TABLE 2 COMPARISON OF MUSKAT, MORGAN, AND MERES' RESULTS WITH THOSE OF THE AUTHORS

L/B	h_0/mB	S/m^2 present work	S/m^2 Muskat, et al.
∞	0.5	1.65	1.75
∞	1.0	6.25	6.0
∞	1.4	13.3	13.0
∞	2.4	49.7	48
1	0.5	3.45	3.5
1	1.0	14.75	15
1	1.4	30.5	33
1/2	0.5	7.71	8
1/2	1.0	33.9	35
1/2	1.4	71.5	73

TABLE 3 COMPARISON OF MUSKAT, MORGAN, AND MERES RESULTS WITH THOSE OF THE AUTHORS

L/B	S/m^2	f/m present work	f/m Muskat, et al.
∞	1.65	2.45	2.50
∞	6.25	5.00	5.00
∞	13.3	7.80	7.50
∞	49.7	19.9	18.0
1	3.45	4.70	5.00
1	14.75	11.1	11.0
1	30.5	17.45	17.0
1/2	7.71	9.85	9.0
1/2	33.9	24.7	24.5
1/2	71.5	37.2	39.0

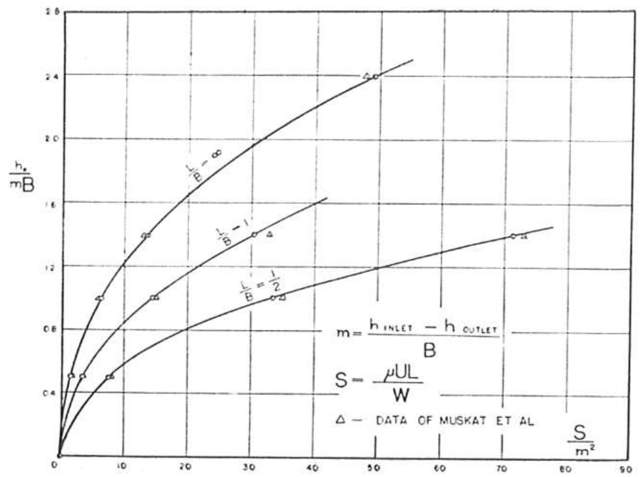

FIG. 2

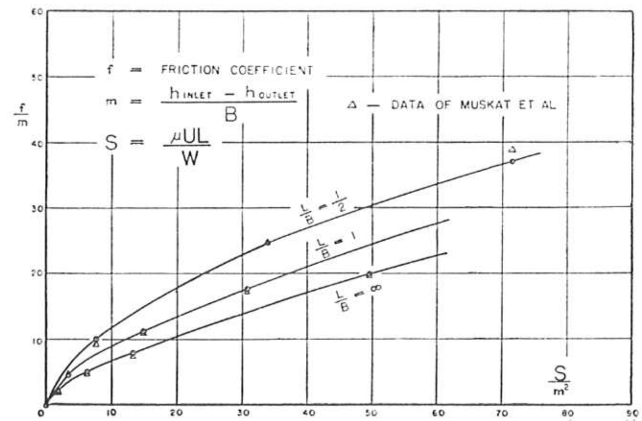

FIG. 3

We check first their (h_0/mB) versus (S/m^2) curve, where m is the slope of the flat slider, the film thickness being given by $h = mx$; also $S' = \mu UL/W$ in the notation of this paper. These results are given in Table 2 and shown graphically in Fig. 2.

As a final check, consider the f/m versus S/m^2 curve, where f is the coefficient of friction, the other symbols having the significance pointed out before. The results are shown in Table 3 and are plotted in Fig. 3.

Conclusion

It may now readily be seen that the Reynolds equation may be solved easily for both finite and infinite sliders, that is, with and without side leakage, for a slider of exponential shape. Furthermore, all the quantities usually desired such as total load, center of pressure, coefficient of friction, oil flow, and so forth, may be found. The proposed solution is exact for the exponential slider and may be used with a high degree of accuracy of approximation for the flat slider.

Furthermore, because of the ranges in shapes possible by the use of different portions of exponential curves, the design possibilities of various modifications in slider shapes may be calculated readily from the foregoing solution.

Acknowledgment

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Discussion

H. J. Henry.[4] Unfortunately, the mathematician only too often ignores the applicability of his solution to a practical problem by the average designer. His solution may be too involved and difficult for the designer. The Michell solution of the Reynolds equation in the hydrodynamical theory of slider-bearing lubrication is an example.

Obviously the authors' solution is exact only for the exponential slider, but by using their solution, performance characteristics of the slider bearing are in surprisingly close agreement with the exact solution for other shapes, particularly the flat slider. The simplification will make their method useful to the designer.

The authors' comment on the use of this solution to a class of slider bearings in which the velocity is not constant but a function of x would be greatly appreciated.

Authors' Closure

The authors wish to thank Dr. Henry for his interesting comments. In particular, the question he brings up regarding the solution for nonconstant velocity of the slider is one which needs careful attention.

If the velocity varies with the time, extra terms appear in the continuity equation and in the Navier-Stokes equations. If the density is assumed constant, the extra term drops out of the

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former. In the latter equations the additional terms may be important or may not be depending on the relative magnitudes of the terms involved. If both types of terms can be neglected, that is, density changes are unimportant and acceleration terms are small, we arrive again at the Reynolds equation, Equation [1] in the paper, with U a function of time. In this case the usual method of separation of variables is applicable.

If the extra terms cannot be dropped the solution must be handled differently. It is the intention of the authors to examine the latter case in the near future.