INDUSTRIAL APPLICATIONS OF COMPRESSED AIR IN PARIS.

	Less than 1 horse power.	Horse power.							
		2 to 6.	7 to 12.	13 to 25.	26 to 50.	50.	100.	150.	
Lithographic printing presses.....	31	25	2	1					62
Printing.....	6	4			2	2			14
Circular saws, etc.....	20	34	3	2					59
Cloth cutting machines.....	29	2							31
Pumps.....		2	1						3
Mills.....	19	2							21
Lathes.....	55	51	9						118
Rolling mills.....	10	6							16
Refrigerators.....	3	1	3						7
Coffee mills, roasters, etc.....	13	1							14
Cutting and drilling machinery.....	7	8							15
Mixing machinery.....	14	4							18
Sewing machines.....	53	7							60
Chopping machines, etc.....	28	7							29
Quitting.....	5	1							6
Electrotyping.....	2	1							3
Embroidery.....	10	1							10
Shearing, etc.....	5	1							6
Turbines and ventilators.....	6	11							17
Machines for carding and rolling.....	5	5							10
Comb factory.....				1					1
Dynamos.....	6	6	1	1	2				16
Machines for surgical and dental purposes.....	4	2							6
Soda water factory.....		1							1
Provision merchants.....	3	1							4
Woodworking machinery.....	2	6							8
Cutting and polishing machinery.....	2								2
Envelope machinery.....	3	1							4
Boot machines.....	1	2							3
Motors.....			2	2					4
Motors for ventilating under-stations.....	33								33
Motors for dynamos and cold stores.....	1	10	9	10	1	10	1	1	43
Lifting beer and wine.....	22								22
Elevators, luggage elevators.....		6	4	10					20
Blowpipes.....	96								96
Lace and trimming makers.....	4								4
Silk weaving.....	2								2
	509	209	34	27	5	12	1	1	798

sults obtained were sufficiently good to justify the Compagnie Generale des Omnibus to construct three new lines in Paris, which will be opened for traffic during the present year. In the Conti system the air is compressed at a relatively high pressure at a central station; it is then admitted into the mains, B, placed beneath the rails (see diagram, Figs. 1 and 2, on previous page).

Branches, C, lead the air nearly to the surface into automatic devices by which the car reservoirs can be charged. By this arrangement it is considered that one central station will be sufficient, whatever the length of the line may be; and as the charging devices can be introduced at short intervals, the dead weight of reservoirs to be carried is relatively small. The distance between the charging stations varies according to circumstances, but for convenience they should be located at the recognized stopping places. Fig. 3 is a diagram that gives some idea of the arrangement. An iron box is sunk into the roadway to inclose the mechanism; this box is covered in by a plate containing two hinged flaps, F, placed immediately over the air nozzle, E. This nozzle is the continuation of a plunger working in the cylinder, E', which can be placed in connection with the air main. As the front truck of the car passes over the rails it strikes the lever, G, and depressing it, opens a valve that admits air beneath the plunger, E, raises it, and causes the air nozzle to

push open the flaps, F, and rise above the level of the road. By the time it has reached its full height the nozzle engages in a connection, H, communicating with the reservoir, D, placed on the car; a valve is opened that admits the compressed air through the nozzle into the reservoirs, which are filled in a few seconds. The valve is then closed, and as the car proceeds the lever, G, is released, the air beneath the plungers in the cylinder, E, escapes and the nozzle falls, the flaps, F, closing over it and restoring the street surface. In the event of the mechanism becoming deranged, air stand pipes are provided, so that the reservoirs can be charged by coupling up.

The results obtained will be watched with considerable interest, so soon as the system passes out of its

one of the fastest cruisers afloat, and these splendid results have been obtained on a displacement of only 4,500 tons.

The engines and boilers are by Messrs. Humphrys, of Deptford.

SPECIFICATIONS FOR A PROPOSED CATALAN AIR SHIP FOR UNITED STATES COAST DEFENSE.

Invented by J. FRANKLIN CAMERON, Brooklyn, N. Y., U. S. A.

At an outlay not exceeding the cost to build, equip and ordnance one cruiser, the United States govern-

experimental stage, which it promises to do shortly under the care of the Compagnie Generale des Omnibus.—Engineering.

THE CHILEAN CRUISER BLANCO ENCALADA.

We give an illustration of the powerful Chilean cruiser Blanco Encalada, built at the Elswick shipyard of Messrs. Sir W. G. Armstrong, Mitchell & Co. Her principal dimensions are as follows: Length, 370 ft.; breadth, 46 ft. 6 in.; mean draught, 18 ft. 6 in., and her displacement is 4,500 tons. We are indebted for these particulars and for our illustration to the Engineer, London. The engraving is from a photograph taken during the gunnery trials of the vessel.

The armament of the vessel consists of two 8 in. breech-loading guns, two 6 in. quick-firing guns, twelve 3-pounder quick-firing guns, twelve 1-pounder guns, two Gatling guns, and five torpedo tubes. At the trials all of these guns and torpedo tubes were discharged in various directions, and the guns at extreme elevation and depression, in order to test the structure of the ship, with the result that all the fittings and other parts were shown to be of ample strength and able to stand all the strains to which they might be subject by the firing of the guns in action. The steam trials showed that the vessel could run with forced draught at a speed of 22.78 knots, and that she could run as long as her coal supply lasted, with natural draught, at a speed of 21.75 knots. Her normal supply of coal is 350 tons, but she can carry 900 tons. With her bunkers full, the above speeds would be somewhat reduced; but starting with her full coal supply she could steam at, say, the mean speed, 21½ knots, for eighty-four hours, and would cover a distance of 1,800 knots, while at the economical speed of 12 knots she could steam for twenty-eight days, and cover a distance of 8,000 knots.

The vessel is sheathed with wood and coppered. She has an inner bottom throughout. She carries the very powerful armament above enumerated. She is

ment could build and equip a large fleet of air ships as described hereinafter, and station them at various points along our coasts. Their cost for maintenance would be only nominal.

These ships would be able to locate and destroy by overhead attack, at one hundred miles seaward, all the navies of the world.

FORM AND DIMENSIONS.

Spindle shaped twin hulls, length tip to tip.....	400 ft.
Diameter of largest section.....	50 ft.
Distance between hulls, 25 feet, plus the tapering, making the outside breadth of ship 50 + 50 + 25.....	125 ft.
Capacity of each hull, 418,800 cubic feet; total cubic feet.....	837,600

VERTICAL LIFT.

Contents of hydrogen gas, buoyancy power based on Renard and Krebs war balloon La France.....	56,000 lb.
Equipped with two engines, each 300 H. P., applied to two vertical propellers. Estimated lift, 22½ pounds per H. P.....	13,500 lb.
Total.....	69,500 lb.

It has been shown by experiments made by Prof. Langley, Dr. Freninges and others, that there can be a much greater lift per H. P. than that given in this estimate. Vertical upward movement may be made at such slow speed that air resistance need not be considered.

DEDUCT

Weight of twin hulls, cloth covered, based on 1.23 pounds to 100 cubic feet capacity, the same as La France, and greater than estimated by Carl E. Myers, aeronautical engineer and manufacturer of hydrogen-tight balloons.....	10,300 lb.
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THE CHILEAN WAR SHIP BLANCO ENCALADA.

Weight of . . . sheets of light cloth, impervious to gas, and stretched vertically, at intervals within the hulls, to prevent surging of gas from end to end of hulls..	200 lb.
Weight of nickel steel frames inclosing the hulls from tip to tip, and to which the hulls are tied to keep them in place, and to prevent backward sagging from head pressure.	4,800 lb.
The frames to be constructed of beveled edge rings welded on their outside, in longitudinal form, to tubing, with the greater number both of rings and tubes on the middle section, and of sufficient strength to support the boat and its equipment as described hereinafter.	
Weight of tubes connecting the hulls to equalize the gas between them, and for a middle coupling.	500 lb.
Weight of a tubular slatted arched roof, tubular joints and elbows; slats of aluminum in sectional lengths to open, as a Venetian blind, fore and aft. Total of lengths, 100 feet, supported on arched girders of steel.	4,000 lb.
This arched roof to cover the upper middle section of the space between the inner faces of the hulls, one-fourth their length. Estimated carrying power about 5,000 pounds, not allotted in these specifications. There are other very important purposes for this arched roof, such as for general stability and safety, and, adopting the valuable suggestion of Hiram Maxim, it can be utilized excellently as a steam condenser.	
Weight of boat, spindle shaped and keeled, length, 120 feet; diameter of largest section, 20 feet, and with duplex compartments at its ends to hold condensed hydrogen gas to replace any escape of it from the hulls.	4,000 lb.
This weight is comprised principally of a cradle and braces by which the boat is suspended to the hull frames, in a cradle formed by jointed braces welded to the lower outer quarter section of each frame, and joined to perpendicular braces from the inner faces of the frames, and such other bracing of boat to frames as may be necessary, and by which the boat may swing on a level keel.	
Weight of two engines of 300 H. P. each, at 15 pounds per H. P. including boilers, platforms and frames.	9,000 lb.
The engines and boilers of steam yacht Norwood weigh 19 pounds per H. P. It is estimated by John P. Holland, an expert naval engineer, that by substituting oil for coal, this weight could be reduced from 19 pounds to 15 pounds per H. P. There are working engines of even less weight, such as Mr. Hargrave's of 107, and Mr. Maxim's of 8 pounds per H. P.	
In addition to the usual advantages of two engines instead of one, it would seem to be better to locate them toward each end of the boat, as far apart as practical. This would prevent tilting of the ship in gusts of wind, and would spare amidships for fluctuating and movable weight, such as her crew and supplies.	
Weight of two horizontal rudders and fixtures, to be located between the hulls at their extremities, and to be angled up and down to give similar direction to the hulls	900 lb.
Weight of two vertical rudders and fixtures to give lateral direction.	400 lb.
Weight of two vertical propellers, located on a longitudinal line beneath the boat. .	1,500 lb.
Weight of two horizontal propellers, 25 feet diameter, one fore, one aft, located at intersecting points of greatest head resistance. Estimated speed, 400 revolutions per minute.	1,500 lb.
Weight of two vertical and two horizontal shafts	1,700 lb.
The propellers to be skeleton frames with transverse metal plates, and the shafts to be six steel rods, one inch in diameter, planted in steel disks at intervals.	
Weight of tanks for oil and water.	1,500 lb.
Weight of crew of eight men and provisions.	1,600 lb.
Weight of dynamite bombs.	2,000 lb.
Weight of duplicate sets of tubular rockers, located under the vertical propellers to protect them.	800 lb.
One set of rockers under each propeller, with a drop of 10 feet. On these rockers the ship can anchor with her keel at an elevation of 12'6 feet above ground.	
Total weight of hulls, frames, rigging, machinery, crew, provisions and ammunition	44,700 lb.
Weight of oil fuel for engines, estimate of John P. Holland, one pound per H. P. an hour, 20 hours $\times$ 600 pounds.	12,000 lb.
Weight of water supply for boilers, 20 pounds per H. P. an hour, equal to 1200 pounds for 600 H. P. Five per cent. an hour loss in condensing; total loss, 600 pounds an hour $\times$ 20 hours.	12,000 lb.
	68,700 lb.

It is practical to reduce loss in condensing below an appreciable point, then, one-half the weight allotted to water could be added to fuel, and thereby gain several more hours' propulsion. Drifting with favorable winds is not taken into consideration.

It is apparent that the engines, when running at full speed, would lighten the ship 600 pounds an hour in fuel consumption, and when the consumption of fuel and water has equaled the actual vertical lift of the propellers, the equilibrium of the ship would be at the sea level, with an upward tendency. It would then

become a matter of judgment with the navigator to elevate his course, or to angle the forward horizontal rudder downward to keep the same elevation, and, when desired, open the slatted roof and work the vertical propellers to effect an easy landing.

Necessary safety valves are not designated in the plan, but are understood to be a part of it.

The only unsolved problems relating to the navigation of an aerial ship as described herein are:

First—With two vertical propellers, each of 300 H. P., how much may be their lifting power in excess of 13,500 pounds, as estimated?

Second—With two horizontal propellers of 25 feet diameter, and the 600 H. P. applied to forward locomotion, how much may be the normal speed of the ship?

With hulls of same form and dimensions as herein given, and with 400 H. P. in place of 600 H. P., Octave Chanute, C.E., an authority on aeronautics, has estimated a possible speed of 35 miles an hour.

Third—Admitting the estimates and claim in these specifications, what then would be the result after a few years of improvements?

Carl E. Myers, an expert balloonist, who has, more than any other person, a practical knowledge in recent ballooning, writes in reference to this plan and its detail and purposes, under date of July 31, 1894: "I have investigated it as fully as my time has permitted, and think it entirely practical of accomplishment in expert hands, and competent to do the work designed." In one of Mr. Myers' papers he says that, from an elevation of 1,500 feet he has hit and killed a duck upon the water by dropping shot from his hand, after two or three preliminary trials for position. From this it would appear to be not difficult to drop dynamite bombs on a ship or within a fort directly below.

Aerial navigation seems to be strictly a governmental affair, and not applicable to commerce or to ordinary travel. This plan describes solely an offensive and defensive war aerostat, against which cities, fortifications and navies, within its radius of flight, would be

vein, and have reached and won the ore deposit by short cross-cuts from it. If an incline is put down on a wide sloping vein, it should lie directly on the foot-wall, as in the present instance. On the other hand, the disadvantage of a vertical shaft cutting a dipping vein is, that when great depth is attained, such long and expensive cross-cuts have to be made through dead work to reach the vein.

This was the case in the present instance. The original owners were old Comstock miners. This mine was developed by the vertical shaft and cross-cut system, and so they applied the same system to this vein, but at 500 or 600 feet depth the expense of 100 foot cross-cuts was very great; so a compromise was attempted between an incline and a vertical shaft, as shown in Fig. 10. This involved some two or three times handling of the ore, and by this system a loaded skip took about half an hour coming up to the surface from the bottom level.

The present manager concluded to abandon the old shaft and reopen the mine by the present incline, following the dip of the vein. Now the loaded skip comes up to the surface in less than a minute.

The friction on the machinery wheels, etc., of an incline is, of course, greater than on a vertical shaft, but expense, time, and labor are saved, and ore is being taken out all the time, instead of a perpetual system of dead work.

As we descended we passed the openings of various levels with platforms and chutes for loading onto the skip.

At the bottom of this incline shaft is the sump, a tank for mine water 25 ft. square. A continuous stream of rusty mineralized water pours down the side of the incline, receiving contributions from the outlets of the different levels, whose floors incline gently at a grade of 10 in. in 100 ft. toward the shaft on either side. The water drains from them by a gutter on the side of the rail track. This fissure vein, as in many cases, is the natural course of a spring. The water that pours down it is not mere seepage surface water, but a living spring in the vein itself.

FIG. 10.—THE OLD AND NEW METHODS OF SHAFTING.

defenseless. Nothing would be left for the science of war but open sea and open field slaughter; perhaps then war would be abolished.

The second step would be the circumnavigation of the earth via both the equator and the poles.

J. FRANKLIN CAMERON.

23 Seventh Avenue, Brooklyn, N. Y.

[FROM THE COLLIERY ENGINEER.]

A TYPICAL GOLD MINE.*

By Prof. ARTHUR LAKES, of Golden, Col.

INCLINE SHAFT AND LOWER LEVELS.

RETURNING to the surface, we descended by the main incline shaft to the sixth level, the lowest in the mine. (See plan of workings in October 18 issue.)

The incline shaft is driven down on the natural dip of the vein and in the vein, whose inclination is 68 degrees from the horizontal.

The incline system of shafting on a vein is the best system in medium size dipping veins when the incline shaft is wholly in the vein and occupies its whole width, together with, if need be, part of the wall work as well. But in a very wide vein, particularly if it is all pretty rich, the vertical shaft is preferable, especially, too, when a great amount of haulage quickly to the surface is required.

If need be, the shaft may be located wholly outside the vein in the country rock, both in inclined small veins and vertical large veins, running close to and parallel with the vein and reaching the vein by short cuts. This is more especially advisable when the vein in question is very valuable throughout its entire thickness.

In the Bassick is an example of a wide vertical vein at Silver Cliff, Col. The shaft having been put down vertically in the center of this very valuable vein when all the valuable material was worked away around it, there was little left to support the shaft but its own woodwork. It would in this case have been better to have put down a vertical shaft wholly outside of the

At the foot of the incline, close to the sump, is a large Worthington pump for pumping up water from the sump through a bronze pipe, composed of brass, tin, and alumina. This pipe is about 5 in. in diameter, and cost \$4 per foot, and, with putting it down, \$5,000. This expensive pipe was found necessary, as iron pipes were so rapidly eaten up by sulphuric acid, sulphate of copper, vitriol, and other metallic acids of the ore.

In this sixth, or bottom level, along the foot wall, modern deposits of green sulphate of copper and red oxide of iron and other metalliferous minerals combined with solutions of lime and silica were seen laying the foundation of a future and modern vein.

In these damp levels the destruction of ironwork is extraordinarily rapid, and the expense of replacing iron pipes carrying air to the drills, etc., is great. These pipes have to be propped up above the wet ground. An iron shovel left only a day in these acid waters is ruined, and I saw large sheets of iron that you could cut like cheese.

Such mine water, it is obvious, could not be used to feed boilers for steam purposes.

In the third level, at a point directly under the bed of the river, there is a good deal of moisture, as well as a large ore body, and the deposition of iron oxide and copper sulphate in belts and streaks was very marked.

In this third level the dike of porphyry we have alluded to makes a sudden bend, and leaving the hanging wall, cuts directly across the vein, slightly faulting it. The vein matter does not pass through it.

In part of the third level toward the south, which is neither very dry nor wet, but dampish, are great quantities of a white fungus, adhering to the old stulls or woodwork, which have a rotting tendency, like dry rot. It hangs down in festoons like white rags, or even coats the side of the mine with a white crust; it burns, when a candle is applied to it, with a disagreeable smell.

This fungus is a fertile source of decay in old workings that are somewhat dry; on the other hand, timbers in the wet drifts saturated with mineral water are almost imperishable. These timbers are so water

* Continued from SUPPLEMENT No. 980, page 15662.