provided, the Eq. (38) and Eq. (39) give the relation

$$\frac{dg_{00}}{dr} = \frac{dg_{00}}{d\widetilde{r}}\frac{1+\omega(F)}{1+\frac{r_g}{2r}} = \frac{r_g}{r^2}(1-\frac{r_g}{2r}), \qquad (40)$$

for determining the function $\widetilde{r}(r)$. We must now turn to the actual correspondence between the expression (39) for the line element surrounding an attracting central body and the observational facts of astronomy. The investigating methods are so well known that it will be sufficient for our purposes merely to indicate the classical tests of GR conducted in solar-system dealing only with the shape of the trajectories of photons and planets. All these tests are carried out in empty space and in gravitational fields that are to a good approximation static and spherically symmetric. Therefore, in sufficient approximation, at great distances from the central body

$$F = (4r_g^2æ^2F_{mn}F_{mn})^{1/4} = r_g/r << 1, \qquad (41)$$

we may take expansion of function $\omega(F) = \lambda_1 F + \lambda_2 F^2 + \cdots$, and that from Eq. (40) we obtain

$$\widetilde{r} = r(1 + \alpha_1 F + \alpha_2 F^2 + \cdots), \qquad (42)$$

provided $\alpha_1 = 1/2-\lambda_1$, $\alpha_2 = \lambda_2+1/4+4(\lambda_1-1/4)^2$, etc. Then, in terms up to the second order in $\widetilde{F} \quad (= r_g/\widetilde{r})$, which is an approximation of interest for available observational verifications, the temporal component of metrical tensor reduces to $g_{00} \simeq 1 - \widetilde{F} + (\lambda_1 - 1/4)\widetilde{F}^2$. With these provisions, Eq. (39) is reduced to standard Schwarzschild line element with the metrical tensor components as follows:

$$\begin{aligned} &g_{00} \simeq 1 - \tfrac{r_g}{\widetilde{r}} + (\lambda_1 - \tfrac{1}{4})\tfrac{r_g^2}{\widetilde{r}^2}, \\ &g_{11} \simeq -(1 + \tfrac{r_g}{\widetilde{r}} + \cdots), \\ &g_{22} = -\widetilde{r}^2, \quad g_{33} = -\widetilde{r}^2 \sin^2\widetilde{\theta}. \end{aligned} \qquad (43)$$

The free adjustable parameter λ_1 in Eq. (43) can be written in terms of Eddington-Robertson expansion parameters as $\lambda_1 = 1/4 + 2(\beta - \gamma)$. While γ controls also other relativistic effects, in particular those related to gravitomagnetism, it mainly affects electromagnetic propagation. The differential displacement of the stellar images near the Sun historically was the first experimental effect to be investigated and is now of great importance in accurate astrometry. The bending of a light ray also increases the light-time between two points, an important effect usually named after its discoverer I. I. Shapiro [49]. Several experiments to measure this delay have been successfully carried out, using *wide-band* microwave signals passing near the Sun and transponded back, either passively by planets, or actively, by space probes, see [40, 46]. The very long baseline interferometry (VLBI) has achieved accuracies of better than 0.1 mas (milliarcseconds of arc), and regular geodetic VLBI measurements have frequently been used to determine the space curvature parameter γ [43, 45, 47, 48, 50], resulting in the accuracy of better than $\sim$ 0.045% in the tests of gravity via astrometric VLBI observations. Detailed analysis of VLBI data have yielded a consistent stream of improvements γ = 1.0000.003 [47, 48], γ = 0.99960.0017 [45], γ = 0.999940.00031 [43] and γ = 0.999830.00045 [50] resulting in the accuracy of better than $\sim$ 0.045%. The major advances in several disciplines notably in microwave spacecraft tracking, high precision astrometric observations, and lunar laser ranging (LLR) suggest new experiments. LLR, a continuing legacy of the Apollo program, provided improved constraint on the combination of parameters $4\beta - \gamma - 3$ [52–55]. The analysis of LLR data [53] constrained this combination as $4\beta-\gamma-3 = (4.0\pm4.3)\times10^{-4}$, leading to an accuracy of $\sim$ 0.011% in verification of general relativity via precision measurements of the lunar orbit. A significant improvement was reported in 2003 from Doppler tracking of the Cassini spacecraft while it was on its way to Saturn [41], with a result $\gamma-1 = (2.1\pm2.3)\times10^{-5}$. This was made possible by the ability to do Doppler measurements using both X-band (7175 MHz) and Ka-band (34316 MHz) radar, thereby significantly reducing the dispersive effects of the solar corona. In addition, the 2002 superior conjunction of Cassini was particularly favorable: With the spacecraft at 8.43 astronomical units from the Sun, the distance of closest approach of the radar signals to the Sun was only $1.6R_\odot$. This experiment has reached the current best accuracy of $\sim$ 0.002% [42]. Keeping in mind aforesaid, the best fit for satisfactory agreement between the proposed theory of gravitation and observation can be reached at $\lambda_1 - 1/4 = (2.95 \pm 3.24) \times 10^{-5}$.

IV. THE RELATIVISTIC FIELD THEORY OF INERTIA

As we mentioned in Sect.2, in the proposed theory of gravitation, the preferred systems and group of transformations of the *real-curvilinear* coordinates relate only to the real gravitational fields. This prompts us to introduce separately the *distortion inertial fields*, which have other physical source than that of gravitation, and construct the relativistic field theory of inertia. The latter, similarly to gravitation theory, treats the *inertia* as a distortion of local internal properties of flat M_2 space. The geometry of Sect.3 is a language which is almost indispensable for the treatment of this problem.

A. The case of unbalanced net force other than gravitational

First, we shall discuss the inertia effects in particular case when the relativistic test particle accelerated in the flat space under unbalanced net force other than gravitational. Let us concentrate our attention on the first observer in two-dimensional Minkowski flat space $M_2 = R^1_{(+)} \oplus R^1_{(-)} = R^1 \oplus T^1$, being regarded as in a state of rest or uniform motion. Suppose this unaccel-