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STEEL STANDARDS AND REGIONAL STANDARDIZATION

- LATIN AMERICA -

by

Fernando Aguirre T., Secretary General, ILAFA, and Anibal Gómez,
Director of Steel Standardization Seminars, OAS

The present paper contains a description of the program of Pan American steel standards developed by the Institute Latinoamericano del Fierro y el Acero, the Organization of American States, and the Pan American Standards Committee. A review is made of the economic, technical and historical factors leading to the formulation of this programme, together with a description of its inception and organization, and an examination of solutions found for various problems. Lastly, an evaluation is made of results after eighteen months' activities.

I. The Origin of the Problem

1. The Situation in Latin America prior to 1960

The evolution of steel consumption in Latin America and its diversification may be followed with reference to six countries - Argentina, Brazil, Colombia, Cuba, Chile and Mexico - for which homogeneous statistics are available. Between 1930 and 1940, consumption remained stationary, reaching one and a half million tons in 1940, as shown in Chart No.1. Almost 80% of the above figure was supplied by imports. However, such low consumption was the logical result of the chronically low capacity for imports affecting the entire area. Four of the countries named already had steel plants in operation, their production capacity increased in the following decade, and by 1950 they were able to supply almost half their combined consumption.

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Chart No. 1

TOTAL APPARENT STEEL CONSUMPTION IN SIX COUNTRIES OF LATIN AMERICA
 (in thousands of tons)

Year	A Production	B Imports	C Exports	D Apparent Consumption	A/D x 100
1930	114.7	1,546.1	-	1,660.8	7
1940	312.4	1,194.5	-	1,506.9	21
1950	1,364.6	1,549.2	-	2,813.6	48
1960	4,102.1	1,659.0	130.2	5,630.8	73

Sources: ECLA, ILAPL.

2. As may be seen in Chart No.2, steel consumption is mainly limited to bars and sections, both of which continue to predominate unchanged from 1930 to 1940. The consumption of rails and tubes varies greatly in the same period, as a result of their almost exclusive use by the railroad and oil sectors, and of the economic variations thereof. On the other hand, a regular increase in the use of flat products is clearly seen - in 1940 there is a 50% increase over 1930, and the same happens again in 1950 over 1940 - brought about by the growing diversification of the metalworking industry in the area.

Chart No. 2

ESTIMATED TOTAL CONSUMPTION IN SIX COUNTRIES OF LATIN AMERICA
BY PRODUCTS
 (in thousands of tons)

Year	A Rails and accessories	B Bars, sec- tions and others	C Wire and wire products	D Plates, sheet and tinplate	E Tubes
1930	327.0	592.1	219.3	310.9	183.6
1940	96.5	648.4	164.3	450.4	138.0
1950	195.0	1,129.4	457.4	674.1	320.9
1960	398.8	1,890.7	583.4	2,105.0	573.0

Sources: ECLA, ILAPL.

3. The steel products consumed in Latin America in the above period were bought and sold according to individual foreign standards governing their characteristics in the countries of origin, or else, according to internationally recognized groups of standards, well known, furthermore, to the consuming enterprises established in the area, due to the origin of their capitals or of their technical advisers. The most widely used among such groups of standards were ASTM and DIN. In addition, in countries where industrial development was highest, important consuming sectors - such as railroads, rolling mills, oil wells - set the specifications under which the materials they required were purchased. Moreover, the steelmakers then entering the national steel markets, specified the qualities and dimensions of the products they were to make, according to the technical characteristics of the equipment they had imported for the purpose, or of the production process they were employing, which was yet another way of bringing foreign standards into the area.

4. A chaotic condition thus arose in the various countries in the area. A single product, such as reinforced concrete bars, for instance, had a variety of diameters and mechanical properties which, from a technical point of view, unnecessarily complicated calculations for reinforced concrete structures: from the users' angle, purchases of such products were made more difficult, and productivity in construction work was slowed down; and producers were forced from the start to make a great number of types of bars, whereby costs were unnecessarily increased, as a result of excessive diversification and of the high stocks to be maintained. The situation in Brazil towards 1955 is typical of the prevalent state of confusion. Brazil is undoubtedly the country where this confusion is most serious, as a result of the rapid growth of the steelmaking and metal working industry.

5. The foregoing picture, also to be found in other industrial sectors, led government agencies or industrial associations to concern themselves with the need to introduce a measure of order and harmony, and so the national standards bodies came into being.

6. In 1935, the country where industrial development and diversification were greatest was Argentina, and it was only natural, in a way, that the Instituto Argentino de Racionalización de Materiales (IRAM) (Argentine Institute for Rationalizing Materials) should be established there, as a result of action taken by the Union Industrial Argentina (Argentine Industrial Association). IRAM, then, came into being as a private entity, its heavy duties being thus made easier to accomplish. It is not surprising, then, that Argentina should be the country most active in steel standardization, and that by 1960, 50 standards should have been issued governing quality and dimensions of steel products, and 22 concerning standard test procedures for the same products.

7. In Brazil, in 1940, in the course of the III Brazilian Congress of Laboratories for Testing Materials, the Associação Brasileira de Normas Técnicas (ABNT) (Brazilian Standards Association) was established, due to the joint effort of technicians, entrepreneurs, industrialists and official agencies. The lack of support initially felt by ABNT affected its action in the field of steel, so that by 1960 only two standards on products - reinforced concrete bars and pig iron - and 3 on mechanical tests for steel, had been issued.

8. In Mexico, the Dirección General de Normas (DGN) (Bureau of Standards) was established in 1943, as a government agency depending from the Secretaría de Industria y Comercio (Department of Industry and Commerce). Although the Industrial Standards Law of 1945 covers the appointment of a Committee on Metallurgy and Manufactured Metal Products, this appointment did not take place, and the participation of steel producers in the preparation of steel standards was thus curtailed. By 1960, the DGN had issued 20 standards on products and 10 on general chemical and mechanical tests, all of which closely follow the ASTM model.

9. In Chile, the Instituto de Investigaciones Tecnológicas y Normalización (INDATECNOR) (Institute for Technical Research and Standardization) was established in 1944, sponsored by the Universidad de Chile (Chilean State University). By 1960, its activity in the field of iron and steel covers 13 standards on products and 7 on test methods for such products.

10. In the following year, 1945, the statutes governing the Instituto Uruguayo de Normas Técnicas (UNIT) (Uruguayan Standards Institute) were approved. By 1960 this Institute had issued 4 standards on reinforced concrete bars and steel tubing.

11. In Cuba, the Negociado de Fijación de Tipos y Calidades de Productos Industriales (Bureau of Types and Qualities of Industrial Products) exists since 1948, its name being changed in 1960 to that of Department of Standards, depending from the Ministry of Commerce. No standards had been issued to that date, due perhaps to low industrial development.

12. The Instituto Centroamericano de Investigaciones y Tecnología Industrial (ICAATI) (Central American Institute for Research and Industrial Technology) was established much later in Guatemala, with the additional objective of approaching standardization activities for all Central American countries. No standards, however, had been issued in the field of iron and steel as of 1960. At about the same date standards institutes were established in Colombia and Peru. Naturally, no steel standards have been issued yet.

13. From the foregoing picture it may be inferred that by 1960 in all the steel producing countries of Latin America, except Brazil, a certain effort had been carried out toward achieving order in qualities and dimensions of local steel products, due to action by national standards bodies.

14. The Situation in Latin America in 1960

In 1960, steel consumption in the six countries named exceeded 5.5 million tons, and whereas import figures remained practically unchanged, production was taking place in all six countries, and three fourths of the total steel demand was being supplied thereby, as may be seen in Chart No. 1. Furthermore, by about the same date, the regional industry in general, and the metalworking sector in particular, had shown considerable progress reflected in a modification in the composition of steel consumption, now concentrated mainly in flat products, which made up over 40% of the total consumption for that year.

15. In their search for ways to attain economic expansion, some Latin American countries realized the need to provide larger market outlets for their growing industrial expansion, and decided to move towards gradual economic co-operation.

For this purpose, nine countries signed the Treaty of Montevideo in 1960, setting a term of 12 years for the establishment of a Free Trade Area and specifying a gradual reduction of import tariffs among the contracting countries. The Central American Common Market was already operating, whereby the five countries in that area made up a single economic unit.

16. The purpose of these economic integration agreements is to substitute regional products for imports from outside the Latin American area, including iron and steel products. However, the publication of differing national standards has now originated at regional level a state of confusion regarding steel products specifications similar to that found in the individual countries. At present, paradoxically enough, these very same national standards are putting up technical barriers against the smooth exchange of steel products, and the need is keenly felt for integration of the diverse qualities and shapes of steel whereof production is already taking place in nine countries of Latin America.

17. In 1960, the Instituto Latinoamericano del Fierro y el Acero (ILAFIA) (Latin American Iron and Steel Institute), established the previous year and grouping major steelmakers of Argentina, Brazil, Colombia, Cuba, Chile, Mexico, Peru, Uruguay and Venezuela, began to operate. ILAFIA was established for the purpose of carrying out technical and economic studies to promote production, marketing and consumption of steel in Latin America. One of its major objectives is of course the promotion of steel standardization, and as such it was included from the first in the work programmes of the Institute.

18. In addition, despite the fact that the Pan American Standards Committee (PASC) had been established in 1947, sponsored by standards institutes existing in America, it was unable to carry out any significant action in 13 years following its inception, due mainly to lack of funds. In 1961, the PASC was reorganized, some operating funds were provided, and its Secretariat began operating provisionally at IRAM. Simultaneously, its statutes were approved, stipulating an organization very similar to that of the International Organization for Standardization (ISO).

19. With ILAFIA and the PASC both active on the Latin American stage, the organizational requirements for technical integration of Latin American steelmaking

were adequately met. So it was that in the course of the International Congress on Standardization held in Argentina in 1960, a recommendation jointly sponsored by ILAFA and the OAS was made, whereby a procedure for unifying such standards was set forth, and a call made to international organizations promoting regional economic development requesting them to provide the requisite assistance for its implementation.

14. Inception and Organization of the Programme

20. Review of International Experience

In 1960, the Organization of American States (OAS) requested from J.R. Miller Co., consulting engineers, a report providing "a comparative study of the problems of steel standardization in India, Latin America and the ECSC, that might be used as a basis for future technical assistance in that field".^{1/}

21. After examining the experience of the ECSC, India, and other countries particularly active in the field of steel standardization, the report suggested that "the Institute prepare models of Latin American recommendations for steel standards" ... "Once they have been approved by the ILAFA membership, such models will be submitted to all Latin American standards institutes, with the recommendation that they be approved as national standards, or that they be borne in mind for later revision of existing standards".^{1/} Regarding the co-ordination of ILAFA with the standards bodies, "the relationship suggested is similar to that of the ECSC with the steel industry and the standards bodies of the six countries composing it."

22. Solutions Proposed

ILAFA activities were started in the same year, and, as regards standardization, research was undertaken jointly with the OAS, and an examination of standards organizations and the steel industry was begun, together with a comparative review of national steel standards, in order to ascertain the possibility of unifying them. This examination led to the conclusion that of the 18 products standardized in one Latin American country or another, "10 of them have similar specifications within certain limits, and that it is possible to frame the standards issued concerning them in several countries, within a single pattern" ... "of the remaining eight, in two cases it is possible to make basic modifications in the requirements stated, in order to make them comparable; 3 products are covered

^{1/} Pan American Union: Steel Standardization in Latin America.
ES-DOC.75/60, Aug. 22, 1960

by different standards based, however, on the various specific properties taken into account; and lastly, other products whereof the specifications vary solely according to the different qualities of the steel required for their manufacture.^{2/} In conclusion, ILAFA proposed the following procedure. The ILAFA Secretariat would prepare draft standards and when their number so justified, a meeting would be called of an international committee composed of representatives of the producers, consumers and standards institutes, who would approve them as ILAFA recommendations. It will be seen that, though starting from different points of view, both organizations reached almost identical conclusions, which would greatly facilitate a later agreement between them to undertake this task.

23. Shortly afterwards, the PASC was reorganized and its Statutes drawn up, empowering it to act very much like ISC in the American area. Organizational conditions required for starting work are thus met. Notwithstanding, regular PASC procedures and funds available only provide a long-term solution. Other means must be found in order to obtain regional steel standards as soon as possible. Certain of the urgent need for action in this sense, the ILAFA Secretariat together with the PASC examined the possibilities of obtaining technical assistance from international organizations operating in Latin America, particularly the system and regulations governing technical co-operation by the OAS.

24. Inception of the programme

As has been stated previously, there are several recently established standards organizations in this area. In general, the resources granted to these organizations are insufficient for the work they are to carry out. This has brought about a lack of properly trained professional staff, and led to consider the usefulness of a combined programme covering both standardization training and preparation of Pan American recommendations. Such a programme fits perfectly into the Technical Assistance Programme of the Organization of American States. "Said programme is of an essentially educational nature and operates through regional advanced technical training centres attended, by means of fellowships granted by the Programme, by professionals of the various American countries, in order to carry out higher studies in divers fields of specialization".^{3/}

2/ ILAFA, La normalizacion siderurgica en América Latina, (Steel Standardization in Latin America), Santiago de Chile, November 1960 (2nd ed.).

3/ OAS: "Direct Technical Assistance Services", Washington, April 22, 1959.

25. Nevertheless, due to the special nature of the problem, ILAFA conducted a number of preliminary consultations with the OAS and the PASO. Finally, thanks to the effort of the Industrial Technology and Productivity Division of the CAS, a formal presentation was made to the Economic and Social Council, who approved, in 1961, the "Programme for Training and Research in Pan American Standardization for Assisting Economic Integration".

26. Organization and Structure of the Programme

It was stipulated that both the PASO and ILAFA would act as organizations co-operating with the CAS. The former would co-ordinate these matters with the national standards institutes in the area stimulating their active participation, and the latter would provide advisory and technical information services required for research work and training. Programme executives are one Co-ordinating Director and the Directors of the Seminars to be conducted.

27. Activities are developed by means of training and research Seminars on subjects selected yearly, with participation, as trainees, of steel plant engineers, representatives of steel consumers, and technicians from standards institutes. The various stages of training concern standardization in general, and supplementary matters dealing specifically with steel standards. For the former, and bearing in mind that the Seminars were conducted in different places and under different conditions, a common schedule was drawn up and covered by lectures delivered by specialists and Programme executives. Regarding matters dealing specifically with steel standards, it was deemed advisable to give uniformity to the variegated knowledge of the trainees by means of lectures by specialists in the respective subjects. Thus, for instance, when dealing with standardization of reinforced concrete bars, the lectures covered steel production processes, rolling, notions of steel behaviour in structures, quality control, interpretation of mechanical test results, and so on, supplemented by visits to selected plants. Lastly, the Programme realizes how important it is for trainees to attend and take active part in the meetings of the Standardization Committees, as a necessary complement to their training.

28. Research work concerns investigation by the trainees of the properties of various steel products, regional consumption trends, technical characteristics of existing production equipment, etc., culminating in the preparation of a draft Pan American standard which may be used later as a basic document for standardization of the respective product.

29. The divers stages of Pan American standardization may be summarized, then, as follows. The Seminar Director prepares a "Pan American Recommendation Outline", based mainly on the various standards existing for the product. This outline is discussed individually by the standards institutes of America, and their opinion is submitted at the Seminars by the respective trainees acting as delegates of said institutes. The outline is then discussed at the Committee meetings which form an important part of the Programme, modified according to proposals by the delegates, and drawn up as Preliminary Draft Recommendation. As such it is again circulated to the standards institutes for a period of national consultation lasting two to three months. The new comments are discussed during the second stage of the Seminar, and a First Draft Recommendation is drawn up and submitted for public consultation for a period of three months. Remarks and comments then received are classified as concerning form or content. The former are either accepted or rejected, and for the latter, the routine PASC procedure is followed, that is, the standards institutes are consulted by mail. However, amendments concerning content have been very few to date, and agreements have been easily reached in every case.

30. Priorities for Standardization

In the first place it was found advisable to undertake standardization by groups of similar products, since this would simplify the selection of participants. Producers and consumers, particularly, are used to dealing with groups of products having certain characteristics in common, such as reinforced concrete bars, flat products, tubes, etc. In order to set the order of precedence for dealing with such groups, quantitative and qualitative factors were examined. Among the former are the order of products according to their percentage of the total steel consumption; the size of purchases, which is inversely proportional to the number of transactions carried out for each group of products; diversification in the use of products, and the existence of technical data. For qualitative factors, organizations and persons familiar with the problem were consulted.

31. As Chart No. 2 shows, priority according to volume consumed is as follows: flat products, reinforced concrete bars (over 50% of column B) sections, wire and wire products, tubes, and rails and their accessories. As these are end use figures, semifinished products are not shown, although their figures are among the highest, due to the size and number of rolling mills in the area. The number of transactions shows the greater or lesser use made of a standard and depends on volume consumed and size of purchases. Products graded according to the smallest lots purchased would appear as follows: flat products, reinforced concrete bars, sections, wire, tubes, semifinished products, and rails. The variety of uses given to some steel products causes the quality of such products to affect a greater number of articles manufactured from them. Consequently, the lack of standards for these products obstructs development in a more widely extended economic sector. For instance, sheets are used to manufacture automobiles, steel furniture, drums, elevators, steel shutters, refrigerators, and so forth, whereas reinforced concrete bars are used practically for construction purposes only. From this point of view, sheets would take precedence over bars, and products would be graded as follows: flat products, wire, tubes, section, reinforced concrete bars, semifinished products, and rails. Lastly, the fact that standards do exist in the area for certain steel products is an indication of the prevalent need for such standards, and is thus a valuable precedent pointing to a national trend, which otherwise would require investigation. The order of products according to the number of countries where standards exist, is the following: reinforced concrete bars, flat products, wire, and sections.

32. Among the organizations and persons whose opinion was requested concerning priorities in standardization were the Secretariat of the Latin American Free Trade Association (LAFTA), interested in speeding intraregional trade; steelmakers, and Programme executives and advisers. With all this information in hand, the FASC and ILAFA set up the following order of precedence of products for purpose of regional standardization: reinforced concrete bars, semifinished products, flat products, tubes, sections, wire rod and wire. Bearing in mind the need for certain

basic standards covering measurement of product characteristics, denomination of steel used in their manufacture, etc., the subjects to be covered in the successive Seminars on steel standardization were scheduled as follows:

- (a) - mechanical tests
- (b) - chemical tests
- (c) - semifinished products and bars
- (d) - flat products - steel designation code - simplification of carbon steels
- (e) - tubular products
- (f) - sections

33. Due to their complex nature, the coding of steel designations and the simplification of carbon steels are to be dealt with in all seminars conducted after that on flat products. Both subjects are understood to be of the greatest importance since the reduction of alloy steels, for instance, is mandatory for a steel plant to operate economically.

34. Some Technical Problems

In the course of preparing outline standards and of their discussion, certain points have arisen on which it has been particularly difficult to obtain unanimous agreement, as required for their approval. Generally speaking, such points mainly concern regional conditions, such as equipment limitations, raw materials characteristics, systems of measures, etc., or else, traditional differences between producers' and users' interests. As a rule, it was found easier to discover an acceptable solution to the latter, rather than to the former, difficulties. The origin of some hard points is briefly examined below.

35. The use of different regional terms to designate the same product was a permanent problem. Thus, reinforced concrete bars are termed "barras para hormigón armado" in Chile and Peru; in Argentina, however, they are called "redondos", in Cuba and Venezuela "cabillas", and in Mexico and Uruguay, "varillas". A number of reasons have been discussed, such as use in the greatest number of countries, etymology, the official word used in Spain, and, finally, one of the several term has been adopted for eventual general use. As a sign of preference it has been used in the name of the recommendation, while equivalent terms in divers

countries are given in a footnote. Such preferred terms already form a solid base for the establishment of a common technical lexicon, the overall study of which is a permanent task of ILAFA. The co-existence of three languages in America - English in the United States, Portuguese in Brazil, and Spanish in the remainder - has been no serious obstacle to Pan American steel standardization. Spanish has been the working language, and translations of the recommendations in their final stages have been made in the countries where they were needed.

36. Size definitions of certain products, such as semifinished and flat products, have caused difficulties due to contradictory definitions in international use. The criterion followed in the case of semifinished products was to give univoical identification to each product, for which reference was made to three parameters: width, thickness and cross section area. The solution given is shown in a graphical representation of such definitions (Fig.1).

37. The adoption of standard product sizes was continually obstructed by the co-existence of the metric system and the British system of measures. The habitual use of ASTM standards, the U.S. origin of production equipment, and technical assistance from the same country, have led many plants to use inches, pounds, etc., thus violating, in a way, the official use of the metric system, mandatory for Latin American countries. Although of late there has been a noticeable reaction against this, and two enterprises - Companhia Siderurgica Nacional, of Brazil, and Compania de Acero del Pacifico, of Chile - have used millimeters and kilograms for all their products, and although there is a most decided will and resolution among steelmakers to follow their lead, this has not always been possible. Whenever this has been the case, it was decided to maintain both measures, though converting inches into millimeters and recommending preference for metric measures. This applies to rounds for bolts and screws, the threads whereof are already governed by international standards. In the matter of tolerances in sizes, the model of the American Iron and Steel Institute (AISI) has been closely followed, mainly due to the origin of production equipment, as explained above, although small modifications have been introduced, based on delegates' experience, and on Latin American, German or Japanese standards. In certain cases, this system of tolerances has been carefully rationalized and made uniform wherever necessary or advisable.

38. A noteworthy discussion has arisen concerning production processes for steel to be used in certain products. As a consequence of impurities contained in certain regional iron ores, Thomas and Bessemer processes are used, and, very often, steel produced under such circumstances fails to meet ASTM test requirements, because producers follow German or French standards. Furthermore, due to different sources of information, different interpretations arise on the same point. After extensive consultation, it was agreed to accept for Pan American Recommendations test requirements derived from all existing processes, with few exceptions.

39. Perhaps the greatest technical obstacle encountered has been the variety of types of the same product originated by variations in size, chemical analysis, or mechanical properties. Regarding dimensions, preferred numbers have been introduced wherever possible, and with regard to steel quality grades, in general, they have been reduced to four types, as follows, according to their tensile strength: 34, 37, 42 and 50 kgf/mm².

40. The fact that a country with such high technical development as the United States should be participating in the formulation of Pan American recommendations has presented no problem to date, due to their decision to act solely in the role of collaborator or adviser, the Latin American countries being the only ones to play an active part in this process. However, the United States have agreed to trade in this area based on quantities and sizes as established in such recommendations.

III. Evaluation of Seminars on steel standardization

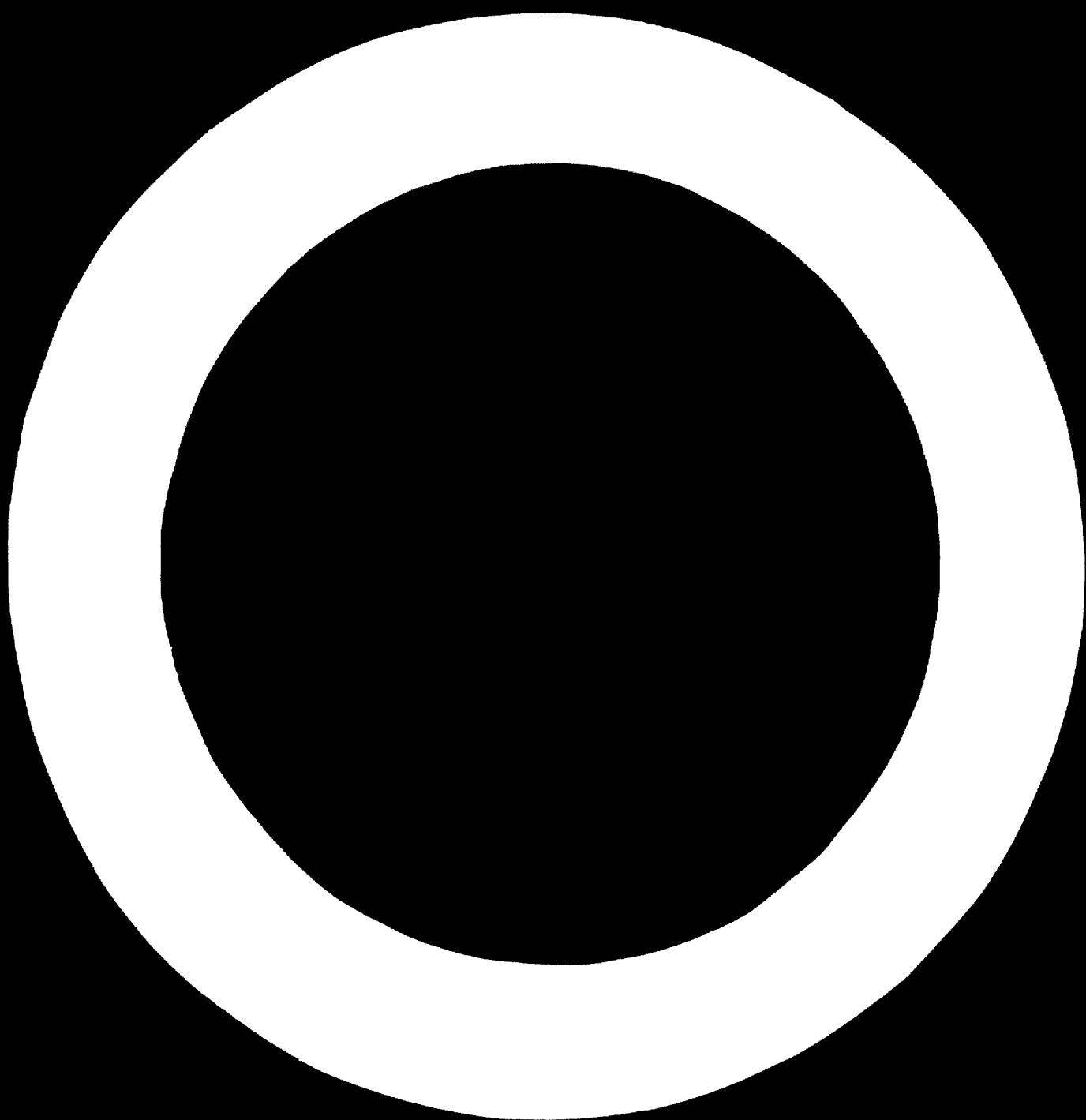
41. In 1962, four seminars were conducted, in the course of which 32 draft recommendations were examined and 56 engineers received training. The first was held in Buenos Aires, and the following drafts were prepared concerning mechanical tests for steel: bend and tensile tests; Brinell, Vickers, and Rockwell hardness tests; Charpy impact test (U- and V-notch); modified Erichsen cupping test; flanging, drift expanding, flattening and bend tests for steel tubes. The second seminar was held in Mexico City and the drafts prepared cover the following chemical tests: determination of carbon in iron and steel by the direct combustion, gravimetric and volumetric methods; determination of phosphorus and sulphur by the evolution and volumetric methods; of manganese by the bismuthate and persulphate

oxidation methods; of silicon by the perchloric acid and sulphuric acid methods; of copper by the iodometric method; of tin by the iodathometric method; of nickel by the dimethylglyoxime method; and of chromium by the persulphate method.

42. In Santiago, Chile, two seminars were conducted on standardisation of bars and semifinished products, organised jointly by ILAFA and ANDATECNOR and assisted by the invaluable services of Shri B.S. Krishnamochar (ISA) in an advisory capacity. Draft Pan American Recommendations were drawn up on the following products: blooms, billets, slabs, sheet bars for rolling structural products; plain, deformed, and twisted reinforced concrete bars, and bars for rivets, bolts and nuts.

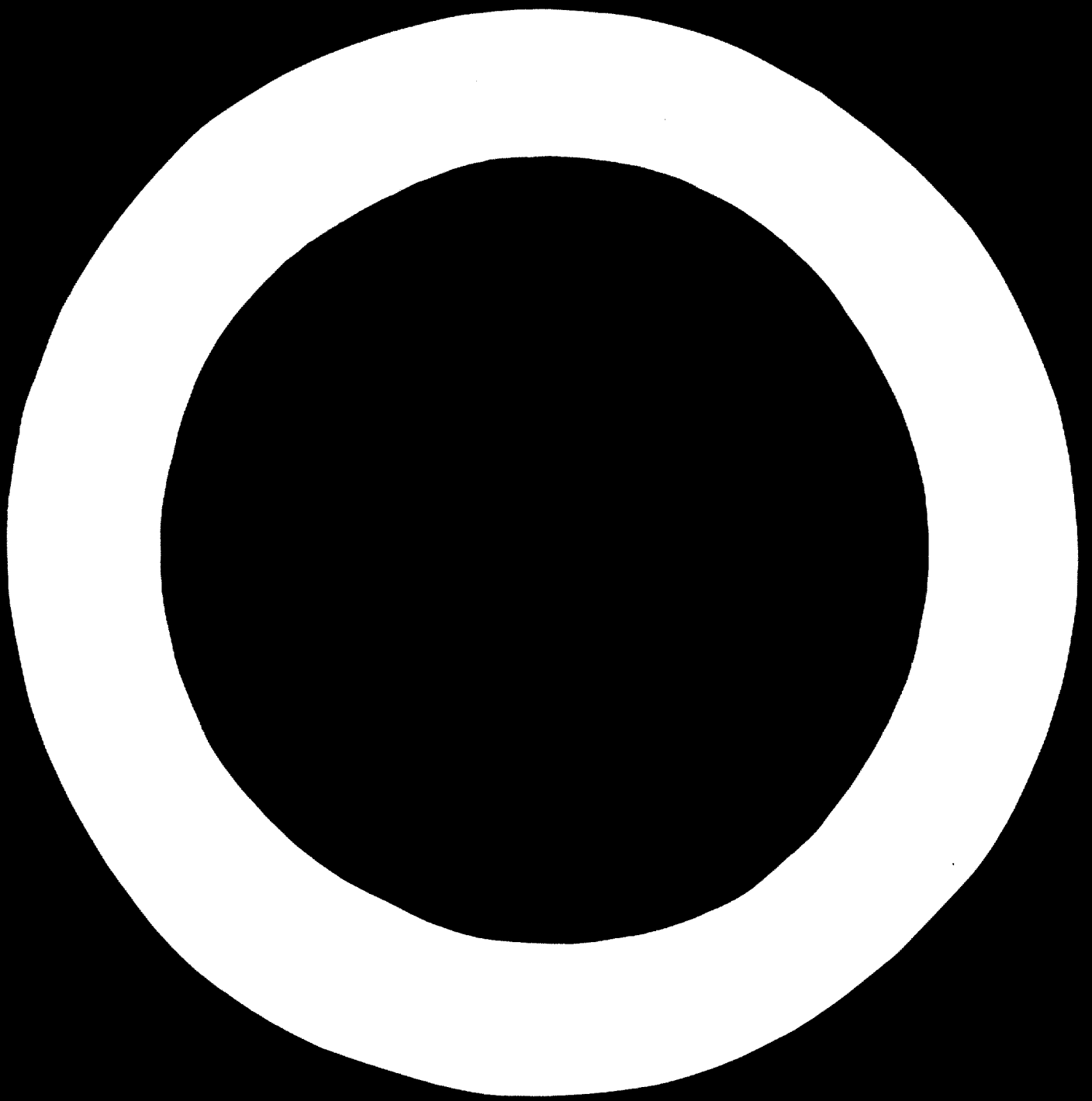
43. For 1963 some changes have been introduced into the programme, whereby training and standards preparation have been separated. This year, activities have been extended to other industrial sectors, and 3 seminars will be conducted in the course of the year on flat products and steel tubes. The first two have been devoted to standardisation of the following products: commercial quality sheets, weldable and structural commercial quality; commercial quality plates, weldable and structural commercial quality; sheet for portable liquefied gas containers; boiler plates; deep drawing sheets; and zinc-coated sheets. In addition, the study of simplification of carbon steels and their designation according to chemical composition were begun. For this purpose, a FASC-ILAFA code has been drafted which is at present undergoing examination in the various countries.

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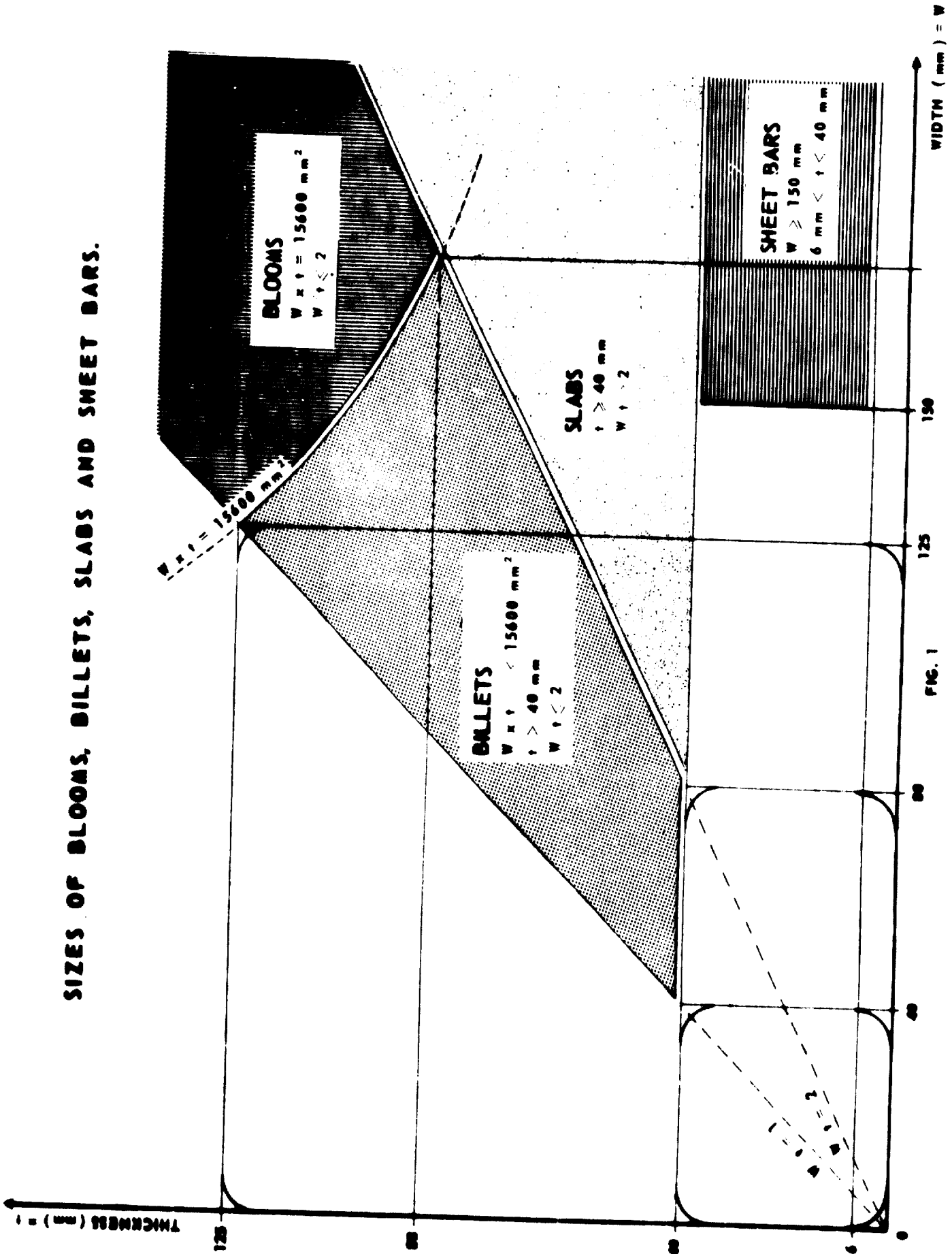


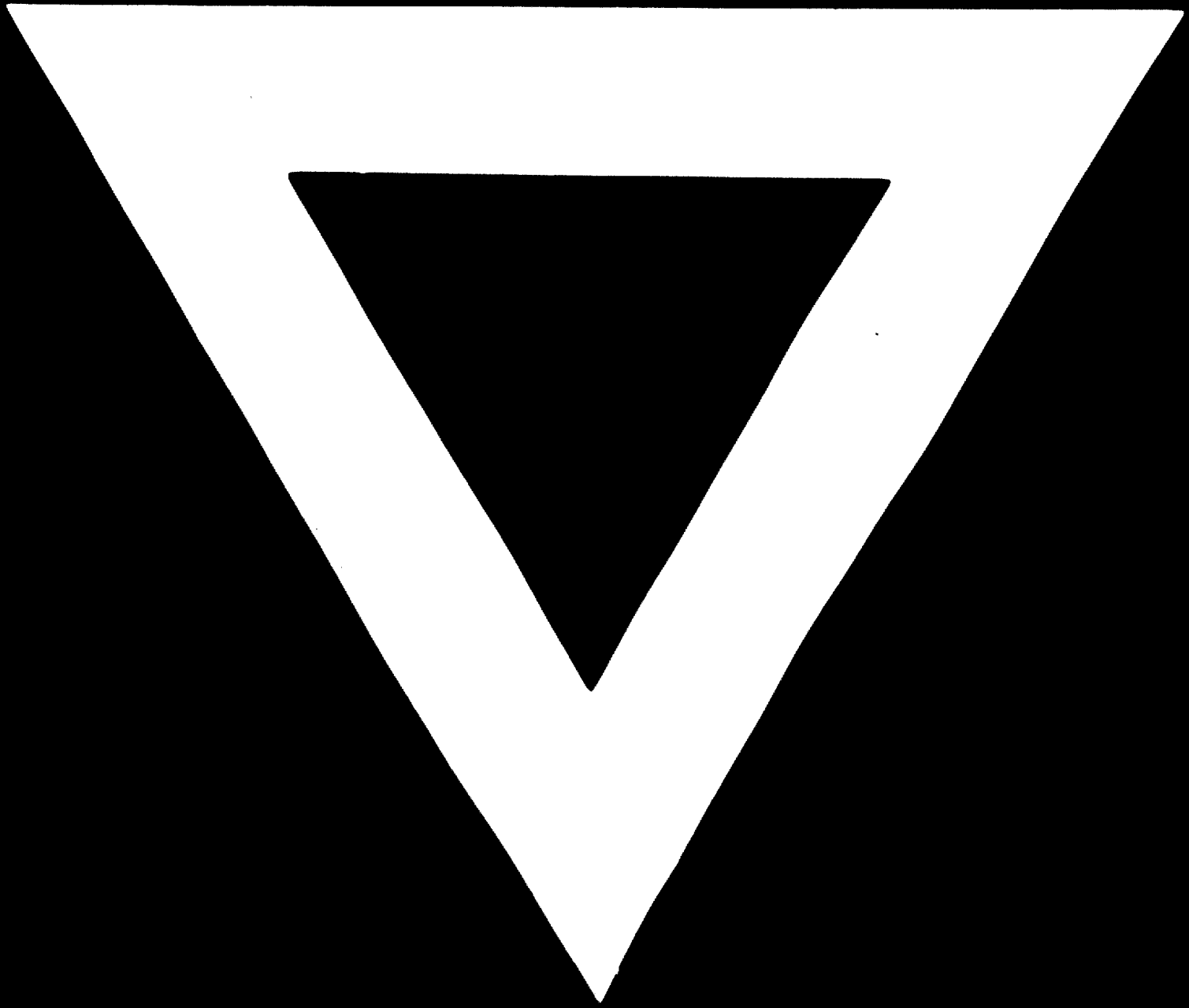
STEEL SY.P.1963/
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Figure

FIGURE



SIZES OF BLOOMS, BILLETS, SLABS AND SHEET BARS.





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