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TRAINING OF SPECIALISTS IN THE FIELD OF INTELLECTUAL PROPERTY PROTECTION AND INVENTION AT UNIVERSITIES FOR MINING ENGINEERING

The relevance of training mining engineering specialists in the field of intellectual property protection and invention is demonstrated. The invention and intellectual property survey of students studying mining, geology, oil and gas exploration and development, etc. at the Russian universities is presented. The major problems connected with the lack of student training in the area of intellectual property protection and invention are discussed. The authors proposed two ways of solving the problems so that to provide mining engineers with applied training in the sphere of intellectual property protection. One of the lines of training is the analysis of the current engineering solutions and advance inventions of the biggest mining and metallurgical companies, which enables learning of underlying principles of patenting of engineering solutions. The second line is teaching of invention philosophy so that students of various specializations in mining engineering improve existing engineering solutions; in this case, even minute improvements of a pilot plant or a technology should accord with the protection documentation rules. In the course of the suggested mode training, students will learn to apply their basic knowledge in the related branches of industry and to disclose new objects for improvement.

Key words: *higher education, engineer, personnel training, mining engineer, invention, patent, intellectual property protection*

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Introduction

The ratio between the extraction and recovery of renewable resources as well a between the volume and rates of mining of nonrenewable mineral wealth is not always optimized and based on scientific evidence [1–3]. In view of deficiency and nonrenewability of minerals, efficient use of natural resources becomes of increasingly higher concern. In this case, the problems connected with introduction of new resource-saving and low-waste technologies, integrated processing of minerals, new approaches to ore concentration and rational use of underground excavations, etc. are successively solved [4–13].

Progression of Russian mining and processing industry toward innovations is confirmed at the annual meetings of the Federal Service for Intellectual Property (Rospatent) and representatives of the biggest energy companies, namely, Gazprom Neft, Transneft, Power Machines, SUEK, SDS Ugol, Mechel, Kuzbassrazrezugol, etc. The late meeting held in October of 2017 in the framework of the Russian Energy Week International Forum focused on the problem of intellectual property control, technology transfer and brokerage, patent strategies in the sphere of intellectual property, etc. at state corporations. Experience of the energy companies shows that sound management of intellectual property increases effectiveness of investment and R&D projects, provides a company with extra drivers of economic advance and is a key competitive advantage on the domestic and external markets, thus generally improving performance capabilities of the company [14].

It should be emphasized that many energy companies in Russia largely undertake exploratory studies and R&D. For instance, SUEK-Kuzbass has a long list of R&D projects for 2018, namely: “Scientific guidance of preparation and development of longwalls 400 m long, with integrated research and elaboration of measures to ensure high productivity of Yalevsky Mine”, “Introduction of dust reduction method for development heading in coal mines of SUEK-Kuzbass”, “Scientific guidance of introduction of research findings on reduction in drilling meterage and explosive consumption in rock fragmentation by blasting”, “Integrated utilization of directional drilling process capabilities with a view to increase production face output”, “Development and substantiation of engineering solutions on utilization of fine coal washing waste of SUEK-Kuzbass”, etc. [15].

The topics of the research projects listed above prove that energy companies are highly interested in innovative technologies as well as in their patenting. Accordingly, the question of personnel potential comes up and the main point is whether it is of the current concern to train mining engineers to deal with the directly related scope of activities and, also, to operate in the sphere of invention and intellectual property protection? In the meanwhile, the problem of training students in the sphere of intellectual property protection and inventive act is extensively discussed on the margins of different-level forums and international scientific–practical conferences worldwide [16–18].

The currentness of student training in the field of invention and intellectual property protection is confirmed by the personnel training philosophy of many large companies. The most illustrious example is Gazprom Neft aspiring to reveal and protect unique technologies. In 2015 Gazprom Neft launched the intellectual property control program concerned with inventions and useful models. One of the key clauses of the strategy is the integrated personnel training, namely shaping of innovative corporate culture and education of personnel. While the strategy is effective, senior management of the sector of exploration and mining have been trained in different areas of the strategy implementation. The prime aspect is evaluation of each project in terms of its patenting capabilities. The intellectual property control has become an essential part of advancement of Gazprom Neft, and the number of patents and application for inventions and useful models has doubled during two years after the strategy introduction (**Fig. 1**) [19].

Having analyzed examples of interaction between universities and top energy companies, it can be concluded that

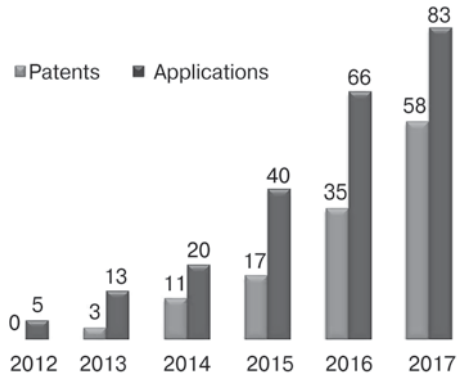

Fig. 1. Patents and applications of Gazprom Neft per year

training of to-be mining engineers in the sphere of intellectual property protection and invention act for the mineral mining and processing industry of Russia is the pressing task [20]

Analytical estimation of qualification of engineers

In the framework of this study, 250 students of Russian mining universities specializing in Mining, Geology, Oil and Gas Recovery etc. were interviewed. Merely 32% of the respondents answered the question on development of inventions, intellectual property protection, rules of patent drafting or useful model claim application that they only had a general idea on the intellectual property protection while 65% of the pollees stated the lack of basic general knowledge in the indicated sphere.

That low level of qualification in the specified field of action is not a surprise as currently training of engineers in intellectual property protection and invention is feebly attended in Russia though there is a training system for specialists in Jurisprudence, including legal safeguard for intellectual property, Management embracing control of intellectual property, Innovatics, etc. Education and training of personnel in the sphere of intellectual property in the specified branches of science are under supervision of the Russian Academy of Intellectual Property, Saint-Petersburg National Research University of Information Technologies of Fine Mechanics and Optics (ITMO) and the Higher School of Economics [21]. Furthermore, there are periodic training courses at the Federal Institute of Industrial Property, Skolkovo Foundation, ITMO University, Gorodissky&Partners patent and trademark attorneys and IP lawyers. For example, WIPO Summer School at the ITMO University educates, among other things, on major practical aspects of intellectual property: basic civil law, copyright law, patent law, etc. However, all the programs of the listed institutions are based on the juridical and economic aspects of intellectual property control. In the meanwhile, it is not a secret that control of intellectual property is only possible after creation of intellectual property. Therefore, together with training of lawyers, managers and patent specialists, it is necessary to add the learning process with the educational programs on intellectual property protection for mining engineers in Russian universities. Moreover, it is required to train mining engineers not in the context of legislation but from the standpoint of invention act, evaluation of research project novelty, writing of specifications of claims and document protection applications. For instance, at the Saint-Petersburg Mining University it is possible to arrange and materialize such activities in the framework of the International Competence Center for Mining Engineering Education as a category 2 center under the auspices of UNESCO [22].

Peculiarities of specialist training in mining

At the modern stage of education development, it is chiefly important to provide mining engineers with applied training in the sphere of patenting and inventions. For prompt introduction of new technologies in the mineral mining and processing industry, it is required to take account of specific features of specialist training within the framework of different disciplines, considering their special characteristics. Mining engineering students during their traineeship should be given a task to detect neck stages to solve various production problems. Moreover, in order to deal with deficiency of personnel capable to invent new technologies, it is necessary to teach a special discipline of “Intellectual property protection and patenting” at the stage of training of bachelors and masters of various professions in mining engineering. Under implementation of this program, students should get necessary knowledge and skills in the area of inventions and patenting, as well as such aspects of these disciplines as:

1. Types of main objects of industrial right and forms of their legal protection:
   - inventions;
   - useful models;
   - production prototypes.
2. Patent document as a form of invention or useful model protection:
   - description;
   - claim;
   - drawing and other deliverables;
   - abridgement.
3. Concepts of patentability, novelty and “force of patent”.
4. Patent research and methods:
   - analysis of general patent situation;
   - examination of technical level of the man-made object under patenting;
   - study of the man-made object trends;
   - investigation of patentability of the man-made object;
   - scrutiny of novelty of the man-made object.
5. Patent search in the system of FIIP (Federal Institute of Industrial Property) and Espacenet.
6. Analysis of competitive ability of Russian patents as against their foreign analogs.

One of the lines of training specialists can be the analysis of the current engineering solutions and advanced inventions of the biggest companies in mining and metallurgy. As a rule, such inventions are specially entered in the data base of the goal-seeking system of the FIIP register and meet such criteria as high performance standard as compared with the international analogs, originality of engineering solution as well as sufficient technical elaboration and availability. Such search can be carried out using the International Patent Classification (IPC) index with regard to specialization of students being trained. For instance, choosing IPC E21 index “Drilling in soil or rocks, mining”, it is possible to investigate the most interesting engineering solutions in these areas. It is necessary to analyze formulas of inventions, discuss dependent and independent claims, as well as achievable engineering result, to study technical problem solved by an invention or a useful model, etc. For example, RF Patent No. 2360106 Clean in situ coal gasification method, related to mining, the engineering result of which is prevention of underground water pollution with products of thermal decomposition of coal by minimization of gasification product migration from underground gas generator [23], or RF Patent

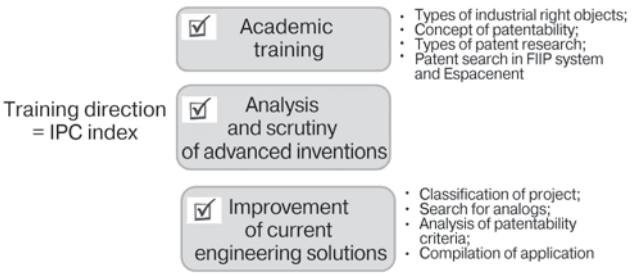

Fig. 2. Student training algorithm

No. 2608140 Method of underground mining at potash deposits exposed to inrushes and flooding, objective of which is to eliminate water entry from brine inrush sites to neighbor panels in the course of mining [24], etc.

Another aspect of training can be invention art teaching of mining engineers, within the framework of which the current engineering solutions should be improved. In this case, even minor updating of a plant or a technology is to be described according to the protection documentation rules. Primarily, it is required to describe a technology domain the useful model or invention belongs to, technical level, essence of engineering solution, drawings in brief (if they are included in the claim), etc. **Fig. 2** depicts a brief algorithm of specialist training in the field of intellectual property protection and invention.

In turn, students educated in "Automation of process procedures and production" should be provided with the similar algorithm training but in the direction of computer programming [25].

In the course of training, students will master key principles of patent claim writing, and this, evidently, will transform quantity of engineering solutions and patent claims into quality. Student will learn to apply basic knowledge they got in the related industries and to discover objects for improvement. Skills and experience gained during education in the field of invention and intellectual property protection will enable future mining engineers to successfully adapt to innovative environment of business.

Conclusions

Finally, it could be emphasized that many big mining and metallurgical plants have introduced innovation systems according to which any employee can make an innovation proposal. Then, the proposal expediency is considered, and, given favorable decision is made, the proposal is implemented, introduced into production and patented. However, researches show that employees generally find no possibilities to improve a technology or equipment for they lack insight into hidden potential of increasing efficiency. This fact is confirmed by the above presented student survey statistics, which makes it possible to deduce that training of mining engineers should prioritize matters of innovation and intellectual property protection as far as student experience essential problems in this sphere.

The suggested ways of solving the problem so that to provide mining engineers with applied training in the area of intellectual property protection will bridge to a certain degree the existing gap in education of qualified engineering personnel for mining industry.

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