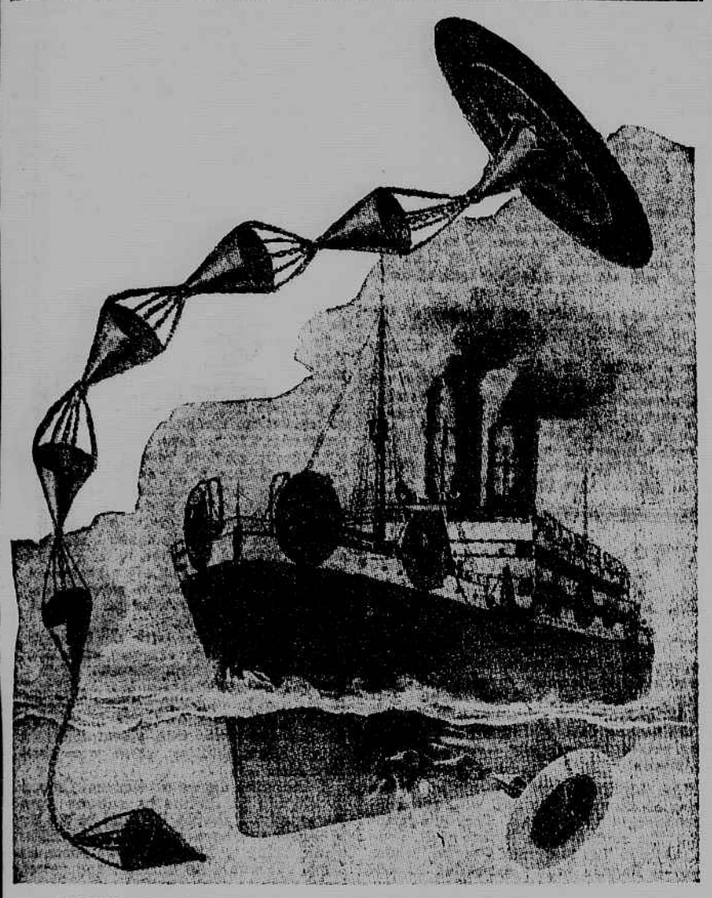
The Great Workshop of Science

Another Safety Device

BECAUSE of the performance shown by models in recent demonstrative tests, some interest has been aroused by an apparatus that has lately been developed to save ocean vessels from sinking after being torpedoed, or damaged by collision, writes "Popular Mechanics," which continues:

"The contrivance comprises a laminated steel disk, to the centre of which is attached a series of rubberized canvas, cone-shaped buckets. More specifically, the closing disk is built up of circular plates so as to have great strength in the middle and flexibility at its outer extremities. It is faced with a thick layer of compressible material that when subjected to pressure will fill and cover, water-tightly, the uneven surfaces surrounding the hole in the hull. The other side of the disk is overlaid with a rubberized fabric that is circular in shape and of greater diameter than the base member. The stopper could be provided in various sizes up to thirty or forty feet in diameter. In use the end cone on the chain would be lowered into the water in the vicinity of the hole in a ship's hull. Upon being caught by the inrushing water it would be pulled through the opening. The whole string of buckets would then be lowered along with the disk so that the latter would be pulled in place over the break. The cones, being of flexible material, would be able to pass through an aperture, regardless of its shape. The disk, once in place, would be held by the pressure of the water against the hull. Thus patched, a ship could stay afloat indefinitely and in many cases make port unaided."



THIS drawing shows the construction details of the big steel stopper and its cone-shaped guiding buckets, a device suggested to prevent the sinking of a torpedoed ship.
—From *Popular Mechanics.*

The World's Largest Electric Ship

IN THESE days, when tonnage is more important than anything but men, it is interesting to read of a new electric ship launched in England, which is said to accommodate from 8 to 10 per cent more cargo than any steam vessel of its size. It is the largest electric ship in the world.

"The London Post," commenting on it, says:

"One of the most interesting ships recently built in England will shortly start on her maiden voyage from a northeast port. This is the first electrically propelled merchant vessel ever constructed in a British yard and is designed on what is known as the Ljungstrom turbo-electric system. In this principle, which has already been adopted on a number of small foreign merchant vessels, steam turbines drive the electric motors which actually operate the propeller. The mechanism is controlled from a switchboard similar to that in an electric power station, and the engine room is unusually compact.

"The advantages claimed for the turbo-electric system, that make it of special interest in existing circumstances, are coal economy and increased cargo space. Tests carried out in the foreign vessels referred to above show a low fuel consumption, while it is estimated that the British ship, which is of approximately 6,400 tons, will accommodate from 8 to 10 per cent more cargo than an ordinary steamer of the same size."

TNT as a Regular College Course

ACCORDING to "The Arizona Republican," the American university has discovered yet another way of ministering to the war needs of the country. One reads:

"TNT, the famous explosive that is playing such an important part in the great war, is now being made at the University of Arizona. Many of the courses at the university have been somewhat modified as a result of the war, and thus notably true is the case of those offered by the department of chemistry. Thus, in the regular course in organic chemistry, tri-nitro-toluol, or TNT, as it is more familiarly known, has been prepared by the students.

"This is probably the most important high explosive used in the present war, and a knowledge of the method of manufacture is not only of great interest to the student, but it may also be very useful to him if he engage in chemical services for the government.

"Like many other high explosives, TNT requires a detonator or fulminate cap to set it off. It is said that a rifle ball may be fired through a box containing this substance without its exploding, and it is therefore as safe to handle and to prepare in the laboratory as the other products commonly synthesized there. This explosive is manufactured from toluol, a by-product of gas works, and Everett M. York, an expert in gas by-products, has been investigating in Dr. Guild's laboratory the possibility of securing toluol from the local gas works."

"The New Chemical Warfare"

A VERY remarkable article by Julius Stieglitz is to be found in the current issue of "The Yale Review." He gives chemistry credit for starting the war, and shows that also at chemistry's door must be laid the responsibility for war's prolongation. There is no question, he says, that—

"without the recent development by her great chemists, especially by Professor Haber, by Professor Ostwald and by Dr. Caro, of methods of converting the atmospheric nitrogen on a large scale into ammonia and nitric acid, Germany would not have dared to open the war in 1914. Without this aid, in the face of the possibility of Great Britain's control of the seas and the cutting off of supplies of nitre and food, Germany would have been compelled to stake all on the chance of a speedy conquest, such as she failed to achieve in 1914 as a result of the Battle of the Marne.

"To medicine is due the credit for protecting the millions of men in arms against disease in camp and trench, an evil which in previous wars is estimated to have cost more lives than actual fighting. To the botanist is due the credit for saving Germany from the alternative of starvation or surrender by the aid he has rendered agriculture in supplying thousands of tons of ammonium sulphate and nitrate prepared from the atmosphere by processes of the chemists. The modern aeroplane, with its load of pilot and observer, of armor and ammunition, would be impossible were it not for the alloys cunningly devised by the chemist, which combine greatest strength and toughness with a minimum of weight. No doubt we all regret that the chemists by stored oxygen, by reagents absorbing carbon dioxide and producing oxygen, by the storage of energy in electric batteries, have kept the submarines, an invention of the physicists, from suffocating in their own foul gases in the depths; but there is comfort for us in the thought that our own submarines may profit by these discoveries."

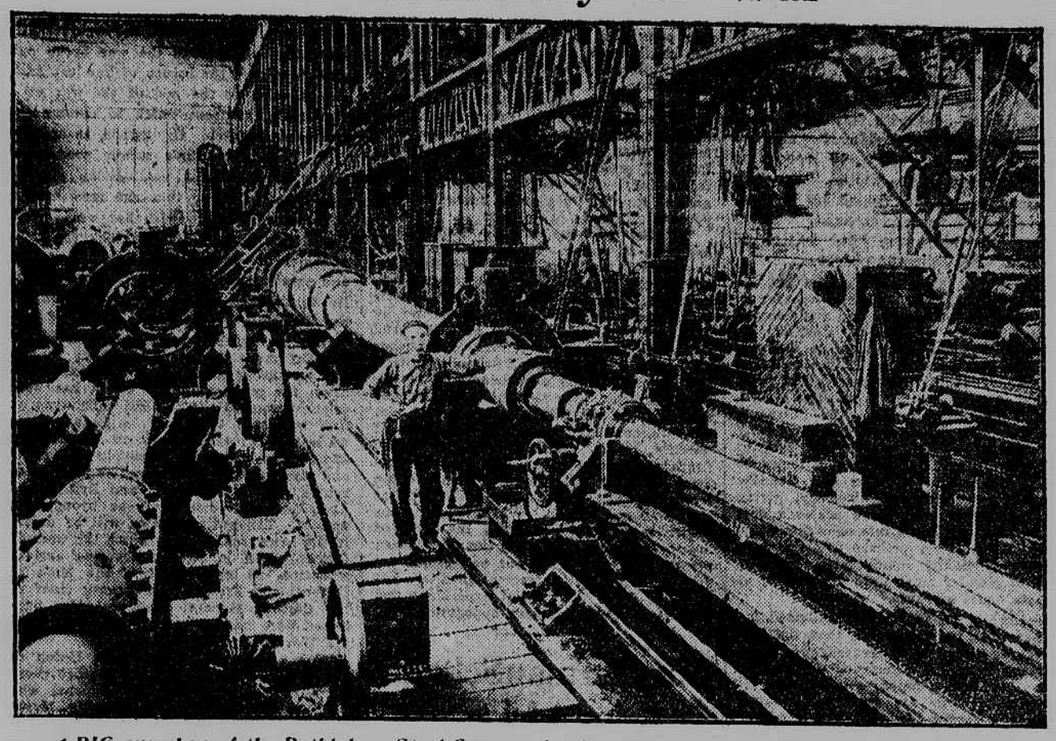
Another service of chemistry since the war consists in supplying the people of this country with chemicals hitherto imported from abroad. In regard to this problem the author asserts:

"Three typical and important illustrations of these tasks must suffice—the providing of drugs for the health of our people, the manufacture of coal tar dyes for our textile, leather and related industries, and, finally, the production of potash for farm and factory. The results are encouraging. Almost all the essential drugs are now being manufactured in the United States, and in a very few weeks the shortage that has existed will be a matter of the past.

"The part which chemistry has in the battle line itself is perhaps the most interesting and absorbing chapter in the history of the war, so far as it is being written by chemists. It is also the most horrifying and depressing, and for very obvious reasons it can be written in detail only after the war is over. When Germany let go the first wave of poison gas in contravention of all international agreements it is said that the British general in command wired to London that if relief were not sent within three days the whole British line would be compelled to retire. This is a measure of the intolerable suffering of the first victims of this treacherous mode of attack, which has been justified in the eyes of the German public only by the claim that the French had first used chemical 'stinkpots.' To the credit of the coördination of science and government in England it is reported that within thirty-six hours a million and a half of the first crude but sufficiently effective gas masks were delivered at the front—simple gauze affairs saturated with absorbent (probably some alkaline liquid) for the dread chlorine gas of the enemy.

A decision probably can be reached only by the side that can hurl against the enemy the greater number of thousands of high explosives."

The Machinery of War



A BIG gun shop of the Bethlehem Steel Company's plant at Bethlehem, Penn. Some of the great rifles that now swing round in United States battleship turrets were constructed in this plant and finished in this shop.
Copyright, Underwood & Underwood.

Neat Little Problem in Chemistry. Can You Solve It?

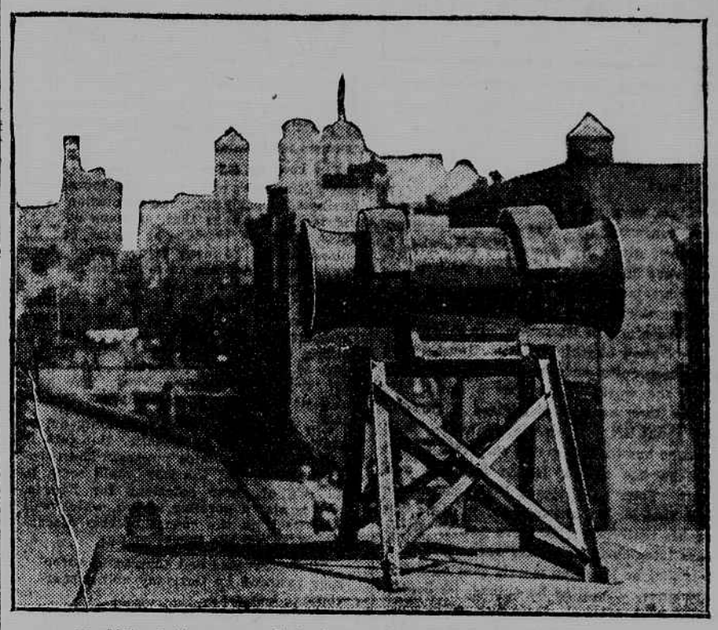
OF ALL the problems for chemists perhaps none is so pressing, and none seems to the tyro so easy, as to discover some way of converting the lower members of the hydrocarbon series—methane, ethane and ethylene—into higher members of the same or other series. If we could make methane and ethane into pentane, hexane and heptane or ethylene into hexylene, and the like, these being liquids under ordinary conditions, we could convert and so condense some of the gases from by-product ovens into gasolene and burn the others for power purposes and for coking.

The method would probably be equally available for use in connection with the distilling of coal at low temperatures. It would be possible also to turn the gas from our oil wells into a stable gasolene. If the process was reasonably cheap it might conceivably be possible even to secure a product from the waste gases of the mines, as Governor Brumbaugh of Pennsylvania has advocated—but that is a far cry.

The immediate need is to convert the richer gas of coke and coal-distillation plants into liquids so that there will be a greater profit in operating such plants at the mines. At present the gas of by-product ovens has to be wasted if it is not produced in close proximity to points where the demands for power are large.

In converting methane into heptane, if the conversion could be accomplished, 9 per cent of the hydrogen in the methane would be abstracted. While methane contains 25 per cent of hydrogen, heptane has only 16 per cent. Ethylene has the same chemical analysis as hexylene. In the other series hydrogen must be added, but these are less important. The trick seems so easy, but nature often seems firmly resolved to resist taking what appears on first sight to be the obvious course.—*Coal Age.*

In Case of Air Raids



ONE of the powerful sirens that are being placed on the roofs of buildings throughout New York City to warn of threatened air attack. The sirens all will be operated at once by the throwing of a single switch.
Photo from *Aerial Age*, by Kadel & Herbert.

Electrocution

THE question as to how death is caused by electricity has long been the ground of controversy between German and Austrian scientists. At the University of Vienna it is taught that the electric current upon entering the body arrests the functioning of the respiratory organs and thus causes death through suffocation. The German authorities, on the other hand, teach that electricity stops the rhythmical beating of the heart, that a sort of dancing or fluttering of that organ supervenes, and as there is no more pumping action to keep up the circulation death ensues.

From a notice in the "Frankfurter Zeitung" it would appear as if Berlin in this instance, too—just as in the realm of politics—has now proved itself the stronger power. Professor Boruttau, of the Berlin University, that paper reports, has recently delivered an address before the Berlin Electrotechnic Society in which he fully demonstrated the correctness of the German view. Appealing to numerous experiments by himself and other specialists, made upon animals and registered in the form of "electrocardiograms," he claimed definite proof for the theory that death is caused by attack upon the heart, which is made to flutter or dance. In addition to this experimental proof Boruttau studied the statistics of 1,200 cases of accident with electricity. From these it appeared that in cases where the current entered the heart death nearly always resulted, whereas death was rare when the current entered the head and brain, in which the respiratory organs have their vital centre.

Discussing means of restoration to life of persons apparently killed by electricity, Boruttau claimed that where the heart is fluttering through electric shock nothing can be accomplished by resorting to artificial respiration. He thinks that the most effective course might be to open the chest and try through massage to restore the beating of the heart, but he admitted that this could only be undertaken in exceptional cases. He also said that a fluttering heart, as experiment had shown, could again be brought to beating rhythmically by means of another form of electricity, either a high-tension rotary current, or by a single discharge from an accumulator (the German is Kondensator).

A Signal Light for the Telephone Receiver

ON several occasions when an executive assistant desired to converse with his superior the latter was busy on the telephone, so he had to wait. To open the door every few minutes for the purpose of looking in or to have the operator notify you when the receiver had been hung up is both annoying and time-consuming. A private concern has installed an inexpensive device which eliminates this embarrassment. The executive's telephone has an extra connection which automatically lights a small blue light at the assistant's office when the former is using his 'phone. As soon as the executive hangs up the receiver the light goes out and the assistant knows that his superior is accessible. This device, which is very inexpensive, consists of two plates connected with wires which run through the cord to the assistant's office. — *Popular Science Monthly* for July.

The Doctor Shakes His Head

Germany Cannot Pull Through. Having Reached the Period of "Cultural Limitations" and Senility of Protoplasm, She Must Fall

ANOTHER volume has been added by Dr. Robert T. Morris to his interesting, widely discussed "To-morrow's Topics" series. It is called "The Way Out of War," and sets forth, as the author phrases it, "notes on the biology of the subject." From a biological point of view he is sure that Germany is doomed, and declares:

"Nations which are dominated by men of some one varietal hybrid type (Hohenzollern, Guelph, Romanoff, Hapsburg) develop ideals in nationalism which cement all ethnic factors in that nation into a group unit that is extremely strong for purposes of offence or defence. Each strong group unit develops ideals which are characteristic of the sort of mental expression belonging to the physical type of the dominant family in that group unit. Ideals belong so largely to the emotional set of faculties that conflict of one sort or another between group units (nations) is inevitable and belongs among the workings of a natural law.

"Whenever a strong nation develops it depends upon the dominance of a varietal hybrid group. The formation of such groups occurs among other animals and among plants. When the dominant varietal hybrid group reaches cultural limitations it falls apart, and the remnants of the variety make further varietal combinations. From among these fragments of dominant types arise various new combinations, some of which may represent closely the original dominant group.

"Eighteen hundred years ago the Roman Empire was characterized by its solidity and its universality. Eight hundred years later the rulers had failed to maintain unity, and that great civilization was lost in a large number of small separate domains. Here and there larger, stronger herds appeared, the larger ones tending to absorb the smaller ones until the Napoleonic wars, and the series of modern wars beginning in 1848 had a tendency to mould into shape modern Germany as a result of internal cohesive force aided by external coercive forces.

"The original unity of the Roman Empire was due to the conquest of other states by a single state of the group, this single state possessing military and political efficiency in higher degree than had been developed by the other states. Among the present varietal hybrid groups history has been repeated by the conquest of various German states by what we call the Prussian State. Various elements forced under the rule of the Prussian State have been rather more rebellious than those which were grouped together under the Roman State.

This Master Is Not Loved

Those of us who have had the privilege of enjoying close social contact with the people in Austria and in Hungary and in South Germany are fully aware of the inimical feeling of these groups toward their master. One reason why the Roman State was more successful in this respect was because of a greater generosity of government which resulted in better affiliation after conquest. Roman methods of affiliation with vassal states did not arouse the antagonism which Prussia has aroused by severe martial methods which have been employed for holding vassal states in chain and which have sent German emigrants to generous governments in preference to their own colonies. At the time of the formation of the Roman Empire through force applied by a single state there were no other competing civilizations like those which surround the Prussian autocratic state and its vassals to-day. In Greece the high development of different cities did not result in the abolition of warfare, and there was constant warfare between the cities.

"The time came when barbarism in mass force with tremendous onslaught could break up civilized Rome when it began to disintegrate as a result of senility of protoplasm and the approach toward cultural limitations. At the present time a number of high civilizations are uniting, as the Greeks or Egyptians could never have united, and it is this union of powerful civilizations which desires to unseat the protoplasmically senile German government while retaining as fully as possible that part of the highly valued German people which retains a magnificent charge of potential energy.

"I do not know which one of the Romans first picked up the idea that Rome had divine mission, but in Germany it was Frederick the Great who first seized upon the idea for his country. This curious phase of psychology . . . carries a considerable degree of weight among uneducated people. From mediæval times up to the present day the Church, when seeking temporal power or working for political ends, has made a point of dickering with kings in such a way as to make them divinely appointed, provided that they behave well in the presence of the Pope.

"Dante in the fourteenth century and Gioberti in the nineteenth century declared that the Romans and their descendants were chosen people, consecrated by divine decree. Conditions are very different in these modern times, when an individual like the Kaiser chooses to declare himself consecrated, while surrounded by thousands of German materialistic mockers and by rival consecrated states. This digression into sociologic comparison of Rome with Prussia is not in truth a digression, because sociology is a phase of physiology; physiology depends upon protoplasmic integrity, protoplasmic integrity depends upon the comparative degree of vitality in any varietal group.

"The decline of nations is marked by a sign which we may call for convenience the 'apædion index.' There is a lessening of the birth rate commonly ascribed by sociologists to social causes. The biologist understands the index as having a deeper meaning, something more fundamental. It relates to the physical inability of a people to bear fully normal families of children. Kaiser Wilhelm read the sign aright several years ago. He proposed artificial methods for opposing the working of a natural law. We know about Teutonic cultural limitations. The Maximilian Harden disclosures and the falling birth rate of Germany clearly indicate to a biologist what is now happening in that state.

When the Protoplasm Grows Senescent

"A sapient world reading of these disclosures and of corroborative testimony in German medical literature made very little response. It compared notes with what it already knew of other capitals, past and present, and put the question down as sociologic without special significance. The question was protoplasmic and significant as handwriting upon the wall. The naturalist recognized it as meaning proven illness of a state the protoplasm of which was becoming senescent. . . .

"The naturalist knows that Prussia need not be feared after the war, as the sociologist fears. The apædion index associated with other phenomena of decline give testimony showing that Prussia in the centres of population had reached cultural limitations about the beginning of the present century. When decline is under way in the representative centres of any nation the movement is rather steadily downward.

"Historians will write of Prussia that was in the same way as they write of Rome that was. When there is a rapid increase in the wealth in any country and corresponding financial ability to raise children, and when this movement is accompanied by an actual decrease in the birth rate, a wealthy country then begins to follow Rome in decline as a natural phenomenon. The expression 'fewer and better children' does not represent a logical sequence. Taken in the meaning of a systematic elimination of the unfit there would be a movement toward a higher plane in citizenship on the part of the few. Practically, following the law of cultural limitations, the few are actually now in evidence, with too many decadent features of the sort belonging to cultural limitations. Brill has furnished important data bearing upon this point.

It Might Go Down With All Mental Flags Flying

"The apædion index does not mean that high mental gifts are to disappear; on the contrary, a nation might go down with all of its best mental flags flying. A parallel is found in the rose which becomes more beautiful when it 'doubles' by increase of petals at the expense of stamens. . . .

"All states which rise like the Roman and German states must fall like these, and for protoplasmic reasons. In regard to later civilization we anticipate that decline will be conducted by microbic influence more than by arms. Perhaps in future civilizations other states which admire and appreciate some one highly developed state will not be surprised at its downfall. The reason why they are surprised nowadays is because the billions of dollars expended upon arms are not expended instead upon the giving of every man in the civilized world a proportionate number of thousands of dollars which would allow him to equip himself in science. Intensive agriculture and collateral sciences which are grouped about that one basic study lead naturally toward avoidance of warfare by arms. Up to the present time in this Great Double Invasion War the money expended for purposes of destruction if apportioned evenly would allow every man in the civilized world several thousand dollars which might be used for purposes of instruction. . . .

"Had any one told the Romans that Rome was to fall he would have been looked upon very much as the Germans now look upon the naturalist engaged in telling them that their government is falling because of the working of the law of cultural limitations.

"Manifest destiny may be viewed in two ways, as it was viewed by the Romans and by the Germans of 1914, and as it is viewed by the biologist. The destiny of Prussia is at least clearly manifest to the student of natural history."

An Indian "Miracle" Explained

A NOTE in "Nature" refers briefly to a lecture by Sir J. C. Bose, which describes and explains a bit of Hindu wonder-working — the "praying palm tree" of Faridpur. At the time of evening prayer the tree is seen to bow its head in prostration, and it resumes an erect attitude the next morning. The lecturer devised special apparatus to record continuously the movements of the tree by day and night, and thus discovered that the movements were due to the diurnal change in temperature.
—*Scientific American.*

A Hun Turbo-Dynamo

IT IS claimed that the largest turbo-dynamo machine in the world has just been completed by the Allgemeine Electrical Company at Berlin. It generates 50,000 kilowatts, which corresponds, at 1,000 revolutions per minute, to 75,000 horsepower. It is characteristic of the hard times now prevailing in Germany that the blades of the turbine had to be made for the most part out of other than nickel steel. As illustrating the economy of space achieved by such a powerful turbo-dynamo, a Berlin newspaper makes this statement:

"The largest steam engine in the municipal electrical plants of Berlin produces a maximum of about 6,000 horsepower; and yet it occupies more space than this turbo-dynamo which generates more than twelvefold the power it yields."

Ash Trees for Airplanes

THE appeal of the Aerial League of the British Empire for ash trees for aeronautical purposes has resulted in between three and four thousand trees being offered within the last few weeks, according to "Flight." The government requirements in the next twelve months are expected to exceed 200,000 trees.—*Scientific American.*