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TRAINING OF ENGINEERS AND ENGINEERING TECHNICIANS 1/

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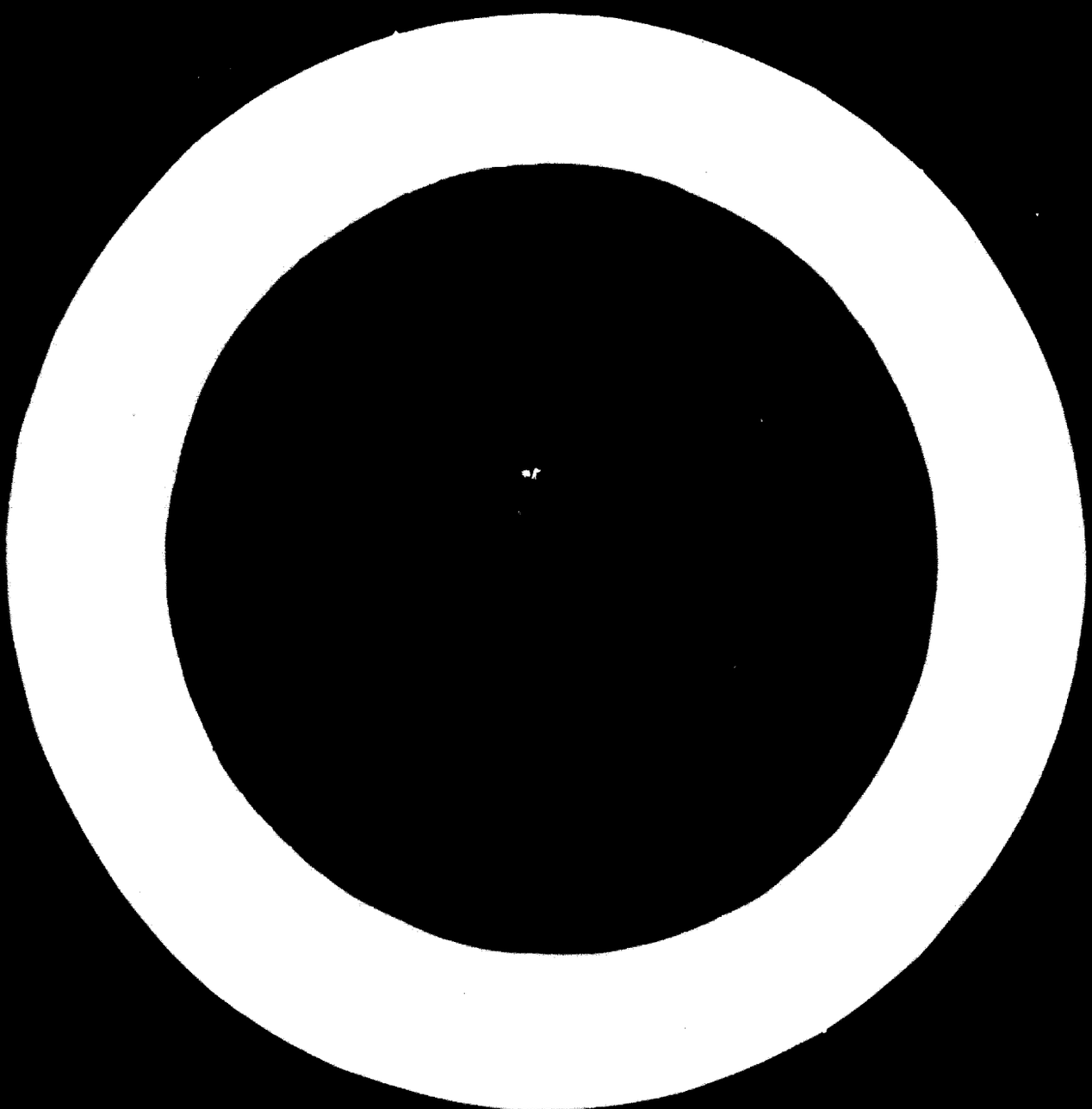


TRAINING OF ENGINEERS AND ENGINEERING TECHNICIANS

Osmo Moilanen

1. Trained Management

There are various levels of management depending on the size of the company. Since it is not possible and not even practical to establish an institute for each level of management Finland has, as a result of historical development, the following three-level for management:

- technical school
- technical college
- technical university

1.1. Technical School

In Finland the technical school consists of a 3-year course. Its purpose is to train engineering technicians, who act as the actual foreman in industry. In addition they work in various types of planning. The entrance requirement to a technical school is 9 years of comprehensive school. In addition to that the applicants need two years of practical working experience. Seven months of industrial training is required of applicants who have completed two years of vocational school. In addition to this preliminary training, students work in the summer for three months, which is compulsory, but most students work during both summers between their studies, i.e. the total of 8 months before graduation. Because of the great (appr. 4-fold) number of applicants the students are chosen in special entrance examinations.

Instruction is given according to the attached teaching schedule (appendix 1). Instruction is more theoretical than in vocational school or practical working experience before technical school gives the foreman his actual skill in his trade.

A technical school stresses no longer solely how the work is done but more why it is done in this particular way. The foreman has to know more about the principle (theory) of work than the worker. This is necessary for two reasons:

Only a person who also knows the work in theory is able to correct faulty performances and disturbances. If the work has not been explained and fundamentals have not been made clear and analyzed, the person does not see the reason for the defect. In that case he will try it in another way, and if he does not succeed, he will try still another etc, until the defect is found. This, of course, gives a major part of original information, but conveying this information in a completely analyzed form is the type of theory which has to be taught to a person supervising the work. This information helps him to encounter new situations without continuously experimenting or, if necessary, he can plan it correctly.

Secondly, knowing the theory is necessary for the development of everything new. Otherwise, development of new working methods or products would be hopelessly slow. In many cases, this development requires even more thorough information than is given at a technical school. Therefore we have several levels of training.

Technical education is necessary for the development of industry. It helps to convey information further and it gives the foreman a broader view of his work.

1.2. Technical College

In Finland technical college lasts 4 years. The entrance requirement is high school (9 years of basic education) and 16 months of training. Three months of industrial training is required of applicants who have completed two years of vocational school. Summer training is not compulsory, but most students work for 9 - 12 months during the three summers before graduation. During the last summer of their education they work on the so called engineering thesis. In the near future technical colleges will be changed so that they are based on matriculation examination (12 years of basic education), and they will be engineering universities.

Technical college trains middle-echelon managers for industry: superintendent engineers, department managers, technical managers or managing directions for medium-sized companies. It also educates people for exacting designing and planning jobs, various types of research work and commercial engineering tasks.

Instruction is given according to the attached teaching schedule (appendix 2). The content of the instruction is even more theoretical then in the technical school. Particularly, the purpose is to give the students a more thorough mathematic-scientific basis. Language instruction is also important, and only lack of time prevents the colleges from giving the mastery of languages which engineers would need.

In the instruction of technical subjects the aim is, besides teaching ordinary technology, to pay attention to technological research and development. The students are given research projects in addition to actual practical training Every prospective engineer preperes a so called engineering thesis, which tends to be a research project limited to a certain field.

Instruction about automation of industry aims at giving incentives to development of industry. Particularly pneumatics is thoroughly studied. Also a basic course in automatic data processing is included in the programme. Besides, in all subjects attention is paid to the trend of future industrial development and its forecasting.

An important job of an engineer, beside the daily routine jobs, is to develop industry. If he does not have sufficient time for that, he has planned his work wrongly or the management of the company has given him too many routine jobs. Industrial development all over the world is now so rapid and strong that keeping up with it requires constant watching and studying. Besides, one can never receive small details of development and special adaptations ready-made; one has to do them himself.

Therefore one of the prerequisites of industrial development is well organized engineering training.

1.3. Technical Universities

Highest instruction in woodworking technology is given at the Helsinki University of Technology at Otaniemi. Graduates from technical college can enter university with exemption from the matriculation examination if they are recommended by their college.

2. Untrained Management

During earlier decades there were many foremen in joinery industry who moved on to management jobs after having been well trained in their own field. Their number has decreased considerably after World War II. The reason has been, above all, the fact that compared with trained management their abilities to develop anything new have been insuffient. This is a result of insufficient theoretical knowledge and the narrow viewpoint resulting from it.

2.1. Courses in Management

Often industry needs, however, such lower management which often participates in actual work, but for which it is not necessary to use people with long training. Their work is routine-like and closely connected with immediate performance. They are not expected to think in a manner which develops production, and they do not generally have much time for it. Industry usually trains this kind of management in short courses. They consist variably of either technical subjects or management subjects or both. Our institute does not give this kind of instruction but there have been plans to develop also this type of activities.

Table 1

Appendix 1

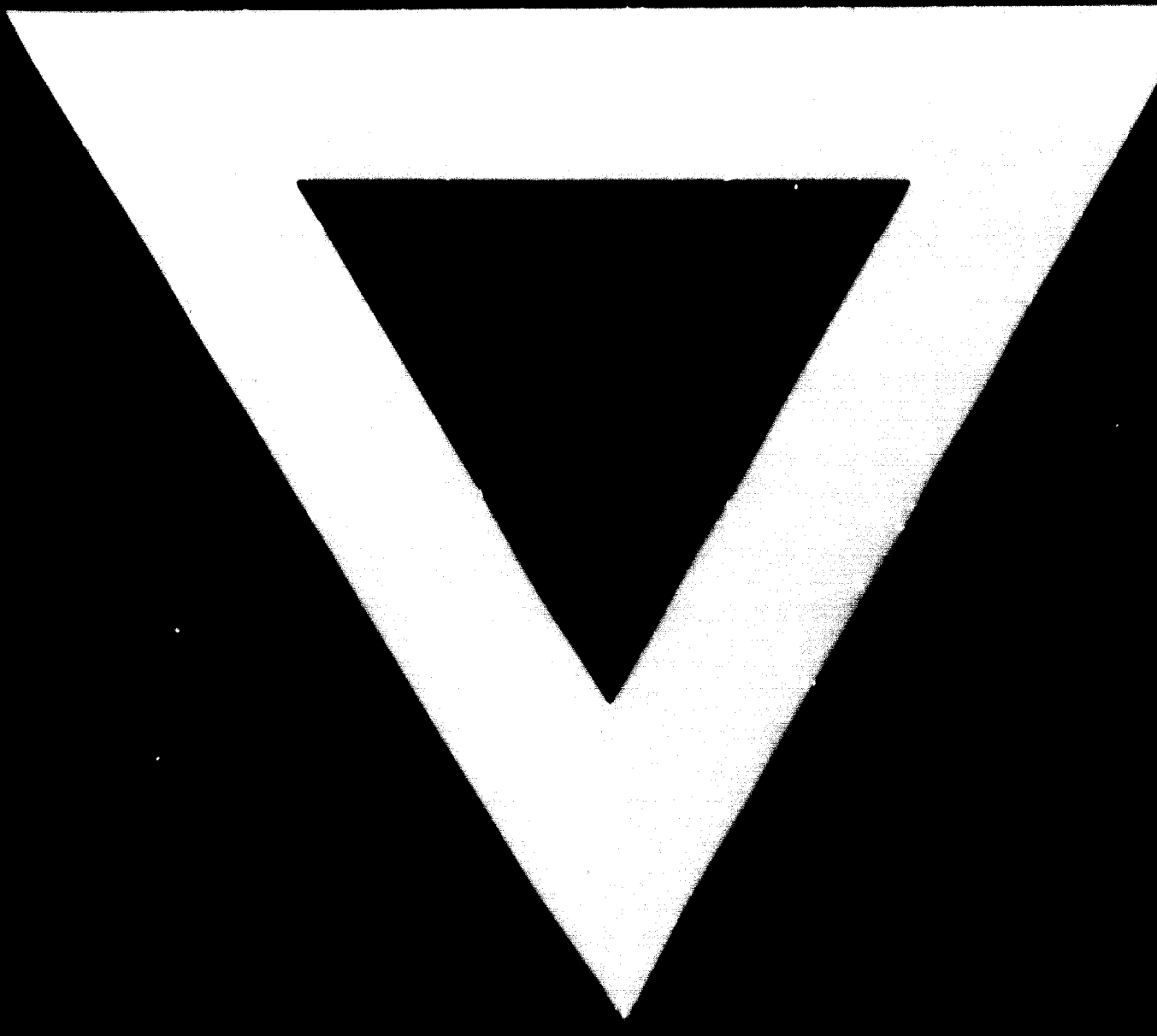
TECHNICAL SCHOOL
Branch of joinery industry

Subjects of study	Weekly hours, Year I	II	III
Mathematics	10	4	
Physics	4	2	
Chemistry	2	2	
Finnish	4		
Foreign languages	4	2	2
Technical drawing	4		
Structure and properties of wood	2	2	
Mechanics and strength of materials		3	
Metal technology	2	3	
Electricity		2	2
Industrial buildings		2	2
Joinery industry	4	8	7
Adhesives and adhesion		2	2
Drying techniques			4
Plant lay-out			4
Technology of wood			4
Forest economy			2
Product planning		2	
Work supervision and law			3
Industrial economy		2	4

Table 2 Appendix 2

TECHNICAL COLLEGE
Branch of Woodworking Industry

Subjects of study	Weekly hours, Year I	II	III	IV
Mathematics	10	6		
Physics	4	4		
Chemistry	4			
Finnish	4			
Swedish			3	
Foreign languages	3	3		
Technical drawing	4			
Structure and properties of wood	2	2		
Mechanics and strength of materials		4		
Thermodynamics		2		
Metal technology	3	2	2	
Electricity		2	3	
Industrial buildings				2
Joinery industry	2	5	6	6
Sawmill and plywood industry			8	11
Adhesives and adhesion		2	2	
Drying technique of wood			2	2
Product planning		2		
Industrial automation			2	6
Plant lay-out				2
Forest economy			3	
Transport technique				3
Management				3
Industrial economy	2	3		
Book-keeping and cost calculation			2	1



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