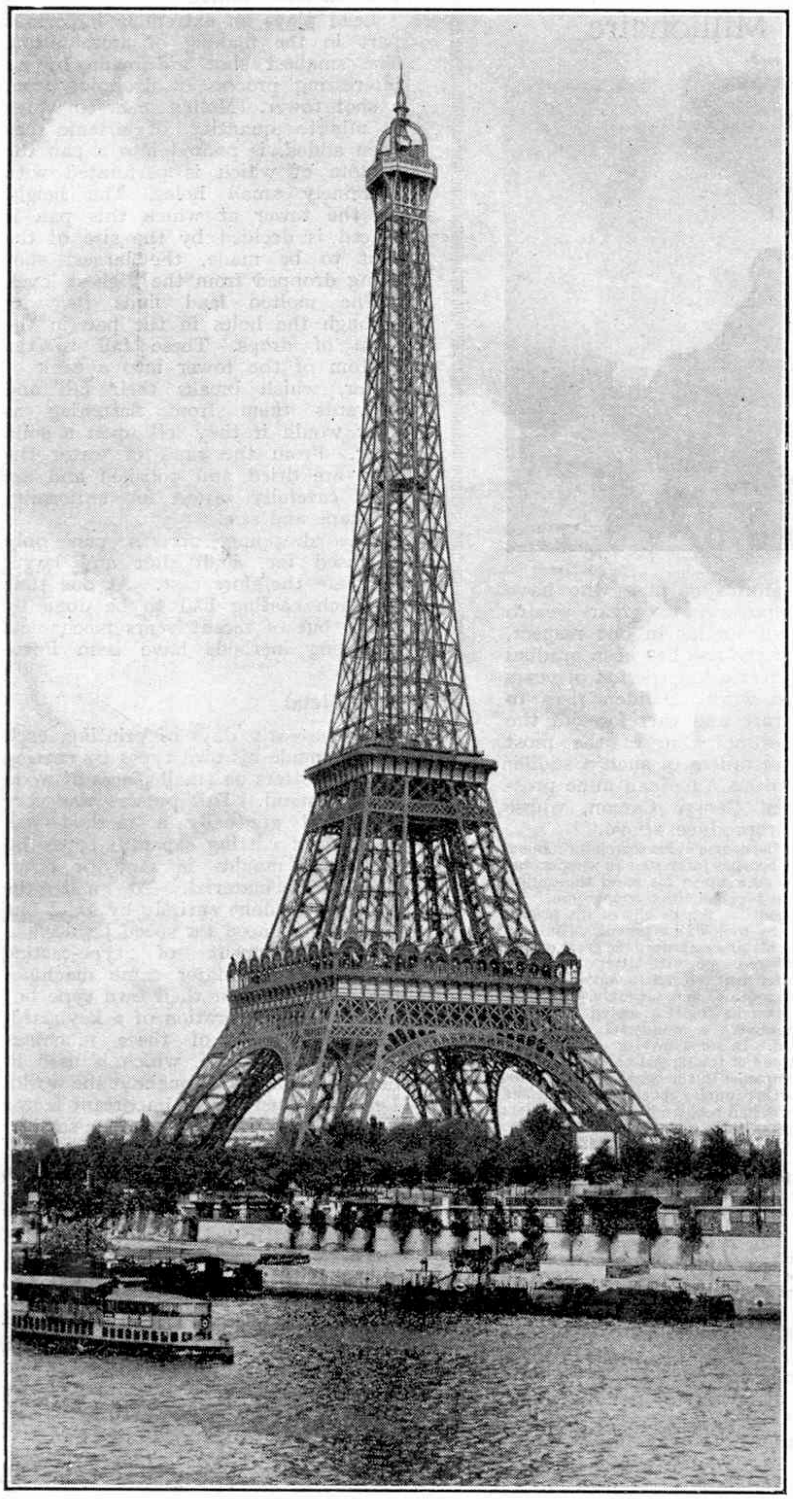
The Highest Structure in the World

The Eiffel Tower and its 6,500 Tons of Iron



Eiffel's Masterpiece
The Eiffel Tower is the Highest Structure in the World

FROM the time of the Tower of Babel to the present day, very high buildings and objects have always exercised a great fascination. The Pyramids of Egypt, one of which is 484 ft. in height, and the Colossus of Rhodes, a bronze statue 105 ft. in height, are early examples of high structures, those of more recent origin including Cologne Cathedral, 528 ft. in height and the Washington Obelisk, 541 ft. in height.

In 1886 a French engineer, Gustave Eiffel, proposed to erect for the Paris Exhibition of 1889 a building that should dwarf every previous structure. His proposal met with strong criticism, and many prominent engineers ridiculed the idea and predicted the speedy collapse of such a towering structure. Eiffel had absolute confidence in the success of his scheme, however, and he commenced operations and persevered with his task. In two years, to the confusion of his critics and the astonishment of his friends, the great Tower was completed in the Champs de Mars, where it stands to this day with unimpaired strength.

A Great Engineering Triumph

Gustave Eiffel was born at Dijon on 15th December, 1832. From his early boyhood he was determined to become an engineer, and was so successful at school in all subjects connected with mechanical or engineering matters that he was placed as a student in the Paris School of Arts and Crafts. Here he qualified as an engineer, and while quite a young man was appointed to superintend the construction of an iron bridge over the river Garonne at Bordeaux. By 1868 he had succeeded so well as to be able to establish his own engineering works, and from that time onward his name became closely associated with striking engineering achievements all over the world. He built the famous Garabit Viaduct of Cantal, the great bridge over the River Douro at Oporto, and the movable dome at the observatory at Nice.

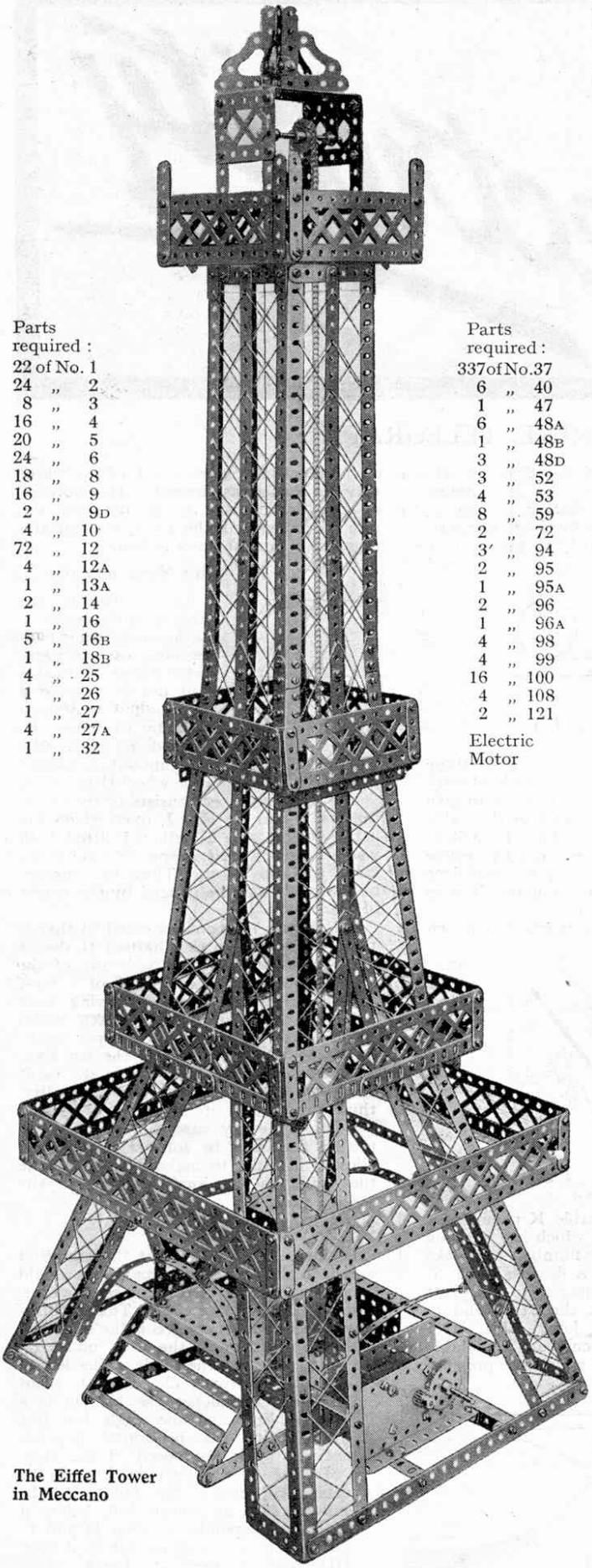
For many years Eiffel gave particularly careful study to the combined effects of iron columns and cross ties, and he was the first engineer to use the compressed air method in bridge construction. After several years of experience in connection with metal bridges, he undertook successfully the building of the framework of the huge Statue of Liberty in New York harbour in 1884, and five years later he became world-famous as the designer and constructor of the great Eiffel Tower—the highest building in existence.

The Massive Foundation

In erecting this huge structure Eiffel's first task was to secure foundations capable of supporting the enormous weight of the tower—6,500 tons. Four trellis-work piers were decided upon and work on the foundations for them was commenced early in 1887. The two piers furthest from the river Seine presented comparatively little difficulty, as a thick layer of gravel was found at a depth of 16½ ft., the ordinary water level of the river. The other two piers gave more trouble, however, as their foundations had to be taken down to twice this depth in order to reach the gravel.

The masonry foundations rested upon concrete, and the four uprights of each of the four pedestals were fixed to the masonry by anchor bolts. In order to counteract any possible displacement of the anchor bolts, a hydraulic press was inserted in each of the four feet of the structure.

The tower itself was built of a series of main ribs braced together by elaborate trellis work. As far as possible the various parts of the structure were finished in the workshops and hoisted to their final positions by cranes, leaving only the junctions to be completed. Two-and-a-half million rivets were used, and on the verticality of the tower being carefully tested, when



Parts required:

22	of No.	1
24	„	2
8	„	3
16	„	4
20	„	5
24	„	6
18	„	8
16	„	9
2	„	9D
4	„	10
72	„	12
4	„	12A
1	„	13A
2	„	14
1	„	16
5	„	16B
1	„	18B
4	„	25
1	„	26
1	„	27
4	„	27A
1	„	32

Parts required:

337	of No.	37
6	„	40
1	„	47
6	„	48A
1	„	48B
3	„	48D
3	„	52
4	„	53
8	„	59
2	„	72
3′	„	94
2	„	95
1	„	95A
2	„	96
1	„	96A
4	„	98
4	„	99
16	„	100
4	„	108
2	„	121

Electric Motor

The Eiffel Tower in Meccano

the structure had reached the height of 720 ft. it was found to be absolutely correct. The total cost of the tower was £260,000, of which the State contributed £60,000.

Electric Lifts for Visitors

The total height of the tower is 984 ft. from the ground or 1094 ft. above sea level. The first platform is 189 ft. up—only 27 ft. lower than the towers of the Cathedral of Notre Dame, Paris. The second platform is 380 ft. up and the actual tower that rises from this second platform is 526 ft. in height, finishing at the third platform at a height of 906 ft.

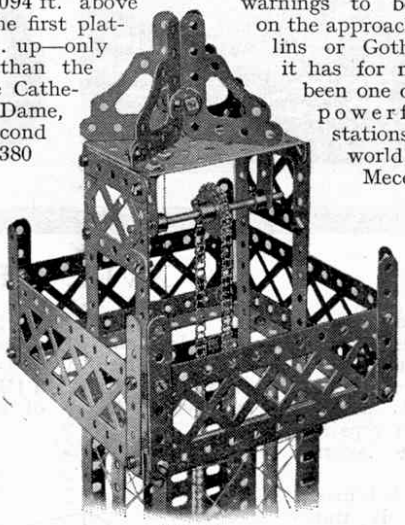


Fig. A

The campanile and lantern above the third platform bring the structure to its full height of 984 ft.—more than twice the height of the dome of St. Paul's Cathedral. A further comparison will no doubt interest the large numbers of our readers who have visited Blackpool. The Blackpool Tower, which seems to reach almost to the clouds, is only 500 ft. in height—scarcely more than half the height of the Eiffel Tower!

The Tower proved a great commercial success during the Exhibition of 1889, and tens of thousands of visitors took a trip to the top to enjoy the wonderful view. Afterwards it was found to be unprofitable, however, and was eventually taken over by the municipal authorities of Paris, partly with the idea of using it as a scientific observatory. The tower has always been very popular with sightseers on account of the marvellous view of Paris and its surroundings that can be obtained from the highest gallery, and for the use of these sightseers electric lifts are installed. Several spectacular feats, such as climbing to the top by means of a loose rope and cycling from the highest platform to the ground, have also been staged from the Tower.

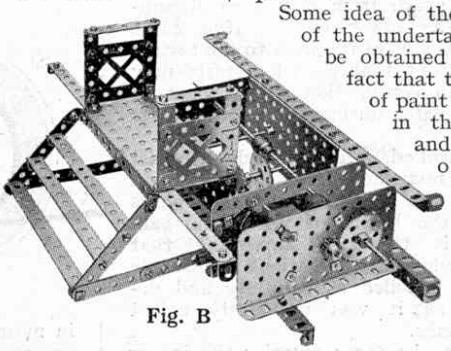


Fig. B

The Tower during the War

During the war the Eiffel Tower proved of the greatest value as an anti-aircraft observation post, enabling warnings to be sounded on the approach of Zeppelins or Gothas. Also it has for many years been one of the most powerful radio stations in the world. Many Meccano wireless amateurs, and especially those who possess valve sets, are familiar with the well-known call sign of the Eiffel Tower—FL. In this connection the Tower received what is perhaps its greatest vindication when General Ferrie, Inspector of French Military Telegraphs, said that "FL." served so many important scientific and military purposes that if such a tower had not already existed it would have been necessary to build one.

It is interesting to know that last year the Tower received the fifth coat of paint since it was built. Some idea of the vastness of the undertaking may be obtained from the fact that thirty tons of paint were used in the process and the job occupied 100 men a total of 4,000 hours!

Eiffel was always extremely proud of his achievement, and the success of his original plans must have been a source of great satisfaction to him. Until the time of his death, in December 1923, he maintained a flat on the third floor of the Tower. There, 906 ft. above the ground, the great engineer would retire to his comfortable room to think in quietness of the past and plan out new schemes for the future.

The Eiffel Tower in Meccano

The Meccano model of the Eiffel Tower is well known.

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Food for Fishes

Fishes need very little food. Some of them are more particular than others, but generally speaking ants' "eggs"—which are really the pupæ of the ants—are welcome, forming excellent food.

Other suitable foods are finely chopped shrimp, raw meat, hard-boiled egg, small worms, or finely broken vermicelli. Small crustaceans and larvæ and pupæ of water flies from ponds and ditches would be a luxury but they are not a necessity. The eggs and fry of the water snails living in the tank also provide wholesome food for the fish.

Minnow
(*Leuciscus phoxinus*)

An Unpleasant Experience

In reference to ants' "eggs," care should be taken to make certain that they have been "kiln-dried" and their fertilisation destroyed. A sixpenny box of "eggs" once cost the writer £15! They had not been correctly prepared, and the whole lot hatched out and took up their residence behind the skirting board beneath the floor of the room!

At night the ants came out in battalions and covered the walls of the room, disappearing when daylight came. Every effort to get rid of them failed. As fast as some were killed a still greater number filled their ranks and nothing seemed to have any effect on them. Finally floors and skirting had to be taken up and the walls and all cavities treated with chemicals, and in this way the ants were finally destroyed.

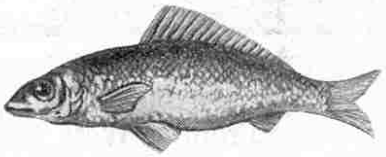
Removing Uneaten Food

On no account must small particles of food be left in the tank to decay. These particles may be removed quite easily, without disturbing the occupants of the tank, by means of a narrow glass tube, used as a "pipette." The top end of the tube is closed by pressure of the finger and the other end is lowered into the tank until it is just above the particle to be removed. The finger is then lifted and water rushes up into the tube carrying with it the offending particle. The top of the tube is again closed with the finger and the tube, with its contents, are then withdrawn from the tank.

A Pressure Jet

If a tank is of sufficient size to warrant the step, greater pleasure may be obtained and more creatures kept in healthy condition by laying on town's water. The jet, which need be no larger in diameter than a darning needle, may be turned downward so as to impinge upon the surface of the water. This tiny pressure jet will drive a stream of silvery air bubbles far beneath the surface of the water and the Minnows will gambol and rush up the glistening track in the most delightful manner. The downward jet may be removed and a fountain jet screwed on at will.

Such a jet provides a splendid means of aerating the water, but it does not obviate the necessity for maintaining healthy conditions by means of plant life. The jet merely enables an increased number of inmates to live in the tank and makes easier the task of balancing the vegetable and the animal life.



Golden Orfe
(*Leuciscus orfus*)

Under these favourable conditions and when more experience has been gained, we may introduce Gudgeon, Chub, Stone Loach, Rudd and the sluggish Tench. It will be fatal to the small members of the aquarium, however, if large specimens of these fishes are introduced among them. A fish in doubtful health should never be placed in the aquarium, but should be kept in a separate vessel until there is no doubt that it is healthy and above suspicion.

A Word of Warning

One word of warning must be given here. No risk should be taken by indiscriminately placing in the tank every aquatic creature that comes to hand, otherwise it may be discovered, all too late, that wolves have been placed with lambs, with an obvious and unfortunate result! For this reason it is not wise to risk the presence of water bugs, beetles or scorpions among the peaceful members of the tank until some knowledge of their various habits has been attained.

Over-feeding is bad for fishes and must be carefully avoided and, as already stated, any particles of food not consumed should be removed immediately before they have time to decay and pollute the water.

On the other hand, if fishes are not sufficiently fed they may be driven to cannibalism or to devour and exterminate smaller and weaker specimens of other species.

NEXT MONTH:—
POND LIFE IN THE AQUARIUM

The Highest Structure in the World

(*Continued from page* 385)

It was one of the first models, and although it has been improved on several occasions, it necessarily retains many of its original features. In fact, it is one of the few models that have not been improved out of all recognition from the early days of "Mechanics Made Easy." The model has appeared in Meccano advertising, on Outfit labels, and in other printed matter for many years, and in this manner has reached every civilised country in the world. It has even been said that were Meccano Limited ever to adopt a trade-mark, the model of the Eiffel Tower would admirably serve the purpose.

The construction of the model requires very little description, because it is so clearly evident from the accompanying photograph. As is the case in the real Eiffel Tower the Meccano model carries a lift electrically operated by the Meccano motor mounted at the base. The lift-carriage is raised or lowered by a sprocket chain, which passes over a sprocket wheel at the top of the tower, mounted on a rod journalled as shown in Fig. A. The sprocket chain is driven by the motor through worm-gearing as shown in Fig. B. The lift-carriage is guided by cords stretched from the top to the bottom of the tower.

The two detailed views make the construction quite clear and there should be no difficulty whatever in building this model, which is capable of further improvement and elaboration—as, for instance, the fitting of an automatic reversing switch to mechanically reverse the motor when the lift-carriage reaches the base of the tower, and to operate it again when the carriage reaches the top of the Tower. Other elaborations will readily occur to our readers.