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18 September 1972

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Original: ENGLISH

Symposium on the Development of the Plastics
Fabrication Industry in Latin America

Bogotà, Colombia, 20 November - 1 December 1972

SUB-REGIONAL INTEGRATION IN PLASTICS PROCESSING 1/

by

Albert Hahn
Bureau d'Etudes Industrielles et de Coopération
de l'Institut Francais du Pétrole
-BEICIP-
Rueil-Malmaison France

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SUMMARY

SUB-REGIONAL INTEGRATION IN PLASTICS PROCESSING[1]

by

Albert Hahn
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Rueil Malmaison France

1. The main single purpose of the petrochemical industry is to produce polymerisable materials for the manufacture of replacements of a large variety of natural products. Thus, over 70% of the world's entire petrochemical output is ultimately polymerised and this proportion is growing.

2. Of this 70% or more, over one-half (around 80%) is represented by what is conventionally called the plastics industry, which produces replacements for such competing materials as paper, wood, leather, hard-fibers, and non-ferrous metals. The rest is divided fairly equally between replacements for natural rubber and for textile fibre.

3. Demand for plastics in the Andean Group is small at present, but Table I shows that in 1980 it will reach appreciable proportions.

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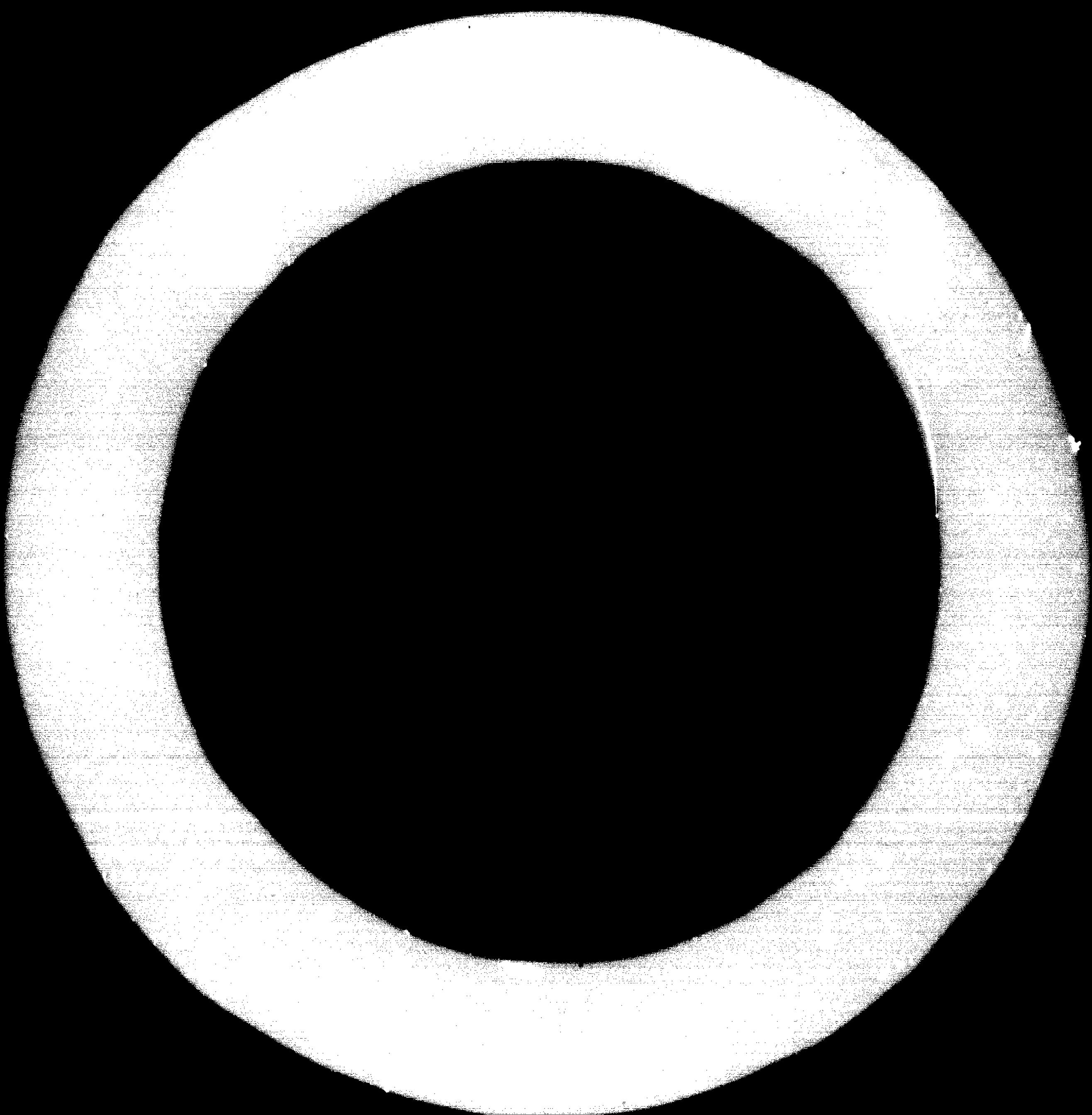

TABLE I

Plastics Consumption - Andean Block 1980

	1.000 T/yr. 1980
Bolivia	250
Chile	1.400
Colombia	1.300
Ecuador	450
Peru	1.350
	5.250

4. Plastics processing has often a "backyard industry" connotation. Entry is easy, expansion is achieved by merely adding more machines so that no economics of scale are achievable and large companies to compete with a host of small-time, low-overhead operators.

5. This is fast ceasing to be the case:

minimum viable plants are becoming larger and plastics processing is increasingly being carried out in special purpose, engineered, grass-roots plants. Not only is equipment becoming more productive but also the industry becomes more sophisticated, only large operations can support the kind of technical service, product development and process engineering overhead required to stay alive in today's competitive environment.

6. In the past it has often been argued that while the petrochemical industry requires long-range planning, the plastics industry can be more or less left to take care of itself. This is no longer realistic, and this paper will examine some economic aspects of the plastics industry, and their implication for the Andean countries.

Moulding Processes	Injection
	Blow Moulding
	Thermoforming
	Rotational Moulding

Semi-finished Goods Blown Films

Oriented Films

PVC Film and Sheet

Pipe

7. Conclusions - This cursory glance at theeconomics of some of the major plastics processing techniques, has nevertheless disclosed a number of potential projects, to be considered for implementation by 1980, on a scale determined by the combined market of the Andean countries. These are:

Large Injected Objects

Pipe Fittings

Thermoforming Sheet

Custom Grinding

Polypropylene Oriented Film

Rigid Calendered PVC

8. It is hoped that these represent but a few of the opportunities for intra-regional trade that actually exist, and that others will turn up over the coming years.

CONTENTS

I - INTRODUCTION

1. The main single purpose of the petrochemical industry is to produce polymerizable materials for the manufacture of replacements of a large variety of natural products. Thus, over 70% the world's entire petrochemical output is ultimately polymerized, and this proportion is growing.

2. Of this 70% or more, over one-half (around 80%) is represented by what is conventionally called the plastics industry, which produces replacements for such competing materials as paper, wood, leather, hard-fibers, non-metallics and non-ferrous metals. The rest is divided fairly equally between replacements for natural rubber and for textile fiber.

3. Demand for plastics in the Andean block is small at present, but Table I shows that in 1980 it will reach appreciable proportions.

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Plastics Consumption - Andean Block 1980

	1.000 T/yr. 1980
Bolivia	250
Chile	1.400
Columbia	1.800
Ecuador	450
Peru	1.350
	5.250

4. Plastics processing has often had to live something of a "backyard industry" connotation. Entry is easy, expansion is achieved by merely adding more machines so that no economics of scale are achievable and large, reputable companies are driven to the wall by a host of small-time, low-overhead operators, - so runs the legend.

5. This is fast ceasing to be the case: the plastics industry is coming of age, minimum viable plants are becoming larger and plastics processing is increasingly being carried out in special purpose, engineered, grass-roots plants. Not only is equipment becoming more productive; as the industry becomes more sophisticated, only large operations can support the kind of technical service, product development and process engineering overhead required to stay alive in today's competitive

environment.

6. In the past it has often been argued that while the petrochemical industry requires long-range planning, the plastics industry can be more or less left to take care of itself. This is, it is hereby submitted, no longer realistic, and this paper will examine some economic aspects of the plastics industry, and their implications for the Andean countries.

II. MOLDING PROCESSES

7. Injection.

The plastics processing industry turns out two kinds of materials : molded parts and semi-finished goods.

8. In the U.S. and Europe, between 35% and 40% of all plastics are molded; and of this, 60% are molded by injection.

9. Fig. 1 shows, qualitatively and approximately, how the economocs of the four major molding processes respond to the overall length of run. These curves speak for themselves, injection molding which is used to make around 60 % of all thermoplastic moldings, is also the process where costs are most sensitive to the ultimate size of market.

10. Fig. 2 is somewhat more ambitious. It is an attempt to show how the total injection molding costs vary with length of run for different shot sizes. For given run length, molding costs can be seen to decline as the shot gets larger. Unfortunately, it is not as easy to find a 50.000 unit market for, say, a 3.6 kg part as it is a 300.000 unit market for a 150 g. part. Please note that this figure represents an attempt at generalization in a field where traditionally this is felt to be somewhat meaningless. We nevertheless felt that for purposes of illustration we would be forgiven for abstracting from such complicating factors as intricacy and surface finish of the part, number of cavities, nature of the resin, etc.

11. Injection molding of large parts is thus a field where potential opportunities for integration and trade are certain to exist. One way of tackling the problem of mold amortization is trading in molds - leasing, second-hand purchases, etc. This, however, has its inconvenient sides: higher working capital requirements for

the molder, production planning difficulties, and so on. Another approach would be regional standardization of certain parts, and creating industries specialized in making large moldings, partly for export. Such applications as bathroom cabinets, garbage cans, chair shells and toilet seats come readily to mind. Among the smaller moldings, pipe fittings may also be an area that would benefit from standardization: it is doubtful whether production of a complete line of injected fittings is worthwhile below a demand for pipe of around 30.000 T/yr, which is probably more than will be the case in any single Andean country even in 1980, but may well be reached by combining several markets.

12. Another problem in the case of large moldings is to keep the machines working. Thus, whereas the figure shows that an ultimate run of, say, 50.000 is satisfactory for a 3.6 kg. object, it should nevertheless be kept in mind that the economics behind these figures assume the press will be turning out seleable moldings 3.500 hours/yr or roughly 150.000 cycles per year.

13. Blow Molding

Figure 3 shows the same type of curve, this time for large blow-molded parts. Transportation difficulties here stand in the way of intra-regional trade, but then the economic threshold runs are good deal smaller. Such applications as 1.000 l. residential water tanks seem promising at an ultimate series of around 20.000 but the problem of keeping the machines busy also arises since using high molecular weight HDPE such a part could probably be produced at a rate of 30.000/yr.

14. Thermoforming

Thermoforming taken by itself is a process where length of run is of little importance, since mold amortization costs are only 10% or so of those for injecting a part of the same size (assuming this were possible). On the other hand, economics of scale appear at the sheet extrusion end of the process. A modern ABS sheet line can easily turn out 2.000 T/yr. It would thus at first sight seem inadvisable to put up thermoforming plants near the markets they are to serve, but to concentrate sheet extrusion in a single place. This would, however, make it more difficult to recycle the thermoforming scrap back to the extrusion plant; and scrap may amount to 30-40% of the molder's purchases. All this considered, regional integration of the extrusion-thermoforming process would probably best be accomplished by extrusion of plate at a single location and thermoforming near the various markets provided a reasonable price could be obtained locally for the scrap. In Europe, scrap is usually returned to the sheet extruder and the price structure is such that ABS scrap is worth to the molder around 17 ¢/lb as against 50 ¢/lb for virgin sheet, so even in industrialized economics it appears that savings to the molder resulting from scrap recovery are relatively minor.

15. Rotational Molding

Rotational molding, other than of vinyl plastisols, seems to be developing at a rapid rate and can be seen from Fig. 1 to be well suited to economics where runs are generally short. Here, however, economics of scale exist in the grinding step. A differential between granular and powder resin prices of 4-5 ¢/lb, such as exists in Europe, for example, can only be achieved by large custom-grinding plants of a size unlikely to be viable for a long time in the Andean countries. Rotational molding thereby loses some of its appeal for developing regions in general, except if based on imported resins.

III. SEMI-FINISHED GOODS

16. Blown Film

Although practically no country is too small to support a handful of blown film lines, with its attendant conversion facilities (often run by entirely different operators), it may be a sobering thought that even in developing countries such as Brazil competition is by now so intense that 750 T/month is considered the survival level for a blown film plant. This points out the necessity of encouraging the appearance of few plants, vertically integrated from extrusion to printing to bag-making, except perhaps in the field of small, general-purpose packaging where the value-added in printing and conversion exceeds the cost of unconverted film.

17. Other film conversion processes - coating, extrusion coating, lamination, metallizing, are even more capital intensive and represent processes that could be carried out at a single location, once packaging markets become more sophisticated. But here it must be kept in mind that the conversion industry needs extremely good communications with its clients, so that it is not in practice a very likely candidate for regional integration.

18. Oriented Films

Polyolefin oriented weaving tapes and fibrillated products should have a bright future in the Andean countries. Although in Europe, there are a few merchant producers of weaving tapes, the trend is nevertheless definitely towards captive production by the various fiber industries. This will probably be the case in the Andean countries as well.

19. Mechanically bioriented films can only be produced on a very large scale, and it is doubtful whether even at the end of the decade such products as PET film will be made at all by any of the Andean countries. A possible candidate for production on a regional scale is bioriented, extruded PP film, which appears to be able to compete with cellophane even in high-speed packaging applications. This would reduce imports of viscose-grade pulp for cellophane.

20. PVC Film and Sheet

Because of its capital-intensive nature, production of both rigid and flexible calendered PVC film and sheet are likely candidates for regional integration.

21. Flexible calendering, melt-roll coating and plastisol coating turn out essentially fashion-sensitive goods: upholstery materials, table cloths and the like. The market of a single developing country is thus unlikely to be sufficiently attractive because of the high frequency of product changes, so that production on a regional level may be the only way to achieve reasonable order lengths, it is likewise an industry that requires frequent communication with the retail trade.

22. As to rigid calendering, at least half of the PVC sheet made by this process goes into packaging and a thorough study would have to determine which of the various regional markets could support a rigid line by 1980. For those regions where the outcome of such an evaluation is negative other alternatives exist, such as the *"Calendrette"* process or even simple extrusion, which despite their well-known drawbacks can at least be operated at a level of, say, 500 T/yr of sheet, as opposed to a minimum of around 2.500 T/yr for a single rigid calender.

23. Pipe

Pipe is a major outlet for PVC, and to some extent for polyethylenes. In Europe, these days most people would agree that nothing below 20.000 T/yr. can any longer be considered a viable operation. Even in smaller markets such as those represented by the Andean countries, plants should be built with a view towards reaching some 12.000 T/yr within, say, 5 years after start-up. It should be remembered that in most developing countries PVC pipe is being introduced in the face of competition from mature, well-entrenched materials such as asbestoscement pipe, which is made in several countries, or cast-iron. And unless PVC pipe can be produced on a scale allowing prices to be attained that permit competition with other materials, thermoplastic pipe will never achieve any real penetration of the various markets - water supply, residential construction, utility conduits, field drainage, etc.

IV- CONCLUSIONS

24. This glance at the economics of some of the major plastics processing techniques, even if somewhat cursory, has nevertheless disclosed a number of potential projects, to be considered for implementation by 1980, on a scale determined by the combined market of the Andean countries. These are :

Large Injected Objects
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25. It is hoped that these represent but a few of the opportunities for intra-regional trade that actually exist, and that others will turn up over the coming years.

Fig 1

MOLDING COSTS

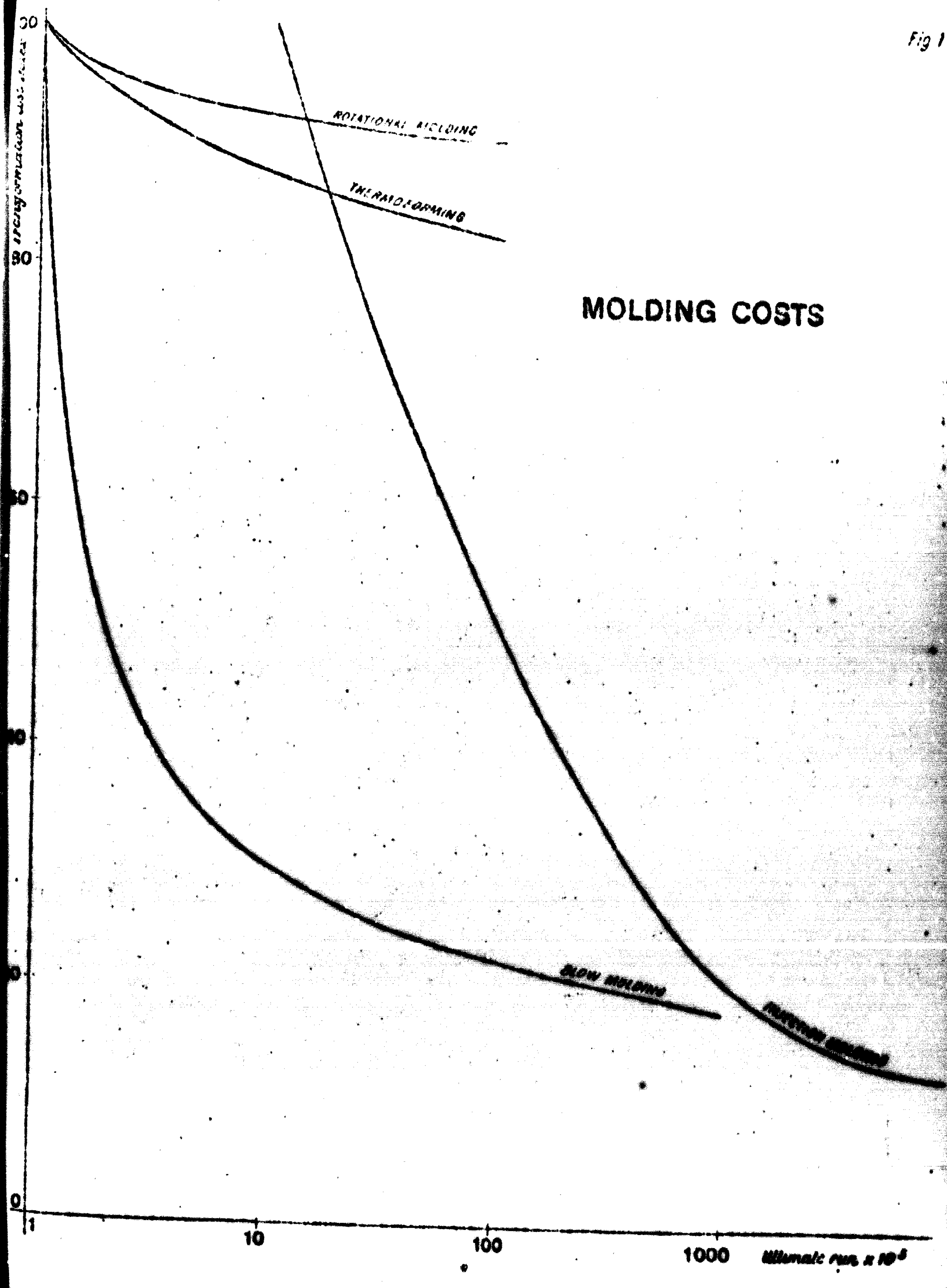


Fig.2

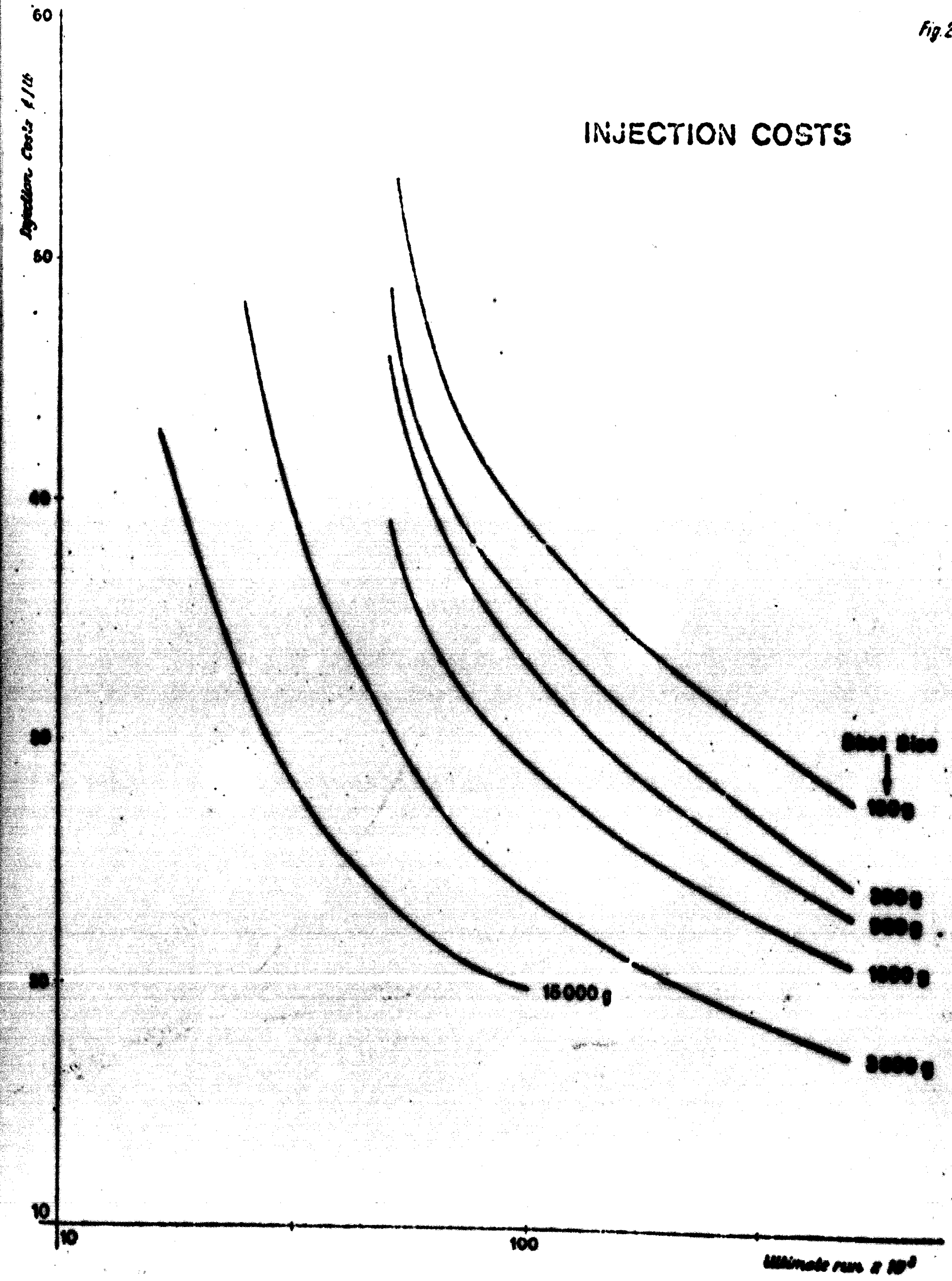
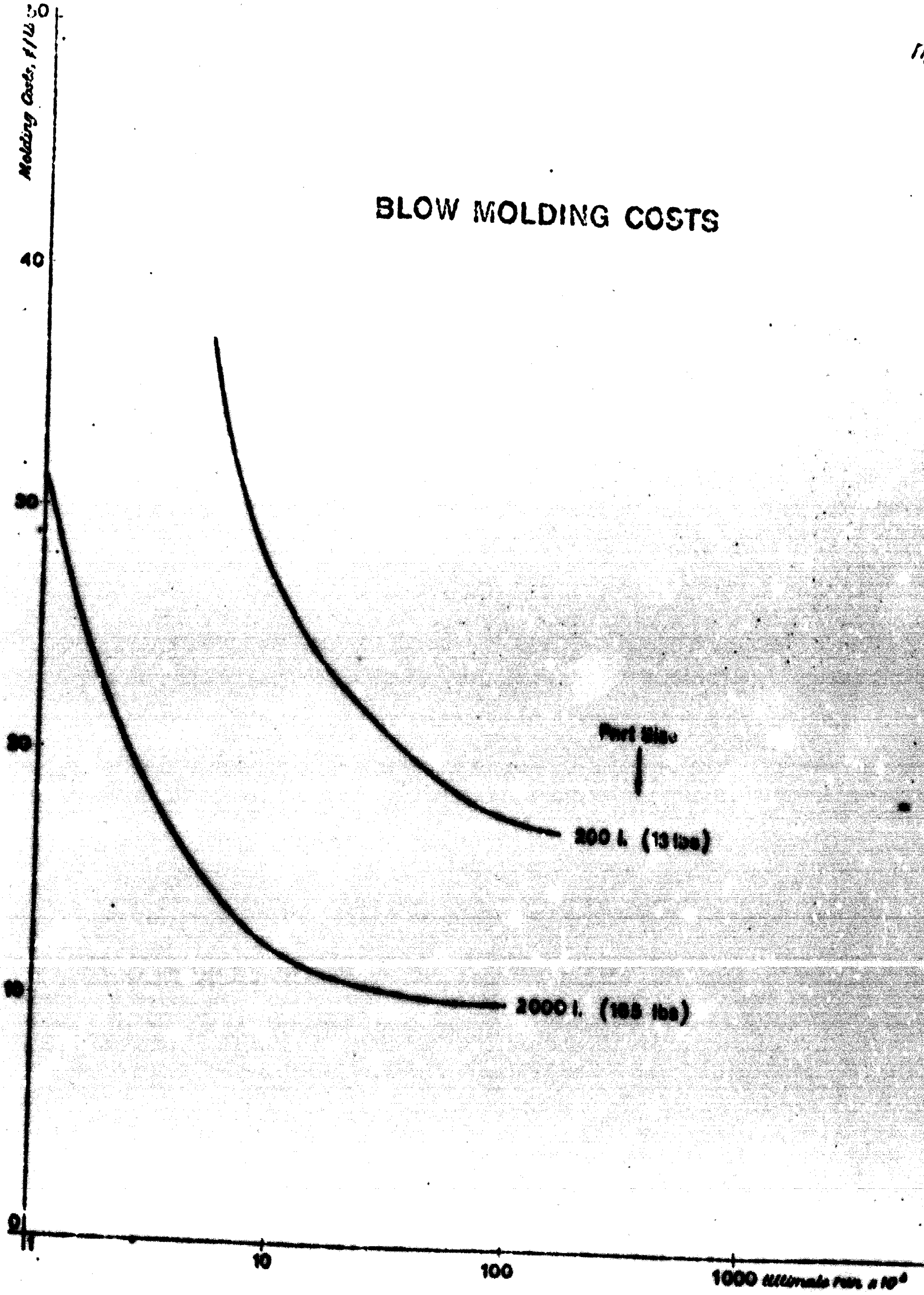


Fig 3



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