

plest controls, and one of the easiest to operate, that have thus far been devised.

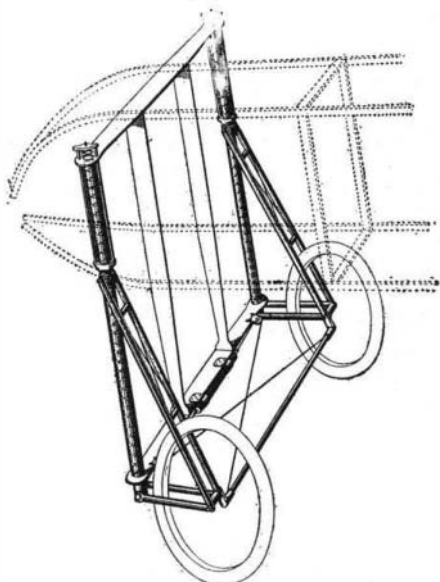
Fig. 4 shows a side elevation of Bleriot's No. XII. monoplane. This machine has the motor mounted at the bottom of the body, in order to obtain a low center of gravity. The shaft of the propeller is placed just beneath the plane, and is chain-driven from the motor. The vertical rudder is located above the rear wheel, and at the end of a fin keel above the body. The horizontal rudder is at the extreme rear end, and there is also a horizontal non-movable tail above the rear part of the body. This machine is provided with a deeply-curved monoplane surface having a lifting power of over 5 pounds per square foot at a speed of 32 miles an hour. Photographs of it and of the No. XI. in flight were published in the SCIENTIFIC AMERICAN of June 26th and August 7th and 14th.

From the above it can be seen that the latest Bleriot monoplanes are notable for their extreme simplicity, their good stability, and their excellent lifting power. These machines give a good indication of the lines along which development may be expected in the future in the way of a simple and compact aeroplane.

### THE SENSE OF DIRECTION IN BEES.

By GASTON BONNIER.

It has long been known that a worker bee returns in a straight line to the hive when she has finished her collection, even if the distance is as much as two miles. Langstroth and other eminent apiculturists attribute this power to the perfection of the compound eye of the bees, which enables them to recognize objects at great distances. Others conjecture that the bees returning to the hive recognize objects which they have noted on the outward journey. Still others think that both on the outward and homeward journeys the bees are guided by a very powerful sense of smell which is located in their antennæ. Dadant



FORWARD CHASSIS OF BLERIOT MONOPLANE.

The braces from the wheels are connected to spring shock absorbers in the vertical tubes.

asserts that all bee keepers believe that bees are attracted by the odor of flowers more than a mile away.

Varied experiments, which I have made or repeated recently, prove very clearly that it is neither by sight nor by scent that bees are guided in their direct flight over distances which may attain one and one-half miles, both in leaving and in returning to the hive.

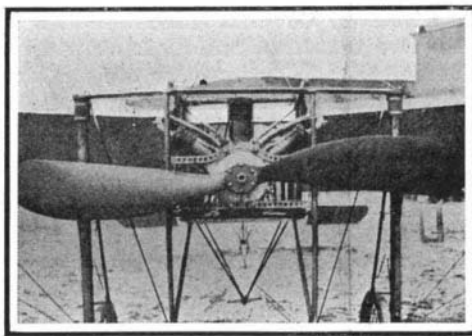
In the first place, in regard to sight. I have repeated with several variations the experiment made by the American Indians when seeking for wild honey. They catch a few bees which are feeding on flowers, set them free, and note the direction of their flight; then they move to another spot and repeat the operation. The hive is found at the intersection of the two lines of flight thus determined.

This experiment does not solve the problem, but shows merely that when bees are disturbed in their work they return to the hive in a straight line. I have varied the experiment as follows: I collect a number of bees in a large district where I know there is only one hive. I place these bees in a closed box, where I can liberate them one at a time, and carry the box to a considerable distance, remaining on the circumference of a circle described around the hive with a radius of  $1\frac{1}{4}$  miles. At a certain spot I liberate one of the bees. I note the place of liberation and the direction of flight. I go on a little farther, and liberate a second bee, making the same notes. The hive is found at the intersection of the two lines of flight. Now, both of these bees were shut up in the box during their journey to points distant from the place where they were caught. They could not recognize their course by means of the objects which they had seen in coming from the hive by a different road, and even if we admit that their eyes are mar-

velously long-sighted they cannot see the hive through intervening trees, woods and hills.

In a variation of the experiment blackened collo-dion is brushed over the two compound eyes of the bee and, as an extra precaution, over the three small simple eyes. Bees thus blinded return in straight lines to their hive, as before. These facts prove that sight is not necessary for a direct return to the hive.

Let us now examine the sense localized in the antennæ, which is more or less comparable with the



FRONT VIEW, SHOWING MOTOR, PROPELLER, AND CHASSIS.

sense of smell. In the first place, we may repeat the classical experiment of Lefebvre, which shows that the odors of various substances are not perceived by bees at any great distance. A needle which has been dipped into ether is brought near the head of a bee which is feeding on a drop of syrup. The insect at once directs its antennæ toward the needle and exhibits symptoms of great excitement. The experiment is then varied by bringing the needle wet with ether near the abdomen, the breathing pores, the feet and other parts. No special movement of the antennæ and no agitation of the insect are observed. The needle may be dipped into various odorous substances with the same result. In certain cases bees are repelled by perfumes which are agreeable to us and appear to detect odors of substances which we regard as odorless, but despite this delicacy of the sense of smell, odors are perceived only at a small distance. Now, what will happen if the olfactory organs are removed? Francis Huber was the first to prove that if a bee engaged in gathering honey is deprived of its antennæ it remains able to return to its hive, from which, however, it is afterward expelled as unfit for work. These facts suffice to prove that the sense of smell is not necessary for the return of bees to the hive.

The following experiments, which I have recently made, show that bees can almost always follow a definite direction without error, and distinguish between two directions which include a very acute angle. About 200 yards from the hive, in an open field, I place on a table a cluster of dead branches covered with syrup. On the following morning the exploring bees, which leave the hive at dawn, earlier than the workers, discover this new source of honey and organize a regular traffic of workers between the hive and the table. The supply of syrup is maintained by frequent renewal, and I catch every bee and mark it with talc, mixed with a green pigment. In the evening I place a second table with twigs and syrup about two yards away from the first. On the following morning the explorers discover the second table, and organize a regular traffic between it and the hive, but the traffic on the two routes is conducted by different bees. None of the marked ones comes to the second table, but the workers which visit the first table may be recognized by the green marks applied on the preceding day. I keep up the supply of syrup at both



ARRIVAL OF BLERIOT ABOVE THE ENGLISH COAST AFTER HIS 37-MINUTE FLIGHT ACROSS THE ENGLISH CHANNEL.

M. LOUIS BLERIOT AND HIS AEROPLANES.

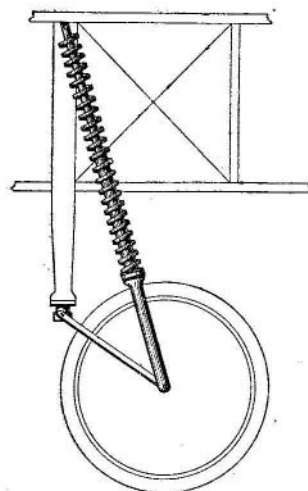
tables, and mark with red the bees which visit the second. With rare exceptions the green-marked bees continue to come to the first table, and the red-marked bees to the second table. This experiment proves that the bees are capable of discriminating between two directions inclined to each other at a very acute angle. In this case the angle is that at the apex of an isosceles triangle with a base of two yards and a height of about 200 yards. If the experiment is varied by placing the tables 20 yards apart, the few exceptions above noted do not occur. The two systems of traffic are entirely independent. If, then, the tables are brought back to their former positions, most of the green-marked bees still visit the first table and most of the red-marked bees visit the second, but there is a considerable mixing of bees at each table.

Certain facts well known to bee keepers may be explained by the sense of direction. If a hive is moved a few yards, the workers returning from the harvest are unable to find it, and settle on its former site, even if this is occupied by a new platform, or basket, destitute of the odor of the hive. The eyes and the antennæ of the bees do not enable them to recognize their home, although it is only a few yards away. The habit of returning to a given point sometimes persists for a long time, as is shown by the following experiment of Huber, which has since been often repeated. In autumn honey was placed on a window sill, but during the winter access to the honey was prevented by the closing of a shutter. When the shutter was opened in the following spring the bees returned, although the honey had been removed. In this case the impression was retained for several months. From all the preceding facts I conclude that bees possess a special sense of direction, similar to that of homing pigeons. This sense does not appear to be located in the antennæ, but probably resides in the cerebral ganglia.—Cosmos.

### REMEDIES FOR OLD AGE.

By DR. L. MENARD.

EVERY living creature, on arriving at the age of maturity, begins to grow old. In the human species



REAR WHEEL WITH SHOCK-ABSORBING SPRING.

the burden of age is felt more or less heavily by different individuals. It is a matter of heredity and hygiene. Some persons become old prematurely, but every person is old when a certain age is reached. Old age, or senility, is a physiological condition. It seems that if we could discover the mechanism of senility we ought to be able to delay its approach and to remain young despite the number of our years. The alchemists sought the solution of this problem, which still engages the attention of scientific men. The ancients thought that an old man could be reinvigorated by infusing into his veins the blood of a young man. They made the experiment, but, it is unnecessary to say, without success. The antiquity of the process of transfusion of blood is shown by passages from ancient authors. Allusion is made to it in the historical writings of the ancient Egyptians and in the treatise of anatomy written by Herophilus. A passage in Ovid, also, appears to refer to it. Sismondi relates that the experiment was tried on Pope Innocent VIII., and a contemporary writer says that in this case a certain Jewish doctor opened the veins of three boys, all of whom immediately died, and that the doctor fled and the Pope was not cured. It was thought possible to restore youth to the old, health to the ill, and reason to the insane, by this operation which, in France, was so greatly abused that the practice was forbidden by law. It has lately been taken up again, but for a very different purpose, to avert the danger arising from profuse hemorrhage.

Transfusion of blood cannot remove the effects of the old age of the organs. A living creature extracts from the surrounding medium the matter necessary for the performance of its vital functions. It transforms this matter, assimilates the useful portion and rejects the useless portion, as well as the waste products of its metabolism. In a culture of bacteria, these waste products accumulate and produce symp-