

January 1934

TECHNOLOGY REVIEW

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A woman with blonde, wavy hair and blue eyes, wearing a light-colored, off-the-shoulder top, holds a lit cigarette in her right hand. The background is a soft, neutral tone.

*Chesterfield—
I enjoy them a lot*



*...to me they're Milder
...to me they TASTE BETTER*

They Satisfy

© 1934, LIGGETT & MYERS TOBACCO CO.

THE TABULAR VIEW

THIRTY-FIVE YEARS

THIS month marks the 35th anniversary of The Review and the publication of its 221st issue. We record this milestone, not because we feel that the attainment of a vigorous and respectable middle age deserves editorial fanfare, but by way of giving thanks to those friends — subscribers, advertisers, contributors — who have supported the magazine in fair weather and foul. We gratefully report to them that The Review enters its 36th year sound of wind and robust of appetite. ¶ The Review's major objective is to serve broadly M. I. T. and its alumni — to reflect the prestige, dignity, and manifold interests, professional and personal, of a great company of educated men. The attainment of this objective requires that it be, in content, authoritative and stimulating; in appearance, dignified and handsome; in appeal, not parochial but national. That The Review has come through the depression thoroughly solvent, without any reduction of standards or services, and with its influence and reputation unmistakably widened induces us to believe that the future will bring the magazine measurably nearer its objective.

AIR transport is developing so rapidly that articles about it are almost sure to be out of date when they finally reach the reader. The chance is worth taking, however, and The Review presents in this issue two contributions: the first offering an answer to the question, Just how comfortable, safe, and reliable is air transportation? and the second, an answer to the even more ubiquitous question, Just how much time does air travel save over rail travel when the time from civic center to airport is counted? The author of the first article, DANIEL C. SAYRE, '23, has been a frequent contributor to these pages. E. J. WHITCOMB, '11, co-author of the second, is President of the Whitcomb Travel Bureau and he has had a varied and intimate experience in all forms of travel service. H. E. LOBDELL, '17, is Dean of Students at Technology and Publisher of The Review. ¶ Bridge players and even poker players will doubtless find sound information and advice in the article on the mathematics of card shuffling on page 132. Its author, L. F. WOODRUFF, '18, is Assistant Professor of Electrical Power Transmission at the Institute. In collaboration with E. L. Rose, '21, also in the Electrical Engineering Department of Technology, Professor Woodruff has worked out the design and construction of a machine for rapidly shuffling and dealing cards for bridge. ¶ CHARLES E. LOCKE, '96, is Professor of Mining Engineering and Ore Dressing at the Institute and has been a member of the staff since 1901. A great teacher and the friend and counsellor of literally thousands of Technology men, he is peculiarly well qualified to write the third of a series of departmental histories being published by The Review. ¶ F. A. MAGOUN, '18, is Associate Professor of Humanics at the Institute.

WE SPECIALIZE IN EVERYTHING!



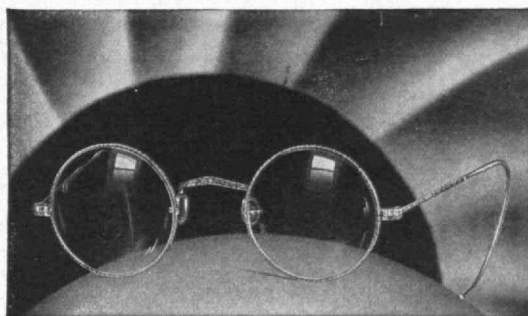
PREPOSTEROUS! But how else can we define our unique service? ¶ With available facilities unsurpassed, we believe, by those of most large companies, we are in a position to handle every phase of a wide range of undertakings. ¶ In addition to up-to-date shops for production in wood and metal, we have well equipped laboratories for research and testing, as well as reliable contacts in many other fields. ¶ Our customers include such representative companies as Thomas A. Edison, Inc., Standard Brands Incorporated, and E. R. Squibb & Sons.

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FRAMES • OPHTHALMIC APPARATUS • SCIENTIFIC INSTRUMENTS

G-E *Campus News*



CABLE-GRAM

It's not easy to tell you how, for many years, G-E chemists have been fiddling around with Glyptal (a synthetic resin of the alkyd type, made from phthalic anhydride and glycerine as base materials); or how, in studying high-molecular-weight organic compounds, they found that the flexibility of Glyptal could be varied by changing the length of the chains of the polyesters—ho, hum! But you may be interested in knowing that Glyptal compounds make excellent printing rolls, tooth-brush handles, gaskets, ash trays, automobile finishes, and—what not.

These chemists not long ago turned out Glyptal-cloth insulation for cable. Soak it in oil; it won't care. Heat it to 200 degrees F., if you wish. Its resiliency is remarkable; its tenacity, terrific; its durability—it makes other insulations seem like wrapping paper.



"X-RAY AS YOU GO"

It's just the thing for customs inspectors, veterinarians, baggage men, and detectives—this new portable x-ray announced not long ago by J. H. Clough, U. of Rochester, '16, new president of the G.E. X-Ray Corporation.

The set can be toted around easily, and operates, safely, from an ordinary light socket. It will make x-rays of the human body, industrial fluoroscopic examinations, and radiographs of locked trunks, suspicious packages, and the like. It is particularly

adapted to making x-rays of animals and for use in cases where the machine must be moved to the patient. A layman can operate it easily and with safety.

It brings the x-ray within practicable reach of the veterinarian. The first set built was rushed from exhibition at Chicago to Belmont Park, and there used to inspect the right forefoot of one of the best-loved horses of the modern turf, which was on the point of being prematurely retired for a puzzling lameness. So simple and quiet was the operation of the x-ray that the horse was not in the least nervous. "Well, well, boys," neighed Equipoise, "I'm sure glad you came along."



99.9909% PERFECT

Soap that's "99.44 per cent pure" may be pretty good, for soap; but in the matter of reliable control of street lights—well, lend your ears.

Carrier current controls the street lighting in one district of Springfield, Mass. In the last year there have been but 32 failures (from all causes, lightning included) in 350,928 controller operations. That's within .0091 per cent of perfection.

Carrier current makes use of wires and transformers already installed, avoiding duplication and congestion of circuits. In Springfield, a 700-cycle current, transmitted for eight seconds, operates 481 controllers, turns on 675 lights. Used 30 seconds, it turns them off. A second frequency of 460 cycles is available to control off-peak water heaters and other devices. This is the only G-E installation of its kind—a temporary distinction, we hope.

C. E. Jennings, Ohio State, '12; F. M. Rives, U. of Texas, '23; and J. L. Woodworth, U. of Idaho, '24, were responsible for this job.



96-27DH

GENERAL ELECTRIC

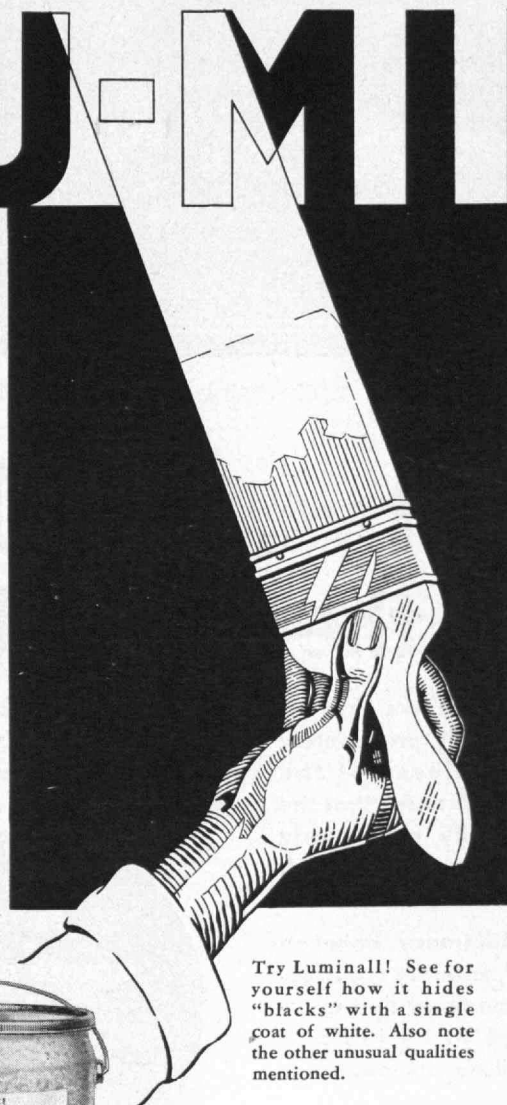
Jet Black

becomes a

Brilliant White

with one Coat of

LU-MIN-ALL



Try Luminall! See for yourself how it hides "blacks" with a single coat of white. Also note the other unusual qualities mentioned.

M'g'd in Canada by
Standard Paint & Varnish Co., Ltd.
Windsor, Ont.

DRAW a brush dipped in Luminall across any jet-black surface—one (1) coat hides the black completely.

That is because Luminall can and does contain more pigment than other types of paint.

In addition to the qualities of any good paint, Luminall has these added advantages won't yellow with age reflects 90% of light has no odor OK. to use on wet plaster or concrete dries in 40 minutes comes in white and 8 pastel shades.

« « TABLE OF COVERAGE » »

TYPE MATERIAL	COVERAGE
Cinder Block	1 coat 150-175 sq. ft. per paste gallon
Sand Finish Plaster	" " 175-250 " " " " "
Concrete Block	" " 200-350 " " " " "
Celotex	" " 200-225 " " " " "
Sand Lime Brick	" " 250-350 " " " " "
Concrete	" " 400 " " " " "
Finish Coat Plaster	" " 500 " " " " "
Painted Surface	" " 700-750 " " " " "

COUPON

NATIONAL CHEMICAL & MFG. CO.
3617 South Wall Street, Chicago

Sirs: Please send me free sample of Luminall in care of my dealer.

My name.....

My address.....



**G.T.M. SPECIFIED
GOODYEAR
CONVEYOR BELT**

STYLE C-36", 28 OZ. DUCK, 6 PLIES WITH EXTRA
12" WIDE REINFORCEMENT

TOP COVER $5\frac{1}{16}" \times 1\frac{1}{16}"$ —PULLEY COVER, $1\frac{1}{32}"$,
LENGTH, 253'6"—CAPACITY, 100 T.P.H.

123'4½"

\$.0008 Per Ton vs. \$.00197 —and the G. T. M.

COST records can seldom be so directly compared as in the case of a large gas producing plant in St. Louis, Mo., which has kept track of the performance of five other belts and one Goodyear Belt, specified to the same job by the G.T.M.—Goodyear Technical Man.

All six belts tackled the same duty, handling run-of-oven coke, cold, abrasive, on an inclined coke conveyor.

The results tell the story:

BEST OF 5 PREVIOUS BELTS

Total Life	1067 days
Total Tons	928,465
Cost Per Ton	\$.00197

GOODYEAR BELT

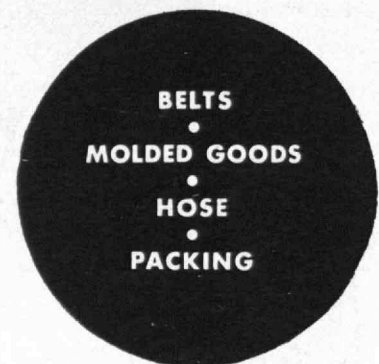
Total Life	1576 days
Total Tons	1,275,990
Cost Per Ton	\$.0008

The owner-user remarks that an accident undoubtedly prematurely ended the usefulness of the Goodyear Belt; also notes that the Goodyear originally cost nearly \$600 less than the best record belt of the five others.

There is the difference between quality belts of ordinary construction and the Goodyear Belt accurately specified to its job and scientifically built for its job.

Why not give your plant—and profits—the benefit of cost-reducing Goodyear Mechanical Rubber Goods? See if the G.T.M. can save you money. Write to Goodyear,

Akron, Ohio, or Los Angeles, California, or call your nearest Goodyear Mechanical Rubber Goods Distributor.



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THE GREATEST NAME

IN RUBBER

GOODYEAR

The Technology Review

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Vol. 36

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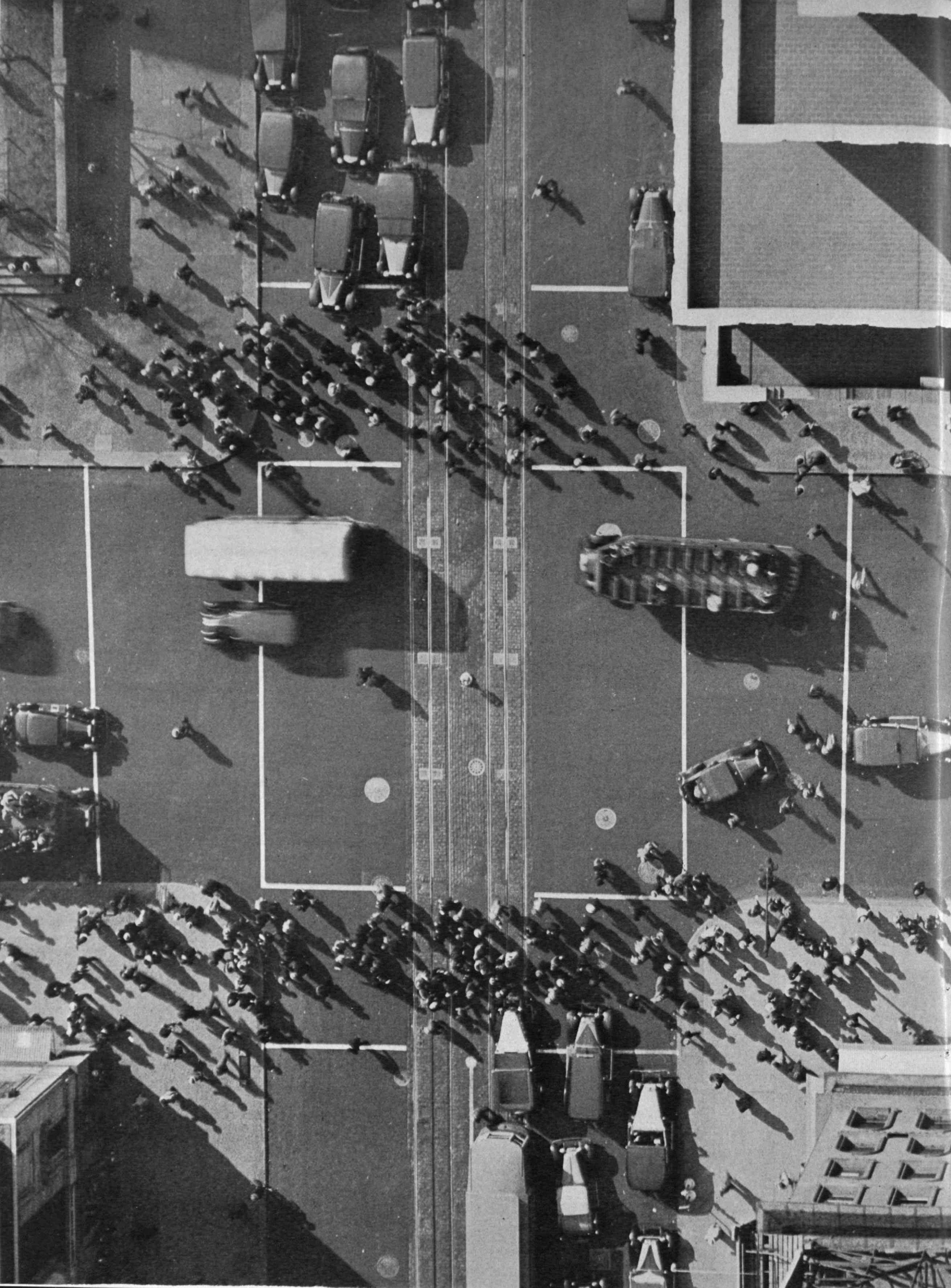
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THE TECHNOLOGY REVIEW

Vol. 36, No. 4



January, 1934

Gentility in the Air

What Have the Airlines Accomplished in Providing Quiet, Comfort, and Reliability?

BY DANIEL C. SAYRE

IT IS going to be difficult to get used to the idea of airplane transportation as a middle-aged institution, but it did have its 30th birthday a few weeks ago. Nothing can get past that milestone and still be considered a youngster except an occasional movie star, the Prince of Wales, and some geological processes.

Even more strange to those who knew the airplane in its rugged youth is the increasing attention designers and operators are paying to such middle-aged things as quiet, comfort, and a reputation for safety and reliability. Not so many years ago an airplane passenger received about the same consideration as a customer on an amusement park roller coaster, who is told to hold his hat and not stand up, and then sent off in a rush of noise, wind, and nausea.

An airplane is no magic carpet even now, but the trend toward gentility is on. Booking agents already are looking you in the eye and urging airplane travel not only because it is faster, but also because it is cleaner, more comfortable, and even quieter.

As long as the design of the entire airplane was left up to the aeronautical engineer, little progress was made in reducing the noise level within the cabin. Many of the early trimotors, some of which are still in use, treated their occupants to a racket of 120 decibels, the very ultimate of bearable noise. When the acoustical experts were finally called in, they found the quietest of all

A PRELUDE TO THE STUDY ON
PAGE 130 OF HOW MUCH TIME
IS ACTUALLY SAVED BY AIR
TRAVEL OVER RAIL TRAVEL

transports operating at 90 decibels, about the highest level reached in the New York subways.

Aeronautical engineers had always approached the problem as one

requiring a reduction of the noise at its source. This, they reasoned, was fairly hopeless. They knew in a general way that much of the noise came from the propeller, and another large part of it from the mechanical clatter of the engine. Mufflers would obviously reduce the exhaust noise, but they also reduce the power output, a price the designers are unwilling to pay.

The acoustical engineers after actual tests were willing to concede most of the above. They found that the external noise of an airplane comes 35% from the propeller, 35% from the exhaust, and 30% from the engine itself. Muffling the engine and reducing the propeller tip speed 100 feet per second dropped the noise level only seven decibels, leaving it still far too high.

They did, however, realize the possibility of insulating the cabin interior from the source of the noise, and in a series of Curtiss Condors and in the new Douglas Transport have been carrying out their ideas with splendid success.

Present good practice in cabin insulation places a multilayered shell between the external noise and the interior of the airplane. Immediately inside the outer cover, whether of metal or fabric, is a moderately thick layer of sound insulating material such as kapok. Next

FOR COMFORT'S SAKE

Weight per passenger of safety and comfort equipment on a modern high-speed, 10-passenger air transport

Item	Pounds
Seat and felt.	19.0
Laminated window glass.	4.4
Sound proofing and cabin lining.	16.3
Heating and ventilating system.	4.4
Air stewardess and accessories.	19.0
Lavatory.	4.4
Ash trays, coat racks, call system, etc.	22.5
Total.	90.0

Airlines assume the average passenger to weigh 170 pounds, his baggage 30.

comes a layer of felt, separated from the kapok by several inches of airspace. Finally comes the lining of the cabin, now usually of fabric to avoid the noise that would be set up by large vibrating panels of plywood or bakelite. Even the floor is generally of some sound-absorbing material, sometimes in the form of balsa or kapok sandwiched between metal plates.

Special care is taken in insulating by rubber the frame of the airplane from engine vibration at the engine mounts. The floor, chair supports, windows, and ventilating and heating system are in turn rubber insulated from the frame.

After all this is done, an extremely important search for leaks is conducted. Nothing is permitted to rattle. Fixed windows are used, and the ventilating and heating system is carefully designed to prevent sound entering through it. Doors are gasketed, and even keyholes through which noise might come are taboo.

It is difficult to say whether any considerable further refinements in cabin insulation are possible. The future may see quieter running engines and geared propellers, with the resulting decrease in noise at its source. In any case the noise level is now reduced to 70 decibels, or somewhat below that in Pullmans, which run between 70 and 80 decibels.

Less spectacular than the new quiet, but also adding greatly to passenger well-being, are recent trends in ventilating and heating. Gone are the direct exhaust pipe heaters and open-window ventilation systems. Most of the latest transport planes heat and ventilate the cabin through a single unit. Air is taken in through a scoop near the nose, and passed over a steam radiator connected to a small boiler heated by the engine exhaust gases. The heated air is then introduced either in front of each seat or at the back of the cabin, and the stale air drawn out through openings in the roof. Heat control is thermostatic, and a temperature of 70° F. can easily be maintained with sub-zero external conditions.

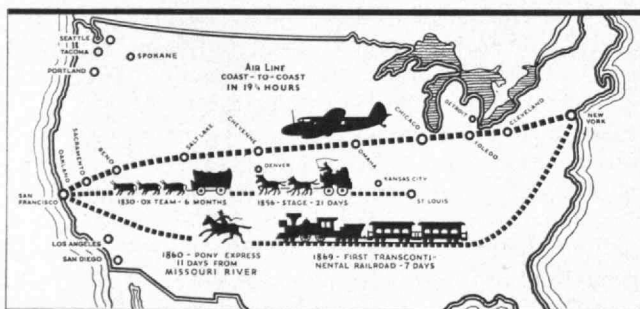
Just how much air should be admitted per passenger is still a debated topic. It is generally agreed that more than the usual allowance for buildings is desirable to ward off any tendencies toward airsickness. Probably 75 cubic feet of air per minute per passenger is ample.

The new cabins are roomier, with six foot headroom, 40-inch seat spacing, and wider aisles. Airplane chair design has been carried to the ultimate in posterior luxury. Roomy, insulated from vibration, and padded and cushioned to the extreme, they can be made to recline at any desired angle short of the complete horizontal.

Even so, it is now generally realized that no chair can be ultimately satisfactory on the long, all night services offered on the transcontinental and coastal routes. American Airways and Eastern Air Transport have therefore started experiments on real sleeper planes. The former has equipped a plane with seats designed so that the back of alternate seats can be let down to the horizontal to rest on the edge of the seat behind. On this platform mattresses are placed and the bed made up. The Eastern Air Transport attempt takes the form of a plane with permanent upper and lower berths and side aisle. Both solutions, of course, decrease the passenger capacity, but a six- or eight-place sleeper completely filled would be more profitable than the quarter filled day-coach planes common at night under present conditions.

The strong analogy apparent between the present experiences the airlines are undergoing with the sleeping problem and those experienced by the railroads many decades ago extends also to the matters of watching over the general welfare of passengers and providing food for them. In the former department the airlines already have something of an edge. Certainly the personable, hospital-trained young ladies serving as stewardesses on the airlines are an improvement on the standard Pullman incumbents with their over-hungry whisk brooms. The air passenger is also provided with free reading material, maps of the route, and periodic hot bouillon snacks. Smoking is permitted except during takeoffs and landings. In providing meals, the airlines have not yet matched the resources and advantages of the smoothly-riding dining cars. On some airlines the stewardesses serve substantial meals in flight, which obviously limits the menu choice. On others, the passengers are fed at restaurants of the Harvey type during stops. To avoid loss of time, these must be important junction points where some stopover is required in any event. In either case, the airlines have adopted one policy in connection with serving meals which has proved universally popular with their customers. They make no charge for them.

INFINITELY more serious, of course, than any considerations of creature comfort are those of operating safety and reliability. Unfortunately, the problems



United Air Lines