An analysis is made of the structure of transient sidewall shear layer of a rapidly rotating compressible gas in a cylinder. The fluid motion is caused by a mechanical perturbation at the sidewall. Considerations are given to the fluid flow over the spin-up time scale based on the local Ekman number. It is assumed that the ratio of the thickness of the Stewartson layer to the scale height of the basic density field is small but finite. A leading-order linearized formulation for transient Stewartson layers is obtained for general-type time-dependent mechanical perturbations at the cylindrical sidewall. As specific examples, two canonical cases of the sidewall perturbations are dealt with: (1) the case of a step change, and (2) the case of a sinusoidal oscillation. The theoretical solutions acquired are shown to be in agreement with the available results. Physical explanations are offered to describe the main features of transient sidewall layers. © 1998 The Japan Society of Fluid Mechanics Incorporated and Elsevier Science B.V. All rights reserved.