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CONSUMPTION AND PRODUCTION OF SYNTHETIC RUBBER IN THE WORLD 1/

by

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C O N T E N T S

INTRODUCTION

This paper contains information on the development of synthetic rubber consumption and production between 1960 and 1980, and some estimates regarding the years after 1980.

In order to present a picture of the evolutional pattern of synthetic rubber consumption and production in the last 10 to 15 years as well as forecasts for the next decade the authors attempted to give data reflecting the world level and the situation of some developed and developing countries.

The paper includes data on developed countries with important consumptions and productions of synthetic rubber and developing countries for which published data and information were available.

The development of consumption and production of rubber latices is outside the scope of the present paper.

I. DEVELOPMENT OF RUBBER CONSUMPTION IN THE WORLD

Rubber is a raw material indispensable to modern civilization. Some industries cannot function without rubber or rubber goods and one can confidently state that there is today virtually no industry which does not employ rubber in one form or another. The largest rubber consumer has been and will continue to be the automotive industry. Important amounts of rubber are also consumed by mechanical goods industry, electrotechnical industry, consumer goods industry, etc.

Until 1932-1934 the world consumption of rubber was covered solely by natural rubber since synthetic rubber was only at its beginnings.

Researches and experiments in the field of synthetic rubber, demonstrated the possibility of producing elastomers with some physical and chemical properties surpassing those of natural rubber. These qualities contributed to the continuing growth of synthetic rubber consumption, the diversification of applications and consequently to the rapid growth of production capacities and of the range of types of synthetic rubber in industrial production.

The fast growth of synthetic rubber consumption after the war stimulated the development and diversification of synthetic rubber production in many countries. Therfore in 1961, the world production of synthetic rubber equalled that of natural rubber, and the world consumption of synthetic rubber showed a steady increase. This trend is expected to last. In fig.I /1-6/, one can see the development of world rubber consumption between 1920-1985 for total, natural and synthetic rubber.

In fig.II /1-8/ and III /1/ the evolution of rubber consumption in some developed and developing countries between 1955 and 1980 is presented.

II. DEVELOPMENT OF SYNTHETIC RUBBER CONSUMPTION IN THE WORLD

Since the growth of natural rubber production was limited and, on the other hand, it was possible to manufacture a wide range of synthetic rubbers with properties superior in some respects to natural rubber and even "tailored" such as to meet specific end-uses, the production of synthetic rubber continued after World War II, the continuously growing demands of rubber being covered mainly by synthetic rubber. The share of synthetic rubber in total world consumption is continuously and rapidly growing, from 36 % in 1955 to over 78 % in 1985.

The share of synthetic rubber in total rubber consumption in some developed and developing contries is presented in fig.IV /1/.

It can be seen that the same steady increase of the share of synthetic rubber in total rubber consumption is shown by some of the developed countries, for example the United States, Canada, Japan for which the share will be about 80 % in 1980.

The developing countries show the same tendency towards an increase of the share of synthetic rubber in total rubber consumption. This share - with the exception of India will be in the range from 62 to 74 % in 1980.

Together with the development and diversification of synthetic rubber production one can observe certain changes in the structure of rubber consumption.

The production of new types of synthetic rubber with superior properties or with characteristics designed to meet specific applications,as well as the emergence of new consumers, are the main factors continuously modifying the proportion of the various types of synthetic rubber in the world rubber consumption.

The evolution of the structure of world synthetic rubber consumption between 1955 and 1975 is illustrated in fig.V /8,9/.

It can be seen that the share of styrene-butadiene rubber in the total synthetic rubber consumption declines from over 88% in 1955 to about 77 % in 1965,and an estimated 57 % in 1975 - although the absolute quantities of this type of rubber are increasing ; while the share of stereoregular rubbers (polybutadiene and polyisoprene) is increasing from 8.5 % in 1965 to 24.4 % in 1975 or roughly a three fold increase in this period.

The share of ethylene-propylene rubber,although expected to increase tenfold within ten years,cannot be regarded as truly representative since the estimated growth is referred to the year 1965 when the share of this type of rubber amounted to only 0.4% of world synthetic rubber consumption.

For the other types of synthetic rubber under consideration,the respective shares vary insignificantly,especially in the last interval examined.

Thus in the future a significant increase of the share of stereoregular polymers in total synthetic rubber consumption is expected,together with a decline in the share of SBR.

Since the United States has an important share in the production as well as in the consumption of synthetic rubber,the consumption structure in this country can be considered as being

representative for developed countries in general, fig.VI /10,11/.

It can be seen that in 15 years the share of styrene-butadiene rubber declined from ~ 80 % in 1960 to 52 % in 1975, while the share of stereoregular polyisoprene and polybutadiene rubbers will reach 25 % in 1975.

Published data on the structure of synthetic rubber consumption in some developing countries are very scarce. Nevertheless they show a tendency of decline of the share of SBR together with an increase of the share of stereoregular rubbers.

In general, the data on the structure of synthetic rubber consumption show that the number of main types of synthetic rubber has grown from 4 in 1955 to 7 in 1975, excluding specialty rubbers used to a lesser extent - this being the main reason why they were left outside the scope of this paper.

As shown before, world's ever growing demands for rubber are covered now, and will be increasingly covered in the future by synthetic rubber.

III. DEVELOPMENT OF SYNTHETIC RUBBER PRODUCTION

In the last 15 years (1955-1970) the production of synthetic rubber in the world has grown almost fourfold, being about 5 million tons in 1970. It is estimated that in 1985 the production will reach the level of about 15 million tons /1,7/.

Available data show that in the developed countries the production of synthetic rubber is steadily growing. Thus in the United States a growth rate of about 4.5% per yr. is expected for 1975-1980 while in other countries such as U.K., France,

Germany and Italy the rates of growth vary from one period to another. In developing countries the production is also expected to increase in the next 10 to 12 years. For instance, in Argentina, Brazil and Mexico the production estimated for 1980 will exceed by 40 to 50 % the production expected in 1975, while in India an almost 2.5 times increase in production is expected in 1980 relative to 1975.

IV. DEVELOPMENT OF SYNTHETIC RUBBER INDUSTRY IN THE SOCIALIST REPUBLIC OF ROMANIA

In Romania within the framework of industrialisation and multilateral development, a special attention was given to the chemical industry which during the present five-year plan will be growing more than twofold.

Among the branches of chemical industry, petrochemical industry has a prioritary place. The organization and development of a synthetic rubber industry in Romania were determined by the following main factors :

- availability of raw materials
- existing experience in the design and operation of processes and complete plants
- an own research capability allowing the development of processes for new types of synthetic rubber, as well as the improvement of already existing processes and
- development of an own machine building industry.

Until 1963 Romania's rubber consumption was covered entirely by imports. After the synthetic rubber factory CAROM came onstream the internal demands for general purpose butadiene-styrene rubber have been covered from national production.

Romanian synthetic rubber consumption is growing steadily. Thus, in 1980 a synthetic rubber consumption 3.0 to 3.5 times higher than in 1970 is expected. The range of synthetic rubber types utilized will broaden in the future especially on the account of polybutadiene, polyisoprene, EPDM, and other specialty rubbers.

The largest rubber consumer, will remain the automotive industry. However, important amounts of rubber will be destined to the manufacture of mechanical and consumer goods.

In the ten years elapsed from the start-up of the CAROM synthetic rubber plant the initial production capacity was doubled thanks to the contribution of Romanian researchers, designers and engineers.

Within the next ten years a rapid growth of the Roumanian synthetic rubber production is expected. This will cover the internal synthetic rubber consumption and at the same time will create availabilities for export.

Together with the growth of S B R production, the production of polyisoprene will be developed, the start-up of the first units being planned for 1975.

For the next years the construction of plants for the manufacture of polybutadiene rubber is also planned.

Besides the general purpose synthetic rubber like SBR, polybutadiene and polyisoprene - as substitutes for natural rubber - the range of synthetic rubbers made in Romania will include in the future other type such as EPDM, butyl, nitrile, etc.

The Romanian synthetic rubber industry is based on petrochemical raw materials.

As regards the technical-scientific foundation, the research in the field of synthetic elastomers has begun in Romania about 15 years ago and the emphasis on the development of research in this area as well as in the field of monomer synthesis is constantly growing.

Main directions of research have been the synthesis of rubbers by emulsion polymerization (a process used in the manufacture of CARCM rubber) and by solution polymerization with stereospecific catalysts. The latter method allows the synthesis of a new range of elastomers such as polyisoprene, polybutadiene, EPDM, etc.

In designing research plants the basic elements of the processes were taken into account in order to build plants of a universal type possessing the flexibility required by the changes called for on synthesizing a new product.

In direct correlation with the research in elastomer synthesis, the research related to the synthesis of the respective monomers has also been developed. This research was concentrated on the utilization of the entire range of petrochemical raw materials available. This approach has been determined by economic arguments related to their complex processing.

Simultaneously, research in the field of polymer characterization has been developed by working out specific methods of analysis aimed at finding correlation between structure and properties and consequently the fields of application of the respective elastomers.

The development of the technical-scientific foundations is also promoted by the establishment of research cooperations

with various countries. By such joint efforts an improvement of results can be achieved.

The research work in the area of monomer and elastomer synthesis materialized in a number of technological processes patented or applied for in Romania and abroad.

Work on new types of polymers is continuing, i.e. the thermoplastic elastomers - especially SBS triblock polymers - . These polymers are important mainly because of their processing technology, similar to the processing of termoplastic materials.

Among the types of synthetic rubber which show promises for the future, the transpolypentenamer is interesting mainly for its high green strength.

Also to be mentioned are the researches still in progress in the synthesis of liquid polymers with functional end groups. The large scale manufacture of such polymers might influence substantially the process of tyre manufacture, the largest rubber consumer.

DEVELOPMENT OF WORLD RUBBER CONSUMPTION

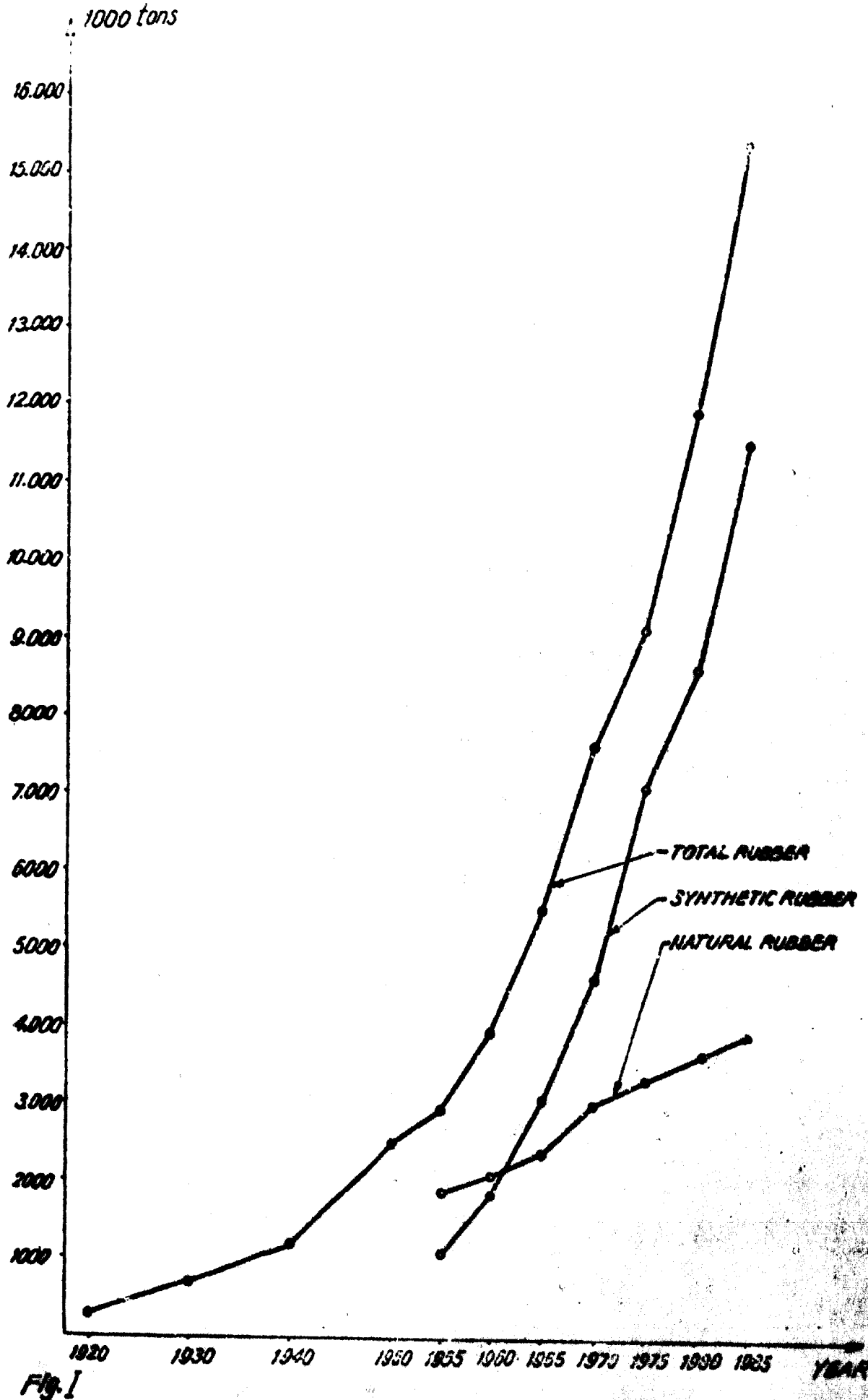
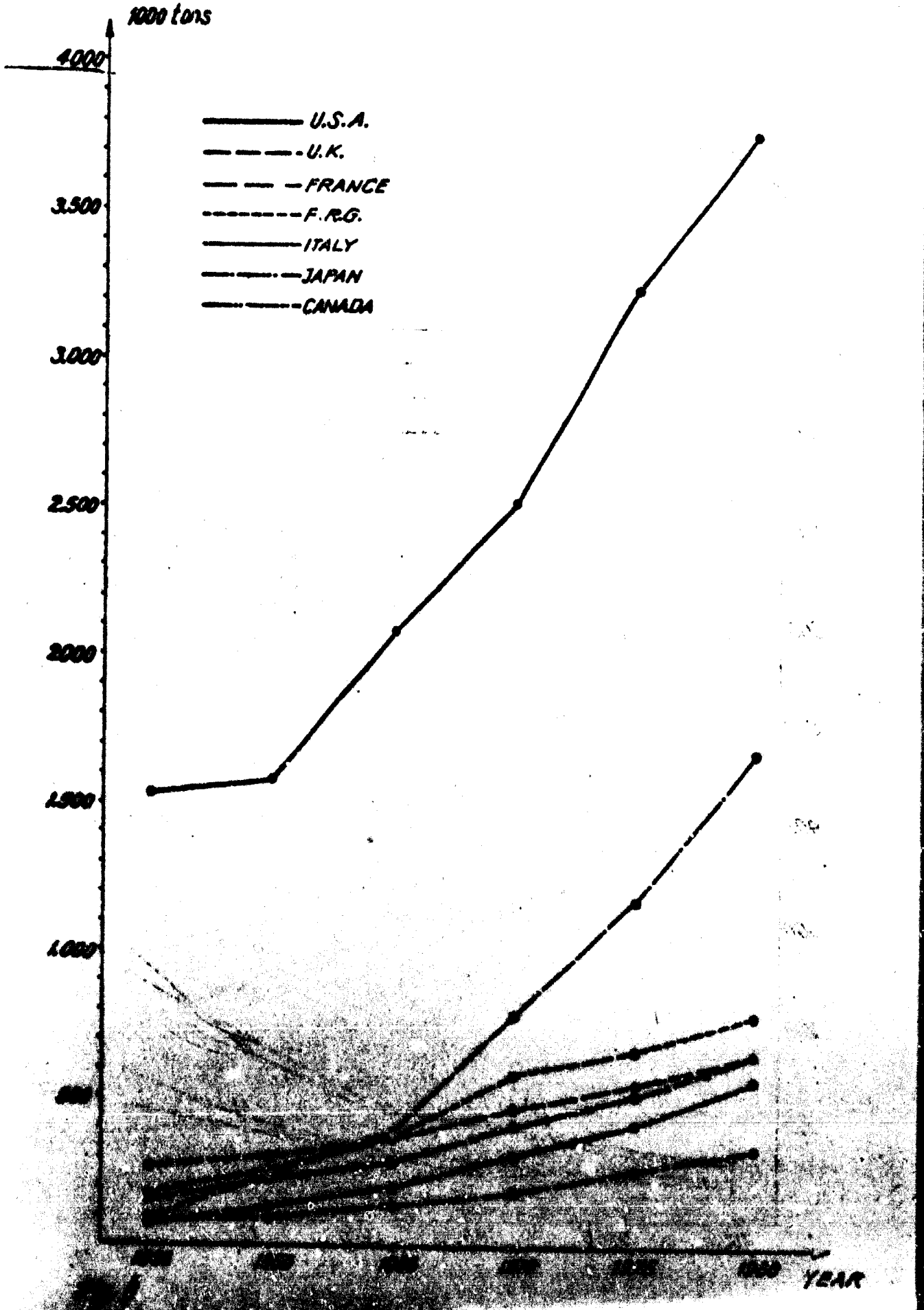


Fig. I

DEVELOPMENT OF RUBBER CONSUMPTION IN SOME DEVELOPED COUNTRIES



DEVELOPMENT OF RUBBER CONSUMPTION IN SOME DEVELOPING COUNTRIES

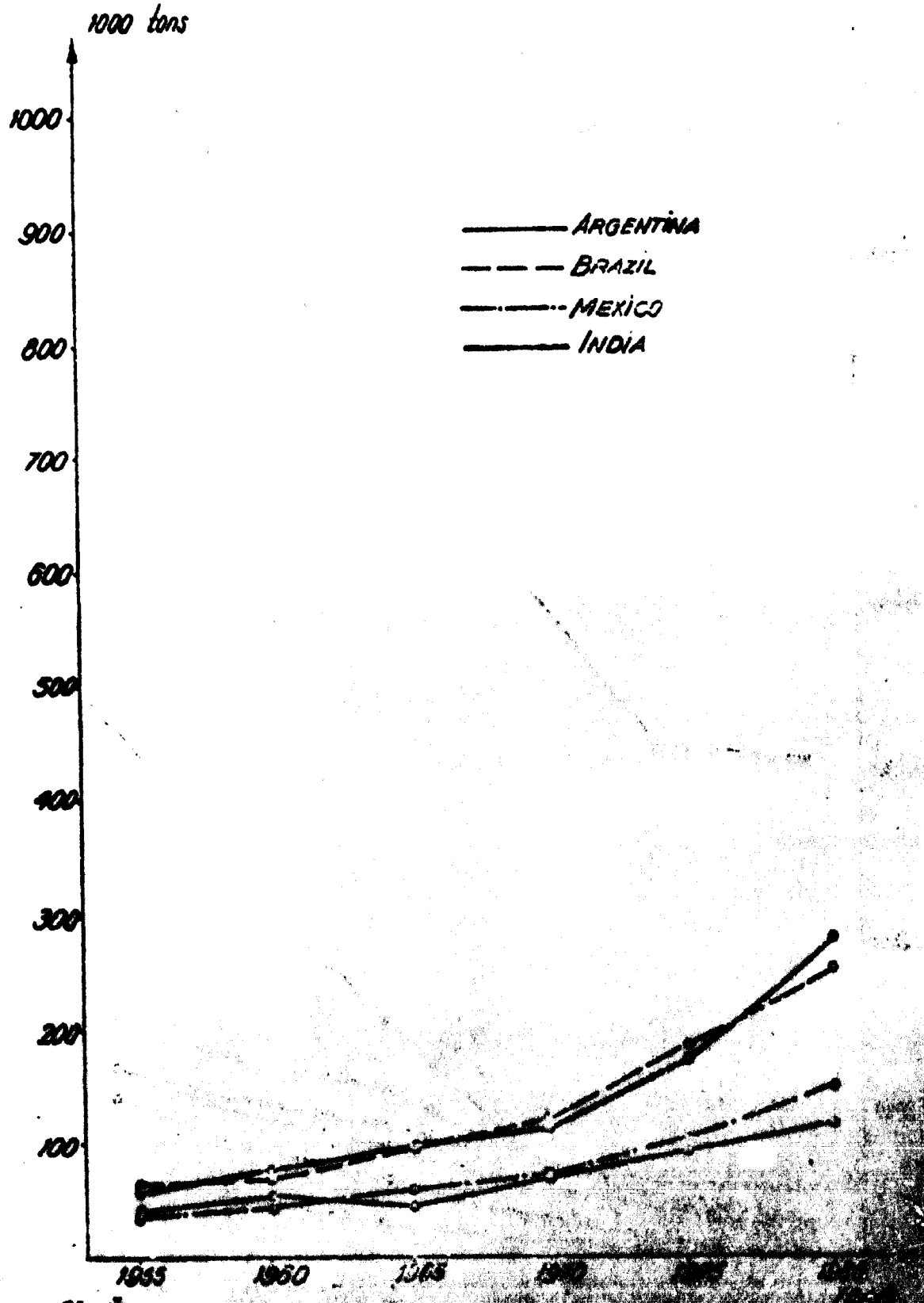
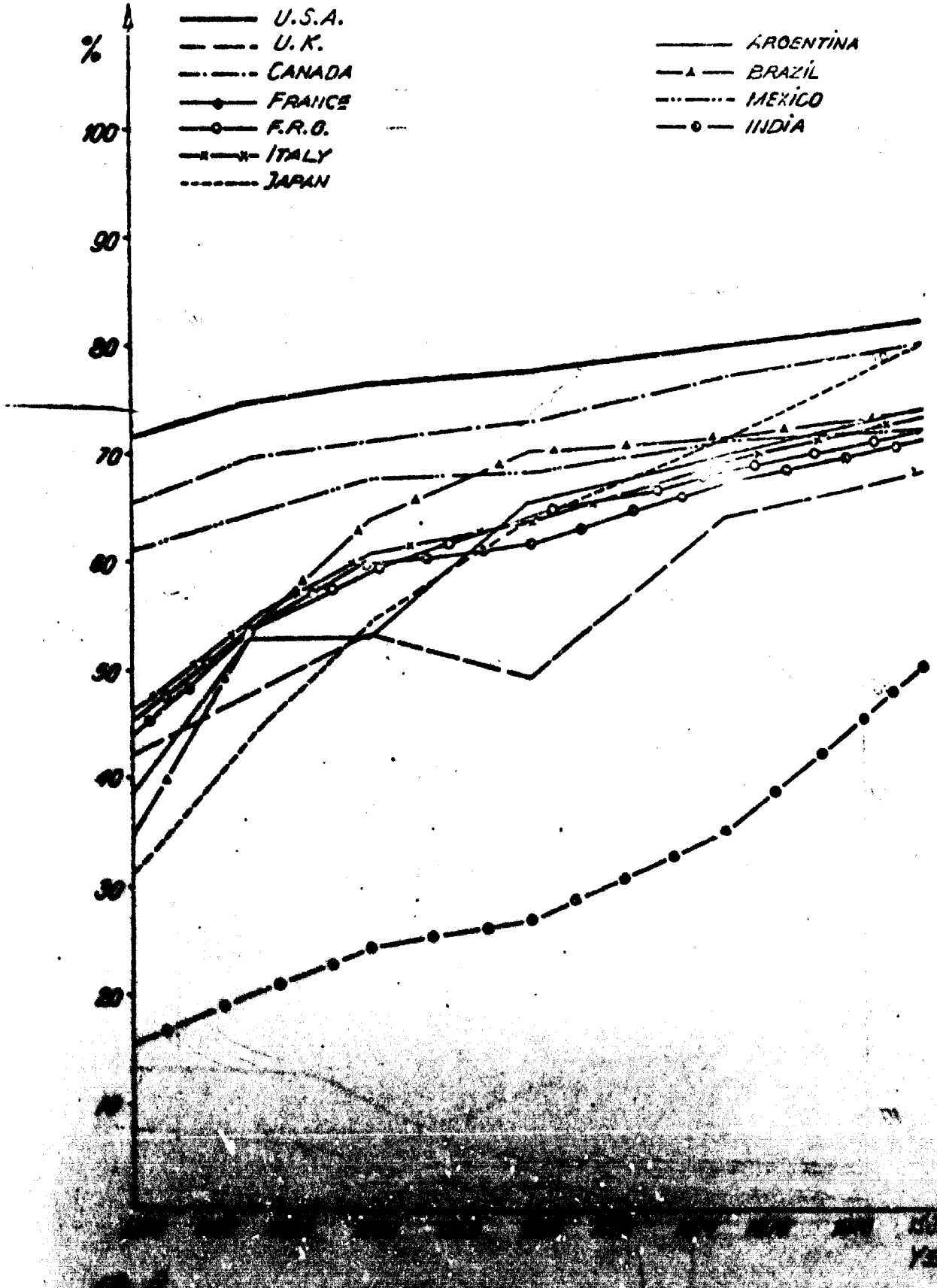


Fig. III

SHARE OF SYNTHETIC RUBBER CONSUMPTION IN SOME DEVELOPED AND DEVELOPING COUNTRIES



STRUCTURE OF WORLD SYNTHETIC RUBBER CONSUMPTION

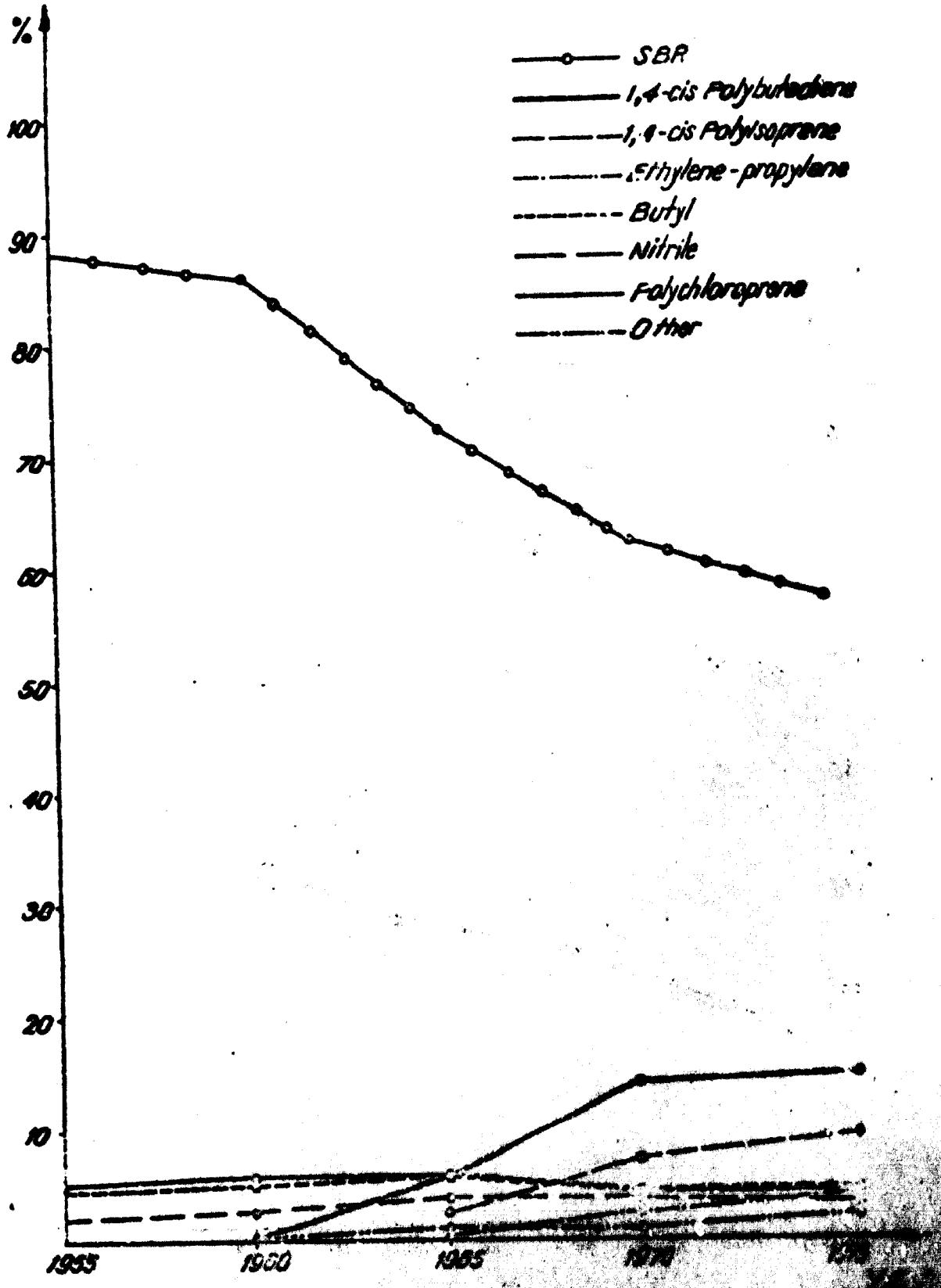
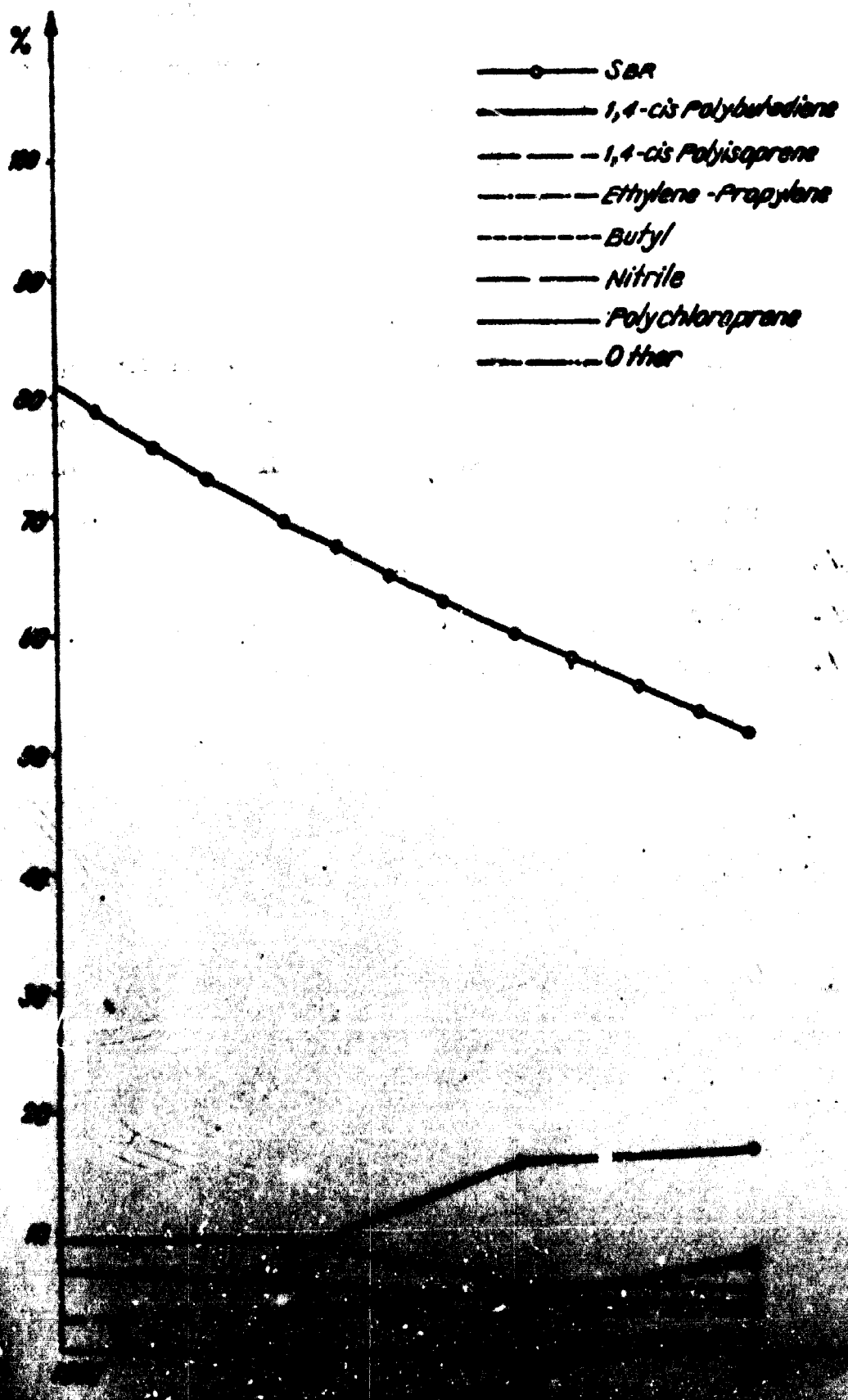


Fig. V

STRUCTURE OF SYNTHETIC RUBBER CONSUMPTION IN THE UNITED STATES



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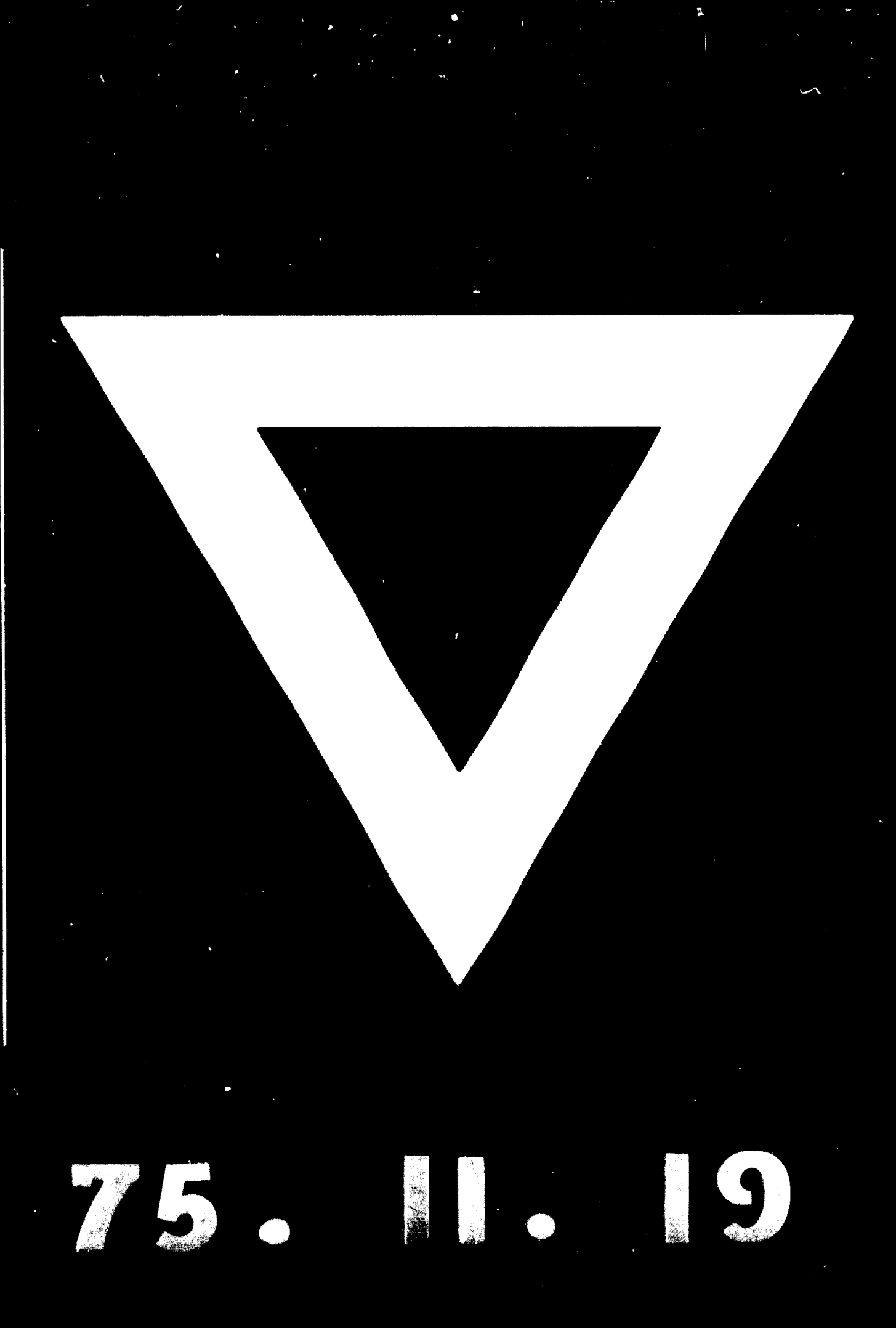
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