January 1938

# TECHNOLOGY REVIEW

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# THE TABULAR VIEW

LIFE begins at 40. We will be excused, we hope, for this bromide by the fact that this issue marks the 40th anniversary of The Review, its first number having been published under the date of January, 1899, 260 issues ago. While 40 years is a venerable age as magazines go, we nevertheless feel that it is not a birthday that deserves fanfare — such fanfare as we shall certainly expect to drum up when The Review reaches the half-century mark. We wouldn't bring the matter up at all were it not an opportunity to thank all of our friends for their steadfast support as demonstrated by their many letters, their responses to inquiries, and their suggestions for improvements. This friendliness and interest emboldens us, in return, to say and to believe that for The Review life is just beginning.

WITH the possible exception of brain teasers, no subject published in The Review in recent years has provoked such widespread response as that of stereoscopy. It all began with an article, more journalistic than scholarly, by members of The Review staff last March (page 191), but it perhaps reaches its apogee with the article on page 121 by DR. RALPH P. JOHNSON, '36. A physicist, Dr. Johnson is now plying his trade in the research laboratories of General Electric Company. He speaks and writes with a soft southern accent. ¶ ALBERT G. DIETZ, '32, tells us that he has been interested in woods as long as he can remember, although he admits having deserted his favorite material for a brief session in a steel mill. In his present capacity as an instructor in building construction, he has an admirable opportunity to study wood as an engineer. His article on page 124 is the direct result of the months he spent last summer at the Forest Products Laboratory at Madison, Wis. ¶ The Editor of The Review has lived beside the Chattahoochee, and he knows the Marshes of Glynn and, better still, the poetry of Sidney Lanier, who wrote with beauty and understanding of the deep South and who also preached the relationship of poetry and music. It is a pleasure, therefore, to present his grandson in the pages of The Review, writing on another relationship with music — that of science (page 128). STERLING LANIER is an instructor in English at Technology and an able musician. He writes not as a scientist but rather as an artist who is interested in what science can do for his art.

THE REVIEW received a melancholy sort of pleasure from the fact that it published in its December issue an article that largely was a tribute to the genius of William E. Taylor, Vice-President of the American Can Company, who died shortly after that issue appeared. It was a slight tribute to a great engineer, and we are glad that it was published before Mr. Taylor's untimely death. ¶ Another death coming with all the force of a coincidence is that of Dr. Nils Gustaf Dalén, with whom the first story of the Trend of Affairs section of this issue largely deals.

# MAIL RETURNS

LETTERS FROM REVIEW READERS

## *Brain Teasers — Awards and Answers*

"MAY the best *men* win!" we wrote in announcing in November that the first five readers returning the best answers to the Fourth Series of Brain Twisters would each receive a year's free subscription to The Review. We had forgotten, in our masculine complacency, that a woman returned one of the best sets of answers in a similar contest last year and we had not anticipated that two women would submit winning solutions to this latest series.

The Review called in Dr. R. D. Douglass, '31, of the Institute's Department of Mathematics, to check the returns and select the winners in consultation with the Editors. This he did with his usual enthusiasm and thoroughness, and his slate was accepted without change.

The five winners, in the order in which they were graded, taking into consideration the time of receipt, completeness, and accuracy, were: (1) Alice Hunter Kimball, '36 (with George E. Kimball); (2) Walter O. Pennell, '96; (3) William L. Sullivan, '27; (4) Donald S. Miller, '27; (5) Louise B. Whipple.

Others, whose returns lacked the completeness of the foregoing five or whose answers arrived later, but who nevertheless sent in admirable sets of solutions, were: Edward H. Barry, '16, Charles H. Bartlett, Hobart O. Davidson, '20, Lang S. Dzung, '37, Howard M. Edmunds, '05, James C. Funnell, Martin A. Gilman, '36, R. M. Packard, and Francis E. Wilmot, '25. To all of these, The Review makes an editorial genuflection, admits them to its inner circle of Brain-Teaser Solvers.

We present below, for those who pant for the answers, the solutions which rated No. 1:

From Alice H. Kimball, '36,
George E. Kimball:

*No. 1.* Suppose that the number of coconuts in the pile is divided into parts, one of $A_1$, the other of $A_2$ coconuts. In each operation, one coconut is discarded from the $A_1$ pile, each pile is divided into four equal parts ($B_1$ and $B_2$), and one part discarded. The remaining parts are now combined so that at this point there are $3B_1$ coconuts in the first pile and $3B_2$ in the second pile. The process is repeated three times more.

It is evident that the number $A_2$ must be divisible by 4, four times. Hence, $A_2 = 4^4n$, where $n$ is an integer. By taking any particular solution for $A_1$, the general solution is then obtained by adding $4^4n$ to this.

It is also evident that a possible value for $A_1$ is $-3$, for after discarding one coconut, the remaining number will be $-4$. One-quarter of this is $-1$, and three-quarters is again $-3$. This process may be repeated as many times as we wish.

The general solution of the problem is, therefore,

$$A = 4^4n - 3.$$

The lowest positive value is obtained with $n = 1$, and gives $A = 253$.

*No. 2.* By an argument similar to that used in the first problem, we find that the original number of coconuts $A$ must be of the form $A = 5^5n - 4$, if the divisions during the night are to be successful. The number $B$ left in the morning will then be $B = 4^5n - 4$.

For the morning division to come out even, we must also have $B = 5m$, where $m$ is also an integer. We must therefore have $1024n - 4 = 5m$.

The integral solutions of this equation are

$$m = 1024r + 204$$
$$n = 5r + 1$$

where $r$ is an integer. Taking $r = 0$ gives $n = 1$ and $A = 3121$.

*No. 3.* Let $a$ be the radius of the pond, $S$ the area over which the cow can graze, and $w$ the angle formed by the tether in the two extreme positions of the cow on the shore of the pond. A little geometry then gives for $S$,

$$S = \pi a^2 + a^2(2\pi - w)\cos w + a^2 \sin w.$$

Since the area of the pond is one acre, and the area $S$ must also be one acre, we must have

$$S = \pi a^2, \text{ or}$$
$$a^2 (2\pi - w) \cos w + a^2 \sin w = 0,$$

which reduces to $\tan w - w + 2\pi = 0$.

This transcendental equation can be solved only approximately. The approximate solution is $w = 1.790 = 102.56°$.

The length of the rope is given by

$$x = 2a \cos (w/2)$$
$$= 1.251a.$$

Since $a = 117.75$ feet, the length of the rope is 147.31 feet.

*No. 4.* Let $a$ be the radius of the pasture, and $w$ be the angle formed by the tether in the two positions when the cow is as far along the fence as she can get. The area $S$ over which the cow can graze is, then,

$$S = \pi a^2 + a^2 w \cos w - a^2 \sin w.$$

We are given that $S = \pi a^2/2$. Hence,

$$a^2 w \cos w - a^2 \sin w + \pi a^2/2 = 0, \text{ or,}$$
$$w \cos w - \sin w + \pi/2 = 0,$$

the root of which is $w = 1.906$.

The length of the rope is given by

$$x = 2a \cos (w/2)$$
$$= 100 \cos .953$$
$$= 57.92 \text{ feet.}$$

*No. 5.* Let $A$ be the original position of the boat, $B$ the landing place, $C$ the place where the man strikes the road, and $D$ the tavern. Also let $E$ be the point at which the road meets the shore, and $F$ the point at the foot of the perpendicular from the original position of the boat to the shore. Let the angle $ECB$ be $x$ and the angle $BAF$ be $y$.

Let us first assume that the point $B$ is known. The point $C$ is then determined by the fact that the time over the route $BCD$ must be a minimum. If the time for this part of the trip is $t_1$,

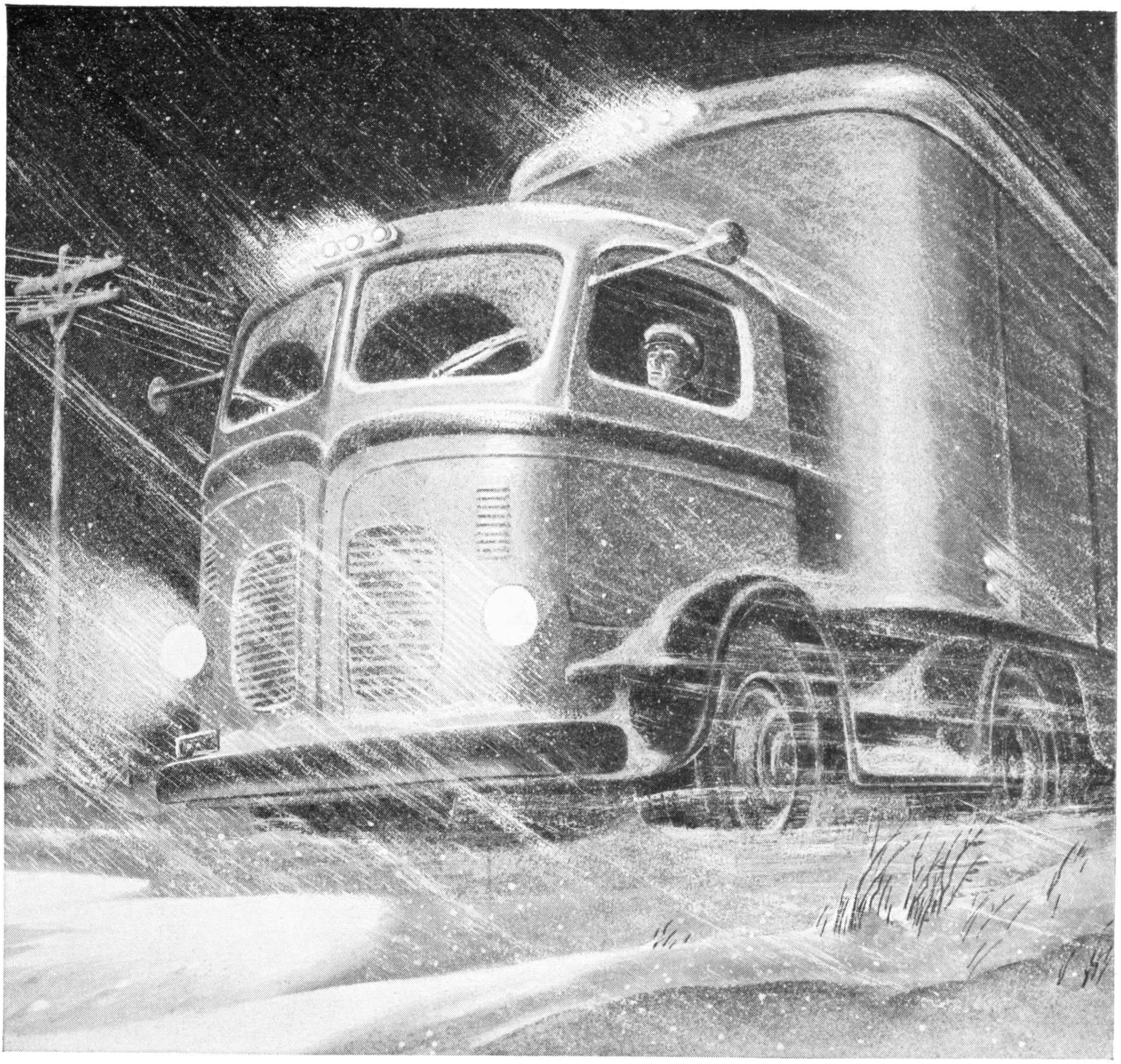
$$t_1 = BC/6 + CD/10.$$

But $BC = EB/\sin x$, and $CD = 5 - EB/\tan x$. Hence,

$$t_1 = EB/6 \sin x + 5/10 - EB/10 \tan x$$
$$dt_1/dx = - EB \cos x/6 \sin^2 x + EB/10 \sin^2 x.$$

For the minimum, $dt_1/dx = 0$, which requires $\cos x = .6000$. Note that this result is independent of $EB$.

Now let us consider the point $C$ as known. Then the point $B$ is determined by the necessity of (*Continued on page 108*)



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## MAIL RETURNS

*(Continued from page 106)*

making the time over the path $ABC$ a minimum. If this time is $t_2$,

$$t_2 = AB/2 + BC/6.$$

But $AB = 1/\cos y$, and $BC = EC/\cos x$. Hence,

$$t_2 = 1/2 \cos y + EC/6 \cos x$$

$$dt_2 = (\sin y/2 \cos^2 y)\, dy + (EC \sin x/6 \cos^2 x)\, dx.$$

We also have $EF = \tan y + EC \tan x =$ constant. Hence,

$$\sec^2 y\, dy + EC \sec^2 x\, dx = 0.$$

Putting $dt_2 = 0$, we now find

$$\sin y = (1/3) \sin x.$$

These two results give $x = 53° 8'$ and $y = 15° 28'$. This, in turn, gives $AB = 1.038$ miles, $BC = 3.403$ miles, $CD = 2.958$ miles. The times for the three stages are: $AB$, .519 hours; $BC$, .567 hours; $CD$, .296 hours. The total time is 1.382 hours, saving all of seven minutes over the obvious way.

*No. 6.* Let $s_1$ be the distance the car goes before the actual breakdown, $s_2$ the distance between this point and the place of the hypothetical breakdown, and $s_3$ the distance from this last point to the destination. Let $5v$ be the speed of the car before the breakdown, and $3v$ the speed of the car after the breakdown. If $t$ is the time in which the journey would have been made without a breakdown, we have the following equations:

$$\begin{aligned} s_1/5v + s_2/5v + s_3/5v &= t \\ s_1/5v + s_2/3v + s_3/3v &= t + 120 \\ s_1/5v + s_2/5v + s_3/3v &= t + 80 \\ s_1/5v &= 60 \\ s_2 &= 50 \end{aligned}$$

Solving for the five unknowns:

$s_1 =$ 50 miles $\quad v = 1/6$ mile per minute $=$ 10 miles per hour
$s_2 =$ 50 miles
$s_3 =$ 100 miles $\quad t = 240$ minutes $=$ 4 hours

The total distance is, therefore, 200 miles.

*No. 7.* Let $x$ be the age of the girl now. Four years before the girl was born, the man was $24 - x$. When the man was five years younger than the girl is now, the girl was $2x - 33$. Hence, $24 - x = 2(2x - 33)$.

Solving, $x = 18$ years.

*No. 8.* Let $x$ be the age of the ship. The age of the boiler is then $49 - x$. When the ship was $49 - x$, the boiler was $98 - 3x$. Hence, $x = 2(98 - 3x)$.

Solving, $x = 28$.

*No. 9.* Let $m$ be the number of men, $w$ the number of women, and $c$ the number of children. Then,

$$\begin{aligned} m + w + c &= 100 \\ 5m + w + c/10 &= 100 \\ \hline 4m - 9c/10 &= 0 \\ 40m &= 9c \end{aligned}$$

For integral solutions, $m = 9n$; $c = 40n$; $w = 100 - 49n$. The values of $n$ (which must be integral) which give positive solutions are $n = 0, 1, 2$. These give the results shown in the table below:

| $n$ | $m$ | $w$ | $c$ |
|---|---|---|---|
| 0 | 0 | 100 | 0 |
| 1 | 9 | 51 | 40 |
| 2 | 18 | 2 | 80 |

*No. 10.* Let $r$ be the lower of the two rates, and $R$ the higher rate. Suppose the woman with 10 eggs sells $a$ at the low rate and $A$ at the high rate. Suppose that the woman with 30 eggs sells $b$ at the low rate and $B$ at the high rate. Suppose that the woman with 50 eggs sells $c$ at the low rate and $C$ at the high rate. *(Concluded on page 148)*

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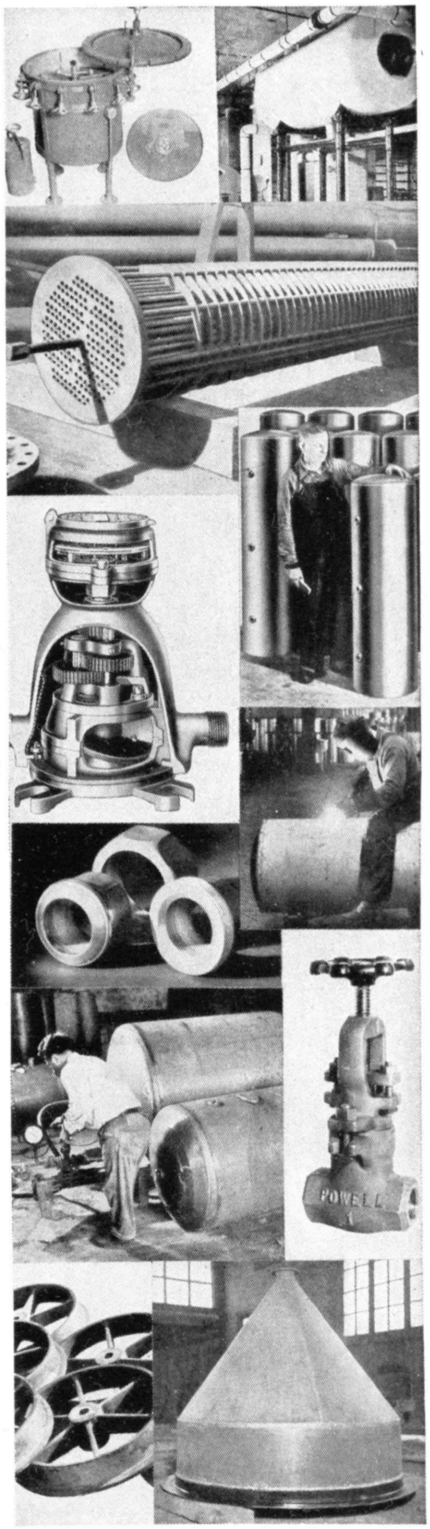


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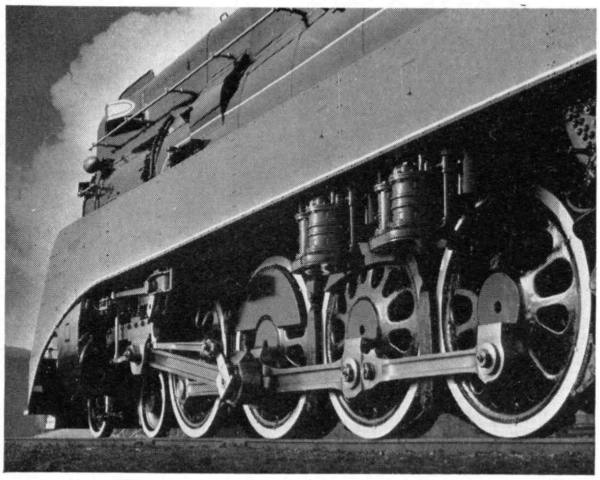

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## CONTENTS





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Charles S. Foster

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