The article deals with the model of slowly aging viscoelastic material which makes it possible to take the effect of the load on the aging process into account. From the overall reaction the component is isolated which does not depend on the aging process, and to describe it, known dependences for material, invariant in time, are used.

In the heredity theory of elasticity one of the principal conditions is the choice of the heredity influence functions, i.e., the choice of the kernel $K(t, \tau)$ in Volterra's integral equations. In practice equations simple integrals are used, as a rule.

The most general nonlinear theory of viscoelasticity with simple integrals is the principal quasilinear theory of viscoelasticity with physical dependence for deviators in the form

$$
\sigma_{ij} = \int_0^t \Gamma(t, \tau) \varepsilon_{ij}(\tau) d\tau - \int_0^t \Gamma_n(t, \tau, \theta, \varepsilon) \varepsilon_{ij}(\tau) d\tau,
$$

where $\varepsilon$ is the strain intensity; $\theta$ is the relative change of volume. In the general case, when there are no constraints on the kernels in (1), it is difficult to actually find the solutions [2, 3].

To simplify the solutions, a special kind of kernel [2] is often used:

$$
K(t, \tau, \sigma(\tau)) = h(\tau) \varphi(t - \tau) F(\sigma(\tau)),
$$

where $h(\tau)$ is a function determining the aging process of the material (aging function); $\varphi(t - \tau)$ is a function characterizing the hereditary properties.

Since (2) is represented by the product of a function of time and a function of $\sigma$ alone, nonlinearity in time does not change (the creep curves are similar to each other). The results of tests [2] show that the nonlinearity of creep strain of materials becomes softened in time.

This phenomenon is described by Vasil'ev's dependence [2]:

$$
\varepsilon(t) = \int_0^t \int_\eta^t \frac{\partial}{\partial \sigma} F[\sigma, \eta] h(\eta - \tau) \frac{\partial \sigma}{\partial \tau} d\eta d\tau,
$$

which has all the shortcomings of multiple representations involving difficulties with the choice of kernels and with inversion.

The main structural materials (polymers, metal, concrete) do not change their properties rapidly in time, i.e., they age slowly. To describe the behavior of such materials, Stoffer and Straus [4] suggested the dependence

$$
S(t, t_L) = \int_0^t \left\{G(\gamma(t) - \gamma(\tau)) \dot{E}(\tau) \dot{E}(\tau) \right\}^{1/2} \frac{1}{H(\tau, t_L)} E(\tau) d\tau,
$$

where $S$ is Kirchhoff's stress tensor; $E$ is the unit strain tensor; $\dot{E}$ is the strain rate; $\gamma$ is
the function of parametrization describing the length of the arc via time; \( G \) is a material function not depending on the aging process; \( H \) is a material function describing aging. In (3) a component not depending on the aging processes is singled out.

It is important that in (2) and (3) the material functions describing aging depend solely on time. Consequently, it can be postulated that the processes causing aging proceed independently on the process of deformation. However, the data of experimental data of [5, 6] indicate that the aging process is affected by the load.

The theory of viscoelasticity is widely used for describing the behavior of various structural materials; it is therefore of interest to find a hereditary physical dependence that takes the effect of the load on the aging process into account and is suitable for practical use.

Confining ourselves to small deformations, we adopt the physical dependence in the form [5]:

\[
\sigma(t) = Q^{(1)} [\varepsilon(t)] + \int_0^t Q^{(2)}[\varepsilon(\tau), t] + \int_0^t Q^{(3)}[\varepsilon(\tau), t],
\]

(4)

where the difference functional \( Q^{(1)} \) describes the reaction of the material regardless of aging, and the nondifference functional \( Q^{(2)} \) determines the so-called "natural" aging proceeding without influence of the process of deformation; the nondifference functional \( Q^{(3)} \) describes the influence of the load on the aging process. If the load does not affect the aging process, then \( Q^{(3)} = 0 \), and nonlinearity does not change in time.

Let us consider the case when the load is small. For such a load the difference functional \( Q^{(1)} \) may be taken to be linear:

\[
Q^{(1)} [\varepsilon(t)] = \int_0^t Q^{(1)}(t - \tau) \varepsilon(\tau) d\tau,
\]

(5)

and the nondifference functional \( Q^{(2)} \) is taken in the form

\[
Q^{(2)}[\varepsilon(\tau), t] = \int_0^t Q^{(2)}(t, \tau) \varepsilon(\tau) d\tau.
\]

(6)

Using the mean value theorem, we present the integral in (6) in the following form:

\[
Q^{(2)}[\varepsilon(\tau), t] = t_{\text{me}}(t) \int_0^t Q^{(1)}(t - \tau) \varepsilon(\tau) d\tau,
\]

(7)

where \( t_{\text{me}}(t) \) is a function that describes aging.

For slowly aging materials

\[
dt_{\text{me}} / dt \to 0
\]

and for a sufficiently long time interval we can adopt the approximation

\[
t_{\text{me}}(t) = \alpha_1 t,
\]

(8)

where \( \alpha_1 \) is a small magnitude (const).

When the load does not exert a strong influence on the aging process, we assume that

\[
Q^{(3)}[\varepsilon(\tau), t] = t_{\text{me}}(t, \varepsilon) \int_0^t Q^{(1)}(t - \tau) \varepsilon(\tau) d\tau,
\]

(9)

where \( t_{\text{me}}(t, \varepsilon) = \mu \varepsilon t; \mu \) is a small magnitude (const). Then

\[
Q^{(1)} + Q^{(3)} \gg Q^{(3)}
\]

(10)

and the functional operator (5) is represented as: