"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

$$\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial \Pi^{(e)}}{\partial r}\right)+\frac{1}{r^2}\frac{\partial^2 \Pi^{(e)}}{\partial \varphi^2}+$$
$$+\frac{\partial^2 \Pi^{(e)}}{\partial v^2}+k^2\Pi^{(e)}=0. \qquad (1)$$

Its solution is found in the form of a linear combination of the Bessel and Neumann functions: $W_n = J_{\delta_n}(x) + \eta_n N_{\delta_n}(x)$ (5).

η_n is a constant which has different values for different n. δ_n is the solution of the transcendental equation:

$$J_{\delta_n}(y)\, N_{\delta_n}(\varepsilon y) - J_{\delta_n}(\varepsilon y)\, N_{\delta_n}(y) = 0 \qquad (6).$$

$\delta_n^2 = -\beta_n^2$ and β denotes the propagation factor. $\varepsilon = R/Q$. It is pointed out that the numerical values W_1, i.e., the field distribution of the wave propagating in the guide cross section is very hard to calculate, since there is no table for Bessel functions of arbitrary fractions.

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

The values of W_n $(n > 1)$ representing the distribution of the field for local waves cannot be calculated from (5), since β_n is not tabulated and the solution of (6) is very difficult for imaginary δ_n. Therefore, explicit analytical formulas are derived here from elementary functions for W_n and β_n:

$$W''_{n,m} + n^2 W_{n,m} = W_{n,0}\left[d_{n,m} + 2\alpha d_{n,m-1} + 3\alpha^2 d_{n,m-2} + \ldots + m\alpha^{m-1} d_{n,1} + (m+1)\alpha^m d_{n,0}\right] + W'_{n,1}\left[d_{n,m-1} + 2\alpha d_{n,m-2} + \ldots + (m-1)\alpha^{m-2} d_{n,1} + m\alpha^{m-1} d_{n,0}\right] + \ldots + W_{n,m-2}\left(d_{n,2} + 2\alpha d_{n,1} + 3\alpha^2 d_{n,0}\right) + W_{n,m-1}\left(d_{n,1} + 2\alpha d_{n,0}\right) + W'_{n,m-1} + \alpha W'_{n,m-2} + \ldots + \alpha^{m-2} W'_{n,1} + \alpha^{m-1} W'_{n,0}. \quad (14)$$

$$\beta_n = \theta\left[-\frac{0,25}{\theta^2} + \left(z - 1 - \frac{1,5}{n^2\theta^2}\right) d_{n,0} + \left(\frac{z^2}{12n^2} - \frac{1,25}{n^4\theta^2}\right) d_{n,0}^2\right]^{\frac{1}{2}}. \quad (18)$$

Card 3/9

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

where $r = \frac{a}{\pi}(\theta - \alpha)$; $\theta = \frac{\pi}{a} R$; $d_n^2 = \beta_n^2/\theta^2$; m denotes the power of θ. $z = \pi/\theta = a/R$. The curvature in the E-plane is investigated analogously. For this case, formula (5) is also valid, but $x = \gamma r$ and δ_n has to be found from the following equation:

$$J'_{\delta_n}(y) N'_{\delta_n}(\varepsilon y) - J'_{\delta_n}(\varepsilon y) N'_{\delta_n}(y) = 0 \qquad (22),$$

where $y = \gamma \varrho$ and $\varepsilon = R/\varrho$. Again, the solution meets with the same difficulties mentioned above. The formulas for U_n and β_n are derived in analogous manner. For $n \neq 0$ and $n = 0$ various formulas are obtained. The zero-order approximation for $n \neq 0$ has the form:

$$U_{n,0} = \cos n\alpha \qquad (25)$$

$$g_{n,0} = q^2 - n^2 \qquad (26),$$

where $g_n^2 = \beta_n^2/\sigma^2$ and $\sigma = \frac{\pi}{b} R$; $q^2 = \gamma^2 (b/\pi)^2 = (2b/\lambda_g)^2$. The correction

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

for the first approximation is given by:

$$U_{n,1} = \frac{g_{n,0}}{2n}\left(\alpha^2 - \pi\alpha - \frac{1}{n^2} - \frac{1}{g_{n,0}}\right)\sin n\alpha + \left(\frac{g_{n,0}}{2n^2} + \frac{1}{2}\right)\alpha\cos n\alpha, \quad (27)$$

$$g_{n,1} = -\pi g_{n,0}. \quad (27),$$

and that for the second one reads:

$$U_{n,2} = \left[-\frac{g_{n,0}^2}{8n^2}\alpha^4 + \frac{\pi g_{n,0}^2}{4n^2}\alpha^3 + \left(\frac{3}{8} + \frac{10g_{n,0} - \pi^2 g_{n,0}^2}{8n^2} + \frac{7g_{n,0}^2}{8n^4}\right)\alpha^2 - \frac{3\pi g_{n,0}}{4n^2}\left(\frac{g_{n,0}}{n^2} + 1\right)\alpha\right]\cos n\alpha + \left[\frac{g_{n,0}}{4n}\left(\frac{5g_{n,0}}{3n^2} + 3\right)\alpha^3 - \frac{\pi g_{n,0}}{2n}\left(\frac{g_{n,0}}{n^2} + \frac{3}{2}\right)\alpha^2 + \left(-\frac{3}{4n} + \frac{\pi^2 g_{n,0}^2 - 30g_{n,0}}{12n^3} - \frac{7g_{n,0}^2}{4n^5}\right)\alpha + \frac{3\pi g_{n,0}}{4n^2}\left(\frac{g_{n,0}}{n^2} + 1\right)\right]\sin n\alpha, \quad (28)$$

$$g_{n,2} = -\frac{3}{4} - \frac{5g_{n,0}}{2n^2} - \left(\frac{\pi^2}{12n^2} + \frac{7}{4n^4}\right)g_{n,0}^2. \quad (28)$$

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

For n = 0 these three formulas read as follows:

$$\overline{U_{0,0}} = 1, \qquad g_{0,0} = q^2, \tag{29}$$

(29)

$$U_{0,1} = \left(\frac{\pi}{3} - \frac{\pi}{2}\right) a^2 g_{0,0}, \qquad g_{0,1} = -\pi g_{0,0}, \tag{30}$$

(30)

$$U_{0,2} = g_{0,0}^2 \frac{a^4}{45} - \frac{\pi}{15} g_{0,0}^2 a^3 + \left(\frac{g_{0,0}}{3} + \frac{\pi^2}{24} g_{0,0}^2\right) a^4 - \frac{\pi}{2} g_{0,0} a^3 + \frac{\pi^2 g_{0,0}}{12}\left(1 + \frac{\pi^2 g_{0,0}}{5}\right) a^2, \tag{31}$$

$$g_{0,2} = \frac{\pi^2}{6} g_{0,0} + \frac{\pi^4}{30} g_{0,0}^2, \quad g_{0,3} = 0.$$

(31).

Card 6/8

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

$$\beta_0 = i\beta = \sigma\left[\left(z-1-\frac{z^2}{6}\right)g_{0,0}-\frac{\pi^2 z^2}{30}g_{0,0}^2\right]^{\frac{1}{2}}. \quad (32)$$

is the formula for the propagation factor of the fundamental wave, and

$$\beta_n = \sigma\left[\frac{0,75}{\sigma^2}+\left(z-1+\frac{2,5}{n^2\sigma^2}\right)g_{n,0}+\left(\frac{z^2}{12n^2}+\frac{7}{4n^4\sigma^2}\right)g_{n,0}^2\right]^{\frac{1}{2}}. \quad (33)$$

is the formula for the propagation factor (decrement of damping) of waves of higher order. Summing up: As far as the β values published by R. A. Waldron (Ref. 2: Journal of the British IRE, v. 17, no. 10, 1957) constitute a mathematically exact solution of Eqs. (6) and (22) and have also been confirmed experimentally by D. I. Voskresenskiy (Ref. 1: Trudy MAI, vyp. 73, 1957 (Interactions MAI, no. 73, 1957)), the values found for β from (18) and (32) have been compared with those obtained by interpolation from the tables of Ref. 2. A good agreement of the experimental values with those found by approximate and exact formulas proves the correctness of the approximate formulas for all β_n. Since the functions

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

W_n (and U_n) and β_n are interconnected by (6) and (22), it can be assumed that the approximate formulas obtained for W_n and U_n will yield values close to the actual values, and it can also be assumed that these formulas can be used to calculate the field of the fundamental wave and also that for waves of higher order. A similar method for solving the Bessel equation has also been applied by L. Lewin (Ref. 4: PIEE, part B, v. 102, no. 1, 1955). There are 4 figures and 5 references: 3 Soviet-bloc and 2 non-Soviet-bloc. The reference to the English-language publication reads as follows: R. A. Waldron. Journal of the British IRE, v. 17, no. 10, 1957.

ASSOCIATION: Nauchno-tekhnicheskoye obshchestvo radiotekhniki i elektrosvyazi im. A. S. Popova (Scientific and Technical Society of Radio Engineering and Electrical Communications imeni A. S. Popov) [Abstracter's note: Name of association was taken from first page of journal]

SUBMITTED: February 19, 1960

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

KISLYUK, M.Zh.

Curved wave guide with a rectangular cross section. Radiotekhnika 16 no.4:3-10 Ap '61. (MIRA 14:9)

(Wave guides)

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

KISLYUK, M. Zh.,

"Investigation of Bent Waveguides of Rectangular Cross Section." Dissertation for the Degree of Candidate of Sciences, Leningrad Electrotechnic Inst. of Communication im. M. A. Bonch-Bruyevich. Defense held on 23 June 1960.

The structure of the electromagnetic field in a bent waveguide is investigated. A mathematical expression is obtained for the determination of the field structure. A procedure is proposed for the calculation of the coefficient of reflection in coupled straight and bent waveguides, which makes it possible to choose a rational radius of the bend. The set of theoretical and experimental work performed makes it possible to obtain scientifically justified and practically convenient calculations for the standing-wave coefficients of the waveguide bend.

Izv Vysshikh ucheb. zaved MViSSO SSSR po razdelu Radiotekhnika, vol. 6, No. 1, 1963 p. 98-102 (original checked--Cand. of Sciences as in original.)

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

REEL #228

Kiseler, A. Ya.

to

Kislyuk, M. Zh.

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"

"APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6

END

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000722830003-6"