

also states that by collecting the drops of resin which collect in spring upon felled pine and fir trees about 60 liters of oil could be secured from every cord of wood.

THE Technical Department, Aircraft Production, of the Ministry of Munitions of Great Britain has prepared a detailed report on an example of the new German 300-h.p. Maybeck aero engine taken from a Rumpler biplane which was brought down in France in January last. These engines are described in the report as undoubtedly representing a great improvement in general design and efficiency as compared with the old 240-h.p. Maybach engines found in Zeppelin airships. The quality of the workmanship of every part, including the exterior finish throughout, is exceptionally good, and the working clearances are carried to very fine limits. Every part, nevertheless, shows the usual German characteristics of strength and reliability, combined with standardization and ease of manufacturing in preference to the saving of weight. The engine has six vertical cylinders with a bore of 6.5 in. and a stroke of 7.09 in., and weighs 911 pound complete with propeller boss and exhaust manifold, but without fuel or oil. On an hour's test, running at the normal speed of 1,400 revolutions a minute, it gave on the average 290 b.h.p., the weight being thus a little over 3 pounds per h.p. The consumption of petrol was 0.55 pint and of lubricating oil 0.038 pint per b.h.p. hour. The C.4 type of Rumpler machine from which this engine was taken is a two-seater biplane designed for long-range artillery reconnaissance and photography. These machines are said to be generally flown at high altitudes—15,000 feet to 17,000 feet—until over the lines, and from French reports the 300 h.p. Maybach engines are more flexible and regular in running than the 260-h.p. Mercédès engines generally fitted in them. Their armament consists of one Spandau gun fixed in front of the pilot's seat and firing through the propeller, and one swivelling gun mounted in the observer's seat behind.

## UNIVERSITY AND EDUCATIONAL NEWS

At a meeting of the General Municipal Council and the Chamber of Commerce at Bordeaux on September 10, the proposal to establish in honor of the President of the United States a Franco-American university of applied sciences, commerce and industry was unanimously adopted.

THE Birmingham Metallurgical Society has planned to award scholarships at Birmingham University to technical school students in metallurgy. The purpose is to assist boys who otherwise would be unable to afford a university training in metallurgy.

DR. H. C. McNEIL, associate chemist in the Bureau of Standards, has been appointed acting professor of chemistry in George Washington University, Washington, D. C., succeeding Dr. Charles E. Munroe, who assumes the chairmanship of the committee of explosives investigations under the National Research Council.

WILLIAM C. MORSE, of Washington University, St. Louis, has been elected professor of geology at the Mississippi Agricultural and Mechanical College.

PROFESSOR OWEN W. MILLS, formerly of Westminster College, has been appointed professor of biology at Middlebury College.

## DISCUSSION AND CORRESPONDENCE DUAL QUEENS IN A COLONY OF HONEY BEES

DURING a recent visit, June 3-6, 1918, to the Massachusetts Agricultural College at Amherst, Mass., by the courtesy of Dr. B. N. Gates I was given the unusual opportunity of accompanying him on his inspection of the forty colonies of the bee yard.<sup>1</sup>

It has so frequently been stated that two queens are rarely found in one colony of honey bees that the occurrence of two queens, evidently mother and daughter, living side by side

<sup>1</sup>In addition to many interesting facts of honey bee behavior, I was able to collect material for a morphological study of the developmental stages of the three castes of honey bees. I am deeply grateful to Dr. Gates for his assistance and kindness in securing my material.

in an apparently peaceful condition, seems worthy of note.

The colony in which the dual queens were found is colony 95 of the Massachusetts Agricultural College Bee Yard, and the data in regard to its history were given me by Dr. Gates, with whose permission these notes are published.

On May 23, 1918, Dr. Gates had inspected this hive and found only the old queen. No queen cells were present and the colony was of medium strength, occupying only one story of the hive. The queen was introduced to this colony on August 1, 1917, and was therefore not old, and came of strong stock which had been selected for four years to resist the European foulbrood.

Thirteen days later, on June 5, 1918, on opening the hive a large number of queen cells was first noted; there were seven in all, three cells containing eggs, one a larva about four days old, two with young pupæ, and one empty cell with its cap thrown back, showing that a queen had recently emerged. The varied ages of the developing queens in these cells was interpreted by Dr. Gates as indicative of a tendency towards "supersedure," that is, the replacement of the old queen by a new one.

After a short search, a young virgin queen was found on the comb, her appearance showing that she had only emerged a few hours before. On another comb the old queen was found laying. Her wings were slightly frayed, although she was less than a year old, and her abdomen was considerably larger than that of the virgin queen.

In normal cases of "supersedure" the parent queen is destroyed by the workers prior to the emergence of the virgin, and in swarming it is known that the parent queen leaves the hive on the day that the cell of the new queen is capped.

Such a case of "supersedure," with the survival of both parent and daughter queens in the same colony, suggests a return of the probable ancestral condition of multiple queens, the condition that prevails to-day among bumble bees in the late summer, among certain wasps, and in ants.

After the discovery of the dual queens in a single colony, the old queen with most of the brood was confined in the second story of the hive, with a "queen excluder" above the first story, in which the virgin queen was placed with one sheet of brood and nine empty combs. The subsequent history of the old or parent queen may explain why her workers attempted to supersede her.

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#### PARAMECIA WITH EXTRA CONTRACTILE VACUOLES

THREE years ago I found a race of *Paramecium caudatum* which possessed more than two contractile vacuoles. A preliminary note on the behavior of these vacuoles was published in this journal (1915, Vol. 42) and two years later an account of the morphology, physiology and genetics of this new race appeared in the *Journal of Experimental Zoology* (1917, Vol. 23). In this paper the following conclusions were presented:

1. The number of contractile vacuoles range from two to seven. Three- and four-vacuolated forms are most abundant.

2. Apparently any individual has the potentiality for higher numbers of vacuoles. The appearance of the vacuoles depends on two things—(a) the rapidity of division; rapid fission does not give time for the vacuoles to form, (b) the amount of catabolic waste in the environment. If the percentage of waste is relatively high the average number of contractile vacuoles in the paramecia of the culture is high. In new cultures made up with fresh hay infusion the average number of vacuoles is low. The effect of rapidity of division can be partially overcome, since old cultures in which the rate of fission has been increased through the addition of new food show an average vacuole number much higher than found in fresh infusions.

3. Although several generations may pass without the appearance of extra vacuoles the potentiality for these organs is inherited and merely waits for the proper (apparently environmental) conditions to call them forth.

4. The extra vacuoles are, in almost all