4. $\dfrac{\partial^2 w}{\partial t^2} = \dfrac{a}{x^n}\dfrac{\partial}{\partial x}\left(x^n \dfrac{\partial w}{\partial x}\right) + f(w), \qquad a > 0.$

To $n = 1$ and $n = 2$ there correspond nonlinear waves with axial and central symmetry, respectively.

Functional separable solution:

$$w = w(\xi), \quad \xi = \sqrt{ak(t+C)^2 - kx^2},$$

where the function $w(\xi)$ is determined by the ordinary differential equation $w''_{\xi\xi} + (1+n)\xi^{-1}w'_\xi = (ak)^{-1}f(w)$.

Reference

Polyanin, A. D. and Zaitsev, V. F., *Handbook of Nonlinear Partial Differential Equations* , Chapman & Hall/CRC, Boca Raton, 2004.

