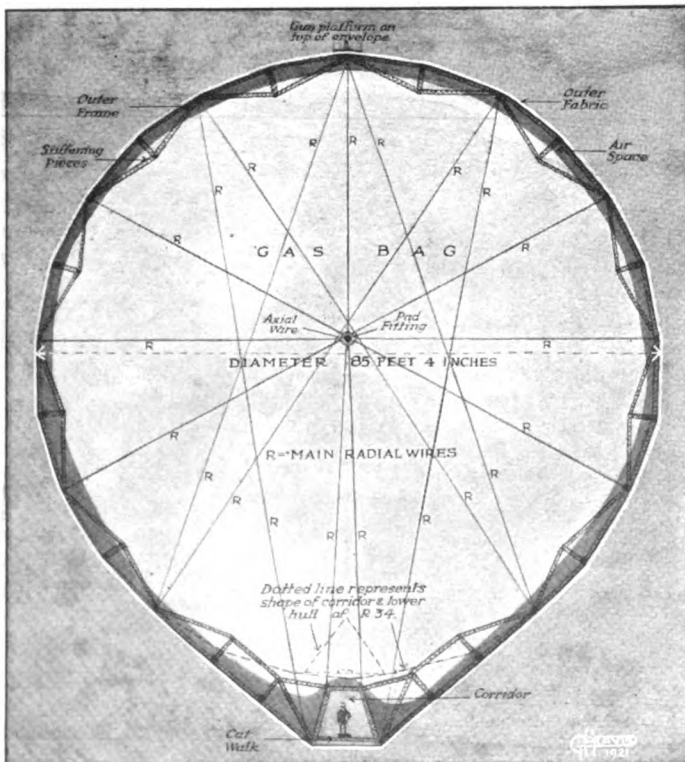


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The nose of the ZR-2 (R-38) carries a conical mooring-eye that fits into a universal joint on the mooring-mast. The bow is reinforced with extra girders to withstand this strain and to prevent the nose from being blown in



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The girders are of duralumin, almost aluminum-light and steel-tough. Miles of wire are used in the internal braces that stay the rigid framework. Only the main radial wires are shown here

America's Largest

The ZR-2, built in England embodies many improvements

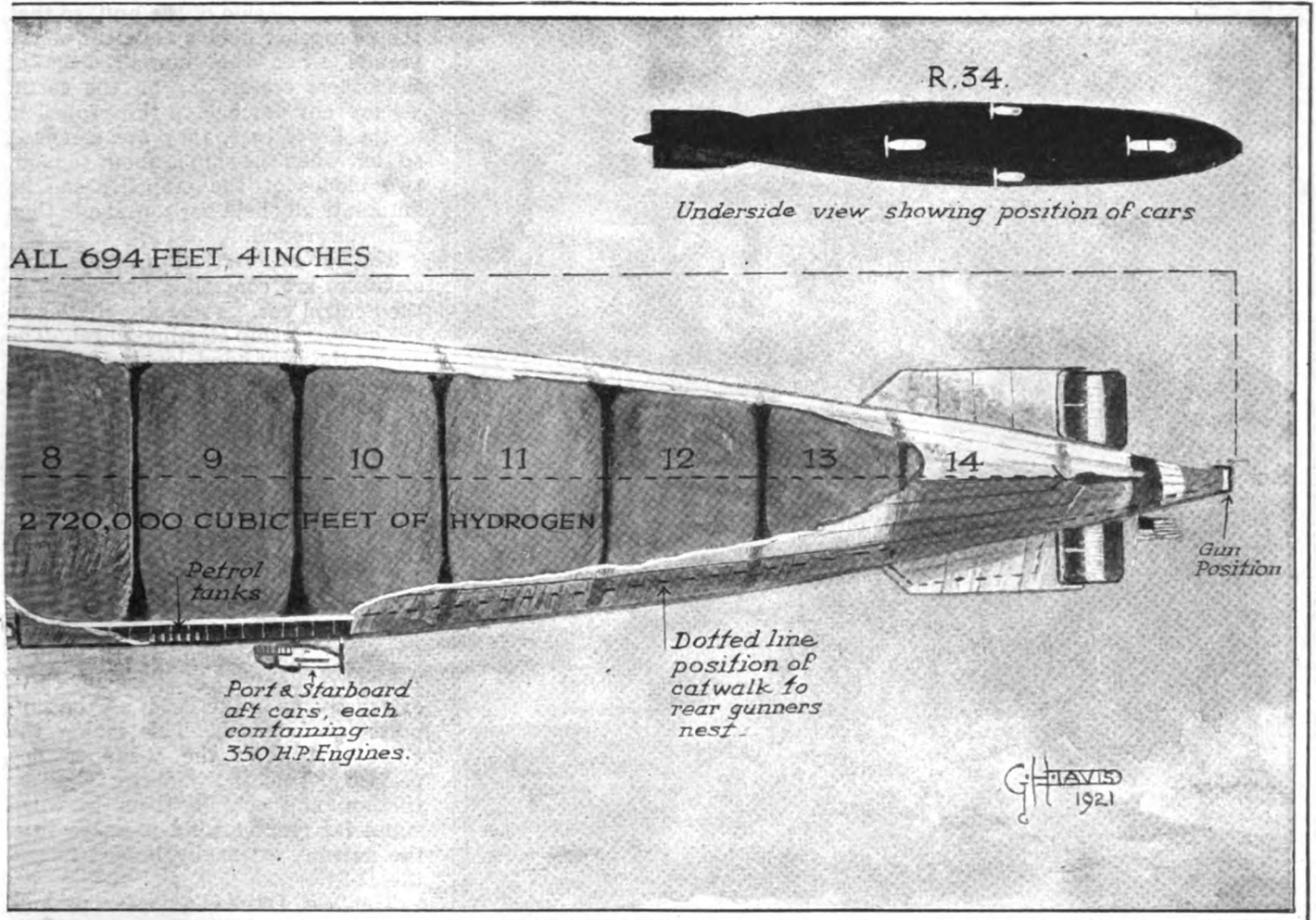
By P. J. Risdon, *English Correspondent*

THE British dirigible R-34, which was the first airship to fly across the Atlantic, is dwarfed by America's new airship, the R-38, built in England for the United States Navy. The R-38, renamed in the United States, the ZR-2, was the finest and most efficient military airship in the world on the day when it was being made ready for delivery to its Yankee crew.

The experience gained in flying the R-34 has led to many improvements in the construction of the ZR-2. The new ship is larger and more powerful. Its length of 694 feet exceeds that of the R-34 by fifty-one feet, the diameter of the gas envelope is seven feet greater, and the lifting capacity of the larger balloons is utilized in carrying more powerful engines, larger bombs, and a greater supply of gasoline.

An examination of the plans of the ZR-2 gives a clear idea of the newest developments in rigid airship construction. The stiff outer framework is built of lattice girders rigidly bolted together. These are made of an aluminum alloy called duralumin, which is almost as light as aluminum and nearly as strong as steel. Strong as this framework is, the air pressure against the vast hull is so great, particularly when it is

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Aerial Battleship

for the United States Navy
not found in the famous R-34

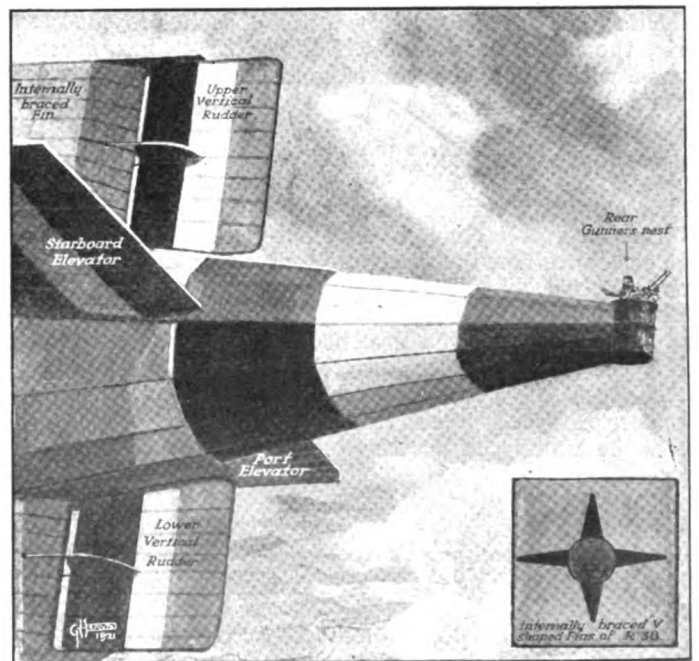
Drawings made by G. H. Davis

driven at its maximum speed of sixty-five miles an hour against a strong headwind, that the outer framework is reinforced by thousands of guy-wires. Of these, the central axial cable is the most important, since it runs from bow to stern through the gas-bags and strengthens the ship longitudinally. To this "keel" the other guy-wires are secured.

The duralumin framework is covered on the outside with three-ply canvas and rubber, laced on and doped to render it waterproof. The whole of the vast hull is then coated with aluminum paint. Experience has proved this very effective in reflecting the sun's rays so that the light cannot penetrate the fabric and damage the rubber, while by reflecting the heat of the sun the temperature within the hull does not fluctuate so violently.

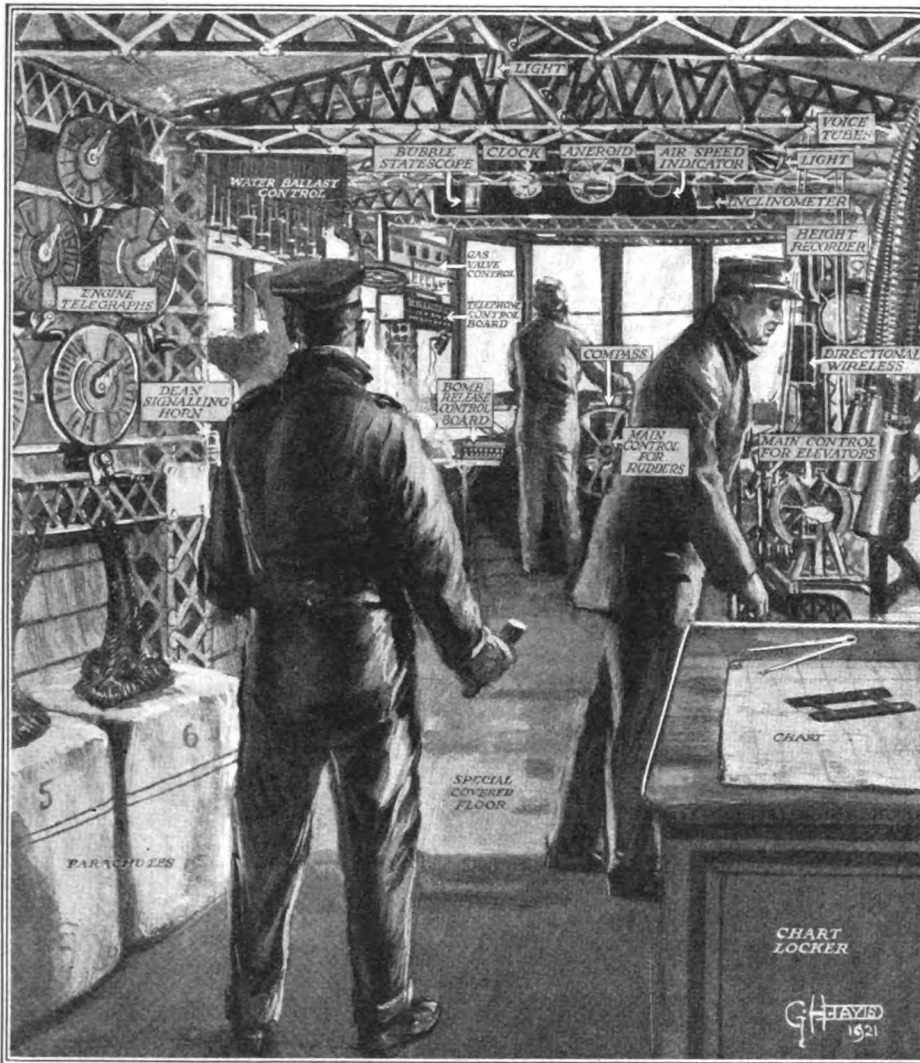
There are fourteen gas-bags, which extend from the nose just aft to the rudder and elevator joints, the extreme ends of the ship having no gas-chambers. The twelve forward sections are forty-nine feet in diameter, the thirteenth is forty-one feet, and the fourteenth is thirty-three feet. All are fitted with an elaborate system of valves, and every precaution is taken to clear away the explosive mixture of air and hydrogen from

The maximum speed is from fifty-five to sixty-five miles an hour. The placing of the cars differs radically from that of the R-34. There are seven instead of four, and the flying controls are separated from the engines. The dirigible is propelled by six 350-horsepower English engines, four direct drive and the after two geared. The ZR-2 is considerably faster, carries more gasoline, and has a greater cruising radius than the R-34



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Rudders and elevators are of the balanced type. Air pressure on surfaces lessens strain on the controls. The fins are V-shaped and internally braced in order to reduce air resistance

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Here is the interior of the control car. The ZR-2 is steered by large wheels. All of these complicated instruments must be watched constantly, and frequent calculations based on their readings determine how to trim ship and maneuver for a landing

higher up the side of the hull, so that their propeller blades are clear of the ground when the bumping-bags of the others are resting on the earth. To prevent damage to the propellers of the lower cars, they are arranged so that when the ship is about to land, two blades of the propeller can be automatically held horizontal and thus clear the ground.

The great vertical rudders and elevators are controlled by wheels in the control car. These are similar to the ordinary ship steering-wheel. The one on the right hand, looking forward, controls the elevators, and the other in the nose of the car actuates the vertical rudders. The ZR-2 is so large and the size of the controlling surfaces at the stern of the ship so great that new construction methods were adopted.

The ZR-2's Rudders Are Unique

They were made in the shape of fins, following the design of the latest Zeppelins, and instead of bracing them externally, as in the R-34, all the supports are internal. This makes the outer surface of the V-shaped fins perfectly smooth, reduces the air friction, and enables them to withstand far greater wind pressure than the narrow, externally braced fins of the R-34.

The "cat-walk" is a narrow passage leading from the radio-room in the control-car clear aft along the bottom of the framework. It is so called because it is only twelve inches wide.

Several of the gasoline-tanks are what is known as "slip-tanks." If it is necessary to lighten ship suddenly (as is frequently the case) these tanks can be thrown overboard. The cooking apparatus and the bunks for the officers and men are also located along the cat-walk.

A speed of sixty-five miles an hour is attained by the six 350-horsepower engines. Four propellers are direct connected, and two geared.

A formidable craft in warfare will be the ZR-2. With its armament of fourteen Lewis guns and one one-pound automatic, the big airship will have an effective reply ready for attackers and a means of leaving its mark on water craft below. One of the Lewis guns shoots downward from the center of the under side. Another is planted on the stern. The one-pounder is mounted in warship style on a *tourelle* that raises or lowers it so that it can fire directly up and virtually on a straight line. But the ZR-2 carries her chief sting in her bomb-racks, where four 520-pounders and eight 230-pounders are held on a trigger release ready to deal destruction to unlucky ships steaming beneath, ships whose speed the great dirigible can easily double.

the inside of the ship. To prevent all avoidable leakage, the gas-bags of the dirigible are of single-ply cotton fabric, the inner surface of which is covered with a single layer of gold-beater's skin.

Gas-Bags Alone Cost \$200,000

This skin is obtained from oxen. It forms an extremely light and efficient gas-container, but the supply of skins is limited, since only one can be obtained from each ox. Nearly six hundred thousand skins are needed to line the gas-bags of a dirigible of the R-34 class, and although the skins are worth only about three cents apiece, the amount of labor employed in scrubbing, cleaning, and applying them to the cotton fabric is so vast that the cost of the gas-bags alone is not far short of two hundred thousand dollars. A gas-bag will ordinarily last for two years.

The shape of the ZR-2 differs from that of the R-34 owing to the extension of the lower bays of the envelope frame, which gives the ship a more oval appearance. The arrangement of the cars on the under body is the

result of experience gained in flying the R-34. This ship had four cars, each provided with a motor. The ZR-2 has seven, six of which are "power eggs," while the seventh is used solely to house the controls.

This is an advantage for exact navigation. The R-34 had a big car forward, or rather two cars jointed together but divided by a space of one inch. The forward car held all the delicate control apparatus, and when the engine in the rear car was running, the vibration and noise inconvenienced the navigation and control officers, who were separated from the engine-room only by an inch of air space.

In the under body of the ZR-2 the control car is placed as far from the engine as possible. The nearest engines are the port and starboard fore-engine cars, which are far enough away to insure silence for the control car. All these cars are placed very low on the hull. The control car and the fore and aft pairs of engine cars are provided with "bumping-bags," or shock-absorbers, since they rest on the ground when the machine lands. The two midship cars are slung