ABOVE *the* WEATHER

How substratosphere transport will appear. Note its streamline shape

altitude. The viscosity of the atmosphere decreases with the temperature, reducing friction between the plane and the air.

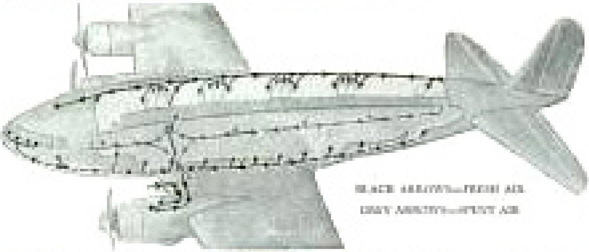
Since 1934 we have been studying conditions in the troposphere. Many of the bugaboos that seemed to make passenger-carrying at 20,000 feet a risky business were much easier to overcome than we expected. In the upper air man resembles a fish out of water and he has to carry his own atmosphere with him. The most satisfactory way of doing this is to seal the cabin and increase the pressure inside of it, converting the plane into something like a flying

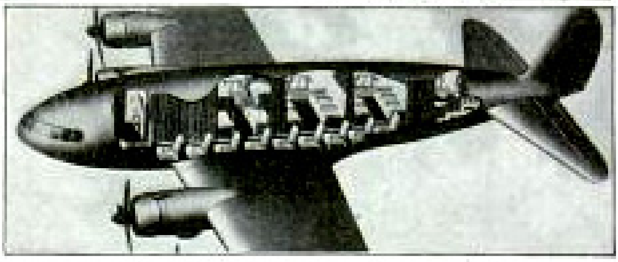
Observer holding oxygen tube in his mouth as he records readings in laboratory plane

with, we decided that since passengers are flying in comfort at 8,000 feet, there is no need to maintain sea-level pressure inside the cabin. An inside pressure equivalent to 12,000 feet is even satisfactory. The planes are being built to withstand an internal pressure of six pounds per square inch, twice as strong as they need to be. As a final check, men have been placed in sealed chambers, the pressure built up to comparable amounts and then suddenly released by smashing a window with a brick. There were no bad effects.

During the last few years I have lived for many hours in the substratosphere as part of a $100,000 research program conducted preliminary to passenger-carrying. Primarily we were concerned with safety. Also we sought the best means of supercharging the engines and cabin.

Heating the cabin air will be accomplished quite satisfactorily by our present steam-heating system in spite of the low outside temperatures. This is because the





Top, radiometeorograph attached to balloon to take weather readings in high altitudes. Center, left, sketch showing air-circulation system in "upper level" ship. Right, modern kitchenette will be feature of the high-flying transport. Bottom, left, "high-altitude" dressing room. Right, cutaway drawing gives glimpse into sealed cabin.

submarine. One hazard that this suggested was that if the internal pressure ruptured a window the passengers and crew might expire in the upper air. This myth has been exploded as far as the altitudes we are contemplating are concerned. To begin

incoming air acquires some heat during compression in the superchargers. The ratio of oxygen and other gases remains constant in the atmosphere, hence there will be no need to supply the passengers with special respirators or introduce pure oxygen into the cabin. One part of the experimental program was to investigate conditions when storms were reaching up into the stratosphere. We found that at 20,000 feet we could fly over ninety-five per cent of all storm conditions. Even in the very infrequent cloud masses that poke up that high there are no true storm conditions such as are found at the bases of the same clouds. There is practically no turbulence or rough air even in the clouds, and the clouds are so thin and dry that they resemble wisps of smoke rather than fog. There is not enough moisture present to build up dangerous ice formations although thin coatings of hoar frost may form on the plane structure occasionally.

Winds at such altitudes are variable. That means, as today, that pilots will still shop around for favorable winds for their trips before they take off and will fly at altitudes that give them boosting tail winds. They will not always climb to 20,000 feet just because they are able to. Sometimes they will be able to take advantage of winds that will boost their speed 100 miles per hour or more. In still air at 20,000 feet the high-altitude passenger transports will cruise at 240 miles per hour on sixty per cent of power.

High-altitude operation, flying at 20,000 feet or higher, is feasible only for distances of 750 miles or more. Likewise, high-altitude hops on the commercial airways will be limited for sometime to distances not greater than 1,000 to 1,500 miles. Longer flights, considering the fuel weights necessary and the power diverted to supercharging, would mean too small a pay load.

Taking off in a pressure-cabin transport, the pilot will head toward his destination as soon as he leaves the ground and will climb steadily at the rate of 500 feet per

(Continued to page 142A)

"Cop" on Beat Is Motorized to Save Both Time and Feet

Three policemen demonstrate how they cover their beats faster by using motor scooters. The transportation is quite economical

Suburbanites in Inglewood, Calif., no longer need feel sorry for the policeman walking his long, long beat through the neighborhood. The patrolmen have been motorized. They ride a fleet of small motor scooters which cover the ground faster and cover the beat oftener, traveling thirty miles an hour and 130 miles on a gallon of gas. Further, the scooters enable the police to respond quickly to emergency calls.

Suction Grip for Auto Headlight Saves Lens from Breakage

To prevent breakage of the lens when removing it from an automobile headlight, a vacuum grip has been developed. It is a bell-shaped tool with lever grip, employing the mechanical vacuum principle instead of natural suction and thus providing a firm and certain grip.

Flying Above the Weather

(Continued from page 27)

minute. But the passengers will be climbing only 300 feet per minute, at least as far as pressure changes are concerned. They will not experience the usual discomfort of a fast climb because the atmospheric pressure inside the cabin will be reduced at a slow and comfortable rate.

Shortly after taking off the pilot cuts in the cabin superchargers at low speed. At 5,000 feet the passengers will be in an atmosphere of only half that apparent altitude. At 10,000 feet the pilot shifts the superchargers to high speed and by the time he has climbed to 14,700 feet the apparent altitude inside the cabin is only 8,000 feet. At 20,000 feet the pressure inside the cabin is the same as at a 12,000-foot altitude, still low enough for comfort. It will take about forty minutes of climbing for the pilot to reach his cruising altitude. In approaching his destination the pilot will start descending while still half an hour or more out, dropping at an efficient angle in order to recapture some of the power expended in the climb. During the descent, cabin pressures will be held at a rate of change more comfortable than is possible in present transports.

The Boeing pressure air liners will have two independent sets of supercharging and heating apparatus, either one of which can assume the full load.

Twenty thousand feet is just about the optimum altitude for passenger-carrying. When we go much higher than that all sorts of complications appear. The air becomes so thin that engines are hard to cool in spite of the low temperature. Gasoline starts to evaporate and fuel tanks and carburetors have to be supercharged. The cabin structure must be built strong enough to withstand pressures of more than 1,000 pounds per square foot. Air is not a good insulator above 25,000 feet and we run into spark-plug trouble.

To me, predictions that we will be flying at 100,000-foot, 50,000-foot, or even 35,000-foot levels within five or ten years are ridiculous. By that I don't mean that higher flight is impossible or that it won't be done now and then as a matter of research or for military purposes, but that the idea now appears impractical as a passenger-carrying project.