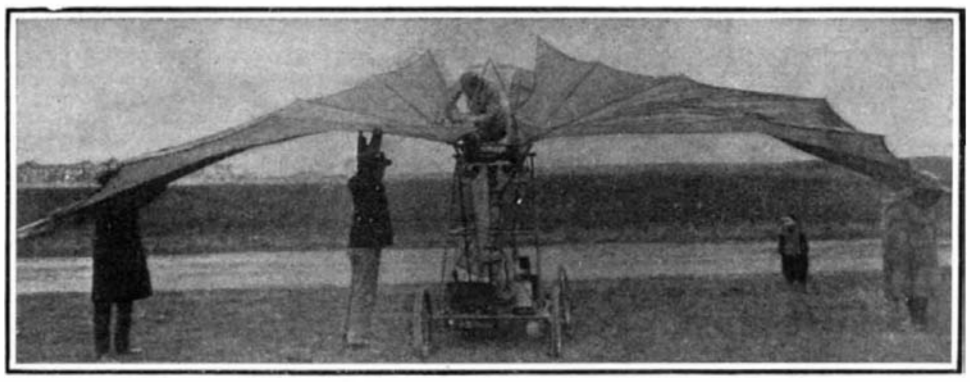
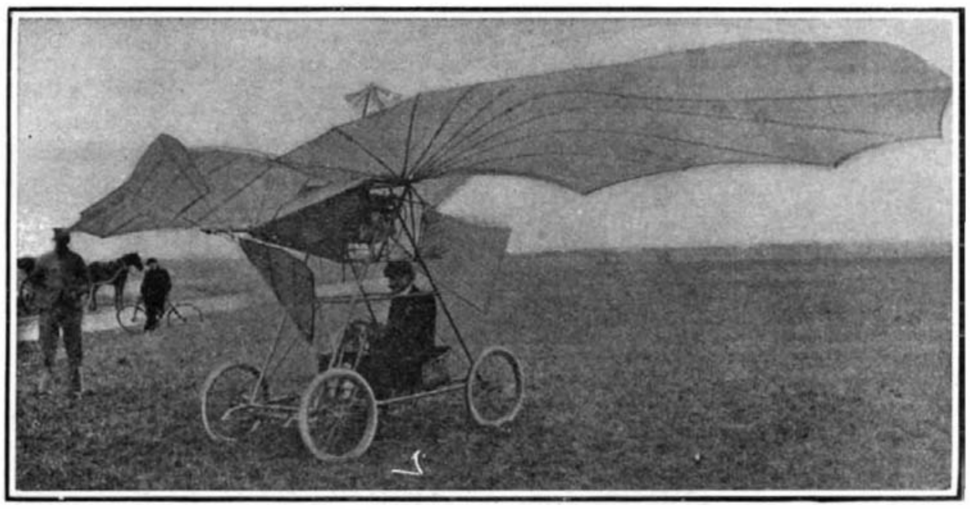
SOME RECENT FOREIGN FLYING MACHINES.

The present year bids fair to see the solution of the problem of the "heavier than air" flying machine, judging from the number of aeroplanes now being experimented with by inventors the world over. The following descriptions will give an idea of some of the latest attempts at solving the problem of flight with a machine of this kind.



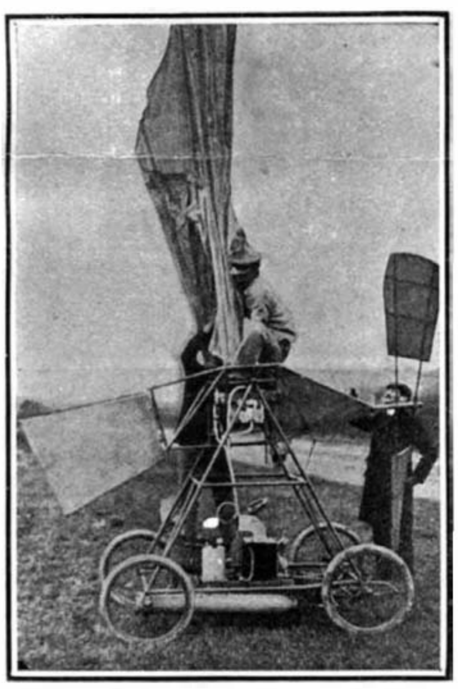
Front View of Vuia Aeroplane.



The Vuia Aeroplane Ready to Rise.

The aeroplane is mounted on a light quadricycle so that it can be drawn along the ground by its propeller until sufficient speed is attained to enable it to rise in the air.

Four of our illustrations show the recently invented aeroplane of M. Vuia. This machine consists of a pair of wings covered with varnished silk which, when unfolded, have the appearance of a gigantic bat, as can be seen from two of the annexed illustrations. The aeroplane is mounted on a framework of steel tubing carried on four pneumatic-tired wire wheels, the front pair of which can be steered after the manner of an automobile. In the upper part of the framework is a carbonic acid motor, capable of giving 25 horsepower when operated at high pressure. The motor drives the propeller placed in front of the wings, and thus draws the machine along the road. When sufficient speed is attained the machine is expected to rise in the air. The speed necessary for this is estimated to be about 36 miles an hour. As soon as the machine is in the air, it can be steered to the right or left by means of a vertical rudder, while its inclination is varied by means of varying the angle of the wings, which are made to turn about their horizontal axis. The total weight of the complete machine is 195 kilogrammes (639.76 pounds), to which must

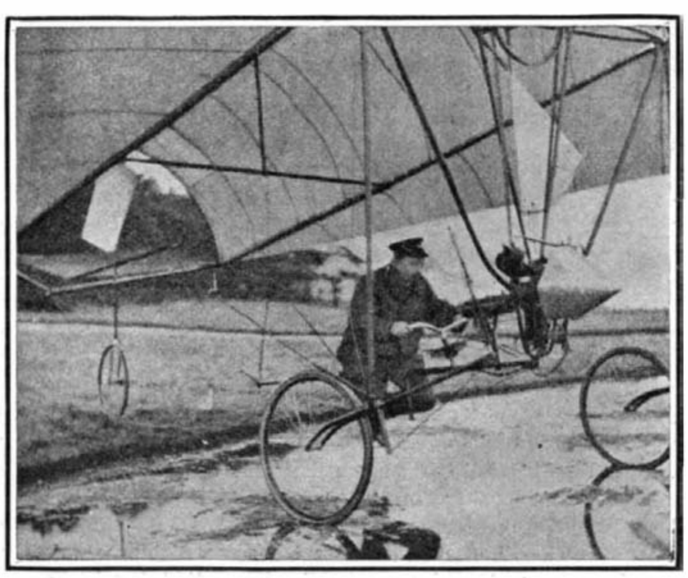


The Aeroplane with Wings Folded, As It Ran Along the Road.

be added the weight of M. Vuia, which is 50 kilogrammes (164.04 pounds). The length of the wings from front to back is 2.40 meters (7.87 feet). Their breadth is 8.70 meters (28.54 feet). The propeller is 2.20 meters (7.21 feet) in diameter and has a pitch of 2.35 meters (7.71 feet). In the initial experiments made some weeks ago with this machine, the wind blew so hard that it was impossible to extend the enormous wings of the aeroplane. Consequently, the inventor confined himself to experimenting with the propeller, while causing it to draw the machine along the road with the wings folded. The road was muddy and rutty, and there was a slight up-grade. Notwithstanding this, when the propeller turned the machine started and attained a speed of 12 miles an hour. The wind blew from the side. On the return trip, which was slightly downgrade, a little higher speed was attained. M. Vuia, accompanied by his mechanic, rode back and forth several times with the same success.

There is, of course, considerable difference between 12 miles and 36 miles an hour, the estimated speed at which the machine is supposed to leave the ground; but the first experiments were sufficiently successful to encourage the inventor and those who witnessed them. Moreover, this quadricycle, if run on a smooth, flat track, can be used for studying with great ease and in a practical manner the best form to give the propellers which it is intended to use for aerial propulsion, and the variations in their efficiency according to the speed with which they are revolved. It would be worth while to fit such a machine with a 100-horse-power Buchet motor, weighing 2.2 pounds to the horse-power, in order to see what could be accomplished. The experiments made thus far were certainly very interesting, and all those having the conquest of the air at heart will follow any future ones the inventor may make, with the greatest attention.

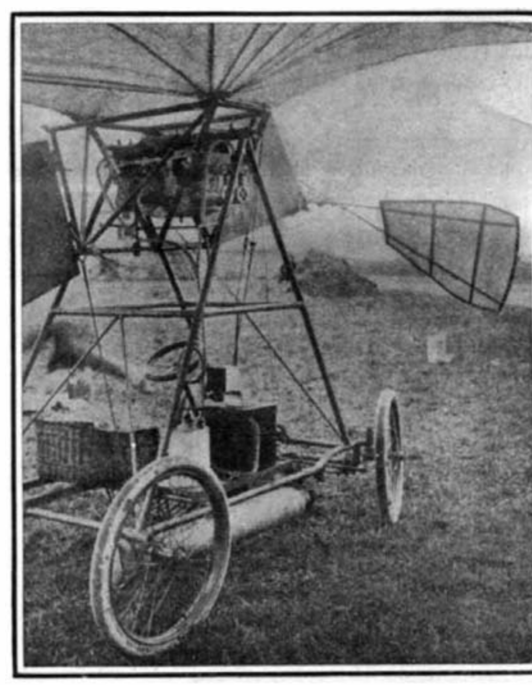
Four other illustrations, shown herewith, depict a new aeroplane of somewhat similar construction, which is the invention of Mr. J. C. H. Ellekammer, a Dane who has made a name for himself in connection with the motor bicycle which he invented, and the chief features of which are a patent starting valve and "turbine" carbureter. Mr. Ellekammer began work about a year ago upon this aeroplane and in its trial so far it has been altogether successful. The novel feature about this machine is the long semi-circular body within the front end of which is mounted a propeller. The latter produces a powerful draft beneath this curved body and draws the machine forward through the air. The propeller is driven by a belt from a three-cylinder motor placed directly beneath it, and the cylinders of which set at an angle of 120 degrees, and work upon a single crank. The motor is air-cooled, as usual. Two large triangular wings serve to steady the machine and help support it. The operator sits upon a saddle just back of the motor. Three bicycle wheels are used to support the machine when it is upon terra firma. The machine is constructed of light steel tubing and canvas. Its length is 28 feet, and its width across the wings, 32 feet. It is fitted with an 8-foot propeller, and its width complete, is 287 pounds. The most important feature of the whole machine is said to be that the operator can maintain it at any desired angle to the horizontal. The machine is said to have flown when tethered to a pole and run around a wide circular track surrounding it. At present the inventor is constructing a motor of larger horsepower. As soon as this is completed he plans to give a demonstration before Prince Waldemar of Denmark, who is greatly interested in aeronautical matters.



The Danish Aeroplane Running Along on the Ground Before Rising.

VIEWS OF NEW FOREIGN AEROPLANES.

A distinctly novel type of flying machine is what may be called a revolving aeroplane apparatus. This is shown at the bottom of the next page. It consists, as may be seen, of two triangular wings inclined somewhat with the horizontal, and suitably mounted on rollers on a circular track. The track is supported upon a framework of steel tubing, within which the operator is supposed to sit. Mounted upon the wings are two propellers which are driven by belts from a motor placed at the base of the wings and also mounted on the same frame with them, the idea being that the wings, driven by the propellers, will revolve rapidly and lift the machine in a vertical direction. After it has attained the desired height, the operator can tilt it by moving his body toward the rudder, and thus can cause it to move forward as well as rise. A parachute can be carried within the circular frame and opened in case the machine falls. The photograph is of a model constructed of oak, bam-



Near View of 25-Horse-Power, 4-Cylinder Compressed-Air Motor.

boo, canvas, and steel tubing for the purpose of showing that the machine could be built on a large scale. The wings are 30 feet across and they have a periphery of 27 feet. The rudder was about 7 feet long and the propellers about 10 feet in diameter. The total weight of the machine was in the neighborhood of 300 pounds, and it was fitted with a light air-cooled gasoline motor of 3¾ horse-power, weighing some 50 pounds. This machine is the invention of an Englishman, Mr. George Clout, whose present address is 234 West 14th Street, this city. He has spent some fifteen years working out this idea and is desirous of interesting capital for the purpose of building a practical machine along these lines.

An engineer living in Monaco, Mons. M. Léger, has recently tried to find a satisfactory solution of the problem of flight by a combination of a hélicoptère and aeroplane. His invention is based on the following considerations:

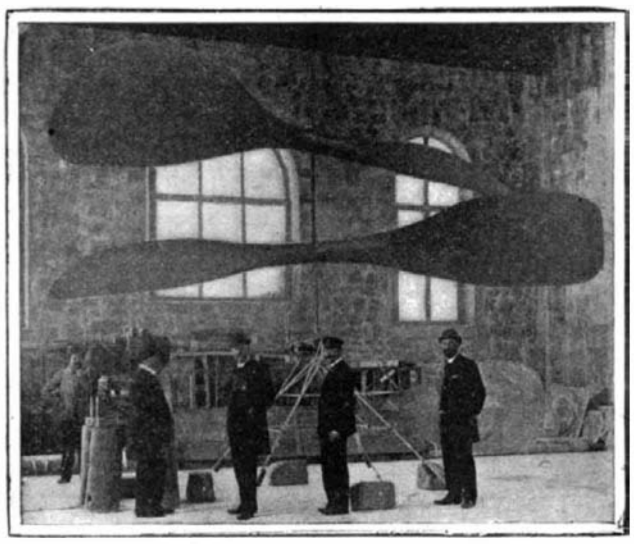
If helicopeters have failed to give the desired results, this is due to the fact that separate screws were used for support and for propulsion. Now a vertical air screw in a horizontal air current (and likewise a horizontal screw in a vertical current) will never work satisfactorily. One of the blades of the screw will in fact possess with regard to the air an absolute speed equivalent to the sum of the tangential speed and the speed of propulsion, while only the difference of these two will be operative on the other side of the screw. One of the blades will accordingly tend to rise more rapidly than will the other, with the result that the equilibrium of the whole machine is upset. Léger accordingly uses two screws, which serve simultaneously for supporting and propelling the machine. These screws are arranged at an oblique angle, their common axis being placed in a vertical direction for rising and descending, and in an oblique position for horizontal movement. These screws, rotating in opposite directions round their common axis, mutually deal with the resulting recoil. If now the machine be given supporting surfaces, the axis of the screws being inclined as far as the horizontal position, it will work as an aeroplane and have the advantage of this type of airship, viz., the requirement of much less power for propulsion, or the attainment of a far higher speed with a given amount of power.

Léger has recently carried out experiments with a helicopter of half the dimensions required for lifting a man (see annexed cut) in the presence of the Prince of Monaco, who takes an active interest in this work and who has repeatedly presented reports on the same to the French Academy of Sciences. The screws of this apparatus were 6.25 meters (20.5 feet) in diameter and 1.75 meters (5.74 feet) in breadth. They were made of highly resistant reinforced aluminium sheets, and were each 21 kilogrammes (46.29 pounds) in weight, while the complete apparatus without the motor weighed 85 kilogrammes (187.39 pounds). It was operated by an electric motor placed on the ground and driving the screws through a shaft and universal joints.

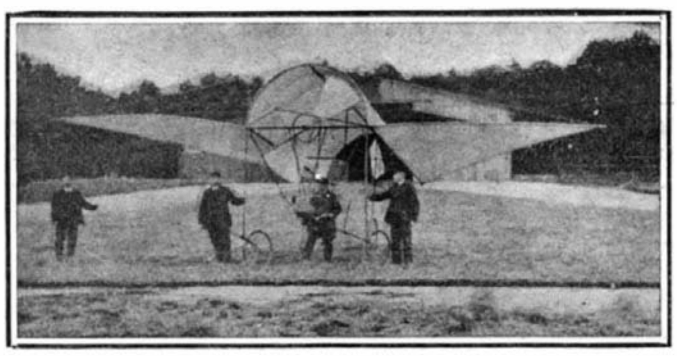
The experimental machine carried 25 kilogrammes (55.11 pounds) dead weight, the total amount to be lifted thus being 110 kilogrammes (242.5 pounds), which was actually raised by the expenditure of 6 horse-power. Now motors of a maximum weight of 2 kilogrammes (4.4 pounds) per horsepower, inclusive of the amount of fuel required for one hour's operation, are at present constructed. Fifteen kilogrammes (33.06 pounds) of the load above referred to will accordingly correspond to a motor of 7.5 horse power and 30 kilogrammes (66.13 pounds) to the weight of a man of half size. Now 110 kilogrammes (242.5 pounds) were lifted by 6-horse-power, i. e., 18.3 kilogrammes (40.4) pounds) by each horse-power. Consequently 7.5 horse-power may be expected to produce an ascensional force of 7.5 × 18.3 = 137.25 kilogrammes, or 313.08 pounds. As the machine, motor, and half-size man weigh respectively 85, 15, and 30 kilogrammes, there is a total weight to be lifted of 130 kilogrammes (286.59 pounds). Therefore there should be 7.25 kilogrammes, or 26.49 pounds surplus lifting power, which is ample.

The inventor intends shortly to construct and to test a helicopter of larger size. This flying machine is to be provided with screws of 12.50 meters (40.02 feet) in diameter. The output of its motor will be 100 horse-power. It is intended to transport a man and carry an amount of fuel sufficient for six hours' operation. According to M. Léger, its dimensions as compared with those of other flying machines will be rather moderate.

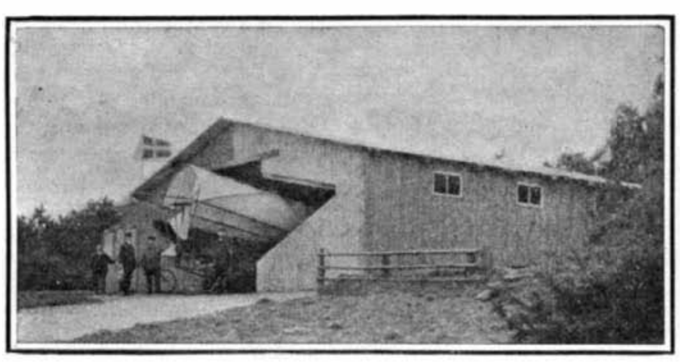
Diagram of Leger's Helicopter.



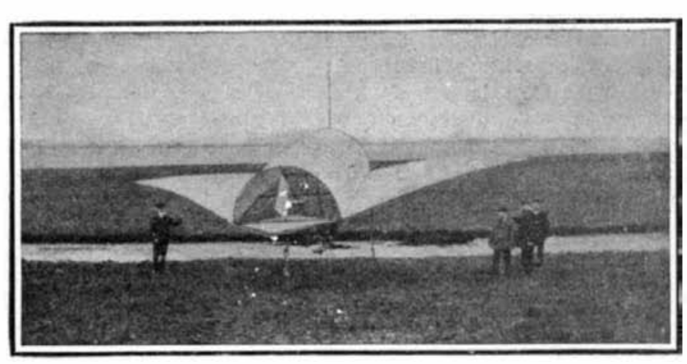
The Oppositely-Revolving Propellers of the Helicopter.



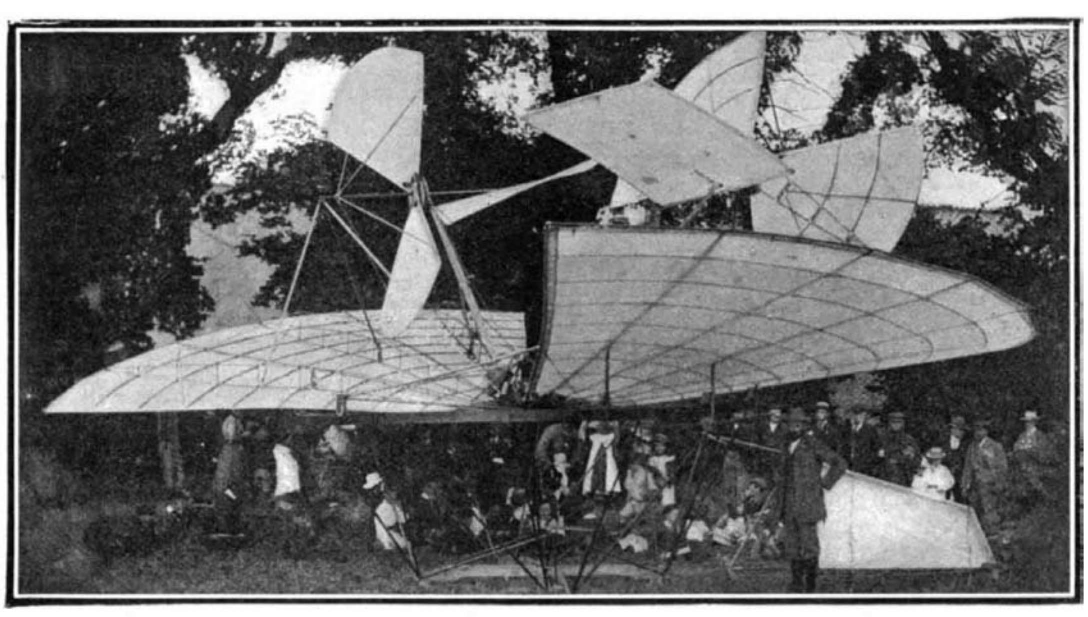
Front View of a Danish Aeroplane.



The Aeroplane Leaving Its Shed.



Rear of Aeroplane, Showing Rudders.



An English Machine Consisting of Revolving Wings Driven by Propellers.

RECENT FLYING MACHINES OF THE HEAVIER-THAN-AIR TYPE.

Trade of the United States with Europe.

Europe takes two-thirds of the exports of the United States and supplies practically one-half of the imports. This statement summarizes the facts which have been developed by a series of discussions of the trade of the United States with the countries of Europe recently presented by the Department of Commerce and Labor through its Bureau of Statistics. These discussions have presented an analysis of the trade with each country of Europe by principal articles, and when summarized show that Europe takes more than a billion dollars' worth of the exports from the United States, while all other parts of the world take a little less than a half billion dollars' worth. In no year since 1899 has the value of exports to Europe fallen below one billion dollars, while that to all other countries has never touched the 500 million dollar mark. Prior to 1900 the exports to Europe had never been as much as one billion dollars in value; in that year they crossed the billion dollar line, being 1,040 millions, and have since that time averaged about 1,050 millions per annum. In 1900 the exports to all sections of the world other than Europe were 354 million dollars in value, but have grown year by year until in 1905 they were 498 millions, the growth since 1900 in exports to the non-European countries having been proportionately greater than that to Europe.

On the import side, Europe supplies, as already indicated, about one-half of the merchandise brought into the United States. Prior to 1890 the share of the imports drawn from Europe averaged about 55 per cent; after 1890 the average was a little more than 50 per cent; in 1905 it was 48.4 per cent. This reduction in the percentage of the imports drawn from Europe is apparently accounted for by the growing demand in the United States for tropical and subtropical products which are supplied almost exclusively by the other grand divisions of the world. The value of tropical and subtropical products brought into the United States in 1905 was 508 million dollars, against 303 millions in 1895 and 218 millions in 1885. Most of this class of imports comes, of course, from the non-European sections of the world; much of it from South America, especially coffee and India rubber; much of it from the southern part of North America, especially sugar, sisal, and tropical fruits; a considerable part from Asia, including tea, raw silk, and spices, while Oceania contributes sugar, spices, cocoa, and other products of this character, and Africa Egyptian cotton, India rubber, hides and skins, and a small supply of sugar.

The trade of the United States with Europe is composed on the import side chiefly of manufactures and materials for use in manufacturing; on the export side of food stuffs, manufacturers' materials, and manufactures. The manufactures imported from Europe are chiefly the higher grades of cotton, silk, and wool fabrics into which labor, and in many cases hand labor, largely enters; while chemicals, certain grades of iron and steel manufactures, toys, wines, china and porcelains, cut and plate glass, and other articles of this kind contribute largely to the grand total. In addition to this, however, there are imported from the European countries certain articles the product of their respective colonial possessions, including India rubber, fibers, tobacco, hides and skins, wool, tin, raw silk, diamonds, and various tropical and subtropical productions. The articles exported to Europe are chiefly breadstuffs, meats and live cattle, and fruits, for food; raw cotton for use in manufacturing, and a variety of manufactures, including copper in pigs, bars, and ingots, mineral oil, agricultural implements, boots and shoes, manufactures of wood, oil cake, cotton-seed oil, vegetable oils, naval stores, and various manufactures of iron and steel.

Of the 1,021 million dollars' worth of merchandise sent to Europe in 1905, 239 millions was manufactures, the other 782 million dollars' worth being largely food stuffs and manufacturers' materials. With the growing tendency of our steadily increasing population to consume at home a larger share of the food stuffs produced in the United States, and to increase the consumption by our own factories, the supply which can be spared for Europe is decreasing rather than increasing, and as a consequence the percentage of exports sent to Europe is slowly decreasing.

Prior to 1887 the share of our total exports sent to Europe was over 80 per cent; since that time the percentage has gradually fallen until it reached 72 per cent in 1902, and in 1905 was but 67.23 per cent of the total, while the share of the exports taken by those grand divisions to which the exports are chiefly manufactures shows an increased percentage in 1905 compared with 1904.

A NEW FRENCH COMPOUND LOCOMOTIVE.

BY FRANK C. PERKINS.

The powerful tank locomotive herewith illustrated has recently been constructed and placed in operation by the Compagnie du Chemin de Fer du Nord. It has two sets of six-coupled driving wheels, one set in front and the other at the rear, with two bogie wheels connected with each truck, one pair following the six forward drivers and the other pair on the rear truck leading the six rear drivers. Each set of eight wheels is carried in its own separate swiveling truck. There are two separate sets of tanks for water and fuel, one located over the forward driving wheels, and the other over the rear drivers and inclosed with a cab as noted in the illustration.

This locomotive is of considerable length, measuring 16.186 meters over all and including the bumpers. The total heighth of the locomotive is 4.22 meters and the total width 2.874 meters. The following interesting data as well as the drawing and photograph was furnished by G. Du Bousquet, l'ingenieur en chef du materiel et de la traction of the La Chapelle works of the Chemin de Fer du Nord.

This locomotive has a boiler with 130 tubes, each 4.75 meters in length and of an external diameter of 70 millimeters. The total heating surface of the boiler is 244.55 square meters, of which 234.56 square meters represents the heating surface of the tubes.

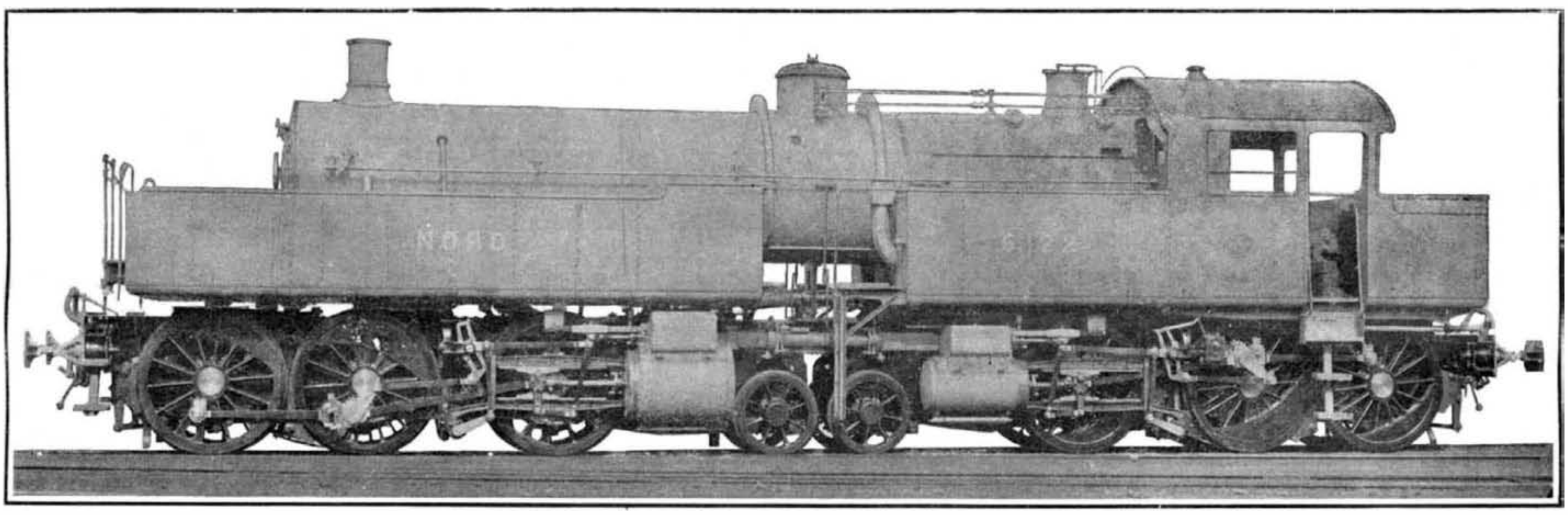
The grate is 2.54 meters in length and 1.186 meters in width, giving a total grate area of about 3 square meters. The steam pressure is said to be 16 kilogrammes per square centimeter for this boiler, with a maximum steam pressure of 6.5 kilogrammes per square centimeter for the low-pressure cylinders. The boiler shell has a diameter of 1.456 meters and is constructed of steel plate 17 millimeters in thickness. It is mounted 2.8 meters above the rail. The steel frames are more than 12 meters long and are spaced 1.142 meters apart.

The high-pressure cylinders are 400 millimeters in diameter and the low-pressure cylinders are 630 millimeters in diameter, the piston stroke in each case being 680 millimeters. The diameter of the six driving wheels is 1.455 meters, while 0.850 meter represents the diameter of the four bogie wheels. The total wheel base of each truck or the distance from the center of the bogie wheel axle to the last driving wheel axle is 5.795 meters, while the total wheel base of this tank engine is 12.59 meters.

The total weight of this French engine empty is 81.482 tons, while its weight complete with water and fuel ready for operation is 105.43 tons. The total adhesive weight of the locomotive complete is 88.93 tons and it has a maximum effort when working as a compound engine of 18,607 kilogrammes with an increased tractive effort of 24,064 kilogrammes with a direct admission of steam at high pressure in the large or low-pressure cylinders. The coal bunkers are capable of holding five tons of fuel, and the capacity of the water tank is 12.8 tons of water.

The method of carrying the steam from the boiler to the cylinders on the swiveling trucks and from the trucks back to the smoke box is as follows: The steam pipe runs from the steam dome down to a swivel joint arranged vertically over the king-pin of the truck with its axle in line with the king-pin. Thence it is led to the high-pressure cylinders, from which it passes to the low-pressure cylinders through a length of flexible coupling. The exhaust is led to the smoke box through a swivel joint in the center of the low-pressure cylinder truck.

Provision is made for supplying both the high-pressure cylinders and also the low-pressure cylinders with high-pressure steam when found necessary, in starting heavy loads or on heavy grades when increased power is found desirable. In this case the engine operates as a simple locomotive with four cylinders.



A NEW FRENCH MALLET COMPOUND LOCOMOTIVE.

Total heating surface, 2,361 square feet. Steam pressure, 228 pounds. Cylinders: High-pressure, 16 inches, low-pressure, 25 inches diameter, by 27 inches stroke. Weight, 105.4 tons.

Opening of Broadway Extension to Harlem River.

The final section of the new subway at the extreme north end of Manhattan Island to the south bank of the improved Harlem River or ship canal was completed and put into operation on March 12, with the exception of two deep underground stations located at 168th and 181st Streets. These are 100 and 125 feet below the surface at Washington Heights, and are connected by electric elevators in shafts sunk through solid rock; no stops will be made there until they are finished, which is promised at an early date. The shafts are 15 feet by 32 feet in size. The size of the stations cut in the rock are 320 feet long, by 73 feet wide at the shafts, but narrower at each side sufficient for platform space. Trains are now run from the Battery at the extreme south end of the island to the 157th Street station, there a transfer is made to the train running over the extension to Harlem River and King's Bridge every eleven minutes. When all the stations are completed it is expected trains will be run through without transfer. A person is now able to have quick transit from one end of the island to the other for the moderate fare of five cents, a certainty which but a very few years ago seemed like a visionary dream.

The first elevated structure of the Broadway section of the subway is in the neighborhood of West 125th Street, over what is known as Manhattan Valley. The road then runs underground under Broadway or King's Bridge Road to 169th Street thence north in a straight line under St. Nicholas Avenue and Washington Heights to 199th Street, where it emerges from the hill on to the second elevated structure, comprising three tracks over what is known as the Inwood Valley to 218th Street station located on the south bank of the Harlem River and opposite the south end of the drawbridge over the river at this point.

It is expected a new double-decked drawbridge will supplant the present one by which the road can be carried over the Harlem and the tracks of the New York Central and Hudson River Railroad now running along its northern bank, up under Broadway to Yonkers. It has taken five and a half years to complete this section.

A most charming and desirable residential section of the city will thus have convenient and frequent transit to all other business sections.

Rush Paper.

Very little paper has been made of late years from rags. Vegetable substances are employed, as alfa, wood, and straw; the idea has not prevailed that the wild or cultivated rush can be employed for this purpose. But an inventor has ascertained that, when suitably treated, the plant will produce a very white and consistent paper pulp by means of the following treatment: 1,000 kilogrammes of the green rush, cut up as fine as possible, is mingled with a caustic lye of 30 deg. B., and boiled in an autoclave for five or six hours under a pressure of 6 kilogrammes at 170 deg. C. The pulp is washed with water, sulphuric acid in suitable quantity added, then bleached with chloride of lime and washed energetically. It is then suitable for employment in the manufacture of paper.—Le Papier.

HOW SHINGLES ARE MADE.

BY DAY ALLEN WILLEY.

Although over $20,000,000 worth of shingles are manufactured in the United States yearly, this portion of the timber industry is perhaps least known of the several divisions into which the products of the forest enter, partly for the reason that the making of shingles, especially in the eastern part of the country, is usually carried on in connection with the ordinary sawmill. In fact, the making of shingles is classed as a part of the sawmill industry, but in the States which produce the greater proportion of the shingles, one finds very large plants devoted to shingle making entirely.

As everyone knows, hemlock, cypress, and white pine are used extensively for roofing purposes. Cedar, however, is employed to such an extent that over half of the shingles annually cut in the United States are of this wood, the output of white pine shingles representing about $3,500,000 in value and the cypress $3,000,000, nearly all of the remainder being contributed by hemlock, which is used widely in the East. As cedar forms such a large proportion of the forest growth of Oregon and Washington, we find in these States the majority of the mills devoted entirely to making shingles. They secure the raw material usually in the form of "bolts"—logs which have been cut to the exact length of the shingles desired, so that it is only necessary to split the bolt into the requisite thicknesses and finish the sections for commercial purposes. As a rule, the mills are located in the vicinity of woodland which has been stripped of the first growth.

As is well known, the custom prevails in the Northwest in cutting large trees of making the necessary incision anywhere from 6 feet to 10 feet above the ground, as the felling can be done with more safety and less difficulty. Consequently, a single stump of a tree 5 feet or 6 feet in diameter will cut into a surprisingly large number of shingles if it is sound in the heart. The bolts are made with cross-cut saws operated by hand, or portable saws driven by engines mounted on trucks belted to mechanism especially designed for this class of work. As the lengths into which the stumps or trunks are cut make them of a size which can be readily handled, the use of a tramway or skidway is unnecessary, and frequently advantage is taken of some watercourse to construct a flume of suitable dimensions. This consists merely of a conduit of planks supported at various distances from the surface according to the grades to be overcome. The water may be secured from a spring or creek on the hillside, although at times it is diverted from a larger stream by damming the latter, the fall of water in the flume being sufficient to carry the bolts to the mill.

Some of the flumes in Washington are ten and twelve miles in length. As fast as the timber is removed they are extended through the tracts where the bolt cutters are operating, since it is only necessary to place the bolts in the flume and thus transport them directly to the mill pond. The cost of building the flume is so small, that this novel method of transportation is generally the most economical by far. But a small amount of water is required, as the cedar is so light that it will float in a very shallow depth. At the mill end of the conduit it enters a pond, where it is kept in a boom like the ordinary sawlogs until required.

The shingle mill, like the sawmill, is provided with an inclined way leading into the water. This is fitted with an endless conveyer, upon which the bolts are guided by the "bolt puncher," as he is termed. Leaving the conveyer, they are taken by hand or by another conveyer to the cutting machinery, and there reduced