices, the matrix is placed in a casting box and molten metal poured over it. As soon as the metal is cool the matrix is stripped away, and the resulting casting, known as a stereotype, provides a perfect reproduction of the original blocks and typesetting in a form ready for printing.

So much for the main press campaign. In addition to this the advertising department prepares each year many thousands of advertisements for use by dealers in their local publications. These cannot be standardised, for the requirements of each dealer are different; and consequently separate layouts, copy and sets of blocks are issued. In order to cope with the requirements of this side of the work a floating stock of nearly 10,000 blocks is maintained!

The advertising campaign is designed to awaken interest in our products, but as it is impossible to feature anything like a full range of them in the actual advertisements, it is necessary to provide complete lists in the form of catalogues for leisurely consideration. The public are urged to secure a copy of one or other of these catalogues, either by direct enquiry from a Meccano dealer or by postal application to us. We prefer the first course for several reasons. It brings the public immediately into contact with the products themselves, and provides the dealer with an opportunity to amplify verbally the brief catalogue descriptions.

Nevertheless a big percentage of enquiries reach us direct, the number growing rapidly as the advertising campaign intensifies. At its height several thousands of applications reach us each day,

and a large special staff has to be engaged to cope with the work of opening the letters, noting any cash enclosed, checking the "keys"—to which I refer later—and finally sorting the letters in bundles to accord with the particular catalogue to be sent in reply.

As most of my readers know, we ask boys who apply for literature to send us the names and addresses of three of their chums. To each of these chums a special booklet is sent, and thus practically every application involves the dispatch of four replies. It may be imagined how much work is involved in preparing the literature ready for dispatch, inserting this in the envelopes, and finally addressing these ready for dispatch.

In the aggregate, millions of pieces of advertising literature are issued to the public each year, either direct or through our dealers. This figure disregards the instruction manuals packed with the outfits and the advertisements in the Meccano Magazine. These

two items alone account for one-and-a-half million pieces of "after sale" service literature.

The provision of complete advertisements and of catalogues does not end our dealer-aid service. In addition the dealers are supplied with display material—showcards, window transparencies, streamers, price tickets, background screens and lantern slides—to assist in the creation of attractive window displays. We are fortunate in that our products themselves can be used to make a more appealing window display than any spectacular but lifeless card or wooden set-piece. Working models focus attention far more effectively, and the building of Meccano display models is therefore as much a part of our publicity work as the press advertising. I dealt with the work of the Model Building Department in my last article.

In order to secure the maximum efficiency

from the sum allotted to advertising it is essential that we should know whether or not each item of expenditure is creating a satisfactory return. Various means are available for checking the results from press advertising, but we mainly use what is known as the "key" method, which is generally recognised as one of the most effective. The "key" consists of a Department number inserted in the address at the foot of each advertisement, as for example:—"Meccano Ltd., Dept. 29, Old Swan, Liverpool." Every newspaper or periodical used has its own particular number, and thus when the replies come in it is an easy matter to sort them out according to these numbers, and so ascertain how many are to be credited to each publication. At the end of the campaign the replies under each number are totalled up and their relationship to the amount spent in each publication is examined and recorded. These records are extremely useful when the time arrives for planning the subsequent season's campaign, for they clearly show the "pulling power" of the various publications used during the past season, and thus enable us to decide which to use again.

Every year, at the end of February, the world-famous British Industries Fair is held, in two sections running simultaneously at London and at Birmingham. Merchants and trade buyers from almost every country in the world attend the Fair in order to examine the most recent developments in the wide range of British industries. At the London section of the Fair one of the most interesting features is the display provided by the toy industry, and here the Meccano stand is always prominent. At this stand advertising literature in many languages is distributed to buyers from foreign countries, and experts are present to deal with all enquiries as they come along. The 1933 Fair opens on the 20th of this month, and I hope that all readers who are able to do so will inspect the Meccano stand at the White City.

THE END.



Meccano advertising literature is printed in 16 different languages. The above illustrations show two folder covers. The one on the left is printed in Russian and the one on the right in Chinese. These illustrations show how curious some of these advertisements appear to British eyes.

