Republic of Belarus

OPEN JOINT STOCK COMPANY «NPO CENTER»

EQUIPMENT AND TECHNOLOGIES

Minsk


General director of NPO Center
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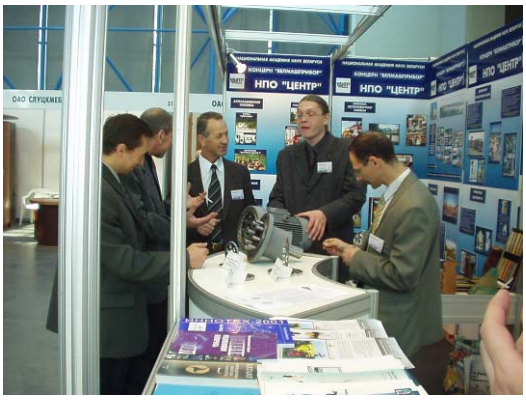


Open joint-stock company «NPO Center» was established in 1981 on the basis of a scientific subdivision of the Academy of Sciences of BSSR which was engaged in research of new technological processes. Within a short period of time the enterprise turned into a scientific and research, experimental and production centre to create a new generation of equipment for aviation, space and atomic industries. At that same time work was begun on creating the technological equipment for ore-dressing and processing industries. Even first models of crushers, mills, classifiers and centrifuges of centrifugal principle of operation proved to be a promising streamline.

At present «NPO Center» is both one of the biggest manufacturers of equipment for crushing, breaking and classifying different materials and a leading producer of centrifugal machinery in CIS countries territory.

A high scientific and technical potential of the enterprise and great experience in development and adoption of new technologies make it possible to create new equipment irreplaceable in many branches of industry.

Basic models of equipment, key technical solutions and developed manufacturing processes are patented and have no analogs.

Production facilities supplied with modern equipment furnishes an opportunity to perform all kinds of metal-working, to provide for manufacturing of large-size and advanced complexity constructions, production lines and complexes. The enterprise has the certificate on DIN 18800-7 class E confirming the right to manufacture and supply for export welded metal constructions.

In 2007 «NPO Center» got the certificate of conformity of quality management system to engineer and manufacture centrifugal machinery, medical refrigerator and laboratory centrifuges in compliance with STB ISO 9001-2001 requirements.

More than 450 units of crushers, mills, size-reduction complexes, classifiers and classifying complexes which are made in «NPO Center» are being successfully operated at the enterprises of Belarus, Russia, Ukraine, Estonia, Kazakhstan, Uzbekistan, Viet Nam.

Within a period of more than 25 years a united team has been formed which comprises not only workers of the enterprise but our customers and partners as well.

At present our company is a reliable partner for more than 100 CIS countries enterprises which identify us as a progressive, actively developing plant where advanced technologies are being developed and applied both in manufacture of modern equipment and in business management system.



«NPO Center» renders a full range of services associated with the application of our equipment and technologies:

- preliminary and laboratory testing on breaking, classifying and dewatering of your material with the run of our equipment which permits the optimal modes of operation of the equipment to be set and the actual results of this work to be presented to the customer with the characteristics of obtained material;
- the elaboration of the technological part of a production project;
- engineering, manufacturing and supply of equipment;
- installation and commissioning, training of operating personnel;
- warranty and extended guarantee, manufacture and supply of spare parts and lining elements.

High skill and a long standing working experience of «NPO Center» specialists give warranty to our clients for a qualitative execution of works and reliability of delivered equipment. We are always individually working with each customer and elaborate equipment and technological lines which correspond as much as possible to your exactly requirements.

The enterprise is always open for a mutually beneficial partnership and businesslike co-operation. A vivid example of such a co-operation is Scientific and Research Association «Ural-Center» which was established in 1991. It comprises:

- OJSC «NPO Center» (Minsk);
- Public Corporation «Ural-Omega» (Magnitogorsk);
- Joint-Stock and Production Centre «Uralmekhanobr-Engineering» (Yekaterinburg).

Scientific and technical co-operation of the three enterprises makes it possible to carry out efficiently before contract studies on the customer's material, to solve the problems of a comprehensive design taking into account both the demands of our customers and fitting out of the complexes with all the auxiliary systems. In so doing delivery on turn-key basis is provided as well as a prompt solution of warranty and after-sales service problems.




The impact mode for breaking down materials which is realized in centrifugal crushers and mills has great reserves for the increase in productivity of the processes of crushing and milling, the improvement in quality of the product, the reduction both in power consumption and in specific consumption of materials. In impact-centrifugal crushers the breakage of materials takes place through the impact of material against the impingement surface at its speedup in the field of centrifugal forces in the rotating accelerator. The process of breakage of the material by impact mode in comparison with the breakage due to shear stresses which takes place in cone and jaw crushers has a number of advantages:

- obtaining of the material mainly of regular cubical shape;
- improvement in strength of crushed material;
- selectivity in opening;
- a high degree of mechanical activation of freshly ground material.

Impact-centrifugal crushers make it possible to perform the operations of crushing of any hardness materials, abrasive difficult-to-machine materials including. The basis of «NPO Center» crushers' construction is a supporting assembly "on an air cushion" which enables the self-balancing system of the working unit of the crusher to be created as well as the stable work of the equipment to be maintained at considerable unbalances arising from the uneven wear of the working parts and the uneven distribution of the material. This gives decisive advantages to our crushers in comparison with both centrifugal crushers having supporting assemblies of rolling and conventional crushing equipment – cone, jaw, hammer and rotary crushers. The most considerable advantage is low capital and working costs which are under the influence of the following factors:

- to mount the crushes it is not required to have special foundations, they can be installed on an even site and at any level of a production building;
- the design itself secures simplicity and conveniences to do the job on the replacement of the lining elements in the accelerator due to unconventionally made assemblies and fastenings;
- it is not required to do a dynamic balancing of the accelerator after the lining elements have been replaced;
- the crushers show stable work without vibrations at unbalances reaching 2 kg;
- the cost of the lining elements is 3-4 cents per ton of the material being crushed;
- the grain composition of crushed material does not depend on the wear of the lining elements.

The general principle of operation of an impact-centrifugal crusher is shown in Fig. 1. By a high-pressure fan (8) in the chamber (7) the air pressure necessary for the «floating» of the rotor and for forming an air gap between the rotor (5) and stator (6) is generated. The originated air cushion under the rotor fulfils the role of a gas bearing. The unique construction of the crusher's working body is a self-balancing system and it secures a stable work of the equipment.

Through funnels (1) the source product is fed into the separating cone (2) which distributes the product evenly along the channels of the accelerator (3). Having got in the rotating accelerator peripheral velocity necessary for the ejection and respectively kinetic energy, the source material strikes against the crushing chamber surface (4) and breaks down. (See Fig. 2).

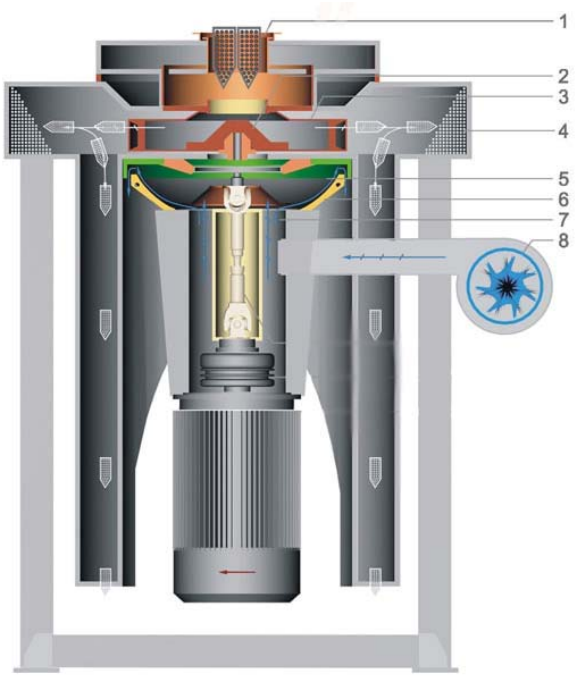


Fig 1

Fig 2

Technical properties

Description		Value			
Model		ДЦ-0,63	ДЦ-1,0	ДЦ-1.25	ДЦ-1.6
Throughput capacity, t/h		5-15	15-60	60-150	150-300
Max linear size of the feeding lump, mm		25	40	60	70
Electric motor power, kW		22-55	45-132	110-200	160-315
Overall dimensions, m	Length	2,1	2,8	3,2	3,7
	Width	1,7	2,4	2,8	3,2
	Height	2,2	2,4	3,0	3,6
Mass, t		2,5	4,8	9	13

Impact-centrifugal crushers make it possible:

- to break materials of any strength and hardness;
- to increase considerably the degree of crushing and to extend the range of controlling the fractions' content in the product;
- to redistribute the correlation of crushing and milling operations towards the increase of the former and to reduce the total costs for obtaining the final product;
- to reduce the feed-size of the comminuting equipment at further stages of the process of concentration and thereby to raise the productivity of comminuting redistribution by no less than 30%;
- at the cost of selectivity of impact breakage to start beneficiation at the stage of crushing;
- to obtain crushed rock with high consumer properties:

  - the content of prickly and plate-like particles in crushed stone corresponds to group I in compliance with State Standard 8267-93;
  - the strength of crushed stone is 10-15% higher than the initial strength;
  - the dustiness of finished fractions after screening does not normally exceed 1%;
  - the riddling (0-5 mm) which is obtained at screening of crushed product in its granule composition and isometric grain shape can be either an excellent filler material for road concrete mix or feedstock for obtaining high quality building materials.

Classifiers are intended to separate materials by size or density of the particles in the air flow. Our classifiers are characterized by:

- a high separation accuracy
- a possibility to provide the operation in a closed circuit without the removal of dust into the atmosphere;
- stability to obtain a pre-assigned granule composition;
- a possibility to regulate the borderlines of separation of the source product within a wide size range during the operation;
- low metal consumption and low power intensity.

Centrifugal classifiers

Air-centrifugal classifiers with a dynamic area of separation (КЦ) are applied to obtain fine-dispersed powders of a prescribed fractional composition within 10 up to 80 mkm size-range.

The operation of a classifier is based on separation of material into coarse and fine fractions at the cost of interaction between the field of centrifugal forces and the air flow.

The regulation of separation products size is done by variation in rotating speed of the accelerating rotor and also by change of the amount of the air flow.

Classifiers of this type are used to obtain high quality filler materials, pigments, high-brand cements, micro-talc and other materials.

The running of classifiers during a number of years has shown their high effectiveness, reliability in operation and simplicity in servicing.

Air-centrifugal classifiers with a static area of separation (КС) are applied to obtain fine-dispersed powders of a prescribed fractional composition within 63 up to 400 mkm size-range.

The separation of material takes place owing to the interaction between the centrifugal force and that of aerodynamic resistance which have an influence upon a particle of the material. Going through the tangentially installed blades a powder-gas flow begins to twist. Coarse particles are thrown off on to the periphery of a classifier under the influence of centrifugal forces and then they are sinking along the walls whereas fine particles are carried away from the classifier by the air flow and then they deposit in cyclones.

The regulation of separation products size is done by the change in the angle of installing of adjustable blades and in the amount of the air flow.

Classifiers of this type are applied, as a rule, in combination with the mills for the reduction of ore materials and non-metallic materials.

Technical properties

Description		Value					
Model		КЦ-0,3-1	КЦ-0,4-2	КЦ-0,6-5	КЦ-0,8-20	КС-2.001	КС-2.002
Productivity, t/h, not more than		1	2	5	20	5	20
Borderline size of separation products, mm		0,05-0,01	0,05-0,01	0,05-0,01	0,07-0,02	0,4-0,063	0,4-0,063
Air consumption, thou. m^3/h		2	5	8	20	6	22
Hydraulic resistance, kPa		1-3	1-3	1-3	1-2,5	1-2	1-2
Installed capacity, kW		2,2	7,5	11	15	-	-
Overall dimensions, m	length	1,4	1,4	1,7	2,3	1,2	2,4
	width	1,2	1,4	1,6	2,0	1,1	2,3
	Height	2,2	2,2	2,3	2,5	2,2	5,8
Mass, t		0,35	0,44	0,8	1,3	0,8	1,5

Cascade-gravity classifiers

Cascade-gravity classifiers are applied to separate coarse-dispersed materials into the pre-assigned fractions in the size-range between 0,16 up to 5,0 mm. The separation of material is accounted for by the interaction of gravitational forces field and the air flow. There has been realized a cascade system of separation in the design of the machine when the process of classification has many times repeating nature which makes possible a high precision of separation to be gained.

The advantages of cascade-gravity classifiers comparing to those of traditional sieves are in the absence of expensive wearing close-meshed sieves and vibration mechanisms at separation.

They make it possible to separate wastes of crushing into two, three and more fractions (see the Table). As a result building materials are obtained such as small-size cubiform crushed rock, building sands of specified fineness modulus, fine fillers for concretes and asphalts, filter and abrasive powders, etc.

Long-term running of «NPO Center» air cascade-gravity classifiers demonstrated their high effectiveness, reliability, simplicity in maintenance and a possibility to control fractional composition in a wide size-range without stopping the production.

Classifiers can be applied both independently and together with crushing and sorting lines which is more promising and makes it possible to provide non-waste production.

Technical properties of some classifiers

Description		Value					
Model		КГК-2.001	КГ-3.006	КГ-3.011	КГ-3.012	КГ-3.013	КГ-3.014
The number of separation products		2	3	3	3	3	3
Capacity as to charge, t/h		60	35	40	10	40	60
The size of separation products (can be regulated), mm		5-2 < 2	5-2 2-0,63 < 0,63	5-2,5 2,5-0,16 < 0,16	5-2,5 2,5-0,16 < 0,16	5-1,2 1,2-0,16 < 0,16	5-2 2-0,16 < 0,16
Air consumption, thou. m^3/h		30	28	25	9	25	31
Hydraulic pressure, kPa		2,5	2,0	2,5	2,5	2	2,5
Overall dimensions, m	length	2,5	2,2	3,0	2,4	3,6	3,8
	width	3,2	2,0	2,4	1,6	2,4	2,6
	height	5,5	7,0	7,6	5,8	8,2	8,3
Mass, t		4	2,3	3,5	1,6	4	4,2

Mills and grinding-and-classifying complexes to reduce ore materials and non-metallic materials

The process of fine grinding of ore materials and non-metallic materials in traditionally applied ball grinders and rod mills is characterized by high materials consumption and power-consuming. The grinded product obtained in these mills is characterized by a wide grain composition while its particles have a gravel shape which reduces physicochemical activity of the finished product. Impact-centrifugal mode of grinding which is realized in «NPO Center» mills (grinding complexes) is considerably devoid of these drawbacks.

Classifiers which are a part of the mills serve to withdraw the material of a required size from the zone of grinding and to return the underground product for re-crushing.

Such a layout permits cost-effectiveness of grinding and qualitative indices of obtained product to be significantly improved. The end-product size can be regulated in operation without shutting down the equipment.

The material obtained through «NPO Center» mills is distinguished for a narrow granulometric composition, a low content both coarse and fine fractions. Particles possess a uniform isometric shape with a well developed surface. It contributes to the obtaining of durable and qualitative goods at the reduction of material costs (binders, water) and power inputs.

Depending on the properties of materials, feed size and product size, productivity, requirements for mass and overall dimensions the mills can be of three design versions:

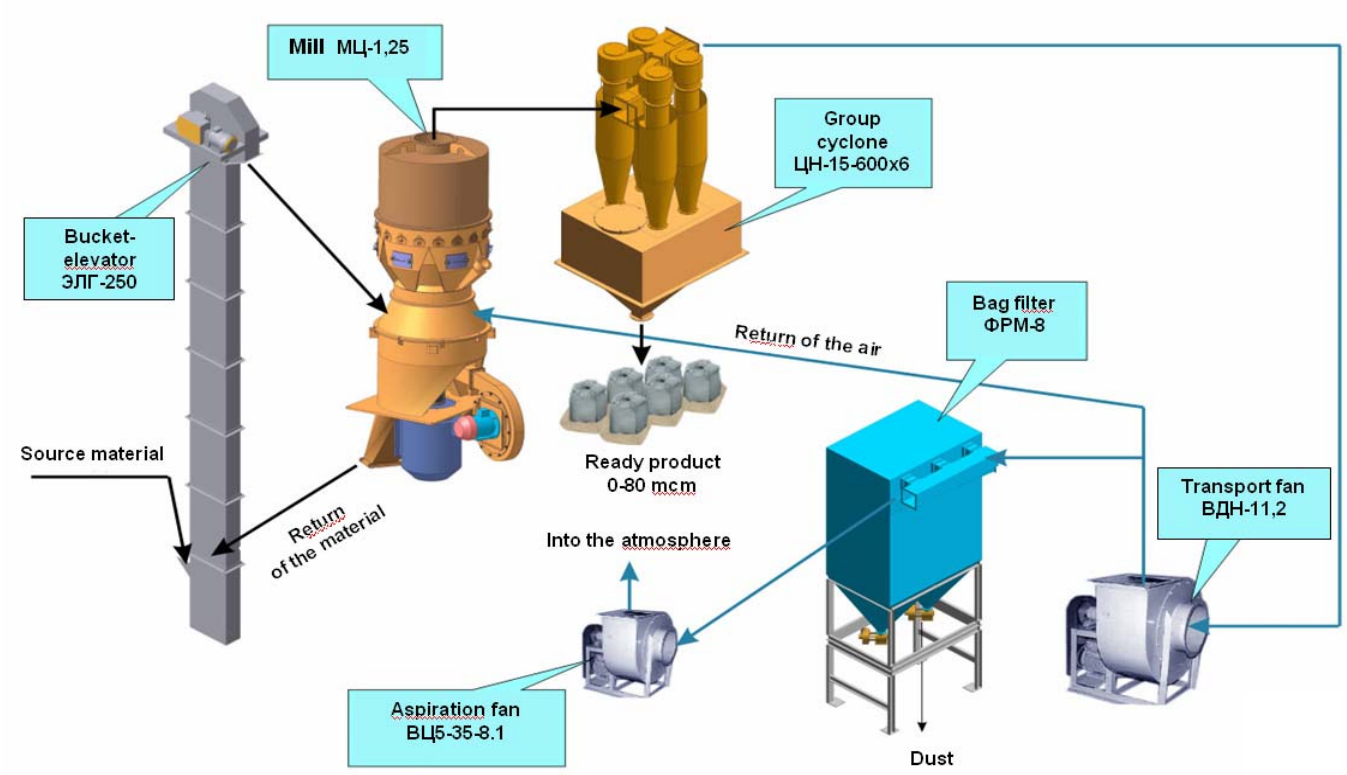
- with a built-in classifier;
- with a singly standing classifier;
- with a built-in and singly standing.

Basing on centrifugal mills «NPO Center» specialists developed different types of grinding complexes (КИ) representing a modular system of appliances (mills, fans, cyclones, filters, systems of automation and control) which are arranged and integrated in the most optimal way to secure high operational indices, simplicity and convenience in servicing, small occupied space and low power intensity.

Technical properties

Description	Value				
Model	**КИ-0,4**	**КИ-0,63**	**КИ-1,0**	**КИ-1,25**	**КИ-1,6**
Productivity, t/h	**0,05-1,0**	**0,5-5,0**	**1,5-10,0**	**3,0-20,0**	**5,0-25,0**
Feed size, mm, up to	**10**	**20**	**25**	**25**	**25**
The size of grinded product (is regulated), mm, not more than	**0-0,02…3,0**	**0-0,02…3,0**	**0-0,02…3,0**	**0-0,02…3,0**	**0-0,02…3,0**
Installed capacity, kW, Not more than	**40**	**160**	**290**	**430**	**520**
Overall dimensions, m, not more than: length x width x height	**5,0x4,0x4,1**	**11,0x4,0x8,7**	**14,0x7,0x9,0**	**15,0x8,0x10,0**	**15,0x8,5x11,0**
Mass, t	**3,5**	**14,5**	**21**	**40**	**50**

Flow diagram of the grinding complex КИ-1,25



Mills for food industry

Centrifugal mills for food industry are used to grind sugar, non-fat spices, cacao, coffee beans, herbs, dry fruits, farm grain products for mixed fodder, whole flower as well as to obtain powders from different materials of medium hardness, the initial size being up to10 mm.

With these mills the product of various fineness of grind can be obtained depending on the installed rotor system (agreed with customer). The machines have batching devices protecting the motor against the overload and improving the quality of milling of the product. The product can be discharged into bags, containers, bins, etc. The mills are easy to maintain, are reliable in service and they require minimal installation costs.

Technical properties

Description		Value			
Model		ДЦ-9613	ДЦ-9717	ДЦ-9612	ДЦ-08
Productivity, kg/h		200...500	до 2000	до 6000	8000
The size of milling, mm		0,05-0,315	0,1-2,0	0,1-2,0	0,1-2,0
Rotor:	diameter, m	0,34	0,46	0,6	0,8
	rotational speed, min^{-1}	6000	5300	3000	3000
Installed capacity, kW		7,75	15-18,5	56,5	75
Rated voltage, V		380	380	380	380
Overall dimensions, m: length x width x height		0,91x0,56x1,3	1,3x0,55x0,9	0,9x0,9x1,7	1,1x1,1x1,7
Mass, t		0,20	0,50	1,00	1,25

Centrifuges for filtration and dehydration

Centrifuges are a kind of equipment intended for filtration and dehydration of suspensions. The application of highly productive centrifuges contributes to the production process intensification.

Centrifuges are easy to integrate into the technological lines:

- on processing ore materials;
- on processing suspensions of micro-biological and cellulose industries;
- on processing food products;
- on treating the runoff of industrial plants and recovering industrial wastes.

The automatic centrifuge with side filtration and batch-type inertial discharge of sediment

The automatic centrifuge with side filtration and batch-type inertial discharge of sediment is intended for dehydration of hard-to-filtrate suspensions in food industry (suspensions of milk sugar, casein, malt-residue, potato, etc.), in chemical industry (ammonium sulfate), in mining industry (fluorite, quartz) and in other industries.

The possibility to detain the material in the centrifugal field at separation factor up to1500 g provides the obtaining of a required quality product as well as the treating of suspensions with S:L phase correlation = 1 : 2 – 1 : 50 and with the size of particles of the solid phase = 10 - 3000 mkm.

Liquid phase withdrawal is done uninterruptedly in the course of charging whereas the discharge of dewatered material, filtration and finishing squeezing – periodically.

The rotor filter element has a possibility of centrifugal regeneration of a filtering partition in the course of rotor discharge. Any type of a filter fabric as well as a metal net can be used as a filtering partition.

On the basis of these centrifuges there have been developed complexes to process potato, fruits and vegetables into dry semi-finished products. The application of this equipment provides a 4 - 6 times reduction in energy expenses to dry the product, the increase in quality and product output and the reduction in metal consumption. A wide application of such technologies will make it possible to reduce greatly fruits and vegetables storage losses.

Technical properties

Description	Value
Model	**ФВП901К**
Productivity on sediment, kg/h	**up to 600**
Rotor: diameter, m **rotational speed, min^{-1}**	**0,9** **1500**
Installed capacity, kW	**30,5**
Power consumption, kW	**17-18**
Pressure in pneumatic system, atm	**3-6**
Overall dimensions, m: **length x width x height**	**2,13x1,8x1,8**
Mass, t	**2,3**

In modern practice the obtaining of milk-protein concentrates assumes more and more importance. The appliance of centrifugesits obtaining makes it possible:

- to reduce protein losses by 70%-90%, to increase the yield of finished product by 8%-10% while producing wet milk-protein concentrates. When producing dry concentrates - by 18%-20%;
- to use an effective method to clarify whey and then make it ready for further processing as well as to expand its area of application;
- to perform sewage treatment.

Automatic centrifuges of blade type with inertial discharge of sediment

Automatic centrifuges of blade type with inertial discharge of sediment are designed to de-water coarse-dispersed materials in potash, mining, chemical, building and other industries. At separation factor 300 – 1100 g centrifuges permit suspensions to be treated with phase correlation S : L = 1 : 1 – 1 : 5, the size of solid phase particles being from 10 mkm. The centrifuges provide productivity as to sediment up to 50 t/h. For suspensions with S : L phase correlation above 1 : 5 the suggested scheme of separation allows to use the centrifuges as continuous thickeners.

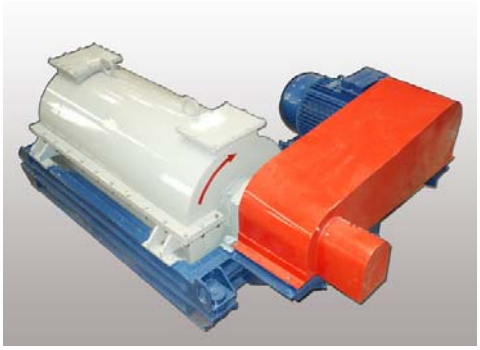
Technical characteristics

Description	Value	
Model	ФЦ 921	ФЦ 844
Productivity as to sediment, t/h	10	50
Rotor: diameter, m rotational speed, min^{-1}	1,0 1500	2,0 640
Installed capacity, кВт	37,5	215
Overall dimensions, м: length x width x height	2,8x1,8x1,5	5,0x3,6x2,4
Mass, t	1,60	15,00

The original supporting and rotor system of centrifuges provides a low level of vibration to give a possibility of carrying out their erection without special foundations on any level of a production area while arranging the technological lines.

The centrifuges feature stable work at the most unfavourable distribution of the material in the rotor, high maintainability and low capital and operating costs.

Sedimentation continuous scroll-discharge centrifuges



Sedimentation continuous scroll-discharge centrifuges are designed mainly to separate suspensions with an insoluble solid phase. They are applied to treat asbestos fibers, aluminum bromide, crystals of bi-aqueous gypsum, diatomite, carbon-graphite dust, calcium-sulfate colloids, carbamide, molybdenum acid, sodium sulfate, chalk, potash, starch, polyvinylchloride, sodium carbonate and other materials.

This centrifuge is intended to separate suspensions with solid phase of small and medium concentration, the size of particles being more than 5 mkm and the difference in density

between solid and liquid phase being more than 20 kg/m^3. When the centrifuge is operating a rather pure clarified liquid results as well as sediment of small humidity . The centrifuges differ from currently available equipment by the drive in which gear belt transmissions are applied instead of a planet gear. The centrifuges are easy to operate and maintain.

Technical properties

Description	Value	
Model	ЦОГШ-0,36.01	ЦОГШ-0,5.01
Productivity as to suspension, m^3/h	3 - 6	15
Operating body: Inner diameter, m Rotational speed, min^{-1}	 0,36 3385	 0,5 2650
Installed capacity, kW	30	37
Factor of separation, g	2300	1950
Overall dimensions, m: length x width x height	 2,5x1,6x0,8	 2,3x1,8x1,2
Mass, t	1,50	2,00

The centrifuge for liquid classification

For liquid classification in the field of centrifugal forces of synthetic micro-powders and natural diamonds, titanium carbide and other materials there has been developed the centrifuge PBK-01.

The centrifuge control system assures a smooth speedup with a specified rate – from 10 to 45 revs/sec, spin stabilization with ±2 % accuracy in holding the rotating speed as well as a smooth braking. The control system is interference resistant, operates successfully at ±15 % fluctuation of supply system and it does not require special skills in controlling and maintaining. Thanks to nearly total absence of vibration on the shell of the unit, the best chosen radius of the rotor and diameter of the glasses there is an increase in assured yield of components amounting to 25% as compared to any other analog. The unit is made complete with four quick-change inserts made from food stainless steel. The system keeps workability within the temperature rate of +5 - +50 °C and at humidity up to 80%.

Technical properties

Description	Value
The highest fill volume, l	6,4
Rotational speed of the operating body, min^{-1}	500 - 3700
The highest factor of separation, g	4500
Period of speedup as far as max rotational speed, not more than, min	4
Period of rotor braking from max rotational speed, min, not more than	5
The number of glasses in the operating body, pieces.	4
The number of quick-change inserts, pieces.	4
Density of classified disperse medium, not more than, g/cm^3	1,6
Duration of one cycle of centrifuging, min	0,1 - 99,5
Power consumption, not more than, kW	2,2
Max permissible balance weight of the glasses, g.	80
Overall dimensions, mm: length x width x height	 990x780x870
Mass, t	0,33

For more than 10 years "NPO Center" has been engaged in development, production, servicing and maintenance of medical and laboratory centrifuges. Proper certificates and licenses of the Republic of Belarus are available.

Refrigerating and laboratory centrifuges

At present refrigerating centrifuges ЦР-01 and ЦР-02 and laboratory centrifuge ЦР-02Л are produced in lots. They are intended for blood and its components fractionation as well as for a biochemical research.

ЦР-01 и ЦР-02 refrigerating centrifuges are designed both for blood and its components fractionation and for a biochemistry research.

ЦР-02Л laboratory centrifuge is intended for a biochemical, laboratory and clinical research.

The centrifuges are fitted with micro-controller modules providing the following functions:

- a smooth controlled rotor speedup, spin stabilization with ±2% accuracy and braking with a specified rate;
- control over the operational period of the centrifuge with the precision of ±1 sec;
- all required protection levels in case of emergency.

Refrigerating centrifuges have the function of temperature control inside the unit with the preset accuracy from ±1 ° C up to ±3 °C.

The workability of both the centrifuges and their control systems survives within + 5 - + 50°C temperature range.

There are additional service functions:

- memory for 20 programmes of operating modes;
- the diagram for the current operating mode of the unit displaying the state of work;
- a possibility to convert the rotational speed into the separation factor and vice versa;
- a possibility to convert time into the integrated factor and vice versa.

Technical properties

Description	Value		
Model	**ЦР-01**	**ЦР-02**	**ЦР-02Л**
Rotational speed of the operating body, min^{-1}	**500 – 3200**	**500 – 6000**	**500 – 3600**
Working range of chamber thermostating depending on the rotational speed, ºC	**-10 - +25**	**-10 - +25**	**-**
The highest factor of separation, g	**3145** (4-glass rotor) **3700** (6-glass rotor)	**6700**	**3100**
Power consumption, kW, not more than	**5,5**	**4,0**	**1,5**
The highest fill volume	**9,6 l**	**9,6 l**	**60 test tubes with up to 18 mm diameter**
Overall dimensions, not more than, mm: length x width x height	**960x740x910**	**960x740x910**	**670x525x516**
Mass, kg, not more than	**250**	**250**	**80**

ЦВ-01 high-speed centrifuge

The centrifuge is intended for the research of physical properties of proteins, nucleic acid and different biological substances. The centrifuge can be equipped with an angle rotor and a bucket rotor.

Technical properties

Description	Value
Model	High-speed centrifuge ЦВ-01
Rotational speed of the operating body, min^{-1}	500 – 15000
The highest factor of separation, g	30000
Period of rotor braking from max rotational speed, not more than, min	3
Duration for one cycle of centrifuging, min	1 – 60
Working temperature range of chamber thermostating, °C	-4 - +20
Permissible balance weight, g	2
Power consumption, not more than, kW	2.0
Max rotor capacity, ml	600
Overall dimensions, not more than, mm: length x width x height	670x525x516
Mass, not more than, kg	100

Unbalanced-throw screen

«NPO Center» constantly improves and increases the range of output. Among the new developments of the enterprise are the unbalanced-throw screens. They are designed to separate mechanically into fractions crushed rock, sand-gravel mixture and other loose materials. The screens can be used both independently and in technological lines of crushing and classification which are engineered by «NPO Center».

Technical properties

Technical characteristics of the screen	ГИ-01 (ГИС-43)	ГИ-02 (ГИС-44)	ГИ-03 (ГИС-53)	ГИ-04 (ГИС-52)	ГИ-05 (ГИС-42)	ГИ-06 (ГИС-33)	ГИ-07 (ГИС-53)	ГИ-08 (ГИС-52)
Permissible load, t/h	180	180	220	220	180	130	220	220
Max size of the material*, mm	100	100	150	150	100	100	150	150
The sizes of the screening surface,m^2 (m)	6,75 (1,5x4,5)	6,75 (1,5x4,5)	8,75 (1,75x5)	8,75 (1,75x5)	6,75 (1,5x4,5)	3,75 (1,25x3)	8,75 (1,75x5)	8,75 (1,75x5)
The number of the screens' decks	3	4	3	2	2	3	3	2
Tilting angle, °	15±5	15±5	15±5	15±5	15±5	15±5	15±5	15±5
Drive power, kW	11	11	15	15	11	11	15	15
Overall dimensions (length/width/height) in run position (15°), mm	5066 3000 3010	5066 3010 3420	5550 3255 3137	5550 3255 2930	5066 3215 2798	3617 2778 2619	5550 3265 3160	5550 3265 2950
Overall dimensions in transportation (length/width/height), mm	5641 2030 1630	5748 2030 2030	6143 2518 1631	6042 2518 1431	5587 2318 1431	4141 2023 1630	6150 2530 1650	6050 2530 1450

* - it depends on complete equipment of the screens

Air filter

Air filter is designed to clean non corrosive, non explosive, indisposed to adhesion and to condensate generation gas from fine-dispersed dust at a temperature up to 100 °C. Regeneration system of filter elements is fitted to the filter employing air pressure and offering freedom of compressed air supply.

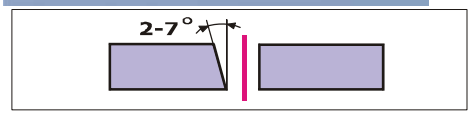
Technical properties

Productivity as to the gas being purified, m^3/h, not more than	8000
Area of filtration, m^2	120
Permissible pressure (discharge) inside the filter, kPa	5,0
Inlet mass concentration of dust g/m^3, not more	50
Installed capacity, kW, not more	2,0
Degree of cleaning, %, not less	99,5
Hydraulic resistance, kPa	2,0
Overall dimensions, mm length width height	 4550 2450 6200
Масса, кг, не более	4400

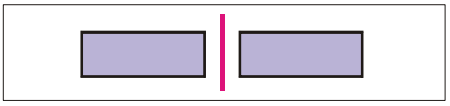
Automated complex for plasma cutting

The complex is intended for the automated figured and linear cutting of sheet metal-roll from corrosion-proof metals, ferrous and non-ferrous metals. It features a high productivity as well as a guaranteed quality.

Gases in use:
- the mode of gas cutting – acetylene, propane, natural gas
- the mode of plasma cutting – O_2, $Ar/H_2/N_2$, Ar/N_2, Ar/H, air



FineFocus Plus cutting techniques. The deviation of the right edge of the cut from perpendicular is from -1 up to +2°



HiFocus Plus cutting techniques. The deviation of both edges of the cut from perpendicular is within -1 up to +2°. Enhanced tightness of the arch. Improved quality of the cut.

Technical properties

The width of the bench for cutting, mm	2000 (2500, 3000)
The length of the bench for cutting, m	3-12
Max speed of cutting, mm/min	8000
Cut accuracy	A EN ISO 9013
Thickness of the metal being cut: - plasma - gas welder	 0,5-80 20-250
Angle of inclination, degree	0-45°
Depending on the customer's requirements plasma cutting complexes of other types and sizes can be made to solve different technological problems.	

Technologies to concentrate minerals

The most energy-intensive process at preparation of mineral raw materials to beneficiation is the process of comminuting. It is this process that defines a final performance of concentration as far as it has been at comminuting when the opening of minerals occurs while the quantity of unopened joints of both ore and non-metallic minerals defines the quality of the final concentrate. It is obvious that if at the stage of preparation of mineral raw materials to beneficiation, just at crushing and comminuting, there have been already created conditions for a selective opening of minerals then the effectiveness of the process of beneficiation itself will increase several times.

In jaw and cone crushers, in ball and rod mills which are a traditional equipment for the most of ore-dressing and processing enterprises it is a problem to realize a principle of a selective opening of minerals because the failure of minerals in them takes place at the cost of static forces of crush, shear, attrition. At this mode of breakage a great number of joints survive which hinder the entire further process of beneficiation. Besides, this method is rather energy-intensive.

The impact mode for breaking minerals embodies a great reserve in increasing the productivity of concentrating equipment, in improving the quality of final product, in reducing energy intensity and materials consumption of the process of beneficiation. In impact-centrifugal crushers the breakage of minerals takes place at the expense of a free impact of the material against the impingement surface. At this mode of comminuting:

- the failure of the material is found along the micro-fissures, margins of cohesion. This implies that a selective comminuting of minerals which have a different resistance to impact takes place. The share of joints which sharply reduce the efficiency of beneficiation process is minimal therewith.
- the overgrinding of the products as well as their sliming up does not take place which is typical for grinding in ball mills; a better opening of mineral grains is attained at more coarse grind as compared to a ball grinding. It is proved by repeated comparative tests at comminuting of ores of different metals;
- the content of slime fractions (less than10 mkm) in the ground product significantly goes down which is conditioned not only by the increase in coarseness of grinding but by the impact mode to crush the material itself with the immediate withdrawal of the crushed product from the grinding chamber into the classifying zone.

The increase in coarseness of the reduction product as well as a drop in the content of slime fractions make it possible to switch to a dry methods of beneficiation for a lot of minerals as well as apply more widely gravitation methods at the first stage of concentration which makes cheaper ore processing. With this water is excluded from the technological process as well as the operation on dehydration. Air classifiers can be used to extract minerals into concentrate at the stage of comminuting, to separate into wastes small fractions of the ground ore with a dump content of useful components. As a result the necessity to locate the additional equipment stands no longer while the quantity of the material arriving for concentration reduces.

Similar technologies have already been introduced at a lot of enterprises of ore-dressing industry. Positive results have been obtained on applying «NPO Center» equipment in the technological lines at dry methods of concentration.

Iron ore concentration

For concentrating mills with the combined methods of concentration the application of dry methods at early stages makes it possible to separate up to 50% of dry dump wastes.

The results of dressing of titanium-magnetite ores (Kachkanar ore-dressing and processing enterprise) by a combined method including impact crushing and dry magnetic separation of the ground material as well as by the current method are given in the Table.

Products of concentration	Combined method			Current method		
	Yield, %	Content Fe, %	Extraction Fe, %	Yield, %	Content Fe, %	Extraction Fe, %
Concentrate 95% class 0–0,071 mm	16,56	64,3	69,05	15,91	62,8	64,83
Wastes of dry concentration	42,33	5,34	14,68	8,0	8,0	4,15
Wastes of wet concentration	41,11	6,1	16,27	76,09	6,28	31,02

Manganese ore concentration

At present a concentrating mill for dressing carbonate manganese ores is operating in the village of Polunochnoye (the Northern Ural). It was engineered and built with the application of completely dry concentration technology. The application of this technology for carbonate manganese ores dressing made it possible to obtain the concentrate with manganese content of no less than 30% (in the source ore – as much as 19%), at it extracting into concentrate – 79% and tails with manganese content as much as 8 %. This technology is developed for the first time and is far superior in its parameters to the conventional patterns of concentration. The obtained concentrate is a conditional product for metallurgy industry while the concentration wastes are used building materials industry.

The application of dry technology of electromagnetic concentration of oxidized manganese ores (the Southern Khingan, the content of manganese – up to 20%) made it possible to obtain the concentrate with 42-44% manganese content, at its yield up to 35%, with manganese extraction of about 75%. The obtained tails therewith in the amount of 64-66% have the content of manganese as much as 8%.

Beneficiation of gold-bearing ores

In the flow-sheets to prepare auriferous ores for beneficiation the air classifiers are applied not only for size-separation of the material but for a prior concentration as well: the extraction of coarse gold into concentrate at the stage of comminuting, extracting into tails of small fractions of ground ore with waste content of useful components. As a consequence the necessity to install nugget traps stands no longer and besides the quantity of the material entering for beneficiation is going down.

The studies carried out on gold-quartz and gold-sulfide-quartz ores showed that the application of impact-centrifugal crushers permits the share of the opened gold in the ground product to be increased from 5 up to 25% (relatively) as compared with the conventional crushers and mills. At the same time there is a cutting of capital and operational costs.

There was also a research on dry concentration of auriferous ores of some deposits. Thus, for example, the analysis of the end products of concentration of Beriozovsky deposit (the Ural, Russia) by dry methods showed that the content of gold in the obtained concentrate came to 100 – 120 g/t at 95 – 98% extraction (the content of gold in source products - 8,3 g/t).

Technology to obtain cubiform crushed rock

Owing to high consumer properties of the crushed rock obtained through impact-centrifugal crushers, its cubiform shape as well as the advanced surface activity of the particles, its application at concrete production, highway engineering, at manufacture of building constructions makes it possible to reduce significantly material and technical resources, to increase the quality of the articles produced.

The technology in question as well as the equipment which is manufactured by «NPO Center» are successfully applied while producing cubiform crushed rock from porphyrite, diorite and other materials for highway engineering in Belarus, Russia, Ukraine and Kazakhstan.

The advantages of cubiform crushed rock application

At highway construction:

In road surface building of great and special importance is a shape of pebbles 2-5, 5-10, 10-15 mm in size which is used for an upper strengthening layer of the road surface. The layer defines the longevity and quality of the road.

The application of cubiform crushed rock at highway engineering and manufacturing of building constructions makes it possible:

- to reduce crushed rock consumption;
- to reduce bitumen and emulsions consumption up to 30%;
- to reduce time and labour expenditures up to 50% at placing asphalt concrete surfacing;
- to reduce cement consumption;
- to increase several times the service life of a road surface;
- to increase a cohesion factor up to 0,65-0,71.

In production of concrete

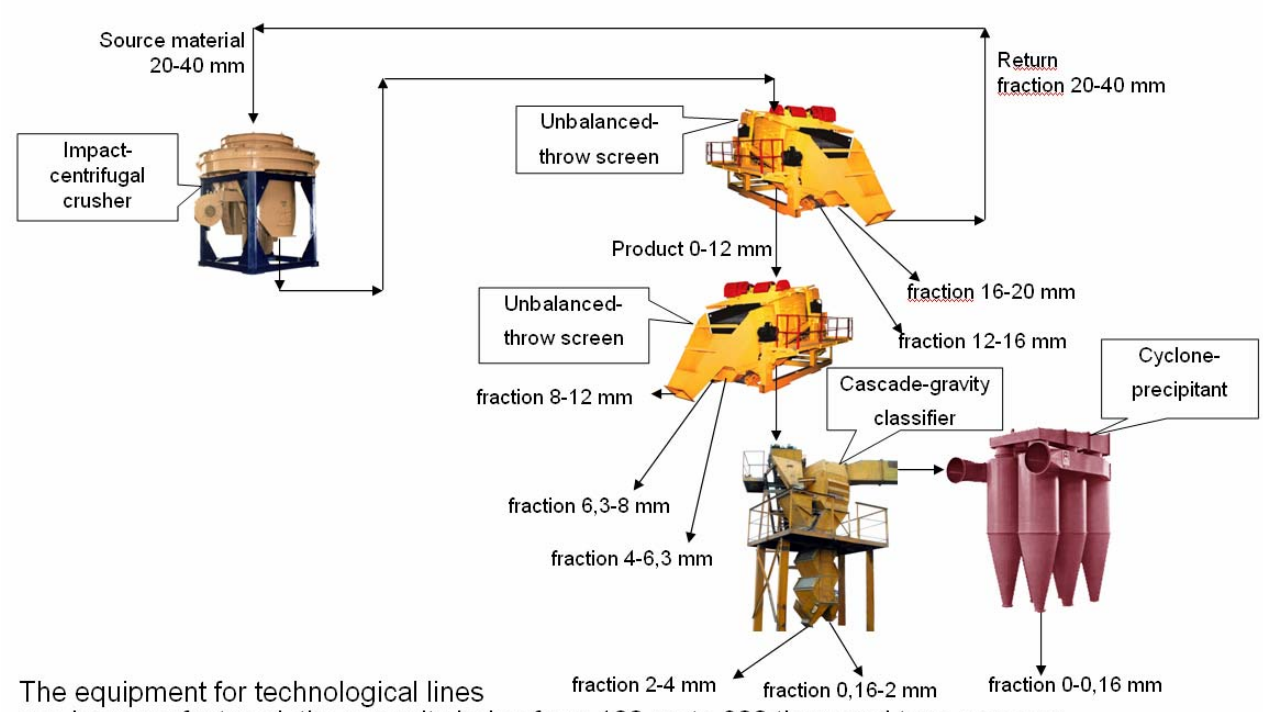
To ensure a high quality of concrete of great importance is a shape of particles of coarse aggregate (crushed rock). It is not to have more than 15% (as to mass) of the grains having a plate-like and a prickly shape.

The conducted tests showed that the application as aggregate of crushed rock obtained by impact-centrifugal crushing makes it possible:

- to reduce water requirement of concrete mix by 3%
- to reduce cement consumption by 5-10 kg/m^3;
- to improve the strength of concrete;
- to cut energy expenses for manufacture by 2,5% on the average, to reduce concrete prime cost by 3% on the average.

It was determined that the application of cubiform crushed rock resulted in the reduction of cement consumption per unit durability of concrete by12,5%.

Technological layout to obtain cubiform crushed rock



The equipment for technological lines can be manufactured, the capacity being from 100 up to 800 thousand tons per year.

Technology to produce man-made sands from the siftings of crushing of the rock

Sand is an indispensable component of practically all the building materials. The rate of growth of road building and the production of reinforced concrete constructions conditioned the rise in demand for construction sand. At the same time the extraction of natural sands often involves the disruption of environmental conditions of some areas. It also destroys the ecosystem of riversides, causes the washing out of the beaches, the formation of landslips, wedging out of the underground water. At quarrying the organizations pay the mining tax and conduct activities on environmental protection. In some countries of the world the natural sand production is under a ban at all.

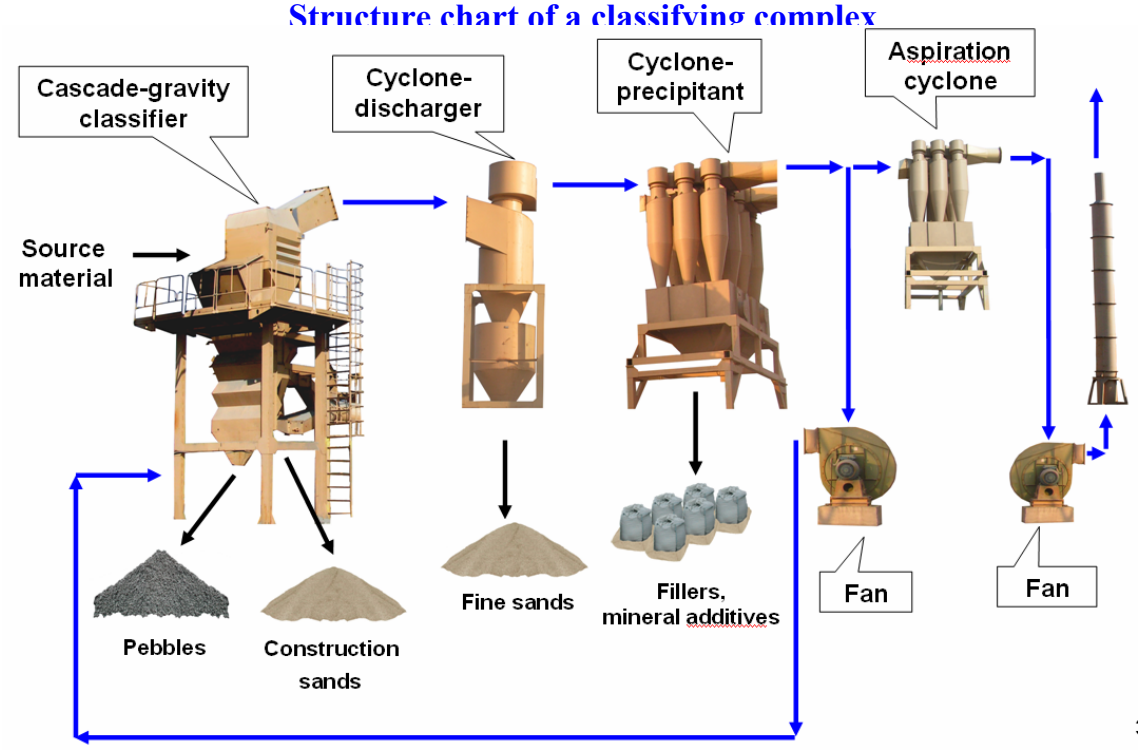
At the same time a great amount of siftings of crushing which result from the processing of the rock are not used in full and are often assigned to wastage. They are stored in slag-heaps and this leads to the environmental pollution while they could become marketable products which price is many times higher than that of the siftings.

After the siftings are processed through the classifying complex it is available to obtain pebbles, construction sands, fillers and other materials. The essential part of the line for obtaining man-made fractionated sands is a multi-product air cascade-gravity classifier which makes it possible to separate the siftings into the required number of fractions. The installation of only one line on siftings classification permits the obtaining of about 200 thousand tons of commercial output per year.

At present, man-made sands have already been successfully applied in manufacture of building materials. In so doing the quality of the materials based on man-made sands occurs in most cases higher than that of similar materials based on the natural sand.

The carried out research showed that the bending strength of fine-grained concrete based on the sand crushed through the impact-centrifugal crusher outperforms by 36 % a similar index of the concrete based on the bank sand. With this, the concrete based on the sand crushed in the cone-inertial crusher has the excess in strength by 29 %. A similar relationship is true also for a durability factor of fine-grained concretes at compression resistance.

Structure chart of a classifying complex



The fractionation of powder aggregate is one of the promising aspects in improving the quality of building materials. It is found that fractionated sands permit the obtaining of the concrete which surpasses in durability the concrete with both bank sand and not fractionated crushed sand or to provide cement saving. Thus, to obtain concrete durability unit (1 MPa) with the crushed fractionated sand the demand for cement is 19 % less comparing to the concrete with the bank sand and 17 % less comparing to the concrete with the non fractionated crushed sand.

Technology to obtain cement of centrifugal-impact grinding

The technology of milling of Portland cement clinker through КИ complexes provides the obtaining of ПЦ400 and ПЦ500 cement brands according to the State Standard 10178-85. The proposed technology has a number of advantages comparing to a ball milling:

- specific consumption of electricity for milling of Portland cement clinker in a centrifugal-impact mill is 12-18% lower than that of a ball mill;
- the concrete mixes based on cements of centrifugal-impact milling are characterized by lesser water requirement (by 4-6 l/m^3) and by lesser cement consumption (by 7-13 kg/m^3);
- there is a possibility for centrifugal-impact mills to regulate the size of particles of the obtained product.

The technology to obtain mixed Portland blast-furnace cements (Pbfc) is developed by «NPO Center» specialists, too. The performed tests on Pbfc in hard concretes of classes B 12,5 и B 7,5 showed that the concretes have standard physical & mechanical and operational characteristics. The proposed technology makes it possible to reduce significantly the cost price of produced material.

The technology to obtain mineral additives from the used agglutinant sand

At foundries a great amount of the agglutinant (burnt) sand is generated which is unfit for further production. It is taken out to slag-heaps and is buried in special mortuaries. Enterprises bear great expenses in the form of payments both for the waste burial and for the transportation to the place of burial.

The research done by the Byelorussian National Technical University in collaboration with the specialists of the Republican Unitary Enterprise «Belorussian Road Research Institute» and «NPO Center» made it possible to develop the efficient method to obtain the activated mineral powder by fine milling of the agglutinant sand. The mineral powder can be a full value equivalent for a dolomite mineral powder which is now used in highway engineering. The presence of organic binders on the surface of the powder affords 10-20% economy of bitumen and permits the process of bitumen aging to be slowed down. Roadway coverings built with the usage of quartz activated powders are more durable.

Mineral powders are a scarce material which is used in the production of road concrete mix and that is why a considerable part of asphalt concretes is produced without them. It causes their high porosity and fast disruption especially due to the cycles of freezing-defrosting. All this leads to the improper state of roadway coverings and heavy expenses for their repairs.

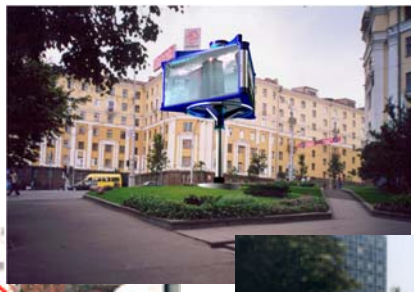
Hence, the production of powders from the used agglutinant sand will make it possible to expand greatly raw materials base of highway engineering, to improve the quality and service life of roadway coverings.

Besides, up to15 % of coarse mineral material (sand) obtained after comminuting can be used as a return material together with the supplied sand in foundry at preparing the agglutinant sand which will be rather economically effective.

According to the calculations done by the Republican Unitary Enterprise «Minsk Tractor Plant» the period of recoupment of a complex to obtain mineral additives from the used agglutinant sands will be less than a year.

Outdoor advertising equipment and small architectural forms

One more line of «NPO Center» activities is designing and manufacturing of outdoor advertising equipment and small architectural forms. Since 1995 the enterprise has produced more than 4000 units of this type of equipment: various billboards, two-side advertising displays with illumination, public transport shelters, different kiosks, telephone booths and so on.



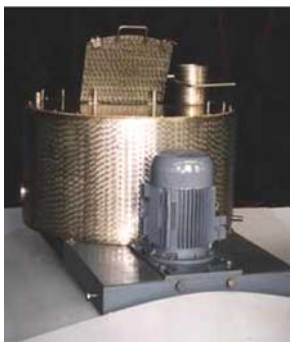
Technological equipment and metalwork

In recent years «NPO Center» has been actively developing the production of different technological equipment of both own design and according to the customer's design. A case in point is a range of machines to manufacture plastic windows, the lines to shape metal sheets which are made in collaboration with a French firm «DUBUS»; mixers for food industry, УД-2500 hose sprinkler system, the mobile unit to utilize organic wastes.

The enterprose manufactures different metalwork to put up and finish buildings and constructions. These articles were applied while constructing the buildings of the Railway Station, the National Library, Metro stations, sports structures, Minsk streets and squares as well as giving these projects an attractive appearance.

THE LINE TO SHAPE METAL SHEETS

УД-2500 HOSE SPRINKLER SYSTEM



MIXER FOR FOOD INDUSTRY

MOBILE UNIT TO UTILIZE ORGANIC WASTES

The groundwork and experience on designing and manufacturing of different centrifugal equipment, test stands to investigate the effect of overloads on materials and people in the outer space made it possible to master the output of attractions which are placed exacting requirements upon reliability and safety of their constructions.

As for now, «NPO Center» has manufactured and installed more than 150 attractions which decorate a lot of parks in such cities of Belarus, Russia and other CIS countries as: Minsk, Moscow, Anapa, Pyatigorsk, Surgut, Stavropol, Novosibirsk, Akmola, Rostov-on-Don, Samara, Lipetsk, Karaganda, etc. Some attractions were sold to the countries of far abroad – the USA, Germany, the Netherlands.

MERRY-GO-ROUND "VZLIOT"

MERRY-GO-ROUND "WALTZ"

GIANT SWING "ZUBR"

CHAIN-TYPE MERRY-GO-ROUND

WATER SLIDE «RUCHEYOK»

LOCOMOTIVE "EXPRESS-CHAUSSEE 2"

MONORAIL ROAD FOR VIEWING

PLEASURE TRIP COACH "ALYONUSHKA"

CENTER

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