2,600 ton superstructure had been in position two years it was moved and broken in half.

The construction of works to withstand forces that are capable of creating such havoc would almost seem impossible. Nevertheless such works have been erected and their influence on trade and civilisation has been enormous.

As a maritime nation Great Britain has always been closely concerned in the engineering problems involved in harbour construction. A few hundred years ago neither the Royal Navy nor the mercantile marine was of sufficient importance to require more harbour accommodation than that provided by the natural inlets and sheltered bays found at such places as Portsmouth, Plymouth, Weymouth, Falmouth and Dartmouth. We find, for instance, that in 1540 there were only four vessels of 120 tons burden registered in the Thames. In Queen Elizabeth's time the shipping of Liverpool amounted to only 223 tons, the largest vessel being of only 40 tons. How different are things to-day, when the shipping of the Thames exceeds 47,000,000 tons and that of the Mersey is nearly 26,000,000 tons!

When we turn to the harbour and dock accommodation provided at our great ports we find a similar change. At the beginning of the 19th century London had not a single dock, whereas to-day there are miles and miles of docks. The docks at Cardiff, Newport, Barrow, Middlesbrough and at many other places did not then exist. Even as late as 1816 Liverpool had only 16 acres of dock area, and Hull and Grimsby were no better than fishing ports, as far as their dock accommodation was concerned.

Taking our survey further afield, we find that the breakwater at Table Bay was not commenced until 1860; that until 1875 Calais Harbour had only 2½ ft. of water on its bar at low water; that Colombo Harbour was not commenced until 1870; that Dover was not selected as a site for a great port until 1845; and that the breakwater at Newhaven was not started until 1878. We might extend the list indefinitely, showing that during the past century work in connection with harbour construction at home and abroad has gone forward by leaps and bounds, and has played a greater part than anything else in the development of civilisation in general and the world's trade in particular.

Even the enormous extensions of recent years have scarcely enabled dock engineering to keep pace with shipping, however. The harbour engineer has encouraged the production of larger vessels by providing better dock accommodation and in turn finds that he is called upon for further efforts. At Liverpool, for instance, the magnificent Gladstone Docks were opened in 1927 and are the largest docks in the world. They cover an area of 58 acres and have an entrance lock 1,070 ft. in length. At Southampton, an even larger dock is now in course of construction, and when completed this will be 1,200 ft. in length and 45 ft. in depth. The entrance will be 135 ft. in width.

Thus the process of expansion continues. Larger docks lead to the production of bigger ships and for the safe handling of these still larger docks are demanded. It is quite clear that harbour-building machinery has not yet reached the limit of its development, and in future we may expect to see even larger cranes in use than the Titans and Goliaths of to-day.

Altitude Record—(*Continued from page 939*)

time has been spent in the detail design of this blower in order to ensure reliability and efficiency, and some thousands of hours of development work were carried out on the test bench with different types of fans, driving gear and bearings, before the mechanism was put into the air. Some idea of the efficiency of the supercharger may be gained from the fact that the rated altitude of the standard "Pegasus" engine can be increased by 50 per cent. by detailed alterations to the compression ratio of the cylinders and blower.

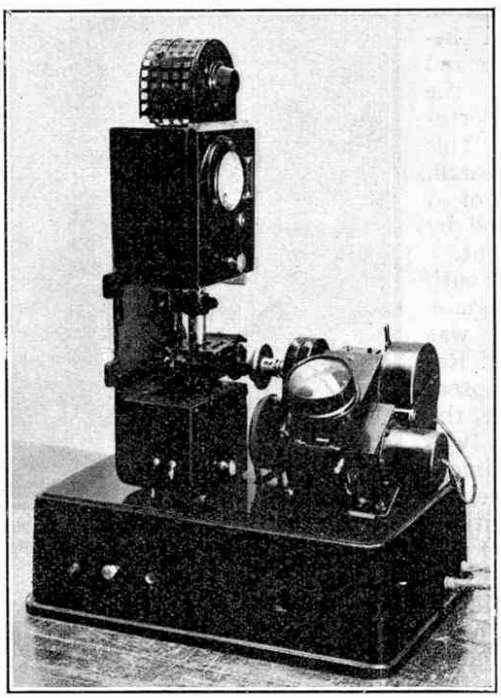
The supercharger on the "Pegasus" is housed in a neat casing at the back of the engine, and is driven by a multiplying gear from the crankshaft at the amazing speed of 23,000 revolutions per minute. This means that during the two hours occupied by Flt. Lt. Uwins in making the new record, the supercharger made more than 2,500,000 revolutions. It also means that the tips of the fan blades travel at a speed of 1,000 ft. per second, or nearly 700 m.p.h.! The compression ratio in the blower is 1.8 to 1. The engine must not, of course, be "opened out" fully on the ground when using normal fuel, and safety devices are incorporated to prevent the pilot from opening out or throttling suddenly and so applying enormous loads on the impellor. To give an idea of the efficiency of the supercharger, however, "flat out" tests were made with doped fuel and it was found that the engine actually developed 1,100 h.p. when the airscrew was revolving at normal speed. The supercharger is normally brought into operation when the machine reaches a height of 11,000 ft.

Some idea of the many difficulties that have to be contended with in the construction of a supercharger of this kind may be gained from the fact that air, when compressed, increases in temperature, while any rise in temperature of the ingoing mixture in an internal combustion engine increases considerably its susceptibility to detonation, or, as it is popularly known, "knocking." It is therefore essential that the compressor should be so constructed that it raises the temperature of the air as little as possible. Many intricate problems also have to be met in regard to suitable bearings and their proper lubrication at high speeds.

Meccano helps in the Film Industry

A New Western Electric Editing Machine

FROM time to time reference has been made in the "*M.M.*" to the use made of Meccano by inventors and engineers. There is indeed an accumulating amount of evidence that Meccano is superseding to a great extent the older methods of model-making. Formerly an inventor who wished to try out in miniature form a new idea must either make for himself the various parts required, or have them specially made for him. In the first case the process was slow and laborious, and seldom satisfactory unless the inventor had considerable skill in such work; in the second case there was the serious drawback of the expense involved. Even when the first set of parts was complete the trouble was not over, however, for almost invariably changes in the design of the model were made, usually involving the preparation of additional parts. Finally there was the possibility that the idea might in the end turn out to be impracticable, so that the time and money spent in constructing the model were wasted.



The new Western Electric film editing machine developed by means of a Meccano model. Photograph by courtesy of the Western Electric Co. Ltd.

The new method of model-building for inventors is to employ the interchangeable Meccano parts, which constitute real engineering in miniature and enable practically any mechanical movement to be reproduced perfectly. The making of special parts thus becomes unnecessary, and when the model has served its purpose and is taken to pieces, the component parts are all available for inclusion in a new model.

One of the most recent applications of Meccano to invention is in connection with the development of a new type of "editing machine" by Mr. H. C. G. Allen of the technical staff of the Western Electric Co. Ltd. Mr. Allen made his first model almost entirely from Meccano parts, the adaptability of which enabled him to solve a series of quite formidable mechanical problems.

Editing machines are used in the film industry for the purpose of viewing rush prints as they are received from the printing laboratories, so that any defects may be instantly detected and removed, or unwanted scenes cut out. It might be wondered why this viewing should not be done by means of an ordinary theatre reproducer. This would involve the use of a theatre, however, and probably only one film at a time could be viewed. The process of editing would thus be considerably slowed up, and time means money to a film laboratory. The new machine, in the construction of which Meccano played so important a part, is shown in the accompanying illustration. As many as a dozen of these machines may be operated in one room, so that as many films may be cut and edited at the same time.

The machine is operated entirely from the mains. It will run either double or single film, that is sound and scene combines on one film, or on separate film. This is an exclusive feature of the machine that makes it extremely valuable for newsreel work, where picture and sound are recorded simultaneously on one film. There is no intermittent action at the picture gate, the film passing through both this position and the sound gate at a smooth and constant speed. The value of this feature lies in the fact that it permits almost completely silent operation, there being no "flap" from the film, an action that always takes place where the intermittent movement is evident.

A "stationary" picture is obtained by means of flashes from a neon or television tube situated immediately beneath the viewing head. These flashes are so timed that they occur at the exact moment when a frame is passing the view-finder. The timing is accomplished through a circuit-breaker mounted on the picture sprocket, and the arrangement consists of a commutator with one narrow segment for each frame, so that as each frame reaches the picture gate a momentary contact is made and the neon lamp flashes. The flash is so quick that the picture appears absolutely stationary, and without the "ghosts" that are usually present in a simple intermittent motion used without a shutter.

A simple amplifier is housed in a drawer directly underneath the sound head. The circuit is so efficient that sufficient volume is obtained from a single stage of amplification to operate a loud-speaker. Alternatively headphones may be used, according to the special requirements of the operator.

Notable features of this interesting machine are its compactness and its simplicity of operation. In addition it possesses the high efficiency and complete reliability that are essential in a mechanism of this nature.