BALL TRAIN OF YARMOLCHUK

The article is devoted to almost forgotten idea of a train running on spheres or balls. The fate of this project was unenviable, although it promised many things and had a considerable feedback both in the USSR and abroad. The invention of Nikolai Yarmolchuk (1898–1979) seemed quite promising, especially since in the 30s of the last century one could only dream of high-speed ground transportation. But the main thing – the unusualness of the idea itself struck. It combined the paradox of thought, the challenge to the usual course of things, a kind of intuitive anticipation of the future.

Keywords: high-speed transport, ball train of Yarmolchuk, history, project, patent.

«Each wheel of this train» was a giant ball or sphere as tall as a man. The sides of the balls are cut off, axes pass there and electric motors are installed. Two such balls, «dressed» in rubber, are fixed in the head and rear of the cylindrical car. The balls protrude out through the slits in the bottom», wrote the American journal Popular Science in February 1934, 85 years ago, about the invention of Soviet engineer Nikolai Yarmolchuk.

The journal prepared a large publication on the extraordinary Russian monorail: «Fragmented and conflicting reports from Russia of a revolutionary new type of railway under secret test there, which aroused the curiosity and interest of the American engineering

New Russian Monorail

RUNS IN TROUGH ON BIG SPHERES

Above, note the fishlike snout of the new Russian monorail that runs in a trough. At right, the strange train in action. In circle, M. I. Yarmanchuk, the inventor

FRAGMENTARY and conflicting reports from Russia of a revolutionary new type of railway under secret test there, which aroused the curiosity and interest of the American engineering world, have just been followed by the first complete details of the new system, and actual photographs of a working model in operation. Fully as remarkable as advance reports, the system proposed by M. I. Yarmanchuk, its inventor, calls for streamlined trains running at 125 miles an hour on giant, flattened spheres, twelve feet in diameter, instead of wheels. Each car is supported by two of these spheres, one at each end, and they are whirled by electric motors contained within their shells and mounted on the rigid axles. Since the center of gravity of the car lies below the axle, the car is not topheavy and will not easily overturn. A single curved trough of reinforced concrete serves as a track, entitling the strange system to be classed as a monorail. According to the inventor, this track should cost no more than a standard automobile highway to build. To test his scheme, the inventor has built and operated successfully near Moscow, a model railway with twenty-four-foot cars on a mile-long track. Plans are now under way to construct a thirty-mile railway on the same system, with 120-foot cars.

CONCRETE TROUGH

BULK OF CAR'S WEIGHT LIES BELOW AXLE

GYROSCOPE

MOTOR

① SUSPENDED FROM OVERHEAD RAIL

② SELF-BALANCING ON RAIL

③ SUSPENDED ASTRIDE RAIL

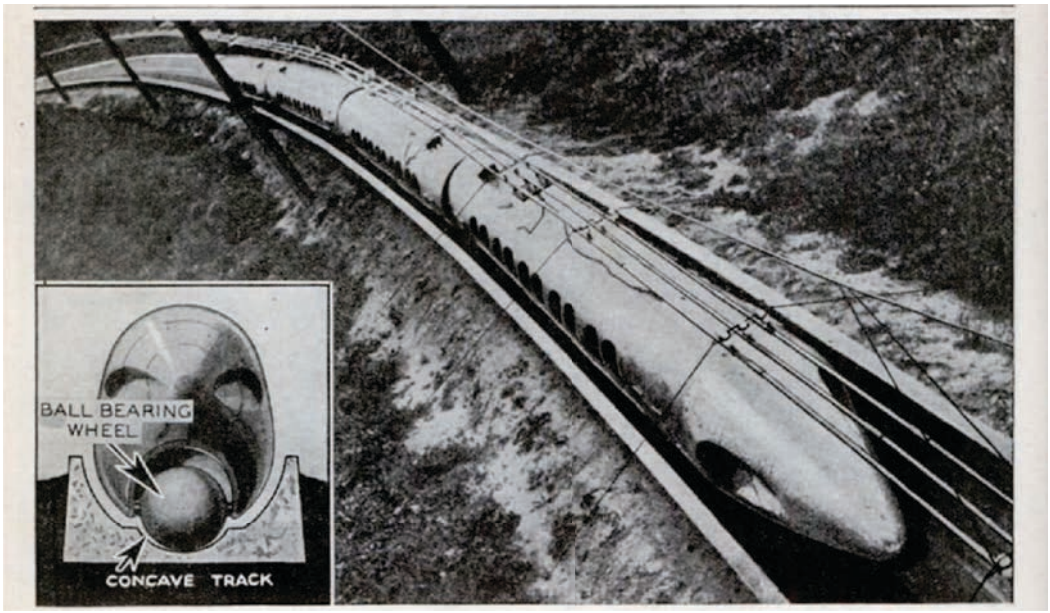
④ SUSPENDED FROM INTERNAL AXLE

Previous Types of Monorail Construction..

New Russian Type

Above, cut-away view of the monorail to show how it runs on flattened spheres. At left, cross sections show principle of new system compared with the old types

Article «New Russian monorail» in the journal «Popular Science» (USA, 1934).



Photos of the working model of the new type of railway.

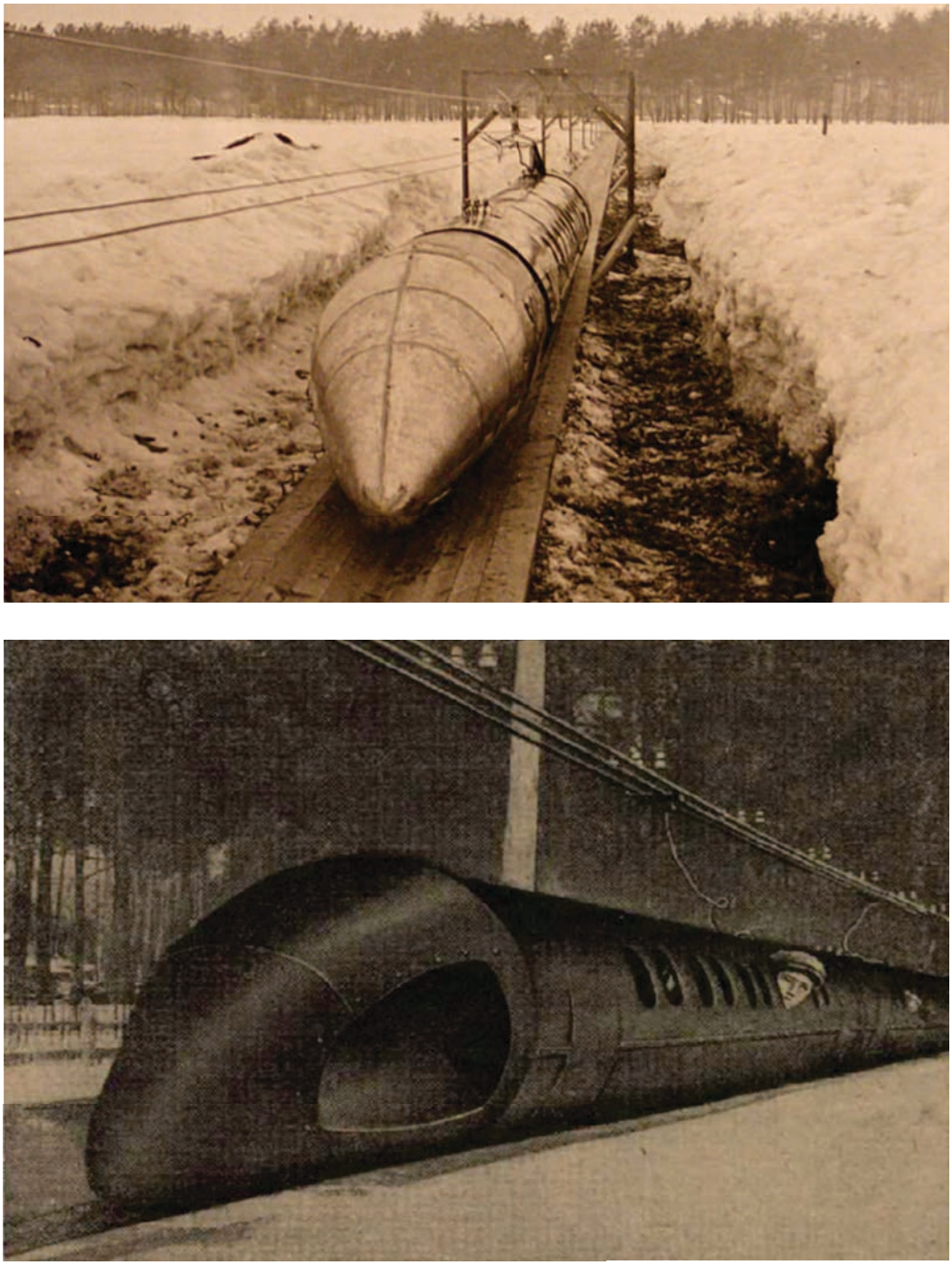
world, have just been followed by the first complete details of the new system, and actual photographs of a working model in operation».

The author of the project after the Russian Civil War got a job as a fitter at Kursk railway. For several years he had studied all the features of this type of transport. In those years, many experts began to think about increasing the speed of trains. Having studied the existing systems and rolling stock, Yarmolchuk came to the conclusion that it is impossible to make new decisions within the existing system, that a completely different type of transport is needed.

According to the young specialist, a significant increase in speed was hampered by the construction of railway tracks and wheels. While driving, the wheel set is held on rails only at the expense of wheel flanges. And with a simple increase in speed, the inevitable beats on the rails would only become more frequent, increasing the load on the chassis of the train and increasing the risk of its destruction. The engineer proposed a radical innovation: instead of a rail track, to use a round-shaped chute tray along which the ball was supposed to move. The wheel in the form of a sphere is not subject to beats and is self-oriented in space.

In the first version, the author also offered completely new car designs. The hull itself also had to have a spherical shape, where all the necessary

Nikolai Yarmolchuk during the test. A shot from the newsreel.



Ball train of Yarmolchuk is rushing along the tray. Collage from a newspaper.

mechanisms and passenger cabins would be placed. The outer surface became the supporting surface and was in contact with the chute. To achieve maximum performance and save space, the train had to be equipped with electric motors. The new system is called «Ball electric chute transport» (abbreviated BECT).

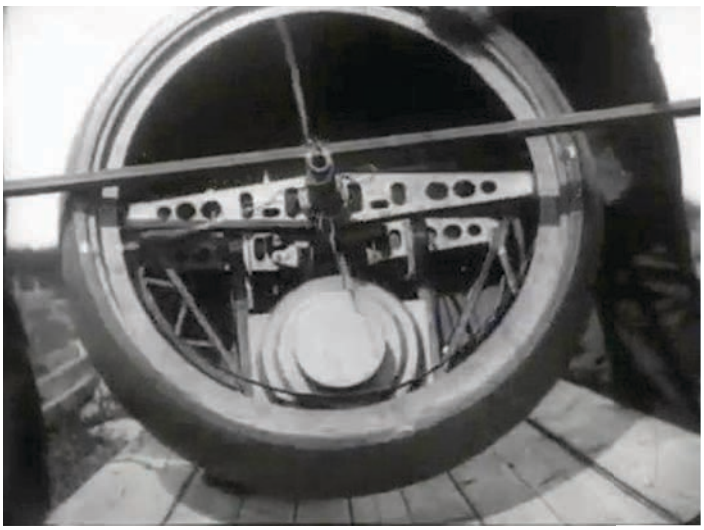
Continuing to engage in the project, Yarmolchuk graduated from Moscow Higher Technical School and Moscow Power Engineering Institute. At the same time, the designer «knocked on all the doors», trying to interest those in charge with his project. In addition to the obvious «speed» advantages, a new type of transport gave significant savings in building materials and was able to simplify the construction of railways themselves. The tray was proposed to be made of reinforced concrete, which would reduce metal consumption. In the 1920s and 1930s, the rails were

Demonstration of wheel stability. After tilting, it should return to its normal upright position. A shot from the newsreel.

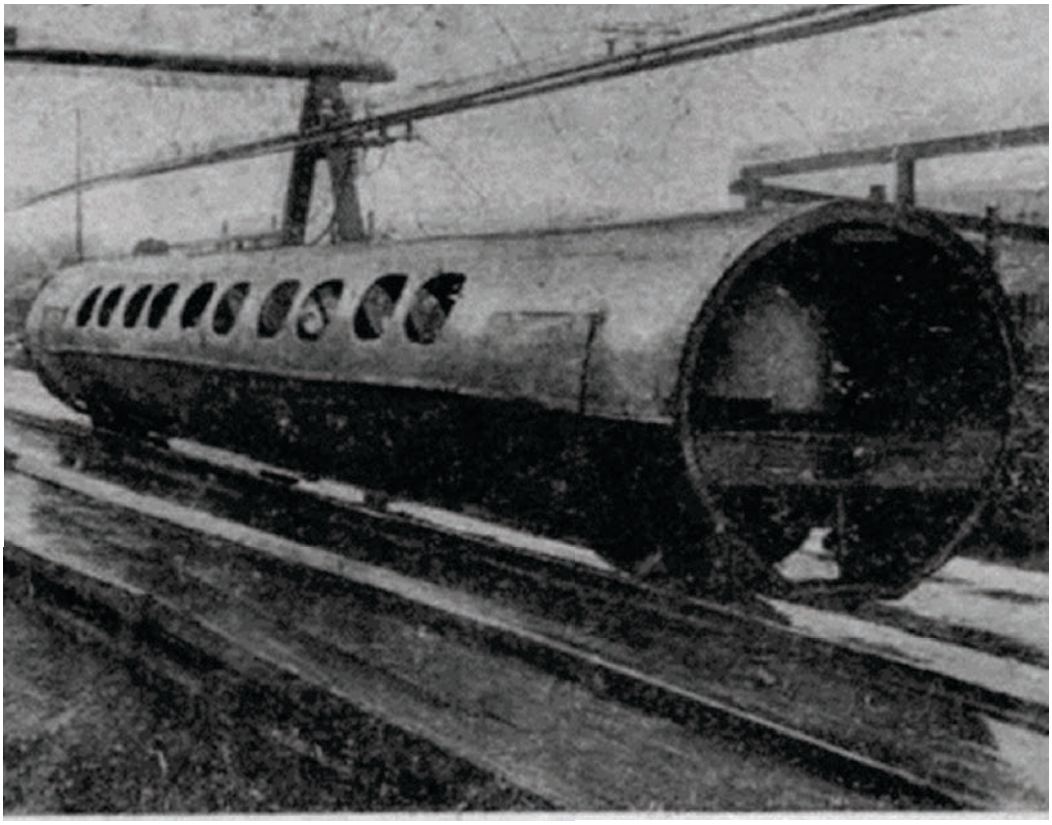
laid manually, and concrete sections could be prefabricated at the industrial site and then mounted on site, which saved installation time significantly. Nevertheless, the project of Yarmolchuk until the end of the 1920s remained only on paper.

Higher education of a young man made its own «adjustments» to the project. Graduated engineer Yarmolchuk decided to abandon spherical cars, replacing them with more conventional, but equipped with the original chassis. The car was equipped with two large wheels, which were located in front and at the end of the frame. New wheels were planned in the form of a «sharoid» with cut off side parts made of metal and covered with rubber. Inside the hull there was an electric motor of appropriate power. According to the creator's estimate, the updated version of the ball train could reach speeds of about 300 km/h and carry up to 110 people. It was able to overcome the path from Moscow to Leningrad in just a couple of hours.

The state turned its attention to a revolutionary project in 1929, when the first model of a ball car was built at MIIT, where Yarmolchuk worked then. The car confidently moved along the tray, which was installed on the laboratory floor. The model moved so «convincingly» that under the People's Commissariat of Communications, a special unit «Bureau of pilot construction of ultrafast transport for development and implementation of the invention of N. G. Yarmolchuk» was created, abbreviated BOSST. From now on, a group of engineers and technicians



Internal wheel units: the frame and the electric motor suspended under it. A shot from the newsreel.



Ball car of N. G. Yarmolchuk.

were already working on the project, and official laboratory experiments began.

After some time, the journal «Technology – to youth» wrote: «The young, unknown Yarmolchuk ran into indifference and hostile attitude of old specialists. They claimed that his idea was ridiculous and impracticable». The ball trains, another journal assured, would become «a powerful vehicle capable of transporting the population of entire cities in the shortest possible time». Of course, the critics of the project were not silent either, but their point of view sank in the whole chorus of praise.

Design work went on until the spring of 1931. The People's Commissariat for Communications ordered the construction of a mock-up sample and allocated one million rubles and a plot of land for this. Not far from the station near Moscow «Severyanin», in a closed area a ball track was built. It consisted of two closed rings with a length of about three kilometers, interconnected. The tray was made of wood. In 1932 a ball car of 1/5 full size was manufactured. Six months later – a train of five cars. The composition was a single body – flexible, smooth, with low ground clearance. The first car was supplied with a fairing, it had a driver's cab. A blue-red ball ride rushed along the tray at a speed of up to 70 kilometers per hour.

89 specialists were involved in construction of the pilot section. Due to the difficult food situation in the USSR, in addition to the railway, a vegetable garden was laid out. On 15 hectares of land vegetables were planted so that employees were not distracted from public affairs. And they, what was the strength, checked stability, safety, braking system, reliability of the tray and the «sharoid». Each test car fit two passengers, however, only in the supine position.

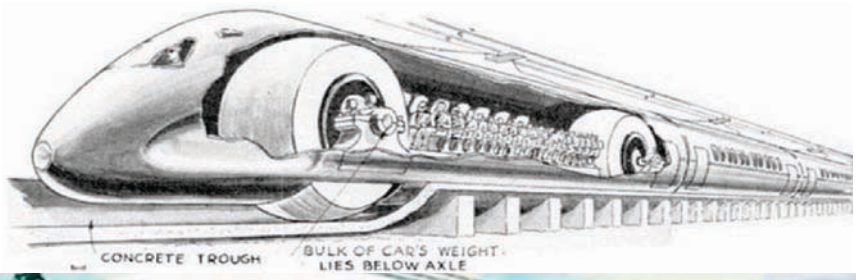
The correspondent of the journal «Knowledge is power» D. Lipovetsky was one of these passengers. Here is how he described his feelings: «When I got into a narrow trailer, I was tormented by doubts. It seemed to me that the train at high speed should jump off the tray, had to roll over. Nothing happened. Gently, slightly swaying, without the usual iron wheel overhang, the train swallowed space. On the curves, it automatically bent, maintaining balance, like a bicycle. The rubber-clad balls whirled noiselessly, carrying the metal snake forward with great speed».

The test results without delay were reviewed by an expert council headed by Academician S. A. Chaplygin. The conclusion was very positive. Its main meaning was as follows: it is necessary to build a ball tray road, no technical obstacles to this are «seen» by this council.

The revolutionary project also inspired Soviet poets. Vladimir Narbut wrote after his trip on the miracle train:

Along the shallow tray
(Almost a chute for a skittle)
It started up.
It flies under the hum,
A shell recalling a certain ...

On August 13, 1933, the Council of People's Commissars obliged by its decree the Commissariat of Communications to begin construction of the pilot-ball track road «as soon as possible». It was about the «medium size road», with reduced cars, with ball skating rinks with a diameter of two meters and a speed of 180 km/h. The construction of an «adult» road for trains with ball skating rinks with a diameter of 3 m 70 cm and a speed of 300 km/h was postponed to the near future. An experimental road would allow



These were intended to be a ball train (passenger cabin layout) and the end station of the experimental route.

one to gain experience in order to advance to super speeds.

It was required to find a suitable route. Two options were proposed: Moscow–Zvenigorod and Moscow–Noginsk. Preference was given to the second option. The new road was supposed to connect the industrial areas of Moscow region. In Moscow, the route started at Izmailovo, not far from the metro and tram stops. According to preliminary estimates, the ball trains could carry up to five million passengers a year.

The construction of the world's first tray road was planned to be completed by the autumn of 1934, by the 27th anniversary of 1917 October revolution in Russia. But the construction had not begun. Problems emerged that are common to all monorail systems. High cost, complexity of switches, icing of the tray in winter. Solving these problems required time and money, that were missing.

No matter what is your attitude to the very idea of a ball train, it is obvious that N. G. Yarmolchuk was a talented engineer, a pioneer in creation of an ultra-high-speed train. Some of his ideas formed the basis for design of hovercraft trains, rubber wheel covers are used in metro trains, streamlined cars and aerodynamic brakes have become common.

Alas, the ball train itself remained only an instructive page in the history of transport development. Test track near the station «Severyanin» was soon dismantled. The cars of the ball train apparently went for scrap.

Nikolai Yarmolchuk himself survived the war, participated in the battle of Kursk, received the Order of the Red Star, being a captain engineer, and then continued to work as an ordinary engineer on the railway.

In the 1950s, in his free time, he led a circle of young designers in the Baumansky District House of Pioneers in Moscow and never stopped working on his «ball project». Moreover, under his leadership, the guys from the House of Pioneers created a universal model of a ball train for driving on roads with any surface and it was presented at the World Festival of Youth and Students in Moscow (1957).

We note two other significant details. First: Nikolai Grigorievich Yarmolchuk, an engineer, on July 13, 1929, as the base of patents of the USSR testifies, filed an application for the invention of the transport system, and according to a message published on January 31, 1935, he was given a patent No. 96929. The second detail: in the Central Museum of railway transport (St. Petersburg) a separate exhibition is now devoted to the project of Yarmolchuk's ball train.

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