- improvement in the quality indices of the equipment developed and the material produced;
- development of equipment for the production of new forms of nonwoven material, including the "melt blown" type;
- development of equipment for light-duty needle-punched and heat-bonded materials (including fibre-reinforced ones);
- development of equipment for the production of bulky spun articles (gloves and the like).

CONCLUSIONS

Domestic equipment has been devised for the production of needle-punched nonwoven geotextile materials from second-grade polycaproamide or fibre-forming polypropylene.

The geotextile materials produced are promising for use in construction of roads, foundations of buildings, in hydrotechnology, and in land reclamation.

Promising trends in the development of equipment for preparing spun nonwoven materials have been noted (light-duty needle-punched or heat-bonded materials, bulky spun articles, etc.).

Coworkers of the Kemerovskii and Kamenskii "Khimvolokno" IAs the "Khimtekstil'mash" SIA, the VNIISV, the GIPROtyumenneftegaz, the SoyuzdorNII, and the "Plastpolimer" SIA took part in this work.

LITERATURE CITED


SYSTEM FOR AUTOMATED DESIGN OF EQUIPMENT FOR THE MANUFACTURE OF NONWOVEN MATERIALS FROM POLYMER MELTS

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UDC 677.494.066: 658.512.2

The contemporary level of scientific-technical progress presents qualitatively new requirements on the organization, methodology, and technical assimilation of work associated with development of equipment for the manufacture of man-made fibres. The most refined form of approach to design of equipment is the development and use of objectively-oriented systems of automated design (SAD) for a specific form of equipment. Such systems have been devised, based on known information from theoretical and experimental studies, mathematical models of technological processes, the use of contemporary methods of applied mathematics, and packages of applied programs, and the use of means of computer technique and design automation.

The choice of equipment for the manufacture of spun nonwoven materials (SNM) as objects for the development of SAD is brought about, primarily, by its theoretical readiness, and by results of studies of process and devices as elements which make up the basis for preparation of a nonwoven material from a polymer melt. Among such elements of the process of preparing a nonwoven material are the process of yarn spinning, the aerodynamic stretching device (ASD),

The SAD developed for SNM permits one to carry out design of the SNM in practically all basic typical stages of designing engineering articles: predesign studies, technical assignment and technical assumptions; preliminary, technical, working project, tests, and introduction.

In the first three stages, down to technical assumption, the basic principles of constructing a machine or line for the manufacture of nonwoven material are determined. Thereupon, by use of computers, on the basis of mathematical models (MM) of the processes of yarn spinning and fabric formation, and also of theoretical and empirical models of ASD, the fundamental parameters of the basic units and of putting them together are evaluated, plus general requirements on the machine, yarn, and fabric. Design analysis problems are solved — quantitative evaluations of the process indices as a function of the conditions under which they take place.

At the draft project stage, the MM serves for checking the correctness and realizability of the basic principles and assumption which determine the functioning of the article being designed.

In technical design using SNM SAD, an all-around analysis is performed for the parts of the project, which include spinning, yarn stretching and laydown, and fabric formation. Problems of parametric synthesis are solved — determination of numerical values of parameters of the SNM, and a search for their optimum values. Data are prepared for setting up a calculation-explanatory record.

In the stage of operating design, verifying calculations are performed.

In testing the equipment, the system performs a mathematical treatment of the experimental data and carries out statistical evaluations of serviceability and reliability.

The structure of an SNM SAD consists of four design subsystems: a yarn spinning process subsystem (YSP), an aerodynamic stretching subsystem (ASS) carried out in the ASD; a fabric forming process subsystem (FFP); and a subsystem for evaluating technical and economic indices (TEI) (Fig. 1). Each of the design subsystems includes a common component — the "economic indices" (EI). Moreover, the system includes the following assurance subsystems: MA, mathematical assurance; TA, technical assurance; PA, program assurance; MTA, method assurance; LA, linguistic assurance; IA, information assurance, and OA, organizational assurance. We shall examine the MA, TA, and PA subsystems in more detail.

Mathematical assurance includes MM for the processes of yarn spinning, aerodynamic force action on the fibre by air in the ASD and formation of the nonwoven fabric.

The MM of the YSP is a system of differential equations which describe the internal deformation of the liquid-plastic jet of the polymer being spun and heat-transfer in it, and