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ESTIMATE OF CAPITAL INVESTMENT FOR MAIN STAGES OF PLASTICS PROCESSING - METHODOLOGICAL APPROACH[1]

by

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ESTIMATE OF CAPITAL INVESTMENT FOR MAIN STAGES OF PLASTICS PROCESSING - METHODOLOGICAL APPROACH 1/

Addendum

by

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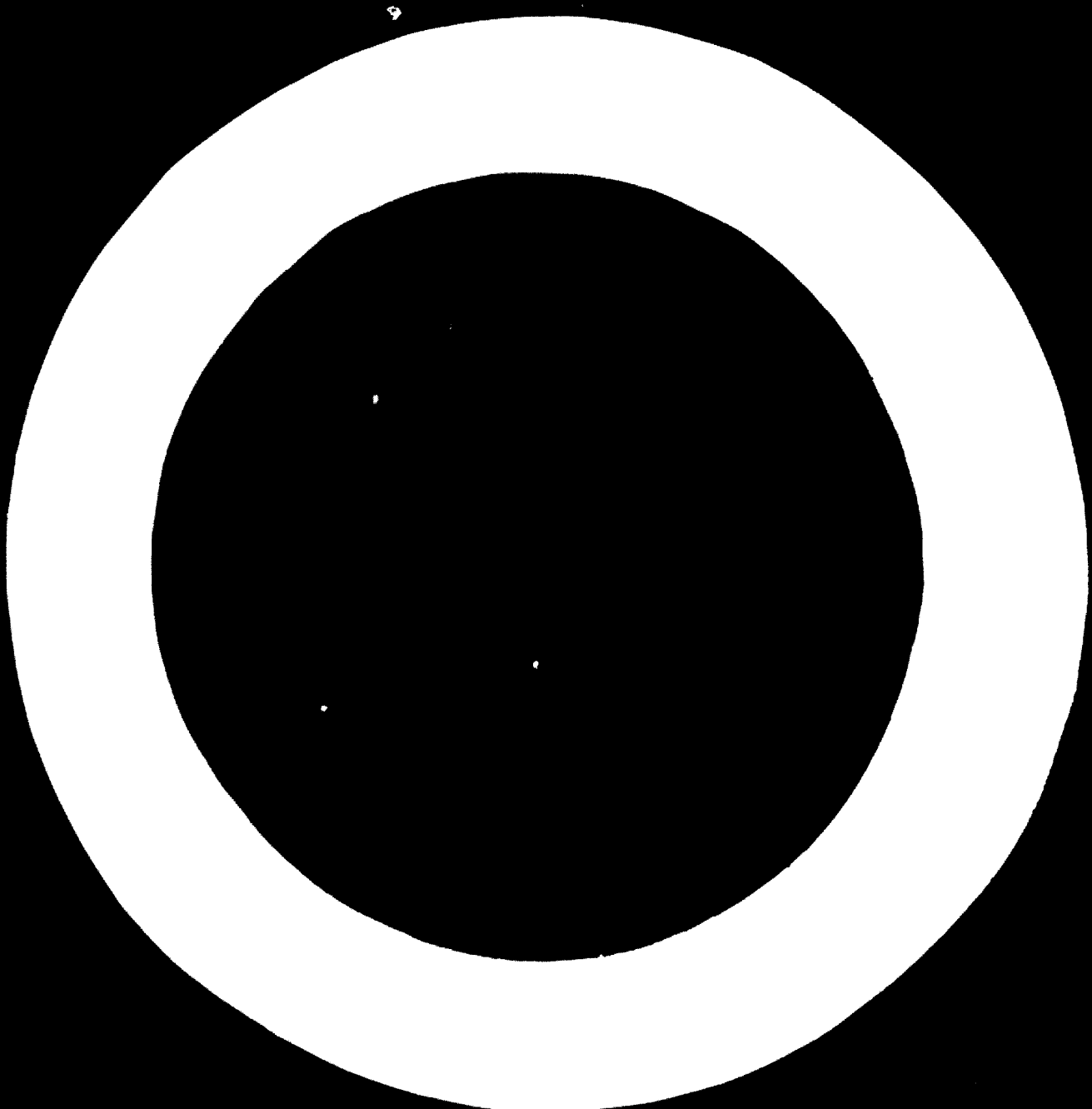


TABLE 1

PRODUCTION STRUCTURE OF PLASTICS IN USSR
(MILLIONS OF TONS)

(DISTRIBUTION OF PLASTICS PRODUCTION)

	1965	1970	1975
Total million tons	0.8	1.54	3.1
Polymerization	33	46	51
Condensation	67	54	49

TABLE 2

PRODUCTION DISTRIBUTION OF MAIN PLASTICS IN USSR

(GROWTH IN PERCENT)

TYPE OF PLASTIC	1965	1970	1975
Polyethylene			
L. D.	100	557	1190
H. D.	100	139	400
Polypropylene	100	5000	25000
PVC and co	100	204	425
Polystyrene and co	100	250	809
Phenolic resins	100	145	233
Epoxy resins	100	200	400
Other plastics	100	203	417

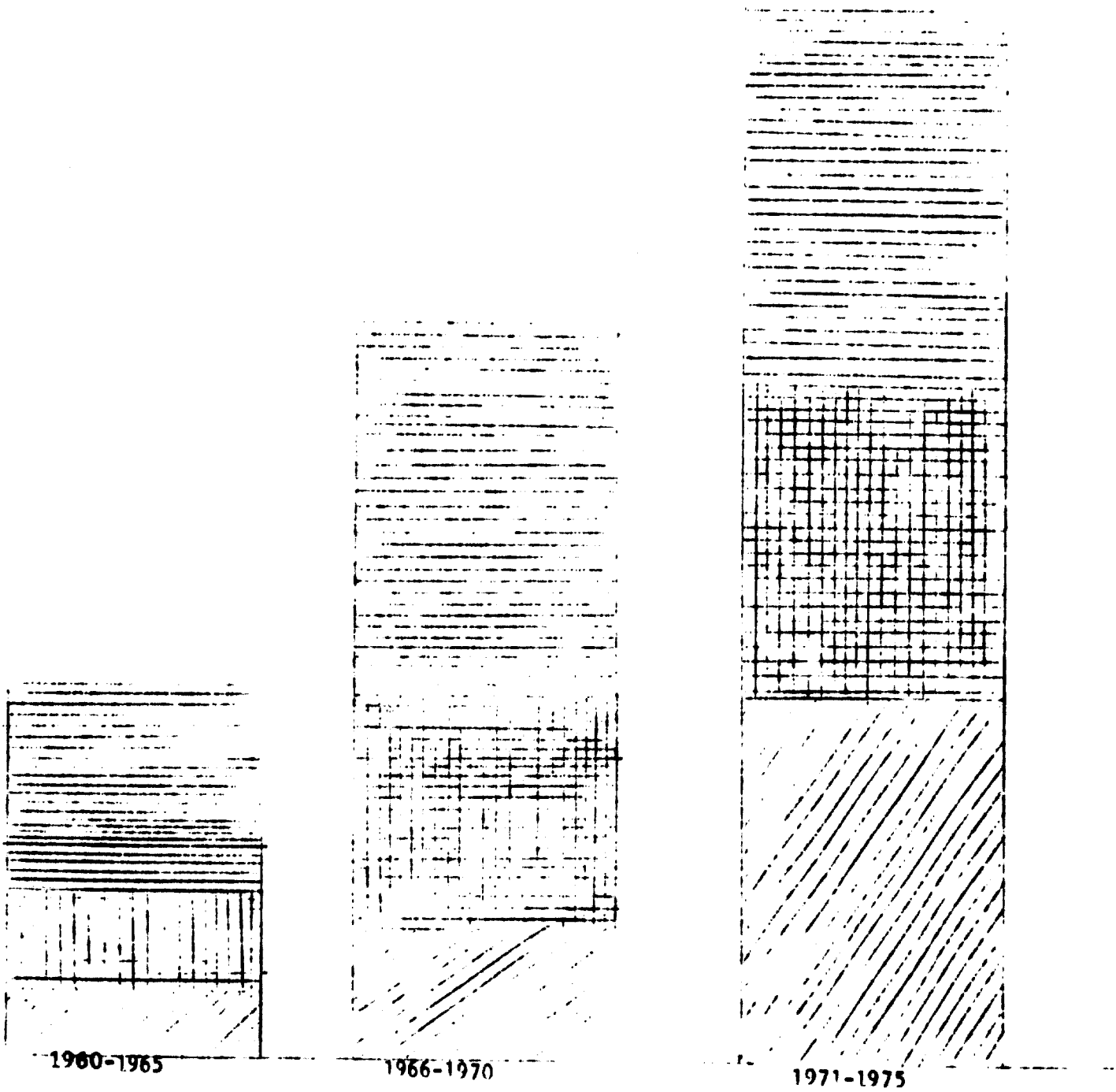
TABLE 3

MARKET DISTRIBUTION OF PLASTICS IN USSR
(IN PERCENT)

USING	1965	1970	1975
Plastics into Chem. industry	18.8	20.2	19.7
Machinery (machinery building)	27.7	27.6	24.3
Furniture and domestic	17.7	18.2	17.2
Building	9.2	10.3	16.1
Transportation	15.3	7.8	6.1
Packaging and travel goods	0.4	4.3	4.9
Agriculture	0.5	1.0	3.8
Toys and other using	10.4	10.6	7.9

TABLE 4

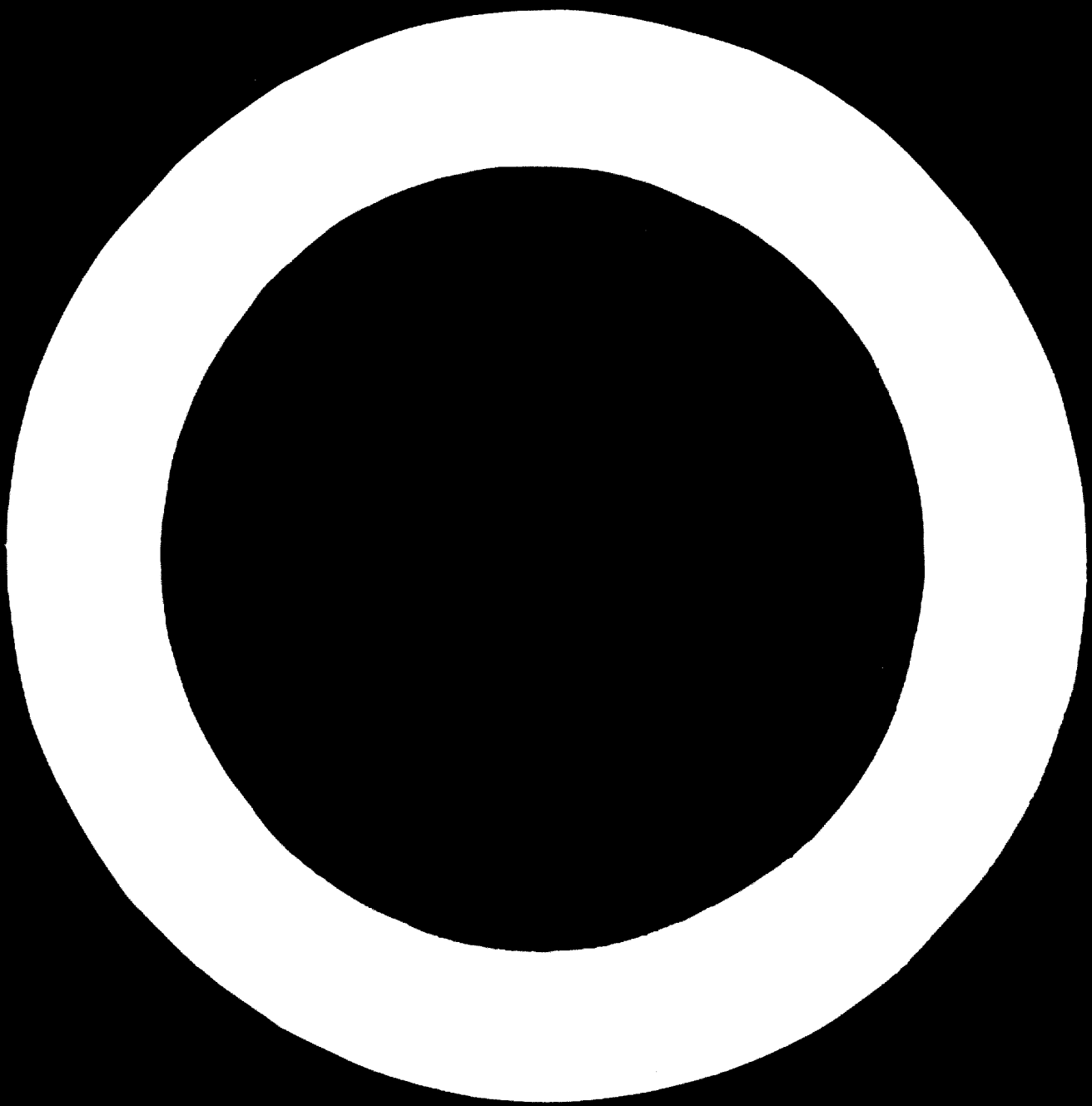
TRENDS IN METHODS OF PLASTICS FABRICATION IN USSR



- Thermosetting plastics forming (plastics pressing)

- Injection moulding.

- Other methods (extrusion, thermoforming, blow moulding, rotation moulding)



ESTIMATE OF CAPITAL INVESTMENT FOR NEW PLANTS OF PLASTIC PROCESSING

METHODOLOGICAL APPROACH

Winding the scope of application of plastic products entails further development and perfection of processing techniques. And increase of processing volume requires the use of highly productive up to-date equipment.

In this report the author endeavors/using relative literature/ to make an estimate of capital investment required for plastics processing units. The calculation was made in dollars.

COST OF TECHNOLOGICAL LINE FOR THERMOSETTING PLASTICS PRESSING

The shop or site for pressing thermosetting plastics is equipped with presses, moulding tool, auxiliaries, means of transportation of materials and finishing equipment, power sourse, production shops and utility premises. The calculated capital investment is to a great extent determined by the press design. For the most part automatic and semi-automatic compression and transfer presses are used.

The above equipment is used for production of articles with inserts or in cases when moulding powder or pellets cannot be fed automatically. Automatic compression presses are equipped

with single driver, but their hydro- and electro-drives are more complex. For moulding-powder supply and ejection of products it is necessary to have an accessory drive and also accessory mechanical, pneumatic and electric units. The above types of presses are also equipped with complex signal and protective devices, ensuring their automatic operation. Unlike the above two types of presses semi-automatic transfer presses are equipped with a preheating cylinder and a device for injection the material into a mould. Automatic transfer press is equipped with devices for pellets feeding and their preheating and also devices for ejection the ready articles from the mould.

Table I shows the correlated cost of different types of presses.

TABLE I.

Correlated cost of presses for moulding thermosetting materials / thou. dol. /

Type of press	Clamping tonnage, t							
	I0	25	50	I00	I50	200	250	300
Semi-automatic compression	2.7	4.5	II.0	I5.0	-	I8.0	-	27.0
transfer	4.2	6.5	I4.0	I9.0	-	23.0	-	34.0
Automatic compression	4.5	8.3	I3.4	I9.0	23.0	33.0	-	-
transfer	6,0	7.3	25.0	34.0	39.0	-	49.0	-

Transportation cost / distance 1200 km/ is on the average 60 dol. for a semi-automatic compression press /clamping tonnage 50t / and 550 dol. for an automatic transfer press / clamping tonnage 250 t/. The equipment is generally installed and assembled by scaffold workers. Labour cost varies between 250 and 1500 dol.

The cost of mould essentially depends on the form of the articles to be manufactured. Its size and shape set the limit of man-hours required for manufacturing of single- or multiform moulds. The cheapest method of multiform moulds production is die sinking. In production of multiform moulds requiring much manual work and expensive machining, more and more often electromechanical treatment is used.

Correlation made between the cost of different moulds used for the production of some most common simple and complex-shape articles is illustrated by table 2.

TABLE 2.

Correlated cost of moulds for production of simple and complex shape articles / thou. dol. /.

Article	Number of forms	Compression moulding		Is transfer moulding	
		Semi-automatic press	Automatic press	Semi-automatic press	Automatic press
Condenser box	8 v	I.4	I.9	-	-
Automatic switch cover	4	9.0	9.9	-	-

Electric equipment box	6	-	-	8.0	10.0
Iron handle	2	-	-	23.0	25.0

All the other equipment necessary for making up a moulding shop or site can be devided into 3 groups: equipment for preparation of press-powder, transportation and finishing of the products.

The equipment for preparing press-powder comprises an electric firnace for drying the materials before moulding. Depending on the size of the furnace its price varies between 1000 and 3000 dols.

In case of transfer moulding pelleting is needed. The cost of pelloter with various moulds and male dies is 15 000 dols.

Electronic heaters have their own power source and are used for pellet preheating to 80-140°C before they are fed to the bin of transfer press or to a compression mould. The cost of a small - bench heater is 1000 to 2000 dols; medium and large electronic heaters cost from 3.000 to 12.000 dols. For post-curing of some articles air-driers are used. Their cost is between 500 and 4000 dols.

For the operation of presses compressed air is necessary.

It is used for driving small presses / up to 50 t/, for blowing off material and fins from the open mould for all types of presses and also for most types of auxiliaries. For medium-size and small-size units a I5 KW main and 7,5 accessory compressors is sufficient. Their cost will be 2.600 and I.500 dollars respectively.

Electric power is needed in large quantities for all types of equipment, especially when electric preheaters or the steam preheated oil are used. /I0.5 - I7.5 cm^2/ is very important for mould heating 6 up to I75°C /.

The cost of a small electric heater is about 50 dols., and a preheater for large moulds cost about 400 dols. The use of preheated oil necessitates the use of temperature controllers which cost from I200 dols. for small moulds and to 4000 dols. for large ones.

From time to time the moulds have to be repaired: ejectors and steel inserts are replaced forms are cleaned and polished. The cost of maintenance equipment should be considered as a part of the total cost of the unit. The maintenance equipment comprises: a lathe, a milling machine, a grinding machine, polishing equipment, metal work tools, etc.

CAPITAL INVESTMENT FOR THE TECHNOLOGICAL LINE FOR INJECTION MOULDING OF THERMOPLASTICS

The purchase price of an injection moulding press is effected

by the design, size of the machine and the presence of special units. The first two factors determine the base price of the machine. Apart from the cost of the main plastication and clamping units the base price normally comprises the drive price. In case of screw plasticators with reciprocating movement the cost of the screw read check valve, extruder cylinder, drive, electric control board and nozzle are taken into consideration.

The dependence of the base price on size and construction of an injection moulding press is shown in table 3.

TABLE 3.

Base prices of equipment depending on its size and construction.

/thou. dols./

clamping tonnage tons	Type of equipment				
	plunger	equipment of screw type	two-staged with separate casting and plasticisation cylinders	of srew type with built-in plunger	with reciprocating screw
175	18.6	22.3	23.0	26.0	-
225	19.2	27.5	31.0	33.0	34.0
300	24.9	33.7	34.0	34.0	36.65
450	42.0	46.0	49.0	54.0	59.0

It can be pointed out, that with similar characteristics of equipment base price to a great extent depends on its type; for example, for the injection moulding press with clamping tonnage of 200-225 tons it ranges from about 17.0 thou. dols. in case of the plunger, to 34 thou. dols, for two-staged machine with pre-plasticization cylinder with a reciprocating screw.

The decisive factors in choosing a certain kind of equipment are the type of the plasticization unit, the operating costs, type of articles which are supposed to be produced by this equipment, the material which will be used. Usually, the majority of the equipment are ordered according to the specification of a consumer, which cause extra expenses.

The expenditure on some auxiliaries for the injection moulding press with clamping tonnage of 200 tons, are as follows /dols./.

Low pressure mould locking	450
Special temperature control of the nozzle during polyamide resin processing	275-675
Special wiring	200-2000
Hydrolic shaft	850
Special screws	450

The consumer also has to pay for the transportation of the equipment to the plant and its installation. The cost of the equipment is usually fob plant-manufacturer price and therefore freight charges are added to the total cost of equipment.

The cost of mould may vary greatly depending on its size, number of forms, construction, gate type, mould temperature, regulating apparatus, type of mechanism used inside the mould for ejection of articles. With many moulds hydrocylinder for swaging and taking off a core pins during the cycles of opening and closing a mould is used. Costs of moulds for injection moulding are given below /thou.dols./

<u>One-form mould</u>: for production of waste-paper baskets of	I,0
for production of large articles with diamrter 300 mm	5,5
Four form mould for production of industrial articles	3,C
Twenty-position mould for production of small heads with screw	4,2

Cost of moulds depends also on the material used for production of plastic articles. For example, production of an article from polyethylene does not require such a careful

mould finishing as for those made of polystyrene or nylon.

While injecting of articles the system of heating or cooling of mould is required. The heating system with one zone of heating costs about 675 dollars. and the system with two-zones - about 1400 dollars.

In production of articles, made of some thermoplastic materials and also a number of constructions the coolers of moulds are required, which provide circulation of cooling water in the mould. There are units which use close a cooling system. Pumping system is also used. Such equipment costs from 3900 to 5000 dollars.

The central cooling unit, which may be used for cooling of all machines of the shop, requires large expenses. This system may be also used for cooling hydraulic systems of moulding machines. Sometimes for moulded articles an additional finishing is required, for example - painting, metallisation, hot stamping etc. For painting a sprayer, a set of masks and a cabine with filtered air and induced-draught fan are required. Its cost / without a compressor/ may be over 365 dols. The compressor costs about 500 dols. and more.

In the equipment for metallization of articles made of plastics beside the above components the following ones are included: vacuum tank, furnace and camera. A small plant of such a type

costs about 600 dollars.

There are other methods of finishing plastic articles, such as offset printing, engraving, etching etc. Equipment for these aims are so specialised that it is difficult to call any cost.

For feeding material to the injection moulding press different equipment is used. It costs 5300 dols. and more, depending on how many bins are used, and also on the length of the system. Cost of a bin for each machine is about 265 dols.

If the system of material pneumotransport is not used, a car-loader for transportation of powder and granulas is required. The cost of such car-loader is about 6000 dollars. It may also be used for extraction or installation of press moulds, and also for other purposes.

For some thermoplastics, for examples, nylon, ABS-resin, polycarbonate and others, a drying equipment for elimination of water from material before moulding is required. Such an equipment costs from I250 to I500 dollars. In a number of cases there exists a nessecity of buying the equipment for pelleting of powder thermoplastic compositions. Such a pelleter depending on its size, costs from I300 to 3I00 dols.

Defective articles, wastes from central and distributive

gates must be reduced to such an extent, that it would be possible to send them back into the injection mould press. A crusher costs about 800 dollars.

For production of colour compositions, a mixing drum is required, which costs about 650 dollars.

The total cost of the line for injection moulding. The investments of the line for injection moulding using screw plastisizer, with reciprocating movement, clamping force 200 t are given in table 4. It is necessary to note, that a part of supplementary equipment may serve several injection moulding presses.

TABLE 4.

CALCULATION OF THE TOTAL COST OF THE INJECTION MOULDING EQUIPMENT

Items	Cost, thou.dols
Injection moulding press	24.8 /Base price/
Auxiliary equipment	
low pressure mould locking equipment	0.450
special bush for nylon	0.275
special wiring	0.50
arrangement with hydraulic core	0.850

special screw /additional/	0.450
freight	0.50
Assembling cost /estimate/	I.50
Total /total cost of assembled injection press/	29.325
Mould	5.50
Die brush	0.I65
Mould temperature regulator	0.675
Total /investment for the mould/	6.340
Pulverizer	0.50
Pulverize painting equipment	0.365
Auxiliaries	0.75
Quality control device	0.50
Total /investment for finishing and decorating equipment/	2.II5
Equipment for transporting and additional processing	
feed bin	0.265
loader	4.00
drier and preheater	0.650
granulator /for scrap/	0.80
tumbling drum /for dry colouring	0.65
Total /investment for equipment for transporting and additional processing/	6.365
Total investment for injection moulding equipment	44.I45

Special equipment for particular cases	
storage bin for bulk materials	5.300
vacuum metallizing equipment	25.0
scrap processing extruder	I0.0
pelleter	I.3
Total investment for auxiliary equipment	4I.6
Grand total	85.745

It is seen from the table that total capital i. estm ta for the line of injection moulding will be much more than the prime cost of one injection moulding machines, even in the case of some items of expenditure, as for example expenses on special equipment, are excluded from estimate calculation. The total expenses exceed basis price of the machine at least by 75%. It is necessary to take into account the cost of power energy and water, which vary depending on the allocation of the plant.

CAPITAL INVESTMENTS OF TECHNOLOGICAL LINE FOR THERMOPLASTICS EXTRUSION

To estimate the initial investments for extrusion line the equipments for simple profile extrusion of soft PVC, impact resistant polystyrene or polyethylene were taken as example.

Nevertheless, the estimate method given here can also be used for other types of extrusion, for instance, for blown film, tube production, wire covering, etc.

Extruder prices for different processing vary in great deal depending on their construction and auxiliary devices /table 5/.

TABLE 5.

PRICES OF ONE-SCREW EXTRUDERS

Items	Extruder screw diameter, mm			
	63,5	89,0	II4,0	I52,4
Extruder output, kg/h	34.0-I02.5	68.0-204.0	I36.0-408.2	454.0-I306.8
Drive power, kw	II.2-22.4	22.4-74.6	37.4-II2.0	93.5-224.0
Extruder price without drive, thou.dols.	7.5-I0.0	9.5-I8.0	I4.0-23.0	25.0-33.0
Speed varistor price, thou.dols.	I.8-7.0	3.I-I7.0	4.0-23.0	7.0-40.0
EXTRUDER TOTAL PRICE, thou.dol.	9.3-I7.0	I2.0-35.0	I8.0-46.0	32.0-73.0

While compiling this table it was accumed that all the extruders have L/D ratio of 24:I. The cost depends on screw material and extruder drive power. The total cost of an extruder includes the drive cost but excludes the cost of its installation

as well as auxiliary equipment necessary for the complete line. The total cost of the extruder installation includes the cost of electric source, cooling water and compressed air.

The die cost depends on its type /extrusion of blown films, rods, wire covering/ and construction complexity. For example, a simple die of a 152,3 mm screw extruder for rod extrusion costs lower than a die of a 63,5 mm extruder for more complicated forms or profiles. The cost of dies for irregular profile extrusion varies from 75 to 5000 dol. depending on the die complexity and article cross-section size as well as on the property of materials processed.

Besides the extruder and die some other kinds of equipment are necessary for extrusion process.

Prices of the auxiliary equipment, depending on their types and sizes are shown below /thou.dol/.

Water baths	1.0-10.0
Receiving devices	1.5-9.5
Cutting devices	2.0-10.0
Feed bins	0.3-1.5
Bin driers	1.0-10.0

The cost of extruder installation to a great extent depends on the sophistication of the equipment and the plant pay-out. As it was noted already, except the above-mentioned equipment, the extrusion line needs the supply of water, power energy, compressed air and the drain system.

The cost of the extruder installation with the screw diameter of II4 mm, including labour cost, accounts for about 3.000 dollars. It varies depending on the specific character of the equipment, the lay-out of the auxiliaries with respect to the line of extruder and the installation method. For example, if electric wiring and water piping are laid under the floor, the installation cost will be higher than in the case both are made over the floor.

THE MODEL OF THE TOTAL ESTIMATE CALCULATION OF THE EXTRUSION LINE COST

Table 6 shows the cost of the complete extrusion line ready for exploitation.

The main unit is the extruder with the screw diameter II4.0 mm.

TABLE 6.

The model of the total estimate calculation of the extrusion line cost.

/the screw diameter of II4,0 mm/

Items		Cost thou.dols.
Extruder		I8.5
Drive		I3.5
Transportation cost		2.0
	Total	34.0
Auxiliaries		
bin, loading installations		0.9
bin drier		5.5
water bath		5.5
cutter		3.0
receiver		6.0
transportation cost		2.0
	Total	22.9
Dies		2.5
Production sites		I5.0
Installation cost		3.0
	Total	77.4

As it can be seen from the table, the total capital investments are twice as much as the cost of the extruder and drive taken together.

In this case, the investment into administrative services, testing laboratories, the equipment for quality control and other needs, are not included. A considerable part of the total expenditures can make the ones on the scrap grinding equipment and devices for packing of finished product and so on. In case these items are included, the total capital investment into the line with one extruder will account for I00 thousand dollars, or even more.

In any case, while organazing the extrusion plant, it is necessary to bear in mind, that the total capital investments into the operating extruder taking into account the cost of auxiliaries, its installation and so on,, can exceed the selling-price of the extruder and drive.

CAPITAL INVESTMENTS INTO THE TECHNOLOGICAL LINE OF THE BLOWN ARTICLES PRODUCTION

In this part, only two types of blowing systems-linear and rotational. The equipment which are used, differ by the type ofof the unit and the blowing method. Of course, the major cost item for any system is the blow moulding equipment. Its price

can range from 35.0 to 150 thousand dollars, depending on size and capacity.

To organise the process of blow moulding which provides high quality alongside with the lowest unit cost, it is necessary first of all to be aware of the desirable output of the line and in this connection the technical specifications of the project.

A typical technological line of blow moulding includes blow moulding machine, moulding tool, finishing, transportation equipment and additional treatment equipment.

Below are given the typical expenses on the line for production of 0.9 litre containers for synthetic detergents. One-position units for blow moulding with four die heads are used on this line. 12 operators are supposed to service the line, working in 3 eight-hour shifts. The output of the line is 24000 bottles per day.

The primary resin is fed to the extruder via the pneumatic system or by gravity. In the given example gravity feed is used. On the lines where resins of different grades and colours are used, it is necessary to have a mixer which is installed in any convenient place between the resin feed bin and the moulding machine.

In the mixer the primary resin is mixed with colouring matters.

It is necessary to have granulator to grind fin and spoiled articles.

Capital investments into the blow moulding line with linear system are given below /thou.dols./

Blow moulding machine	47.I50
Moulding tool	5.82
Equipment for:	
transportation of articles	I6.4I0
transportation of materials and auxiliaries	I0.02
secondary treatment of material	4,8I
testing	0.70
Installation and designing of the equipment	24.5
Total	I09.25

Nowadays, the multi-mould extruder with rotating table for moulds is most popular. In such an extruder several moulds in consecutive order go under the only head for blabk extrusion in order to receive a hot tube and then rotate round the table while the article is cooling down. When using several moulds, the time which is necessary for every article to cool, does not present the extrusion of the blank for the next article. Thus,

the output of such an extruder can be much higher than that of other type extruders.

In this part there will be discussed capital investments necessary for the complete system of blow moulding, where the equipment with rotating table for moulds is used. This system is aimed for the production of 2.3 liter bottles.

To get the right picture of the capital investment into rotation type blow moulding one must take into account the expenditure bending with installation of equipment.

This expenditure is estimated in the table 7.

TABLE 7.

CAPITAL INVESTMENT INTO THE LINE OF BLOW MOULDING USING SIX POSITION ROTARY MACHINE

Expenditure item	Cost in thou.dols.
Blow moulding machine	59.7
Mould /6 pieces/	9.0
Auxiliaries for blow moulding machine:	
Feed bin /vacuum type/	0.5
Water cooler	2.0
Air compressor /double-stage, 18.7 KW/	3.5
Granulator for scrap /with mixer/	3.0

Equipment for transportation	
Conveyor /with air cooling/	2.0
Tubular chutes and bins	0.8
Finishing equipment	
Automatic reamer /including control device/	I2.0
Device for surface treatment	0.5
Electrowires	3.0
Plumbing	I.0
Other costs	4.5
Total	IOI.5

The cost of blow moulding machine itself /including extruder and head for extrusion tablets/ is about 04 of the total cost of the line of blow moulding. In addition, account must be taken of installation costs and other item of costs. It also does not include the costs of technological line, storage and administrative service sites.

It follows that for the installation of automatic blow moulding line the capital investment of IOO-I50 thousand dollars are needed. In cases when additional lines are installed one can use a part of existing accessory and other equipment. Then the expenditure for installation of a new line can be reduced a little. Even so, at the sites with several lines the capital investment would be proportional to the number of required lines.

CAPITAL INVESTMENTS OF TECHNOLOGICAL LINE FOR MOULDING OF ARTICLES FROM SHEET THERMOPLASTICS

While buying equipment for thermomoulding of articles and sheet from thermoplastics primarily one must take into account the type of articles and size of lots and such factors as material and labour cost. The first problem arising while purchasing the machine is the choice of the type /single-stage or double-stage or rotation type/. Availability of single or double heating is prominent in this case.

Suppose we decide to purchase single- or double-stage machine. In this case one must determine the moulding area. Machines are classified into manual, semi-automatic and automatic ones depending upon the handling method. The cost of semi-automatic machine with the moulding surface of 1200x1800 mm is 15 thou.dols. To this the cost of mould and male die must be added. Cost of mould varies depending upon the material and shape of article. Selecting the material for the mould one must take into consideration size of lots and type of processing materials /table 8/.

TABLE 8.

Cost of moulds depending upon the size of lots.

Application of moulds	Size of lots	Material of mould	Cost thou.dols
Experimental works	to 100	wood	0.50-0.70
Articles of simple shape	3-5 thou.	gypsum	0.50-1.50
The same	50-100 thou.	Thermosetting resins with filler	0.7-5.0
Articles of complex shape	100-500 thou.	Metal	1.0-8.0

Above figures concern to single-form moulds. While using multi-forms moulds their cost will increase by 50-100%. The cost of machines is given in table 9.

TABLE 9.

Cost of different types of thermomoulding machines.

Type of machine	Output per hour	Typical articles and materials	Cost, thou.dols.
One or two position	40	Cases of electric apparatus /impact resistant polystyrene, ABC/	10.0-15.0

Three position	I20	Refrigerator door plates /impact resistant polystyrene, ABC/	I5.0-I9.0
Four position	40	Refrigerator insight cameras /impact resistant polystyrene, ABC	2I.0-25.0
One position machines for large articles	4-I2	Boats, cases of cars /impact resistant polystyrene, ABC/	45,0
Machines of continuous moulding for package with rouleau feed	7500-9000	Package /impact resistant polystyrene, cellulose acetate/.	43 -45.0
Machines of continuous moulding for package with simultaneous filling and feeding from extruder	7500-I5000	The same	200.0

The most typical articles, produced by the rotation centrifugal moulding method, may be also made by blow and injection moulding. The comparison of these production process shows, that the prime cost of articles, produced by the various process, depends not only on the volume of production, but on the number of factors, such as configuration of articles, the thickness of walls and other.

While the centrifugal rotation moulding usually needs small

capital investments, but labour requirements are large. When this process is applied, the cost of small articles production is usually higher, those of middle size are the same, and big ones are lower, than using other moulding methods. Sometimes the lower productivity of equipment is completely compensated by reducing or full elimination of secondary operations and by expense reducing for additional mechanical processing.

When a small lot of large size articles are produced, it is also reasonable to use centrifugal rotation moulding because of the relatively small investments. The cost of equipment usually does not exceed 30 thousand dols.

The correlation of economic indexes of the similar articles production is given in table IO.

The correlation of economic indexes of different processes of 75 l vessels. is :

TABLE IO.

Items	Processes		
	centrifugal rotation moulding	injection moulding	blow moulding
Cost of equipment thou.dols.	28,8	75,0	230,0
Cost of moulds. thou.dols.	IO,5	30,0	5,6
Power cost dol./year	3360	4500	5950
Labour cost dol./hour	3,5	I,75	I,75

Raw materials dol./hour	I,05	0,80	0,90
Prime cost of I article/dol./ by lots of			
IO thou. pieces	I,5	3,95	I,63
I00 thou. pieces	I,25	I,25	I,I2
I000 thou. pieces	I,Io	0,98	I,07

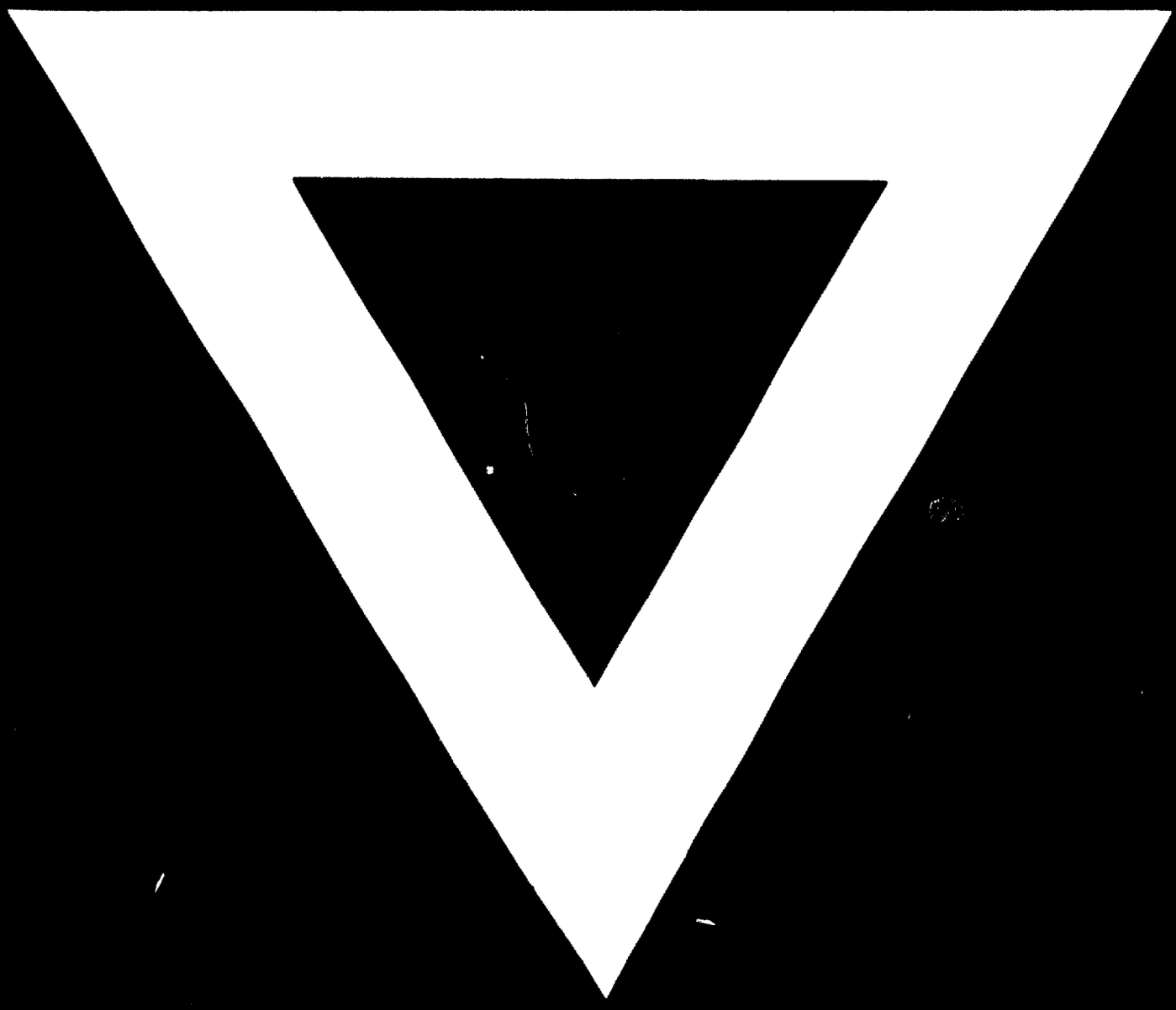
Note: Productivity of 60, 60 and 80 pieces per hour respectively.

The size of lots influences greatly on the prime cost of production, even more, than the production method. First of all it can be explained by the prime cost of the main equipment and moulds. However one can note some regularity of changing the article prime cost, depending on the volume of produced article, the size of lots and technological scheme. When producing small lots /up to IO thousand pieces per year/ independingly on the article volume the centrifugal rotation moulding appears to be economically effective. The smaller costs of production can be explained by small investments.

When producing from IO thousand to I00 thousand pieces per year, the volume of the article /or its weight/ begins to play the main role. In this diapason of production, blow moulding is more reasonable from the economic point of view; while producing of lot with more than I00 thousand pieces per

year it is economical to use the injection moulding. However in each concrete case one shouldn't forget about the configuration of the article and its volume. Big articles / of more than 200 l volume / are produced by centrifugal-rotation moulding, as it is more reasonable from the technical and economical point of view, and capital investments and prime cost are reduced greatly in comparison with other production processes. In general, when production process requires smaller capital investments and articles are repaid in a short period of time, now they are often produced by the centrifugal-rotation moulding method.

Thus, presenting in this paper data on capital investments of organisation of main stages for processing of plastics will help designers and economists to take into account the influence of different factors on calculation and to carry out the preliminary estimation while setting up the production.



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