As an extension of the studies on the dynamical behavior of van der Waals complexes such as those on CO-DME, we have investigated nitrogen-dimethyl ether complex $\text{N}_2-(\text{CH}_3)_2\text{O}$, by using Fourier transform microwave spectroscopy. We have scanned the frequency region from 6 to 25 GHz and have found four sets of $a$-type rotational transitions ranging from $J = 2 \leftarrow 1$ up to $J = 6 \leftarrow 5$ for $\text{N}_2$-DME and $^{15}\text{N}_2$-DME and two sets for $^{15}\text{N}$-DME. Two of the four sets (referred to as group I) of $\text{N}_2$-DME and $^{15}\text{N}_2$-DME have large centrifugal distortion constants. Each rotational transition of $\text{N}_2$-DME showed complicated splitting patterns due to the quadrupole coupling of the two nitrogen atoms and the number of hyperfine components was much smaller for group I than for the other (group II). This observation indicates that the group I complexes involve para-$\text{N}_2$ and the group II ortho-$\text{N}_2$. In the case of $^{15}\text{NN}$-DME only one type (corresponding to group II) of the complexes was detected because of the lack of symmetry. Some of the $a$-type transitions observed for $^{15}\text{N}_2$-DME consisted of closely spaced triplets; the splittings, which were nearly independent of the quantum numbers $J$, were ascribed to the internal rotation of the two methyl tops of DME. The observed transition frequencies of $\text{N}_2$-DME, $^{15}\text{N}_2$-DME, and $^{15}\text{NN}$-DME were analyzed for each set separately, by using an ordinary asymmetric-rotor Hamiltonian. The inertial defects $I_{cc} - I_{aa} - I_{bb}$ thus obtained for $\text{N}_2$-DME were -29.31 (10) and -30.97 (10) uÅ$^2$ for the two sets of group I and -9.98 (9) and -12.58 (11) uÅ$^2$ for group II. These results indicated that the heavy-atom skeleton of $\text{N}_2$-DME was not planar. The observed moments of inertia were analyzed to give the distance between the centers of gravity of the two component molecules, DME and $\text{N}_2$, to be approximately 3.45 Å. By assuming a Lennard-Jones-type potential the dissociation energy was estimated to be $E_B = 0.74 \pm 1.17$ kJ mol$^{-1}$, to be compared with the values 1.0 and 2.5 kJ mol$^{-1}$ for Ne-DME and Ar-DME, respectively. MP2/6-31++g(d, p) calculations suggest that $\text{N}_2$-DME is non-planar and is bound by a very flat potential energy surface, in qualitative agreement with our results.