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UNITED STATES TARIFF COMMISSION

ELECTRON, PROTON, AND SIMILAR MICROSCOPES
AND DIFFRACTION APPARATUS

Report to the President
on Investigation No. TEA-I-24
Under Section 301(b)(1) of the Trade Expansion Act of 1962,
and Section 9 of the Educational, Scientific, and
Cultural Materials Importation Act of 1966



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Note.--The whole of the Commission's report to the President, including the statistical appendix, may not be made public since it contains certain information that would result in the disclosure of the operations of individual concerns. This published report is the same as the report to the President, except that the above-mentioned information has been omitted. Such omissions are indicated by asterisks.

REPORT TO THE PRESIDENT

U.S. Tariff Commission,
May 18, 1972.

To the President:

In accordance with section 301(f)(1) of the Trade Expansion Act of 1962 (TEA) (76 Stat. 885), the U.S. Tariff Commission herein reports the results of an investigation on electron, proton, and similar microscopes and diffraction apparatus conducted under section 301(b) of that act.

The purpose of the investigation is to determine whether, as a result in major part of concessions granted under trade agreements--

Electron, proton, and similar microscopes and diffraction apparatus, frames and mountings for the foregoing articles, and parts of such frames and mountings, which are dutiable under items 708.78 and 708.82 of the Tariff Schedules of the United States (TSUS); and electron, proton, and similar microscopes and diffraction apparatus, and repair components therefor, which are free of duty under items 851.60 and 851.65 of the TSUS,

are being imported into the United States in such increased quantities as to cause, or threaten to cause, serious injury to the domestic industry producing articles which are like or directly competitive with the imported articles.

Following the receipt of petitions filed on November 18, 1971, by two domestic firms, the U.S. Tariff Commission, on November 29, 1971, instituted an investigation under section 301(b)(1) of the Trade Expansion Act of 1962 and section 9 of the Educational, Scientific, and Cultural Materials Importation Act of 1966. Notice of the investigation and public hearing was posted at the Commission's offices in

Washington, D.C., and in New York City and was published in the Federal Register of December 3, 1971 (36 F.R. 23099). The public hearing was held on February 8 and 9, 1972, and all interested parties were offered opportunity to be present. A transcript of the hearing and copies of briefs submitted by interested parties in connection with the investigation are attached.

The information for this report was obtained from fieldwork, from questionnaires sent to domestic producers and importers, from the Commission's files, from other Government agencies, and from evidence presented at the hearing and in briefs filed by interested parties.

Finding of the Commission

On the basis of its investigation, the Commission 1/ finds
(Commissioner Leonard dissenting in part 2/)--

electron, proton, and similar microscopes and diffraction apparatus, frames and mountings for the foregoing articles, and parts of such frames and mountings, which are dutiable under items 708.78 and 708.82 of the Tariff Schedules of the United States (TSUS); and electron, proton, and similar microscopes and diffraction apparatus, and repair components therefor, which are free of duty under items 851.60 and 851.65 of the TSUS,

are not, as a result in major part of concessions granted under trade agreements, being imported into the United States in such increased quantities as to cause, or threaten to cause, serious injury to the domestic industry producing articles which are like or directly competitive with the imported articles.

1/ Commissioner Sutton did not participate in the decision.

2/ Commissioner Leonard dissents from the Commission's finding insofar as it relates to electron microscopes, frames, and mountings therefor, and parts of such frames and mountings, which are dutiable under items 708.78 and 708.82 of the TSUS; and electron microscopes and repair components therefor, which are free of duty under items 851.60 and 851.65 of the TSUS.

Views of Chairman Bedell, Vice Chairman Parker,
and Commissioner Moore

This investigation was instituted to determine whether, as a result in major part of concessions granted under trade agreements, electron, proton, and similar microscopes and diffraction apparatus (as well as frames and mountings and certain parts and components) are being imported into the United States in such increased quantities as to cause, or threaten to cause, serious injury to the domestic industry producing like or directly competitive articles. Although the scope of the investigation thus covered all of the microscopes and apparatus named above, proton microscopes are not yet articles of commerce, and "similar" microscopes of any type have not been developed. Diffraction apparatus is marketed, for the most part, as an integral part of electron microscopes, as are frames and mountings. Therefore, the record does not treat with any of the articles other than electron microscopes.

The electron microscope is an instrument that focuses a beam of electrons by means of an electromagnetic or electrostatic lens system to project an enlarged image of an object on a viewing surface such as a fluorescent screen or photographic plate. They differ from optical microscopes in that the latter use light rays, instead of electrons, to project an image. An electron microscope may be either (1) transmission type, which is used to examine a very thin specimen in depth, or (2)

scanning type, which is used to examine the surface of an object. The transmission electron microscope became an article of commerce in 1939, when the first such instruments were produced and marketed in the United States; the scanning electron microscope was first produced abroad in 1958, but was not manufactured in the United States until 1968.

Statutory criteria

Section 301(b)(1) of the Trade Expansion Act of 1962 establishes four criteria each of which must be met before an affirmative determination can be made. If any one of the four criteria is not satisfied, a negative determination must be reached. In terms of electron microscopes (the article of principal concern to us in this investigation), the four criteria are as follows:

- (1) Electron microscopes must be imported in increased quantities;
- (2) The increased imports must be a result in major part of trade-agreement concessions;
- (3) The domestic industry producing like or directly competitive electron microscopes must be seriously injured or threatened with serious injury; and
- (4) The increased imports resulting in major part from trade-agreement concessions must be the major factor causing or threatening to cause the serious injury.

Based on the evidence in the instant case, our determination is in the negative because the fourth criterion specified by the Trade Expansion Act has not been met.

Transmission electron microscopes

U.S. imports of transmission electron microscopes have trended downward in the past 3 years. Imports of such instruments ranged from 189 units to 210 units in 1969-71; imports in each of those years were less than entries in either of the 2 preceding years (1967 or 1968) and less than average annual imports in the past 5 years.

Despite the recent decline in imports, the evidence shows that domestic producers have been unable in recent years to market a transmission electron microscope which is technologically competitive with imported microscopes. This failure of domestic firms to produce and market instruments of competitive quality, despite the recent decline in imports, clearly indicates that imports are not the major factor causing, or threatening to cause, any injury to the domestic industry. A summary of developments among domestic firms having an interest in the manufacture of transmission electron microscopes is pertinent here.

For many years the Radio Corporation of America (RCA) was the sole U.S. producer of transmission electron microscopes. In 1969, the Forgflo Corp., which had been a principal supplier of electron microscope parts to RCA, purchased the Scientific Instruments Department of RCA, including its inventory of EMU-4 transmission electron microscopes which RCA had introduced in 1965. Although it offered the EMU-4 microscopes at prices * * * those of imported microscopes of comparable kilovolt power, Forgflo was able to market only * * * of the inventory of instruments it acquired from RCA; * * * Expert witnesses testified at the Commission's

public hearing that the EMU-4 model had become obsolete because of the rapid technological advances in the field, and that potential buyers would not purchase the model for that reason. Meanwhile, Forgflo developed a new "Paragon" model of transmission electron microscope which, according to some evidence, may be technologically comparable to some imported microscopes. The company, which developed a prototype of the Paragon in October 1970, entered into three contracts for it, but it has not been able to produce the instruments to fulfill the contracts. Funds have not been available, either generated from within or obtained from outside sources, to support manufacturing operations--a circumstance unrelated to any increased imports of electron microscopes. In August 1971, Forgflo petitioned a Federal District Court for protection of its assets under Chapter 11 of the Federal Bankruptcy Act, and by the end of 1971 the company had ceased all work on the Paragon.

Recently another domestic firm--Elektros Company, Inc.--developed a transmission electron microscope in the lower end of the kilovolt power range which is just now being offered for sale. The company's price for its instrument appears to be competitive with those of imported instruments of comparable kilovolt power. No evidence available to us suggests that imports are affecting the company's operations.

Scanning electron microscopes

U.S. imports of scanning electron microscopes generally increased in recent years, although they declined in 1970 and 1971. After peaking

in 1969 (91 units), imports of such microscopes declined to 76 units in 1970 and 75 in 1971; nevertheless, entries in the latter 2 years were larger than in 1967 and 1968.

Despite the larger volume of imports, the domestic producers of scanning electron microscopes, as a group, have increased their production and sales of such microscopes, expanded their share of the U.S. market, and employed increased numbers of workers in the manufacture of such instruments. Scanning electron microscopes were not produced in the United States until 1968. Aggregate shipments of scanning electron microscopes by U.S. producers increased from one unit in 1968 to 39 units in 1971. The domestic shipments accounted for less than 2 percent of the U.S. market in 1968, but for 32 percent in 1971. Average annual employment of U.S. workers engaged in the production of scanning electron microscopes increased steadily, from 19 in 1967 to 168 in 1971.

Four domestic firms have produced and marketed scanning electron microscopes. Two of the firms accounted for the bulk of the sales in 1971. One of the two firms, which began operations in 1969, has steadily increased its production and sales of scanning electron microscopes since then. * * * The other firm entered the market in 1971 and ranked second in sales among domestic companies in that year. These companies obviously are not suffering serious injury from imports.

Sales of scanning electron microscopes by the other two domestic producers have declined sharply since 1969 * * *

The decline in sales of scanning electron microscopes by these firms,

however, occurred at a time when sales by the other domestic firms were increasing and imports were declining. Thus, it appears that the growing inability of these two firms to sell their microscopes in the U.S. market was not caused in major part by increased imports.

Conclusion

Based on the evidence available to the Commission, we have concluded that even if it were determined that the industry was seriously injured or threatened with serious injury, imports of like or directly competitive articles resulting in major part from trade-agreement concessions are not the major cause of such injury. Therefore, we must make a negative determination with respect to the petitions for relief in this investigation.

Views of Commissioner Young

I am in agreement with the majority of my colleagues that the electron microscope industry 1/ does not meet the criteria established for tariff relief under the Trade Expansion Act of 1962, but the basis of my finding is that increased imports are not in major part the result of concessions granted under trade agreements. As is noted in the statement of my colleagues, this is one of the four statutory criteria that must be met for an affirmative determination under the Trade Expansion Act.

Electron microscopes are highly technical, precision scientific instruments. They have been used increasingly in various types of research and for teaching purposes. Domestically produced transmission electron microscopes were first sold in the United States in 1939, and imports first commenced in the early 1950's. Domestically produced scanning electron microscopes were first sold in 1968 with imports first recorded in 1966.

A number of factors have caused the increased purchases of electron microscopes. Greatly increased interest and expanded effort in scientific research have stimulated demand for more and better instruments. Technological differences in the various types and makes of electron microscopes available have played an increasingly important role.

1/ Inasmuch as proton microscopes are not yet articles of commerce, and since diffraction apparatus is marketed, for the most part, as an integral part of electron microscopes, as are frames and mountings, I do not treat further with any of the articles other than electron microscopes.

Dutiable imports

Electron microscopes--had they been a commercially available product in 1930--would have been dutiable at 40 percent ad valorem. By the early 1950's, when electron microscopes were first imported, the rate of duty was 30 percent. During the decade of the 1950's, when a 4-1/2-point duty reduction occurred, imports are believed to have varied from 30 to 45 per year. Since 1960 there have been two periods when imports fell rather sharply and one period when there was a very sharp increase. During the period of increasing imports, the duty was reduced only 2-1/2 points but during the two periods of falling imports the duty was reduced a total of 10 points. Moreover, despite substantial duty reductions in the period since 1960 (from 25.5 percent to 11 percent) the overall increase in dutiable imports amounted to an average of only one microscope a year.

Although all these duty reductions resulted from trade-agreement concessions, it is obvious that there has been little relationship between the reduction in duty and the volume of imports. I must conclude, therefore, that such duty reductions were not the major cause of the relatively small increase in imports from 1960 to 1971.

Duty-free imports

During the early years of imports of electron microscopes (in the 1950's), some entered the country duty-free as a result of individual bills passed by the Congress, but the number is believed to have been small. From mid-1961 through January 1967, Public Law 87-95 permitted

nonprofit institutions established for educational, scientific, or therapeutic purposes to import electron microscopes free of duty. The duty-free entry provided by Public Law 87-95, as well as the duty-free entry provided by individual bills, were the result of statute, and not the result of trade-agreement concessions. Effective February 1, 1967, however, the circumstances relating to duty-free treatment of electron microscopes changed. The earlier legislation was repealed, and duty-free treatment was provided by new legislation which implemented U.S. participation in the UNESCO Agreement on the Importation of Educational, Scientific, and Cultural Materials (the Florence Agreement). Under this legislation, electron microscopes entered for the use of any nonprofit institution established for educational or scientific purposes were to be free of duty, if no instrument or apparatus of equivalent scientific value is being manufactured in the United States. The legislation also provided that such duty-free treatment shall be considered as a concession granted under a trade agreement for purposes of Title III of the Trade Expansion Act of 1962 (the Title under which this investigation is being conducted). Thus, the duty-free treatment of electron microscopes existing to February 1967 was not a consequence of trade-agreement concessions, while that existing since February 1967 is to be treated as such a concession.

From 1961 to 1967, when the duty-free entry of electron microscopes was a result of legislation, the duty-free imports rose greatly-- amounting to 183 units in 1967. In the first full year of operation under the Florence Agreement (1968), when the duty-free treatment was to be considered as a trade-agreement concession, a significant increase

in imports of electron microscopes occurred, entries reaching an all-time peak of 214 units. Thereafter, no growth in duty-free imports occurred--a decrease which first occurred was exactly offset by an increase which followed.

To summarize, nearly all of the increase in duty-free imports of electron microscopes occurred in the period when the duty-free treatment was not a result of trade-agreement concessions. The upward momentum experienced when the duty-free rate was statutory no doubt contributed to the limited increase which did occur subsequently when the duty-free status was to be treated as a trade-agreement concession.

Quite aside from the statistical comparison of the imports, an additional vitally important factor influenced the extent to which electron microscopes entered. The evidence in this investigation shows that increased imports resulted principally from the advanced technology on the part of certain foreign producers as contrasted with U.S. producers. With respect to transmission microscopes in particular, which in 1971 had accounted for two-thirds of apparent consumption of all electron microscopes in the United States, the domestically produced instruments were at a technological disadvantage.

In light of the foregoing considerations, I have concluded that increased imports of electron microscopes have not been the result in major part of trade-agreement concessions and therefore a negative determination is required under the statute.

Dissenting Views of Commissioner Leonard

I find affirmatively that electron microscopes as provided for by Tariff Schedules of the United States (TSUS) item 708.78, including frames and mountings for such microscopes and parts of such frames and mountings under item 708.82, and electron microscopes as provided for under item 851.60, including repair components for such microscopes under item 851.65, are, as a result in major part of concessions granted thereon under trade agreements, being imported into the United States in such increased quantities as to cause, or threaten to cause, serious injury to the domestic industry producing like or directly competitive products. As to proton and similar microscopes (articles of no commerce in the United States) and diffraction apparatus (no evidence of imports), which articles are also covered by this investigation, I concur in the negative finding of my colleagues.

In order to remedy, or prevent the injury, or threat of injury, that I have found, it is my opinion that the rates of duty for electron microscopes, including frames and mountings for electron microscopes and parts for such frames and mountings, should be increased to 22 percent ad valorem in Column 1 for TSUS items 708.78 and 708.82, and that the duty rate for electron microscopes and repair components now provided for by TSUS items 851.60 and 851.65 should be increased to 22 percent ad valorem.

Statutory criteria

Under Section 301(b) of the Trade Expansion Act (TEA) of 1962, the Commission must determine whether--

- (1) An article is being imported in increased quantities;
- (2) The increased imports are in major part the result of concessions granted under trade agreements;
- (3) The domestic industry producing an article which is like or directly competitive with the imported article is being seriously injured or threatened with serious injury; and
- (4) The increased imports in major part the result of trade-agreement concessions have been the major factor in causing or threatening to cause the serious injury.

For an affirmative finding to be reached, all four of the above criteria must be satisfied. In the instant investigation, the facts revealed satisfy these criteria.

Unique aspects of this investigation

Before detailing how each of the criteria is met, certain peculiarities of this investigation should be delineated. The instant investigation not only is the first under the so-called industry provisions of the TEA which relate to the UNESCO Agreement on the Importation of Educational, Scientific, and Cultural Materials Act (hereafter referred to as the Florence Agreement), but also in other respects is so unique as almost to defy comprehension--and thusly, a reasonable solution.

First, as opposed to the normal investigation of an industry under the TEA, where the Commission has only trade-agreement concessions under the General Agreement on Tariffs and Trade (GATT) to deal with in making a determination, here we have not only those usual concessions, but by direction of Section 9 of the legislation implementing the Florence Agreement, ^{1/} the duty-free treatment provided for by such Act is to be treated as a concession granted under a trade-agreement concession.

Here is an example of some of the questions which can arise under the complicating factor of considering the Florence Agreement concession. Electron microscopes are not only dutiable at reduced trade-agreement rates established by GATT concessions, but are also imported free of duty from any country in the world with whom the United States trades by reason of the Florence Agreement implementing legislation, if the instrument is imported by a nonprofit institution under certain circumstances. What would happen to possible free imports from Communist countries if a tariff adjustment was invoked under the TEA and a rate higher than zero were to be proclaimed? Would the Communist

^{1/} Public Law 89-651, approved October 14, 1966, the Educational, Scientific, and Cultural Materials Importation Act of 1966, reads in so far as pertinent: Sec. 9. Tariff adjustment and other adjustment assistance. Any duty-free treatment provided for in this Act shall, for purposes of title III of the Trade Expansion Act of 1962 (76 Stat. 883; 19 U.S.C., secs. 1901 to 1991), be treated as a concession granted under a trade agreement: PROVIDED, That any action taken pursuant to section 351 of such Act as the result of this section shall be consistent with obligations of the United States under Trade Agreements.

imports still retain the zero rate while the rates of duty to our trade-agreement partners were increased? It seems, rather, that the United States would possibly find that it has a trade-agreement rate in effect as respects an article from a Communist country for the purposes of Title III of the TEA.

Another of the problems which can arise in making a determination in this investigation is whether the true GATT-rate imports should be considered separately from the Florence Agreement imports. Too, if a remedy is to be found, should the remedy for the GATT-agreement imports be different from that for the Florence agreement imports. This is illustrative of the questions which arise in the careful consideration of this investigation, some of which seem to be avoided, even though not obviated, by a possible negative determination.

Due to frequency and amount of duty-free imports of electron microscopes during the period 1960-71 (1,617 units imported duty free and 663 units imported dutiable), a significant problem which should be discussed is that which regards the "like or directly competitive" test under section 301(b)(1) of the TEA, and the "equivalent scientific value" test for imports entered duty free under the Florence Agreement legislation. The latter provides in effect that imports of such articles as electron microscopes may be imported duty free if no instrument or apparatus of equivalent scientific value for the

purposes for which the instrument or apparatus is intended to be used is being manufactured in the United States. Although this test is not a part of the TEA, it has been contended, by both importing institutions and foreign exporters of electron microscopes, that for all intents and purposes, the Commerce Department does in fact apply a like or directly competitive test in making its equivalent scientific value determination. In short, it is argued that the two tests reach the same results. If this is true, it would indicate that all instruments approved by the Commerce Department for duty-free entry are in fact not like or directly competitive, and therefore, the only instruments the Commission would have to consider in making its determination are the units dutiable under the GATT concession rates.

It is the opinion in the instant investigation that the allegations referred to in the preceding paragraph relating the TEA "like or directly competitive" test and the "equivalent scientific value" test are not supported by the evidence which has been presented. Although the Secretary of Commerce may determine there is no instrument of equivalent scientific value manufactured domestically to perform a function in a specified area such as research or teaching, this does not preclude in an overall assessment of the domestic industry and the competition supplied by foreign suppliers that articles produced by the domestic industry (electron microscopes) are like or directly competitive with the article being imported.

The very fact that free entry of an article is premised on a particular "intended" use prevents the equivalent scientific value test from being the same as the like or directly competitive test. This may be illustrated by the simple example of two automobiles which are considered competitive in the market as providing a means of transportation. If there is added as a condition that the automobile will be used only on the desert, it becomes apparent that the vehicle with a superior cooling system--other things being constant--will be selected. Where the vehicle would be used only for ordinary driving, e.g., city or normal highway use, the general capabilities of the automobile would only be considered.

In the instant case, the concept of what a producing industry is should be considered and poses certain difficulties. It is the opinion--without attempting to define the limits thereof--that in this investigation there is a "domestic industry producing an article" within the meaning of section 301(b)(1) of the TEA. As to each of the seven business concerns in the United States which might seem to be a part of a producing industry, one or more of the following is present: There is a production capability and facility; electron microscopes are in fact being manufactured for sale; and research and development over a period of years has been performed resulting in at least the production of a prototype instrument intended for the sale of other instruments.

The concept of a producing industry having been set forth, an attempt is made now to define what producing industry this investigation concerns. It is maintained that the investigation is of the "electron microscope industry." This industry is basically comprised of two products--the transmission microscope and the scanning microscope. The two types of accessory available do offer the capability to perform an alternative kind of research: a transmission microscope with a scanning attachment and vice versa. If such an adaptation is made, however, the performance of the secondary capability is not quite as satisfactory in terms of resolution and other factors as if another unit specializing in the secondary function were utilized. In most instances these two types of electron microscopes are used for different kinds of research or teaching. However, they are based upon the same technology and concepts, i.e., the bombardment of a specimen with electrons resulting in an image viewable on a screen or by means of a photograph. In the United States, there is no producer of electron microscopes who manufacture both the scanning and transmission types. However, such is not the case with the foreign suppliers. The two Japanese firms which export microscopes to the United States produce both kinds of units. Thus, the term "electron microscope industry" refers to the producers of transmission and scanning microscopes and, unless otherwise indicated, reference will be made to electron microscopes without differentiation.

Imports in increased quantities

The trend of imports must be analyzed for a sufficiently long duration in the instant investigation so that we may have information both before and after the time when duty-free treatment was provided by the Florence Agreement implementing legislation (effective Feb. 1, 1967), and when the Kennedy Round trade-agreement rate reductions first became effective (Jan. 1, 1968). There has been a definite trend of increased imports both prior to and after the trade-agreement concessions in 1967. Total imports of electron microscopes from the years 1960-66 rose from 68 units in 1960 to 212 units in 1966. Two factors are reflected in these figures. First, this was the initial period when, in actuality, the development and number of uses for electron microscopes significantly increased. The general market for the product grew rapidly--indicating that saturation of the market was soon to be reached--as both foreign and domestic producers competed to supply the market demand. Second, the enactment and implementation of the statutory duty-free treatment of microscopes is clearly indicated, as noted by the growth from 14 units imported duty free in 1961, to 162 units imported in 1966. Nevertheless, the period from 1967-71, the time when duty-free imports were--and still are--considered trade concessions, reflects a continued increase in total imports, from 256 units in 1967 (compared to 212 in 1966) to 285 units in 1971--all this despite a saturated market where total U.S. consumption declined.

Clearly, this is an article being imported in increased quantities.

In major part

In any petition under section 301(b) of the TEA, there are usually factors other than trade agreements which have a bearing on increased imports. The requirement of the statute, however, is that the trade-agreement concession or concessions have in major part caused the increased imports.

During the last 10 years, the figures clearly show that most of the imports have been free of duty. For the period when the free rate was strictly statutory (1961 through 1966), dutiable imports were 176 units as compared to free imports of 498 units; for the period after the enactment of the Florence Agreement legislation (1967 through 1971), dutiable imports were only 419 units as compared to free imports of 1,119 units. The importance of the duty-free status for imports of electron microscopes was thus first graphically illustrated by the statutory (non-trade agreement) free rate in effect from 1961 through 1966. When the Florence Agreement was implemented, the statutory free rate for electron microscopes was deleted, and during the years 1967 through 1971 every duty-free electron microscope imported was by virtue of a trade-agreement concession as provided for by section 9 of the Florence Agreement implementing legislation. Although a larger number of dutiable instruments were imported in the period since the Kennedy Round rate reductions became effective than previous to 1968, these increased imports alone are not clearly

established to have been caused in major part by the small yearly trade-agreement reductions from 22 percent ad valorem to 11 percent in 1972. That which is abundantly clear, however, is that the free imports were certainly the result in major part of the free rate trade-agreement concession and that when the imports under the two concession rates (dutiable and free) are added together, the answer for the free imports applies as well to the total of both the dutiable and the free.

Serious injury

The evidence available to the Commission shows that of seven concerns engaged in the production of electron microscopes, only one reported a net profit in 1971. In fact, 1969 was the last year in which more than one firm reported a net profit. All other firms are suffering losses--and in several cases extensive losses which would be hard to recoup in the limited market that there is for electron microscopes. If a combined statement were made indicating the net loss which was experienced by the domestic industry in 1971, this figure would be in excess of 1.8 million dollars.

This industry's injury, however, is reflected only in part in its profit-and-loss statement. It has been unable to provide, through sales of capital-generating goods, a cash flow necessary to develop new and technologically superior designs which could effectively compete with imports in the market place. It has been evidenced by

several firms in the domestic industry that they do possess the necessary technological capabilities, but trade concession-inspired imports-- both free and dutiable--have not permitted these firms, let alone the rest of the industry, to realize their potential

There is an excess of idle production facilities which exists in the domestic microscope industry. During the 3-year period 1969-71, this is illustrated by the decline in the number of related workers employed in the production of electron microscopes from 320 workers in 1969 to 254 in 1971. Moreover, it does not appear that this trend will be reversed by the end of the current year.

Major factor

The attempt has been made in the course of this statement to show the interrelationship of the four statutory criteria. In treating with the increase in imports, the concession nature of the imports was mentioned; in describing the connection between concessions and import increase, the impact on the industry came into view; and finally, it must be clear that the establishment of a relationship between concessions and increased imports and the realization that there is serious difficulty in this industry leads positively and unswervingly to the link-up between concession-generated increased imports and serious injury.

Where an industry in the United States is not encroached upon by competing industries or articles of a differing technology, where it

has had within its ranks firms of all sizes and financial resources, where there has been a considerable demand for the articles it produces, and where there are no other extenuating circumstances such as an evaporating market, public policy restraints, and the like, an import share of U.S. consumption exceeding 87 percent must be fingered as the major injuring factor. It may be argued that lack of a good product has caused the domestic industry its miseries, but the fact that there are firms in the industry with "good products" by every objective yardstick refutes that argument. But neither the "good product" firms nor those able to produce a "good product" with a little breathing room can get out from under the suffocating pressure of imports. The major factor causing or threatening to cause serious injury to the domestic electron microscope industry is increased imports in major part the result of trade-agreement concessions.



INFORMATION OBTAINED IN THE INVESTIGATION

Description and Uses of Articles Under Investigation

The electron microscope is an instrument utilizing a beam of electrons, focused by means of an electromagnetic or electrostatic lens system, to project an enlarged image of a minute object on a viewing surface such as a fluorescent screen or photographic plate. Such an instrument may be either (1) transmission type--used to examine a very thin specimen in depth--or (2) scanning type--used to examine the surface of an object. Electron microscopes differ from optical microscopes in that the latter use light rays instead of electrons to project an image. Moreover, the useful magnification of an electron microscope can reach 20,000 times (x) with the use of a fluorescent screen and about 1,000,000 x when the image is photographed and then enlarged; the useful magnification of an optical microscope is limited to about 2,000 x.

The basic electron microscope is an assembly, principally of the following parts:

- (1) An electrical system consisting of a high voltage supply, usually from which two to four values of power in the range of 25 to 100 kilovolts (KV) can be selected, with some instruments having as much as 1,000 KV;
- (2) A device known as an electron gun for emitting, controlling, and focusing the electrons;
- (3) A lens system consisting of electrically charged plates or coils;
- (4) A vacuum pump unit to maintain a vacuum in the electron tube;

- (5) Image viewing and photographic recording systems;
- (6) A mechanical specimen stage, which is for holding the specimen to be examined;
- (7) A stand or frame, usually including a desk and a control panel--all designed as a unit to serve as the mounting of the microscope.

A wide variety of accessories are generally available to permit optimum use of particular models of electron microscopes. Such accessories include various sizes of cameras, TV systems, temperature control units, special devices for handling specimens, high-resolution electron diffraction apparatus, and so forth.

Diffraction apparatus is sold as standard equipment on all electron microscopes. For instruments of 100 KV or more, however, high-resolution diffraction units are generally purchased separately for special research purposes. Information from trade sources indicates that one U.S. producer of various types of analytical electronic instruments has produced a type of electron diffraction apparatus that is not for use with electron microscopes. Since such diffraction apparatus is currently of very limited commercial use and the domestic producer knows of no imports, the diffraction apparatus mentioned in the remainder of this report relates only to the type used in connection with electron microscopes.

There are three size groups of transmission microscopes and two of scanning microscopes. The groups may be defined either in terms of kilovolt capacity--ranging from 25 KV for a small scanning microscope to 1,000 KV for a large transmission microscope--

or in terms of the resolution or resolving power expressed in angstroms. 1/ The number of angstroms indicates the distance between two points of the specimen that can be seen with clarity. Generally there is a direct relationship between the kilovolt capacity and the resolution capability (i.e., the greater the kilovolt capacity, the greater the resolving power). The size classifications of electron microscopes in terms of kilovolts and resolving power are as follows:

<u>Size of microscope</u>	<u>Kilovolt power</u>	<u>Resolution (in angstroms)</u>
Transmission:		
Small-----	Under 100	10-6
Medium <u>1/</u> -----	100	5
Large-----	125-1,000	3.5-2
Scanning:		
Small-----	20-25	250-200
Large-----	30-50	200-100

1/ The most common or popular size currently in use.

The principles governing the use of the light microscope as we know it today have been known for almost 200 years. It is generally accepted that the transmission electron microscope was invented in Germany in 1932 and became an article of commerce in 1939, when the first RCA instruments were marketed in the United States. Commercial use of the scanning electron microscope, invented in the United Kingdom, dates from 1958.

1/ An angstrom is a unit of length equal to 0.0001 of a micron. The greater the resolving power (clarity), the lower the angstrom count.

There have been rapid advances in the technology of electron microscopes since their invention. In 1935 the magnification of the transmission electron microscope equaled that of the light microscope--about 2,000 x. By the mid-1960's the capability of the transmission microscope had advanced to 100,000 x magnification with a resolution of 10 angstroms. Currently, the large instruments are capable of 1,000,000 x magnification with a resolution of about 2.5 angstroms.

Transmission microscopes are considered indispensable in biological research into heart disease, cancer, and viruses. They are used industrially in the examination of the composition of vapors, dust, and textile fibers and the structure of metals, paper, and other materials. The smaller transmission microscopes are used primarily in universities, principally for teaching.

Scanning microscopes are used in the study of the surface topography of specimens by researchers in a variety of disciplines, including botany, paleontology, geology, and metallurgy. New applications for this type of microscope are increasing.

The structure and function of the proton microscopes do not differ appreciably from those of the electron microscope; the electron gun is replaced by a proton gun and the power source is hydrogen. Since proton waves are about a fifth as long as electron waves, the resolving power of a proton microscope should be much greater than that of an electron microscope. Industry sources indicate that worldwide there are currently two or three of the proton scopes in a prototype stage, but none are available commercially. Accordingly, proton microscopes will not be considered further in this report.

U.S. Tariff Treatment

Currently, imported electron, proton, and similar microscopes and diffraction apparatus are dutiable under TSUS item 708.78 at 11 percent ad valorem, and under certain circumstances are duty free under TSUS item 851.60. The 11-percent rate is also currently applicable to frames and mountings for such articles and parts of frames and mountings, which are provided for under TSUS item 708.82.

When electron microscopes were first imported into the United States, in the early 1950's, the Bureau of Customs classified them under paragraph 228(b) of the original schedules of the Tariff Act of 1930 and assessed a duty of 45 percent ad valorem, the statutory rate provided for various optical instruments, including microscopes. The importer protested, claiming that electron microscopes were classifiable for duty purposes as cameras under paragraph 1551 (at 20 percent ad valorem) or under paragraph 353 either as "articles suitable for producing, rectifying, modifying, controlling, or distributing electrical energy," or "articles having as an essential feature an electric element or device." For both types of articles under paragraph 353 the applicable rate of duty at the time of the entry in question was 15 percent ad valorem, reflecting a trade-agreement concession under the General Agreement on Tariffs and Trade (GATT). In 1952 the Customs Court sustained the importer's protest that the importation was classifiable as an article having as an essential feature an electrical element or device (28 Cust. Ct. 39, C.D. 1386).

Counsel for the Government contended that if electron microscopes were not dutiable under paragraph 228(b), then the merchandise was dutiable under paragraph 360 as scientific and laboratory instruments, rather than under paragraph 353. The decision of the court in C.D. 1386 was not appealed and the Government elected to make a new case on another importation of an electron microscope. In the new case brought before the Customs Court in 1954 (32 Cust. Ct. 258, C.D. 1610), the court came to the same decision as in the previous case. The Court of Customs and Patent Appeals (45 C.C.P.A. 87, C.A.D. 678), however, overruled the latter decision and held that the merchandise was properly classifiable under paragraph 360. The applicable rate of duty on the entry at issue was 30 percent ad valorem; reflecting a GATT concession that became effective October 1, 1951. The appellate court classification was followed thereafter. Subsequent reductions in the U.S. tariff applicable to dutiable imports of the articles here under investigation are listed in the following table.

Electron, proton, and similar microscopes, diffraction apparatus, frames and mountings for the foregoing, and parts of frames and mountings: U.S. tariff history of dutiable imports, June 18, 1930-January 1, 1972 1/

Authority	Effective date	Rate of duty <u>Percent</u> <u>ad valorem</u>
Tariff Act of 1930-----	June 18, 1930	40
GATT-----	Oct. 1, 1951	30
Do-----	June 30, 1956	28.5
Do-----	June 30, 1957	27
Do-----	June 30, 1958	25.5
Do-----	July 1, 1962	22.5
Do-----	July 1, 1963	22
Do-----	Jan. 1, 1968	19.5
Do-----	Jan. 1, 1969	17.5
Do-----	Jan. 1, 1970	15
Do-----	Jan. 1, 1971	13
Do-----	Jan. 1, 1972	11

1/ The available information indicates that the only dutiable importation of electron microscopes subject to a rate of duty not listed here was the single importation covered by the Customs Court case in C.D. 1386, in which the merchandise was held dutiable at 15 percent ad valorem. That decision was not appealed by the Government.

Effective August 16, 1971 (Presidential Proclamation No. 4074), a surcharge of 10 percent ad valorem became applicable to certain imported dutiable articles; on those considered here the rate became 23 percent ad valorem. The import surcharge was removed on December 20, 1971 (Presidential Proclamation No. 4098).

At least since the mid-1950's some nonprofit institutions have been able to import electron microscopes free of duty. Up to July 20, 1961, such duty-free treatment was by special legislation granting duty-free treatment individually for microscopes

imported by specified institutions. From July 20, 1961, through January 31, 1967, electron microscopes and parts or accessories thereof that were imported by a nonprofit institution established for educational, scientific, or therapeutic purposes were duty free pursuant to Public Law 87-95 (T.D. 55441). Until August 31, 1963, the effective date of the TSUS, such duty-free treatment was provided for under paragraph 1825 of the Tariff Act of 1930; from August 31, 1963, through January 31, 1967, it was provided for under TSUS item 854.10.

Pursuant to the implementing legislation (Public Law 89-651, T.D. 66-239) for U.S. participation in the United Nations Educational, Scientific and Cultural Organization (UNESCO) Agreement on the Importation of Educational, Scientific and Cultural Materials (the so-called Florence Agreement), electron microscopes and parts and accessories thereof were deleted, effective February 1, 1967, 1/ from item 854.10, and two new items--851.60 and 851.65--were established to provide duty-free treatment for certain articles (including electron microscopes and diffraction apparatus), described as follows:

1/ Presidential Proclamation No. 3754 (T.D. 66-259).

<u>TSUS</u> <u>item No.</u>	<u>Description</u>
	Articles entered for the use of any nonprofit institution, whether public or private, established for educational or scientific purposes:
851.60	Instruments and apparatus, of no instrument or apparatus of equivalent scientific value for the purposes for which the instrument or apparatus is intended to be used is being manufactured in the United States.
851.65	Repair components (including frames and mountings, and parts thereof) for instruments or apparatus admitted under item 851.60 <u>1/</u>

Headnote 6 to part 4 of schedule 8 of the TSUS sets forth the procedures which an institution must follow in order to import electron microscopes and other apparatus duty free under items 851.60 and 861.65 (see app. A of this report).

Under section 9 of the legislation implementing the Florence Agreement (i.e., Public Law 89-651 cited earlier), it was provided that--

Any duty-free treatment provided for in this Act shall, for purposes of title III of the Trade Expansion Act of 1962 . . . be treated as a concession granted under a trade agreement: Provided, That any action taken pursuant to section 351 of such Act as the result of this section shall be consistent with obligations of the United States under trade agreements.

The significance of this proviso to the instant investigation is discussed in the following section of this report.

1/ Frames and mountings and parts thereof imported for use with electron microscopes and diffraction apparatus that were not subject to duty-free treatment under item 851.60 are dutiable under item 708.82, which is covered by this investigation. However, other parts and components for electron microscopes and diffraction apparatus not subject to duty-free treatment under item 851.60 are not covered by this investigation.

Certain Issues Peculiar to This Investigation

"Equivalent scientific value" test of the legislation
implementing the Florence Agreement

In usual circumstances under the TEA, for tariff adjustment or adjustment assistance to be applicable, increased imports causing injury or threat of injury must have occurred as a result in major part of trade-agreement concessions. However, the free rates established in the Florence Agreement implementing legislation were enacted by the Congress and were not rates derived by reason of trade-agreement negotiations. No tariff adjustment or adjustment assistance would have been applicable without the special provision (sec. 9) of the implementing legislation, referred to in the previous section of this report.

In a sense, the tariff adjustment and adjustment assistance provisions of the TEA, as incorporated into the Florence Agreement implementing legislation, gives double-coverage insurance to scientific instruments. The legislation purported to give built-in protection to the domestic industry by providing that free entry would be granted only "if no instrument or apparatus of equivalent scientific value for the purposes for which the instrument or apparatus is intended to be used is being manufactured in the United States" (TSUS item 851.60). (Underscore added.) Moreover, the statute provided that the duty-free treatment was also subject to the provisions of the TEA.

One of the most important considerations of the Commission in arriving at a determination in this investigation is what, if any, is the difference between the "equivalent scientific value" test, which is administered by the Department of Commerce, and the "like or directly competitive" test under the TEA. If the Commission should consider the equivalent scientific value test to be equal in effect to the like or directly competitive test, it would mean that no domestic industry is producing articles which are "like or directly competitive" with instruments being imported free of duty under the Florence Agreement.

A discussion of the Florence Agreement, the history of the legislation making U.S. participation in that agreement effective under U.S. law, and a brief factual summary of the administration of the equivalent scientific value test by the Commerce Department follows.

The Florence Agreement.--The Florence Agreement is an international agreement sponsored by UNESCO. It was opened for signature on November 2, 1950, and entered into force on May 21, 1952; more than 70 countries are party to the agreement at the present time. The United States signed the agreement on June 24, 1959, with the Senate giving advice and consent to ratification on February 23, 1960. The necessary legislation to make the agreement effective under our laws was approved on October 14, 1966 (Public Law 89-651), and became effective on February 1, 1967. The purpose of the Florence Agreement, in general, is to facilitate the free flow of educational, scientific,

and cultural materials by removing barriers. For the United States, the principal barrier was the assessment of duties on some of these materials. The legislation provided for the free entry of such materials either unqualifiedly or under certain conditions, as for scientific instruments and apparatus.

Although other problems delayed U.S. participation in the Florence Agreement, one important roadblock was the matter of the free entry of scientific instruments and apparatus for the use of public or private scientific or educational institutions. ^{1/} In addition to the question of actually granting free entry for the merchandise covered by the Florence Agreement, the particular language of the agreement which was most difficult to interpret and incorporate into legislation was the language stating that scientific instruments would be free of duty provided that "instruments or apparatus of equivalent scientific value are not being manufactured in the country of importation." (Underscore added.)

History of U.S. implementing legislation.--In an analysis of the administration-sponsored legislative bill, as sent to the House Ways and Means Committee, the Department of State explained in some detail the intended meaning of the term "equivalency of scientific value." Such portion of the analysis, printed as a part of the public hearing

^{1/} The United States, as one of the prime movers of the Florence Agreement, preferred to accept the agreement as a package without reservations for certain merchandise.

on the implementation of the Florence and Beirut Agreements held on June 6 and 7, 1966, before the committee, is included as appendix B to this report.

It is of special interest that, in the public hearing, domestic producers, as represented by the Scientific Apparatus Makers Association (SAMA), objected to the indefinite language "equivalent scientific value" in the bill, with its subjective considerations. They contended that a "commercially competitive test" should be applied, and it was suggested that the language be amended--

to provide that whenever the Secretary of Commerce determines that the importation of a foreign-made scientific instrument or apparatus will have the effect of displacing a U.S.-made article . . . an instrument or apparatus of equivalent scientific value to the foreign article is being manufactured in the United States.

SAMA stated that the inclusion of a "commercially competitive displacement standard" in the legislation was both necessary and warranted. The SAMA position paper, as printed in the public hearing report, stated the following:

Such a standard would fill a void created by the proposed unqualified equivalence test and would give the statute a degree of certainty which otherwise it would totally lack. Also, such a standard in the statute would give full force and effect to the intended operation of the underlying equivalence condition . . . and would therefore, be wholly consistent with the U.S. obligations in the Florence accord.

The proposed administration bill, as amended by the Congress, did not adopt the language suggested by the SAMA group. Rather, the Ways and Means Committee, on page 18 of H.R. Report No. 1779, (89th Cong., 2d sess.), stated as follows:

(2) Equivalency of Scientific Value
(a) Generally

The most important qualification upon the duty-free entry of instruments and apparatus under 851.60 is that they are entitled to such treatment only if the Secretary of Commerce finds that no instrument or apparatus of equivalent scientific value for the purposes for which they are intended to be used is being manufactured in the United States. (Underscore added.)

Your committee amended the bill to provide that the determination of equivalent scientific value is to be in terms of equivalent scientific value for the purposes for which the instrument or apparatus is intended to be used. This was done to prevent the bill from resulting in the duty-free entry of an instrument or apparatus in a case where there is available a domestic article which, though different from the foreign article in some scientific characteristics, nevertheless is as capable as is the foreign one of fulfilling the purposes for which the apparatus is intended to be used. Duty-free entry would be accorded only to foreign instruments and apparatus which satisfy the purposes for which the instrument or apparatus is intended to be used by the institution making application in a manner which cannot be satisfied by a domestic instrument or apparatus. The comparative cost of a foreign and a domestic instrument or apparatus would have no relationship to equivalency of scientific value. (Underscore added.)

Summary of Commerce Department decisions

Approximately 150 of the Commerce Department's decisions approving applications for duty-free importation of electron microscopes for the period from and including 1968 to date, as printed in the Federal Register, were examined. The majority of the institutions requesting free entry were colleges and universities; some were hospitals, including those operated by the Veterans Administration; and a few were organizations such as associations, foundations, and local government laboratories. The imported instruments for which duty-free entry was sought came from West Germany, the United Kingdom, the Netherlands, and Japan.

The decisions relating to transmission electron microscopes are summarized below.

Uses

In the training of the students in techniques and applications of electron microscopy; for research as to biological materials--cancer, molecules, viruses, algae, cells, diseases, bone marrow, and so forth; fine structure of materials in metallurgy, polymers, ceramics, physics, and organic chemistry; and in studying the configurations of imperfections in metals and alloys so as to arrive at the underlying problems of strength, ductility, brittleness, fracture, creep, fatigue, and the like.

Commerce Department's reasons for allowing free entry

(1) Teaching.--The applicant intends to use the articles for teaching and requires a transitional instrument for bridging the gap between the use of the light microscope and the research-type electron microscope. The domestic instrument

(EMU-4B) is described as "a highly sophisticated and relatively complex research electron microscope intended for the use of an expert." The relative simplicity of design and ease of operation of the foreign article is a pertinent characteristic of its suitability for teaching.

(2) Resolution.--In cases involving research, the best attainable resolution appears to have been an important factor pertinent to the approval of applications for duty-free importation. The foreign manufacturers in the earlier cases guaranteed 5 angstroms, while the domestic firm guaranteed only 8 angstroms. In more recent years, the foreign manufacturers have guaranteed at least 3 or 3.5 angstroms, compared with the guarantee of 5 angstroms by the domestic firm.

(3) Accelerating voltages.--The domestic instrument offers accelerating voltages of only 50 and 100, whereas the foreign article provides accelerating voltages of 20, 40, 50, 80, and 100; 50, 75, 100, and 125; or 25 and 50. Commerce reported: "It has been experimentally established that the lower accelerating voltages afford optimum contrast for unstained specimens and that the accelerating voltages intermediate between 50 and 100 kilovolts provide optimum contrast for negatively stained specimens." With respect to an instrument having 200-kilovolt accelerating power, Commerce accepted the view that "the additional penetrating power available will allow the applicant to study thicker metallurgical specimens and, consequently, permit the direct correlation between the results of the experiment and the behavior of bulk specimens."

(4) Magnification.--In a number of cases, Commerce stated: "The foreign article provides a continuous magnification from 0 to 60,000 magnifications without changing the pole-piece. The most closely comparable domestic instrument is the Model EMU-4C offered by the Forgflo Corp. The Model EMU-4C, with its standard pole-piece has a specified range from 1,400 to 240,000 magnifications. For survey and scanning, the lower end of this range can be reduced to 200 magnifications or less. But the continued reduction of magnification induces an increasingly greater distortion. The domestic manufacturer suggests in its literature on the Model EMU-4C that for highest quality low magnification electron micrographs in the magnification range between 500 and 70,000 magnifications, an optional low magnification pole-piece should be used." The Commerce Department finding indicated that breaking the vacuum in the column induces the danger of contamination and would very likely lead to the

failure of the experiment. 1/ A similar finding was made concerning a foreign instrument with 220 to 550,000 magnification.

(5) Viewing windows.---In addition to the other advantages of the particular foreign instruments for teaching, Commerce noted that such instruments had three windows for viewing, whereas the domestic instrument provided only one. The extra windows permit the instructor and students simultaneously to view and discuss the image of the specimen under the microscope.

(6) Holder for six specimens in vacuum.---The foreign articles are considered relatively simple, medium-resolution electron microscopes designed for confident use by beginning students. The relative simplicity of design, plus the advantage of a holder for six specimens are important factors pertinent to the approval of applications for duty-free importation. The domestic EMU-4C does not provide a holder for six specimens.

(7) Tilt stage.---The foreign article is equipped with a tilt viewing stage, which has a guaranteed resolving power of 5 angstroms. The domestic model can be equipped with a tilt stage which has a resolving power of 8 angstroms. The Commerce Department has agreed that guaranteed resolving power of the tilt stage of the foreign article is pertinent to the applicant's research studies.

The decisions relating to scanning electron microscopes are summarized below.

Uses

Teaching; materials research ranging from studies of the relation between atomic and microstructure and mechanical properties and extending to application of solid-state physics and to the production of improved semiconductors; study of metals, ceramics, rocks and minerals, plastics, and biological tissues; research on the structure of porous glassy carbon, the distribution of silicon, potassium, and other metals in plant cells, research on a central nervous system disease in sheep, plus the identification and classification of Great Lakes algae, diatoms, and phytoplankton; research in paleobotany, botany, zoology, paleontology, mineralogy, geochemistry, and related

1/ Apparently the vacuum in the column is broken in changing the pole-piece.

sciences, the study of lunar rock and dust samples and a study of microfossils from subsurface and deep-sea sediments; investigation of fracture modes and mechanisms in alloy steels, vanadium, and titanium alloys and composite materials; research in dental restoratives; and research such as the determination of secondary electron emission coefficients for ceramic oxides.

Commerce Department's reasons for allowing free entry

(1) Micrographs.--The micrographs produced routinely with the foreign article were superior in quality to the micrographs produced by the model SM-2 of the Ultrascan Co. This difference in picture quality is pertinent to the applicant's research studies.

(2) Goniometer stage and TV-scan attachment.--The foreign article provides a goniometer stage permitting rotation and tilting at constant specimen level and a rapid TV-scan attachment providing a picture having continuous motion instead of the interrupted motion provided by the conventional mode of presentation. The combination of both is pertinent to the research and is not found in domestic instruments.

(3) Kikuchi patterns.--The foreign article provides an 18° focussed and 11° collimated 2θ deflection of the beam, which permits production of meaningful pseudo kikuchi patterns. Published specifications of domestic instruments do not show this capability. This is pertinent to the research studies.

(4) Resolving power and specimen height.--The foreign article guarantees a resolving power of 200 angstroms combined with a guaranteed specimen height during tilting and rotating for stereo-pair viewing without refocussing for specimens greater than 14 millimeters. Neither of the two most closely comparable domestic instruments--model 700 of Materials Analysis Co. and model SM-2 of Ultrascan 1/--provide such features, which are pertinent to the research.

1/ Ultrascan submitted comments to the Commerce Department in only one of the 150 cases covered by the summary in this report. Ultrascan stated that its instrument met or exceeded all of the specifications of the foreign instruments. However, Commerce did not agree on the grounds that for the applicant's intended purposes there was no domestic instrument of equivalent scientific value

(5) Teaching instrument.--The foreign article is an intermediate microscope which is a step below the highly complex research types. Commerce stated that model 700 of Materials Analysis Co., model SM-2 of Ultrascan, and model 900 of Advanced Metals Research Corp. "are highly sophisticated and relatively complex scanning electron microscopes intended for the use of an expert." Design simplicity and relative ease of operation are considered important factors pertinent for teaching purposes for untrained personnel.

(6) Dual pump system.--This feature permits the vacuum in the column and specimen chamber to be independently maintained. The research studies of the applicant require the recording of images within a few seconds of the sample being exposed to the vacuum system. The dual-pump system of the imported article provides the rapid recording necessary by keeping the electron gun at an appropriate vacuum while the sample is inserted. 1/

(7) Angstroms.--In one 1969 decision the Commerce Department noted that the guaranteed resolution of the foreign instrument was 300 angstroms, whereas that of the domestic (produced by K-square Corp., now Ultrascan) was 500 angstroms. Commerce agreed that the best attainable resolution for the applicant's research project was an important factor in the approval of duty-free importation. 2/

1/ A representative of a domestic firm contended that the dual-pump system was just another "gimmick" for obtaining free entry (i.e., illustrative of a feature not present in domestic instruments). He claimed that essentially the same results are obtained by the single-pump system used in domestic instruments.

2/ The optimum guaranteed resolution of both imported and domestic instruments is currently 100 angstroms.

Trade-agreement aspects of pre-Florence Agreement
duty-free treatment

On July 20, 1961, the Congress established a free rate for imports of electron microscopes and parts or accessories thereof entered by certain nonprofit institutions. Although there is no question that from July 20, 1961, through August 30, 1963, there was no trade-agreement concession as such with a foreign country for the free importation of electron microscopes, the claim is made by a petitioner, Forgflo Corp., that the free rate became a trade-agreement rate when the TSUS became effective on August 31, 1963.

The allegation made by the petitioner is based on the fact that the TSUS showed both a column 1 and a column 2 free rate for electron microscopes under item 854.10. It is contended that the column 1 rate is in effect the trade-agreement rate, while column 2 is the statutory rate. The petitioner is alleging that the loss of business incurred between August 31, 1963, and the effective date of the Florence Agreement implementing legislation on February 1, 1967, was actually attributable to a trade-agreement free rate.

In subpart (d) to headnote 9 of the "General Headnotes and Rules of Interpretation" of the TSUS, it is stated:

the term "rate of duty" includes a free rate of duty; rates of duty proclaimed by the President shall be referred to as "proclaimed" rates of duty; rates of duty enacted by the Congress shall be referred to as "statutory" rates of duty; and the rates of duty in column numbered 2 at the time the schedules become effective shall be referred to as "original statutory" rates of duty; . . .

General headnote 3(e) to the TSUS reads in part:

. . . the rates of duty shown in column numbered 2 shall apply to products, whether imported directly or indirectly, of the following countries and areas pursuant to section 401 of the Tariff Classification Act of 1962, to section 231 or 257(e)(2) of the Trade Expansion Act of 1962, or to action taken by the President thereunder: . . .

In general headnote 3(f), it is stated:

Products of All Other Countries. Products of all countries not previously mentioned in this headnote imported into the customs territory of the United States are subject to the rates of duty set forth in column numbered 1 of the schedules.

All the free rates of duty in the pre-TSUS schedules which were incorporated into the TSUS (such as in item 854.10 on electron microscopes) were uniformly shown to be free in the TSUS in both columns 1 and 2, whether or not such free rate had been bound by a trade-agreement concession (the binding of a free rate amounts to an agreement by the United States not to raise the rate of duty on an article unless such raise is accomplished through the machinery of the General Agreement on Tariffs and Trade). Certainly there was no intention of

making column 1 of the TSUS synonymous with trade-agreement rates where the rates of duty in columns 1 and 2 were the same.

In the Tariff Classification Act of 1962, the enactment providing for the adoption of the TSUS, it was stated:

Sec. 102. At the earliest practicable date, the President shall take such action as he deems necessary to bring the United States schedules annexed to foreign trade agreements into conformity with the Tariff Schedules of the United States and, after such action is completed, the President shall proclaim--

(1) the rates of duty in rate column numbered 1 of schedules 1 to 7, inclusive, and the other provisions of the Tariff Schedules of the United States, which are required or appropriate to carry out the foreign trade agreements to which the United States is a contracting party. . .

Sec. 103. The provisions of the Tariff Schedules of the United States as made effective on the date provided by section 501 shall have the status of statutory provisions duly enacted by the Congress, except for--

(1) the rates of duty in rate column numbered 1 of the tariff schedules proclaimed pursuant to paragraph (1) of section 102 which are lower than the rates of duty in rate column numbered 2 of such schedules for the corresponding items. . . .

The column 1 free rate on item 854.10 (the provision under which nonprofit institutions, prior to February 1, 1967, were entitled to import electron microscopes free of duty under the TSUS) was not listed in Presidential Proclamation 3548 of August 21, 1963, which made the TSUS effective, as a rate required or appropriate to carry out foreign-trade agreements to which the United States was a party.

U.S. Producers

Until the late 1960's, transmission electron microscopes produced by RCA were the only domestic instruments available in the U.S. market. During the 1960's, however, various U.S. firms in the electrical- and scientific-instrument fields (including RCA) utilized some of their research facilities to develop new models of electron microscopes of both the transmission and scanning types. Some of the firms (e.g., * * * 1/) abandoned their projects, while others (including RCA) were successful in developing new models. By the end of 1971, the only model of domestically produced transmission electron microscope available for sale was the EMU-4, which had been introduced by RCA in 1965. Two other domestic firms--the Forgflo Corp., which had purchased the Scientific Instruments Department of RCA in 1969, and Elektros, Inc.--have developed new models of transmission electron microscopes, * * *.

The initial sale of a domestically produced electron microscope of the scanning type occurred in 1968, when the K-square Corp., under the name of Ultrascan Co., entered the market. By December 31, 1971, three other U.S. firms--the Advanced Metals Research Corp., the Materials Analysis Co., and the Etec Corp.--were producing and selling scanning-type electron microscopes. A fifth firm--Coates & Welter Instrument Corp.--has produced scanning-type electron microscopes but had not consummated any sales by the end of 1971.

A brief history of each of the seven firms engaged in research on, or production of, electron microscopes during 1971 is set forth below.

Forgflo Corp.

The Forgflo Corp., located in Sunbury, Pa., was the original petitioner in this investigation. This company claims to have played a major role in electron microscopy for almost 20 years, first as the principal supplier to RCA of high-quality, precision machine parts which were used in the production of electron microscopes, and since 1969 as a producer. In addition, this firm manufactures magnetic heads for use in audio and video recording units and data processing equipment, as well as precision devices for many kinds of scientific instrumentation.

Forgflo Corp. was acquired in June 1969 as a wholly owned subsidiary by Waltham Industries of Sherman Oaks, Calif. Waltham is a conglomerate corporation operating 14 divisions or subsidiaries primarily in the electronics and electrochemical fields. In June 1969 Forgflo purchased the Scientific Instruments Department of RCA (including its inventory of *** EMU-4 models) for more than * * * in cash and notes. Immediately after this acquisition Forgflo launched a program to develop a new instrument. As a result of this engineering effort the company was able to complete a prototype of its new

"Paragon" model in October 1970. Meanwhile, sales of the EMU-4 model were disappointing. Forgflo sold only *** percent of the instruments it had acquired from RCA; the most recent sale was in * * * The lack of sales revenues from its inventory of EMU-4's cut off the necessary funds for initiation of a manufacturing program for the new model. Thus, although Forgflo received three orders for the Paragon model, delivery has never been made. In August 1971 Forgflo petitioned a Federal district court for protection of its assets under chapter 11 of the Federal Bankruptcy Act. By the end of 1971, Forgflo had ceased all work on the Paragon and had laid off *** employees directly associated with the development, production, and marketing of this instrument. Approximately *** other persons lost their jobs as a result of the decline in the firm's sales of all products from * * *.

Elektros, Inc.

Officials of Elektros, Inc., incorporated in July 1970 in Tigard Oreg., informed the Commission of their intention to begin delivery of transmission electron microscopes in April 1972. The new Elektros model ETEM 101 is described in the firm's promotional literature as a "small, compact instrument" which is "the result of

more than 10 years of development." The firm informed the Commission that a prototype of this new model has been operating since 1968.

Elektros, Inc., is owned by Fortune, Inc., a private holding company that also owns a bank and * * * of the Evans Products Co. of Portland, Oreg., a conglomerate with 36 subsidiaries.

Advanced Metals Research Corp.

Advanced Metals Research Corp. (AMR), located in Burlington, Mass., is a petitioner in this investigation. It started research and development work on the scanning electron microscope in 1966 with considerable assistance from the engineering staff of the Massachusetts Institute of Technology. AMR made its first sale in *** and has been the dominant domestic company in production and sales of scanning microscopes up to the present time. In 1971, AMR accounted for * * * of domestic production and supplied about * * * of the U.S. market. Its scanners are reputed to be excellent instruments and competitive with any of the foreign instruments now available.

For several years, AMR, through a subsidiary company, Lico Inc., was the selling agent in the New England States and Canada for products of the North American Phillips Co., a Netherlands-based manufacturer of scientific instruments, including transmission microscopes.

* * *

Materials Analysis Co.

Materials Analysis Co. (MAC), based in Palo Alto, Calif., manufactures scanning microscopes and also microprobes. * * *

MAC is a wholly owned subsidiary of Heath Tecuna Corp. of Kent, Wash., which is a holding company operating eight companies that produce nuclear and other scientific instruments, building products, protective finishes, and various machine products. Heath acquired MAC in mid-1968 in exchange for 120,000 shares of stock.

Ultrascan Co.

Ultrascan Co., presently located in Cleveland, Ohio, was organized in 1966 in Pittsburgh, Pa., to produce scanning electron microscopes. Ultrascan's first president was a former employee of the Westinghouse Corp. and had been associated with that company's research program for the development of a scanning electron microscope. After expending considerable money and effort on the project, Westinghouse ceased its efforts and sold its technology to Ultrascan.

Ultrascan supplied about * * * of the U.S. market in 1969. Since that time, it has supplied * * * .

Etec Corp.

Etec Corp., located in Hayward, Calif., was founded in May 1970 to produce and market scanning electron microscopes. Its product was introduced at a trade show in April 1971, and during that year it sold * * * instruments.

In late 1971, Etec entered into an agreement with Siemens Co., a West German firm that exports transmission electron microscopes to the United States. The Siemens Co. is to market Etec's microscopes anywhere in the world except the United States, Canada, and Mexico.

Coates & Welter Instrument Corp.

Coates & Welter Instrument Corp. (C&W), located in Sunnyvale, Calif., was organized in mid-1969 as a partnership to manufacture scanning electron microscopes, * * * In July 1970 C&W changed from a partnership to a corporation, and in April 1971 it was acquired by American Optical Co. of Framingham, Mass., as a wholly owned subsidiary. American Optical Co. is a wholly owned subsidiary of Warner Lambert Co., an operating and holding company, which, among other activities, manufactures proprietary drugs, cosmetics, ophthalmic lenses, frames and mountings, and scientific instruments.

U.S. Consumption

U.S. consumption of electron microscopes began in 1939 when RCA offered its first electron microscope for sale. Since then the U.S. market has grown materially. During the 1950's, the total number of new electron microscopes (domestic and imported) purchased annually in the United States generally ranged from 60 to 90 units. Annual purchases averaged about 180 instruments in 1960-66 and 326 instruments in 1967-71 (table 1).

Until 1965, all of the electron microscopes sold in the United States were of the transmission type. Scanning-type instruments accounted for about a tenth of total U.S. consumption of electron microscopes in 1967 and about a fourth in the 3-year period 1969-71.

Electron microscopes are capital goods used in scientific and general research, as well as in research and development of new products or processes. These instruments have what may be termed an "indefinite life," i.e., they become obsolete only through the development of a superior model. They do not become worn through excessive use, and, therefore, their turnover rate is very small. Generally users purchase accessories as necessary, make repairs when required, and continue to maintain the piece(s) of equipment they possess. The high cost of replacement makes this imperative. Because there is no trade-in value for used electron microscopes on the purchase of a new unit and the resale of used microscopes is virtually nonexistent, the user will maintain his microscope until

such time as he can justify the purchase of a new unit because of technological advances and/or necessity for the purchase of an additional unit. Annual purchases are also affected by the amount of funds available for research. In the field of medical research, funds for the purchase of an electron microscope may be made available in the form of grants by a Government agency, by individuals to non-profit organizations, or by corporations. Industry at times will not purchase a new electron microscope, but instead will provide grants to universities to perform research in specified areas. This has the advantages of lower costs to individual firms as well as making available better research talent and facilities.

Since the sales of electron microscopes peaked in 1968, the trend of consumption has been slowly downward, reflecting the saturation of a limited scientific market. The rate of replacement, however, for those units sold in the mid-1960's has recently accelerated.

With the new areas of scientific research and the advanced technology of electron microscopes, more applications are being discovered--especially for the scanning microscope. This is reflected in the stronger growth pattern of this type of unit.

U.S. Production (Shipments)

In this report shipments are equated with production because in the electron microscope industry almost all instruments sold are assembled to the specifications of individual customers with regard to instrumentation, accessories, and spare parts. Consequently, there are practically no shipments made from inventory of completed instruments. The only exception to this practice has been respecting the Forgflo Corp. As a part of the sales agreement with RCA, Forgflo acquired the entire inventory of all finished goods (consisting of * * *) plus parts and accessories for these instruments.

Transmission microscopes

During the 1950's, shipments of transmission microscopes by RCA, the sole domestic producer, ranged from 30 to 45 instruments a year, or about 50 percent of the annual U.S. market. Thereafter shipments by RCA (and then Forgflo) declined, while the U.S. market generally expanded. In the period 1961 through January 31, 1967 (i.e., from the enactment of Public Law 87-95 to the enactment of the legislation implementing U.S. participation in the Florence Agreement 1/), the share of the U.S. market supplied by RCA declined from * * * to * * *. During this same period, U.S. consumption of transmission

1/ Public Law 87-95 provided for the duty-free entry of electron microscopes under certain conditions; see U.S. Tariff Treatment section.

microscopes increased from 140 instruments to more than 200 instruments. From 1967 through 1971, domestic shipments declined from * * * to * * *. U.S. consumption in this period averaged about 240 microscopes a year.

Scanning microscopes

As indicated previously, there were no domestically produced scanning microscopes commercially available prior to 1968. About 50 imported instruments were purchased by U.S. consumers between 1965, when such instruments were first produced for sale by the Cambridge Instruments Co. of the United Kingdom, and 1967. In 1968 *** domestically produced scanning microscope was sold; in 1969 and 1970, *** instruments each year; and in 1971, *** instruments. In 1971, domestic producers supplied about * * * of U.S. consumption, with * * * producer---***--supplying about * * * of the shipments. The 1971 shipments by individual companies are shown in the following table.

A-33

* * * * *

U.S. Exports

U.S. exports of electron microscopes have always been negligible. The following table shows the number of both transmission and scanning microscopes exported during 1967-71.

Electron microscopes: U.S. exports, by types, 1967-71 1/

Year	Transmission	Scanning	Total
	<u>Units</u>	<u>Units</u>	<u>Units</u>
1969-----	<u>2/</u>	1	1
1970-----	1	1	2
1971-----	1	4	5

1/ No exports were reported for 1967 and 1968.

2/ No exports were reported.

Source: Data submitted to the Tariff Commission by domestic producers.

U.S. Imports

In the official U.S. trade statistics, dutiable imports of electron microscopes and diffraction apparatus (item 708.78) and of frames and mountings and parts for frames and mountings (item 708.82) have been reported separately, in terms of value, since August 31, 1963 (table 2). The duty-free imports of such articles, however, have not been reported separately, but, since August 31, 1963, have been included with all other scientific instruments, apparatus, and repair parts which enter the country duty free under certain conditions as set forth above in the section on U.S. tariff treatment. The value of imports of such duty-free scientific instruments, as reported in the official statistics, are shown in table 3.

Imports of electron microscopes first commenced in the early 1950's, and during most of that decade imports of such microscopes amounted to 30 to 45 units a year. During the period 1960-66, ^{1/} total imports of electron microscopes increased 210 percent, from 68 units in 1960 to 211 units in 1966. The 68 units imported in 1960 were all dutiable. Duty-free entries commenced in July 1961 and totaled 14 units by the end of the year; dutiable entries amounted to 40 units. In 1966, dutiable imports amounted to 50 units and duty-free imports, to 162 units. The 1966 imports included the

^{1/} All statistics pertaining to the period 1960-66 were provided by counsel for AEI Scientific Apparatus, Inc., and Kent Cambridge Scientific, Inc., in their position paper presented at the hearing. Their statistics were derived from questionnaires sent to all importers of electron microscopes.

first seven scanning electron microscopes commercially available in the United States; six were dutiable and one was duty free.

Data received during the course of this investigation through questionnaires completed by importers of the articles subject to this investigation are summarized in the following table.

Electron microscopes: U.S. imports for consumption of transmission and scanning types, dutiable and free, 1967-71

Year	Transmission			Scanning			Total
	Duti- able	Free	Total	Duti- able	Free	Total	
	Quantity (number)						
1967-----	52	175	227	21	8	29	256
1968-----	60	198	258	45	16	61	319
1969-----	30	164	194	63	28	91	285
1970-----	28	161	189	49	27	76	265
1971-----	19	191	210	52	23	75	285
	Value (1,000 dollars)						
1967-----	1,158	4,303	5,461	983	272	1,255	6,716
1968-----	1,623	5,122	6,745	1,658	591	2,249	8,994
1969-----	964	4,956	5,920	2,339	1,025	3,364	9,284
1970-----	899	5,034	5,933	1,832	1,051	2,883	8,816
1971-----	660	6,078	6,738	2,089	934	3,023	9,761

Source: Compiled from data submitted to the Tariff Commission by importers.

During the period 1967-71, the share of total imports of transmission electron microscopes accounted for by dutiable entries declined from about 30 percent in both 1967 and 1968 to 10 percent in 1971. With respect to scanning-type instruments, the relation of dutiable

entries to total annual entries showed little change during 1967-71, fluctuating between 74 percent in 1968 and 64 percent in 1970.

Imports of diffraction apparatus as accessories to electron microscopes for the period 1967-71 are reported in the following table. The quantities reported here are too insignificant for valid conclusions to be drawn. In most cases, diffraction apparatus is a part of the microscope itself and therefore has not been reported separately by the respondents to the Commission's questionnaire.

Diffraction apparatus: U.S. imports for consumption for use with electron microscopes, dutiable and free, 1967-71

Year	Dutiable	Free	Total
Quantity (number)			
1967-----	8	17	25
1968-----	6	21	27
1969-----	6	11	17
1970-----	4	24	28
1971-----	3	28	31
Value (1,000 dollars)			
1967-----	<u>1</u> / 9	<u>2</u> /	9
1968-----	<u>1</u> / 6	<u>2</u> /	6
1969-----	<u>1</u> / 6	<u>2</u> /	6
1970-----	<u>1</u> / 3	<u>2</u> /	3
1971-----	<u>2</u> /	<u>2</u> /	<u>2</u> /

1/ Value stated on only 60 percent of the units reported.

2/ No value reported.

Source: Compiled from data submitted to the Tariff Commission by importers.

The value of imports of frames, mountings, and parts for 1967-71 are shown in the following table. These articles were reported to have been dutiable under item 708.82.

Frames, mountings, and parts thereof for electron microscopes: U.S. imports for consumption, by types of instrument, 1967-71

(In thousands of dollars)

Year	Transmission	Scanning	Total
1967	429	98	527
1968	424	158	582
1969	460	246	706
1970	502	209	711
1971	577	260	837

Source: Compiled from data submitted to the Tariff Commission by importers.

The value of repair components for the electron microscopes which enter duty free are shown in the table below for 1967-71. These articles were reported to have been entered duty free under item 851.65.

Repair components duty-free electron microscopes: U.S. imports for consumption, by types of instrument, 1967-71

(In thousands of dollars)

Year	Transmission	Scanning	Total
1967	24	19	43
1968	25	43	68
1969	33	96	129
1970	25	72	97
1971	26	103	129

Source: Compiled from data submitted to the Tariff Commission by importers.

There are seven foreign producers who ship electron microscopes to the United States. Exporters of transmission electron microscopes exclusively are Philips Electronic Instruments of the Netherlands, * * *; Siemens Corp. and Carl Zeiss, Inc., 1/ both of West Germany; and AEI of the United Kingdom. Kent Cambridge of the United Kingdom, * * * scanners exclusively. Jeol, U.S.A., Inc., and Hitachi, both of Japan, export both scanning and transmission electron microscopes to the United States.

1/ Carl Zeiss, Inc., concentrates on the sizes of electron microscopes suitable principally for teaching.

Marketing Practices and Distribution of Sales
in the United States

Sales and promotional techniques

Both domestic producers and foreign suppliers of electron microscopes use company salesmen in the field to market their product line. One importer also employs manufacturers' representatives to help distribute its scanning electron microscopes. Among the advertising and promotional techniques most commonly used by producers are sales literature, advertising in the technical trade journals, and attendance at the industrial trade shows and exhibitions such as the Electron Microscopy Society of America Exhibition, the Cellular Biology Show, and the X-Ray Symposium. Other sales techniques which are utilized to interest potential buyers are private showings for the introduction of new models, direct-mail advertising campaigns, public news releases, and demonstrations in conjunction with audio-visual aids.

An important element of sales promotion is the kinds of services promised a prospective purchaser. These services include site surveys before delivery to analyze the layout of a buyer's laboratory in planning the location of the unit. This is necessary to avoid disturbances, such as excessive vibration, which might hinder optimum use. Other services offered are training schools and workshops for new users of electron microscopes and technical support programs for current users. There does not appear to be much variance in the promotional techniques utilized by either domestic manufacturers or foreign suppliers.

Purchasers' considerations

Electron microscopes are usually acquired for a particular purpose or type of research, e.g., examination of cell structure, study of crystalline structures, or for teaching. Since these instruments are most often purchased by institutions and are costly items of equipment, careful consideration is given by the purchaser to various makes and models of microscopes available. The decision as to what particular microscope to buy is most often made by the individual--the scientist, research analyst, or professor--who will be using the instrument. Among the factors to be considered are the user's past experience with--and the reputation of--a particular make or model; the servicing aspects of the purchase contract; the individual features and/or accessories available; and the capabilities of the instrument in terms of resolution, magnification, specimen stage, and so forth. In short, the ability of an electron microscope to perform a specific task is the primary consideration, not price, although it is an important factor in selecting a source of supply.

Some electron microscopes are purchased by means of grants, mostly Federal. In these instances, the purchasing officer of the recipient institution may have considerable latitude in his decision, provided he can justify the selection of a particular microscope for the project at hand.

Distribution of sales in the U.S. market

Sales of electron microscopes in the United States during 1971 were distributed among buyers as follows: 43 percent to universities; 25 percent to Government outlets; 19 percent to industrial firms; 7 percent to private research facilities; and 6 percent to private hospitals. The following table indicates the distribution of electron microscopes in the domestic market in 1971.

Distribution of sales of electron microscopes, by types, and by classes of customer, 1971 1/

(Number)			
Class of customer	Transmission	Scanning	Total
Universities:			
Medical schools-----	77	12	89
Other-----	42	14	56
Government (including hospitals):			
Federal-----	38	26	64
Other-----	11	13	24
Private hospitals-----	22	<u>2/</u>	22
Private research facilities-----	12	11	23
Industrial firms-----	12	54	66
Total-----	214	130	344

1/ The number of units sold in 1971 differs slightly from the number of units consumed during that year as shown in table 1.

2/ No sales were reported.

Source: Compiled from data submitted to the Tariff Commission by domestic producers and importers of electron microscopes.

Prices

During 1969 and 1970, domestic electron microscopes of the transmission type, which had been produced by RCA and were marketed by Forgflo sold in the United States at * * * per unit. The U.S. sales price of four of the five importers of instruments of a similar type exceeded Forgflo's prices in those 2 years. In 1971 Forgflo reduced its price * * * in an effort to liquidate the remaining inventory of EMU-4 microscopes acquired from RCA. Three of the four importers referred to above increased their prices in that year, as indicated in the table on the following page. Forgflo sold only * * * units in 1971, despite the sizable reduction in price. 1/

There has been no domestic competition for transmission electron microscopes of less than 100 KV, which are sold in the U.S. market by six foreign suppliers. The new model of this type which has been developed by Elektros, Inc., is reported available for delivery beginning in April 1972 at a unit price of about * * * . The unit U.S. sales prices of the imported transmission microscopes of less than 100 KV--all entered duty free--ranged in 1970 from \$16,000 to \$55,000, depending principally on the kilovoltage desired by the customer. In 1971 the unit prices of most models of these instruments were increased and therefore ranged from \$19,000 to \$63,000.

1/ The selling prices discussed here include installation costs, which domestic producers and importers reported had amounted to \$1,500 per unit on the average.

During 1967-71, models of more than 100 KV were sold in the United States by four foreign companies, at prices ranging mostly from \$50,000 to \$75,000, depending on the kilovoltage and particular specifications of the different instruments. A few models, however, sold at more than \$500,000 each.

Unit selling prices in the U.S. market of transmission electron microscopes, by specified models, 1967-71

* * * * *

Although imported electron microscopes of the scanning type have been sold in the U.S. market since 1966, no information was available with respect to the selling prices prior to 1970 of the most popular models currently available. Selling prices for the most popular imported models of 0 to 30 KV are shown in the following table together with the selling prices of domestic models.

Unit selling prices in the U.S. market of scanning electron microscopes of 0 to 30 KV, by specified models, 1968-71

* * * * *

For the four models of electron microscopes for which U.S. selling prices of both dutiable and duty-free instruments were reported by the importers, it was possible to estimate the foreign (i.e., the dutiable) unit value and then construct the 1971 U.S. selling price which would reflect the statutory rate of duty. Such constructed prices are shown in the following table together with the 1971 prices reported by the importers and 1971 prices reported by domestic producers for similar instruments.

Prices of imported electron microscopes, duty free, dutiable at trade-agreement rate, and dutiable at statutory rates, and prices of comparable domestic instruments, 1971

* * * * *

Employment

Seven U.S. firms engaged in the development and production of electron microscopes supplied employment data for the plants in which they conducted their operations on such instruments. Only three of the firms were in operation during all of the years for which data were requested, 1967-71. For each of the seven firms, annual data on the average number of employees during 1967-71 in the plants where electron microscopes were developed or made are shown in the table on the following page.

Average number of employees (all persons and production and related workers) in the plants of 7 U.S. firms where electron microscopes were developed or made, 1967-71

* * * * *

Employment data was not received from RCA, which was the only U.S. producer of transmission microscopes during the period January 1967 to June 1969. As indicated earlier in this report, Forgflo Corp. acquired RCA's electron microscope operation in June 1969. In terms of the average number of persons employed in a year, Forgflo is the largest firm for which employment data were received. * * * during the period 1967-71, Forgflo employed an average of * * * persons, including * * * production and related workers. From 1970 to 1971, the average number of all persons employed by Forgflo * * * and the average number of production and related workers, from * * * This * * * in the number of total employees from 1970 to 1971 reflected * * * Until 1969 Forgflo had been an important supplier of parts for the electron microscope operations of RCA.

After buying RCA's Scientific Instruments Department, Forgflo launched a program to develop a new model of electron microscope. This program represented Forgflo's total production operations on electron microscopes through the end of 1971. * * *

The data obtained from five U.S. producers of scanning microscopes on man-hours worked by production and related workers indicates that the total number of such man-hours increased by virtually 100 percent between 1968 and 1971, or from more than 83,000 man-hours to nearly 165,000. These data are shown in the table on the following page.

Man-hours worked by production and related workers on all products and on scanning electron microscopes, by plants in which electron microscopes were manufactured, 1967-71 1/

* * * * *

Expressed in terms of man-years of 2,000 hours each, 1/ employment in the production of scanning microscopes increased from 42 man-years (or 42 persons) in 1968 to 82 in 1971.

1/ The equivalent of 50 weeks of 40 hours each.

Profit-and-loss Experience of Domestic Producers

Of the six domestic producers that submitted profit-and-loss data, only one produced electron microscopes in all of the 5 years for which data were requested. Of the remaining five, one began shipments of electron microscopes in 1968; two, in 1969; one, in 1970; and one in 1971. Electron microscopes accounted for 100 percent of annual sales for three of the six firms for which financial data were received. For each of the other three firms, the importance of electron microscope sales compared with total sales varied considerably from year to year, as shown in the following table.

Ratio of U.S. producers' sales of electron microscopes
to their total sales, 1967-71

* * * * *

As a group, the reporting domestic producers experienced profits in both 1967 and 1968 on the operations of their establishments in which electron microscopes were produced, but sustained losses in each of the years 1969-71 (table 4). In their electron microscope operations, these reporting firms, as a group, experienced losses in each of the years 1967-71 except 1968. 1/

Only one of the domestic producers-- * * *
made profits in its total operations in each of the 3 years it was in operation (table 5). That same firm was the only one whose electron microscope operations were more profitable in 1971 than in any previous year of the period under review (table 6).

The reporting concerns used various accounting methods with respect to their research and development expenses, as indicated in the following table.

Electron microscopes: Research and development (R. & D.) expenditures by domestic producers, 1967-71

* * * * *

The financial operations of each of the concerns which produced electron microscopes during the 5-year period are described briefly in the following paragraphs.

* * * * *

APPENDIX A

HEADNOTE 6 TO PART 4, SCHEDULE 8 OF THE TARIFF
SCHEDULES OF THE UNITED STATES ANNOTATED

6. (a) The term "instruments and apparatus" (item 851.60) embraces only instruments and apparatus provided for in --

- (i) schedule 5: items 535.21-.27 and subpart E of part 2; and items 547.53 and 547.55 and subpart D of part 3;
- (ii) schedule 6: subpart G of part 3; subparts A and F and items 676.15, 676.20, and 678.50 of part 4; part 5; and items 694.15, 694.50, and 696.60 of part 6; and
- (iii) schedule 7: part 2 (except subpart G); and items 790.59-.62 of subpart A of part 13;

but the term does not include materials or supplies, nor does it include ordinary equipment for use in building construction or maintenance or for use in supporting activities of the institution such as its administrative offices or its eating or religious facilities.

(b) An institution desiring to enter an article under item 851.60 shall make application therefor to the Secretary of the Treasury including therein (in addition to such other information as may be prescribed by regulation) a description of the article, the purposes for which the instrument or apparatus is intended to be used, the basis for the institution's belief that no instrument or apparatus of equivalent scientific value for such purposes is being manufactured in the United States, and a statement that either the institution has already placed a bona fide order for the instrument or apparatus or has a firm intention, in the event of favorable action on its application, to place such an order on or before the final day specified in paragraph (d) of this headnote for the placing of an order. If the application is made in accordance with the applicable regulations, the Secretary of the Treasury shall promptly forward copies thereof to the Secretary of Commerce and to the Secretary of Health, Education, and Welfare. If, at any time while its application is under consideration by the Secretary of Commerce or by the Court of Customs and Patent Appeals on appeal from a finding by him, an institution cancels an order for the instrument or apparatus to which its application relates or ceases to have a firm intention to order such instrument or apparatus, it shall promptly so notify the Secretary of Commerce or such Court, as the case may be.

(c) Upon receipt of the application the Secretary of Commerce shall, by publication in the Federal Register, afford interested persons and other Government agencies reasonable opportunity to present their views with respect to the question whether an instrument or apparatus of equivalent scientific value for the purposes for which the article is intended to be used is being manufactured in the United States. After considering any views presented pursuant to this paragraph, including any written advice from the Secretary of Health, Education, and Welfare, the Secretary of Commerce shall determine whether an instrument or apparatus of equivalent scientific value to such article, for the purposes for which the instrument or apparatus is intended to be used, is being manufactured in the United States. Each finding by the Secretary of Commerce under this paragraph shall be promptly reported to the Secretary of the Treasury and to the applicant institution. Each such finding shall be published in the Federal Register, with a statement of the reasons therefor, on or before the ninetieth day following the date on which the application was made to the Secretary of the Treasury in accordance with applicable regulations.

(d) Item 851.60 shall not apply with respect to any instrument or apparatus unless a bona fide order therefor has been placed, by the institution making the application under this headnote, on or before the sixtieth day following the day on which a finding of the Secretary of Commerce favorable to the institution has become final and conclusive.

(e) Within 20 days after the publication in the Federal Register of a finding by the Secretary of Commerce under paragraph (c) of this headnote, an appeal may be taken from said finding only upon a question or questions of law and only to the United States Court of Customs and Patent Appeals --

- (i) by the institution which made the application under paragraph (b) of this headnote,
- (ii) by a person who, in the proceeding which led to such finding, represented to the Secretary of Commerce in writing that he manufactures in the United States an instrument or apparatus of equivalent scientific value for the purposes for which the article to which the application relates is intended to be used,
- (iii) by the importer thereof, if the article to which the application relates has been entered at the time the appeal is taken, or
- (iv) by an agent of any of the foregoing.

Any appeal under this paragraph shall receive a preference over all other matters before the Court and shall be heard and determined as expeditiously as the Court considers to be practicable. The judgment of the Court shall be final.

(f) The Secretary of the Treasury and the Secretary of Commerce may prescribe joint regulations to carry out their functions under this headnote.



APPENDIX B

EXCERPT FROM THE JUNE 6 AND 7, 1966, HEARINGS BEFORE THE COMMITTEE ON WAYS AND MEANS OF THE HOUSE OF REPRESENTATIVES (89th CONG., 2d SESS.) ON BILLS TO IMPLEMENT THE FLORENCE AND BEIRUT AGREEMENTS, PP. 11-16. THE FOLLOWING MATERIAL COMPRISES A PART OF THE STATE DEPARTMENT ANALYSIS OF H.R. 8664

IMPORTS BY EDUCATIONAL AND SCIENTIFIC INSTITUTIONS

Section 6 would make a number of amendments to schedule 8, part 4, relating to importations for public institutions and other institutions established for educational, scientific, literary, or philosophical purposes, or for the encouragement of the fine arts. The descriptive language, specifying the institutions for the use of which the articles described in items 851.10 through 851.60 may be imported duty-free, would be amended by section 6(a) to replace the present words "institution established solely" by the words "nonprofit institution established". Although it is doubted that this change would substantially modify the application of the provision, it would enable a number of the requirements of the Florence agreement to be met by existing, amended, or new items under this present descriptive language without any implication of undue limitation.

The provisions of item 851.10 providing for the duty-free importation of enumerated literary, artistic, and audio-visual materials for use by the specified institutions would be amended by deleting articles made unqualifiedly duty-free by earlier sections of the bill (as books, maps, and music), and to include plans, reproductions of drawings and plans (drawings are already included), recorded video tapes, and globes.

The addition of plans and reproductions of drawings and plans would be designed to implement the provisions of the Florence agreement for the duty-free importation of architectural, industrial, or engineering designs and plans, and reproductions thereof, for study in specified institutions. Reproductions of drawings under this item would include designs intended for study, whatever medium is used, however produced thereon or therein, and whether or not they had previously been drawn on some other material. A conforming amendment would also be made to the headnotes to schedule 8, part 4.

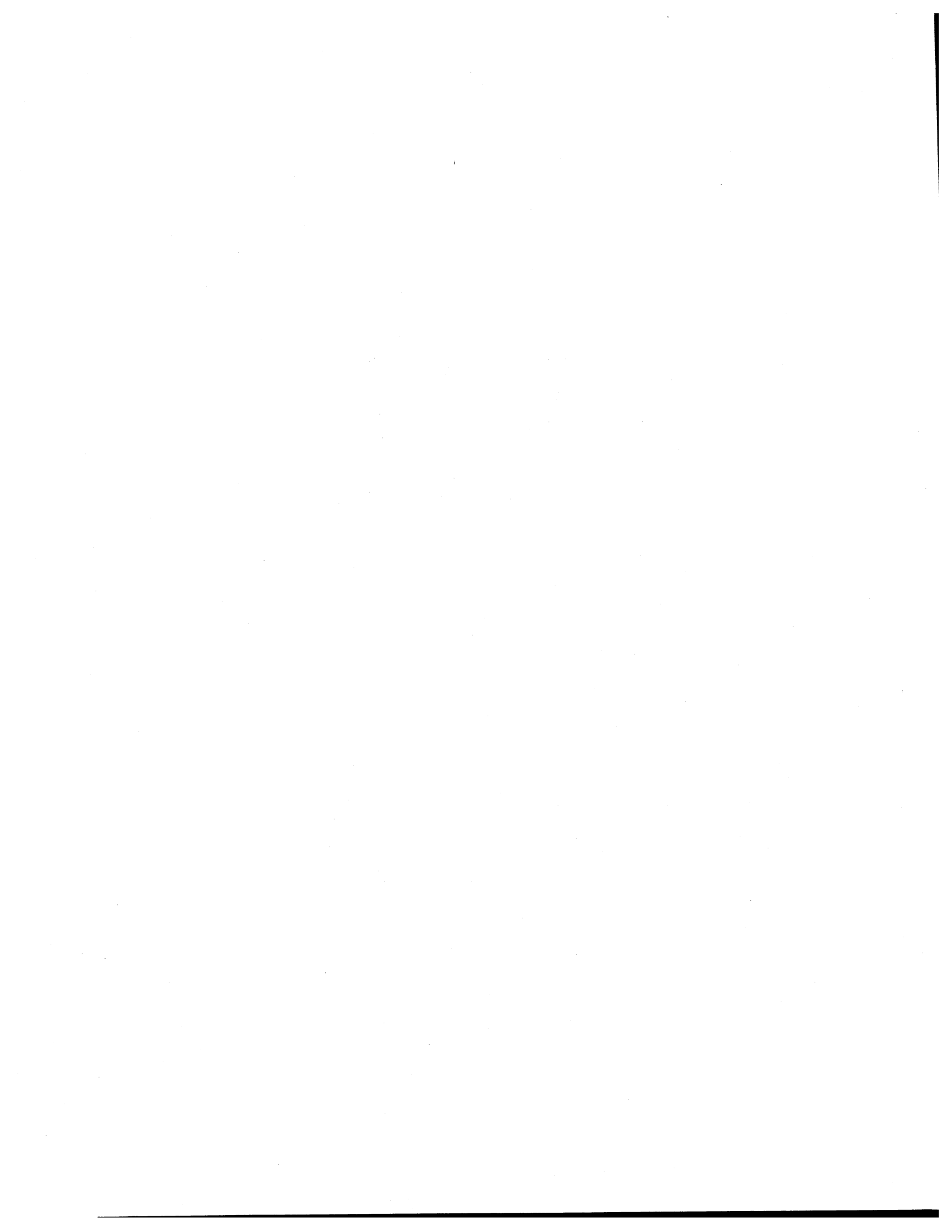
Although video tapes are not named in the Florence agreement (they were not an article of commerce when the agreement was negotiated), they are closely related in use to the audio-visual materials specified therein, and it is believed they would undoubtedly have been named if they had then been articles of commerce. A number of other countries apply the provisions of the agreement to such tapes. Moreover, a number of countries interpret the Florence agreement provisions for the duty-free treatment of maps to cover globes. This bill would not provide for such treatment of globes generally, but only if imported by the specified nonprofit institutions entitled to import under item 851.10.

Since the agreement requires duty-free treatment for all patterns and models imported for educational use by specified institutions, item 851.50 now providing such treatment of models of inventions for exhibition by them would be amended by section 6(b) to include patterns and all models to be used for either exhibition or for educational purposes.

SCIENTIFIC INSTRUMENTS AND APPARATUS

General.—Section 6(c) of the bill would add new items 851.60 and 851.65 to provide for the free entry of certain instruments and apparatus and repair components therefor when imported for the use of certain institutions. The free-entry privilege would apply with respect to such articles imported for the use of any nonprofit institution, whether public or private, established for educational or scientific purposes.

Paragraph (a) of proposed headnote 6 to schedule 8, part 4, would specifically limit, in terms of the Tariff Schedules of the United States, those instruments and apparatus which would fall within the special duty-free entry provisions of proposed item 851.60. Most classes of instruments and apparatus that could be imported by qualified institutions under item 851.60 are those described in schedule 7, part 2. Schedule 7, part 2 covers a wide variety—and the vast bulk—of scientific and professional precision-type instruments and apparatus, whether



optical or nonoptical and whether electrical or nonelectrical, e.g., optical goods, medical and surgical instruments and apparatus, X-ray apparatus, drawing and mathematical calculating instruments, measuring, timing, testing and controlling instruments, etc. However, a relatively small number of instruments and apparatus which may have important value are not included in schedule 7, part 2, and for this reason, are covered in the other provisions of the tariff schedules cited in the proposed headnote definition.

The qualified institutions would not be entitled to import free of duty all instruments and apparatus described in the cited provisions of the tariff schedules. There would be important limitations with respect to the instruments and apparatus to which the free-entry privileges would be extended.

Item 851.60 would not include materials and supplies and would not include ordinary equipment for use in building construction or maintenance or for use in supporting activities of the institution. Thus, this provision would not include ordinary plumbing, heating, lighting, timekeeping, air-conditioning, and other materials, supplies, or equipment used in the construction or in maintenance of buildings to provide for the safety, comfort, or convenience of the occupants thereof. Likewise, it would not include material, supplies, or equipment for the supporting activities of the institution such as might be used in its administrative offices, dormitories, its cafeterias, restaurants, and recreational, athletic, religious, or other such facilities.

Lastly, and most important, proposed item 851.60 would not apply to any instrument or apparatus if the Secretary of Commerce finds that an instrument or apparatus of equivalent scientific value is being manufactured in the United States. This limitation is discussed in detail below under "Equivalency of scientific value".

Under the present headnote 1 to schedule 8, part 4, the articles entitled to free entry must be exclusively for the use of the importing institutions and not for distribution sale, or other commercial uses. In view of the fact that the proposed item 851.60 would provide for the duty-free imports by scientific and educational institutions of equipment, some of which would be long-lasting equipment of high quality and normally dutiable at relatively high rates, it is proposed to amend headnote 1 to impose a minimum period of 5 years during which the institution would be obliged to use the instruments or apparatus for non-commercial purposes and also to refrain from transferring them to any but a similarly qualifying institution. If used for commercial purposes or if transferred otherwise than to a qualifying institution within the five year period, the importing institution would become liable for payment of duties on the article.

In short, instruments or apparatus of types not domestically produced would be admitted free of duty if imported by a qualified nonprofit institution for use exclusively in its noncommercial scientific or educational pursuits. Moreover, it is intended that such imported instruments or apparatus could also be used by such an institution, for example, in diagnostic laboratory work, for the treatment of patients, and in other activities of such an institution which are non-commercial, and need not be continuously or wholly limited to scientific research or educational purposes.

It is considered that an accessory for a scientific instrument or apparatus, in the sense of an article which although not necessarily essential for the use of the instrument or apparatus has characteristics or qualities such that when available for use therewith distinctly enhance the general usefulness of the instrument or apparatus, would itself be an instrument or apparatus under item 851.60.

Equivalency of scientific value.—With a view undoubtedly to avoiding a situation in which the duty-free importation of foreign instruments and apparatus might have a marked tendency to displace domestic articles for purposes of institutional research and education, the Florence agreement limits the provision for such duty-free treatment to cases in which instruments or apparatus of equivalent scientific value are not being manufactured in the country of importation. This limitation has been embodied in item 851.60 and procedures for its implementation are contained in paragraph (c) of the new headnote 6.

In determining whether a domestic and a foreign instrument or apparatus are of "equivalent scientific value", considerable latitude for the exercise of judgment would be required, with each case being decided on its own merits. Such comparisons would have to be made on the basis of the best available information as to the known actual and potential uses of the articles. As a general rule the articles would be compared on the basis of total overall performance. However, they would be compared, where pertinent, on the basis of specific differences between them. Evaluations of equivalency between domestic and foreign instruments or apparatus will be based on the structural and operational

characteristics that are relevant to the functions which an article, such as that for which duty-free treatment is sought, is designed to perform. One article shall be considered equivalent to another, if there are no significant differences between them with respect to the pertinent characteristics. In certain cases the intended use of an article in a particular research project (with special requirements) might serve to illustrate specific differences between the domestic and foreign article for use in the project. In cases in which a comparison would be made between a foreign and a domestic instrument *each of which* is superior in one or more highly relevant characteristics but inferior in others, due consideration would have to be given to both the relative importance of these characteristics for special uses to which the instrument is likely to be put as well as to the equivalence of the instruments for more usual uses.

If it should be found in the case of a particular foreign instrument or apparatus that there was no domestic article of equivalent scientific value, a similar finding would be expected in the case of an application by any qualified institution until it is determined that such earlier finding is no longer justified.

Within the framework of the above broad considerations, characteristics of foreign and domestic instruments or apparatus to be examined very closely, as being highly relevant to the question of the equivalency of the scientific value of the domestic instruments or apparatus, would be such characteristics as the *extent* to which the foreign articles might be able to carry the investigations for which they are intended somewhat further than the domestic, and the comparative *precision, clarity, and reliability* of the measurements or other information which it would be possible to obtain through their use.

There are several characteristics of instruments or apparatus which might have considerably less relevance to scientific value, such as *size, durability, complexity, versatility, ease of operation, compatibility* with other instruments already in a laboratory (or training or experience of potential operators).

In many cases such characteristics would be considered as relating only to matters of convenience rather than to scientific value. However, in some instances one or more of them might be directly related to such value, and if so the superiority of the foreign instrument in such respect might contribute materially toward a finding that there was no domestic instrument of equivalent scientific value. An example of a somewhat similar situation, in relation to speed of operation, would be the case of instruments for making several tests of bacterial cultures, if the domestic instrument operated so much slower than the foreign instrument that the appropriate number of tests could not be completed while the cultures remained in the appropriate condition for testing. Certain characteristics might be relevant only to scientific value in relation to reasonably foreseeable use for educational purposes. One such characteristic might be the construction of an instrument or apparatus so that it can be used, or its functioning observed, simultaneously by a group of students rather than by one at a time. A variant of this would be an instrument which is so constructed that intermediate processes in its operation, which are well known to the scientist and of no interest to him, may be observed by the students using the instrument.

Moreover, there might be exceptional instances in which there would be such a difference between the foreign and the domestic instrument in respect to one or more of the characteristics of lesser relevance as to render impossible the use of the domestic instrument in a particular type of research activity. An example of such a situation in relation to the size of the instrument would be in the selection of instruments for use in space craft. In such a case, although the performance of the two instruments being compared might be identical, only the smaller, lighter-weight one could be used.

In most cases the more refinements an instrument has the greater would be its scientific value. However, this is not always the case. Refinements may be irrelevant. They may render an instrument too bulky for some uses, as for geological research for which a portable instrument is necessary. It might well be that only relatively simple instruments would be practicable for high school or first-year college students, since more highly refined instruments would be too complicated for their use.

The comparative *cost* of a foreign and a domestic instrument or apparatus would have no direct relationship to equivalency of scientific value.

It is considered that there would be justification for a finding that an instrument or apparatus is being manufactured in the United States if a manufacturer in the United States has in stock, or lists in a current catalog and offers for sale, such an instrument or apparatus which it has produced domestically. Moreover, in the case of any other article, such a finding would be justified if there is satis-

factory evidence that a manufacturer is able and willing to produce and have such a domestic article available promptly so that it may be obtained by the applicant without unreasonable delay, taking into account the normal commercial practice applicable to the production and distribution of instruments or apparatus of the same general type.

Provisions relating to special procedures applicable to item 851.60 would be set forth in paragraphs (b) to (d) of new headnote 6 to schedule 8, part 4. These procedural provisions would specify the information to be included in applications for duty-free importation under this item, and provide an opportunity by notice in the *Federal Register* for the presentation of views by interested parties and by other government agencies (including specifically the Department of Health, Education, and Welfare) on the question whether an instrument or apparatus of equivalent scientific value is being manufactured in the United States. Based on the information received pursuant to these procedures and of that available to him in the Department of Commerce, including the Office of the Assistant Secretary for Science and Technology, the Secretary of Commerce would determine the question of equivalency. Provision would be made for dispensing with the formal request for views from the interested parties and other agencies when a finding has been made with respect to a like article and the Secretary is satisfied that the circumstances do not justify a reexamination of the question. Each finding of the Secretary of Commerce would be published in the *Federal Register*, giving a statement of reasons. Free entry would apply under any particular application only if the institution making application has placed the order for the foreign instrument or apparatus on or before the sixtieth day following publication of a favorable finding.

In order that the duty-free treatment of electron microscopes may be subject to the same qualifications as such treatment of other instruments and apparatus, the present provision for the free entry of such microscopes would be deleted from item 854.10.

Repair components.—In item 851.65, relating to repair components for instruments and apparatus imported under item 851.60, the term repair components would embrace articles which are intended to be incorporated into instruments or apparatus which were imported under the latter item. Such articles may be either parts or assemblages of parts which are substantially less than the instrument or apparatus for which they are being imported. In either case the term is considered to imply articles which in their condition as imported would be ready for installation except for possible minor or incidental adjustments.

Repair components would not be subject to the test of equivalency of scientific value, but there, however, would be no intention that item 851.65 would be applied in such a way as to result in an avoidance of the limitation in item 851.60 which provides that instruments and apparatus may be classified thereunder only if no instrument or apparatus of equivalent scientific value is being manufactured in the United States. In this connection, reference might be made to general headnote 10(h), Tariff Schedules of the United States, to the effect that an item providing for an article covers that article whether assembled or unassembled and whether finished or unfinished.

It is intended that item 851.65 would include a reasonable number of components, whether imported with the instrument or apparatus or subsequently, to keep the instrument or apparatus operating with a minimum of delays (such as those resulting from breakdown, deterioration, or loss of efficiency) taking into account the anticipated life of the various components involved and the limitation of the item to components for articles imported under item 851.60.

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APPENDIX C
STATISTICAL TABLES

Table 1.--Electron microscopes: U.S. producers shipments, imports for consumption, exports of domestic merchandise, and apparent consumption, 1967-71

Year and type	Producers shipments	Imports	Exports	Apparent consumption	Ratio of imports to consumption
	Units	Units	Units	Units	Percent
Total, all types:					
1967-----	***	256	-	***	***
1968-----	***	319	-	***	***
1969-----	***	285	1	***	***
1970-----	***	265	2	***	***
1971-----	***	295	5	***	***
Transmission electron microscopes:					
1967-----	***	227	-	***	***
1968-----	***	258	-	***	***
1969-----	***	194	-	***	***
1970-----	***	189	1	***	***
1971-----	***	220	1	***	***
Scanning electron microscopes:					
1967-----	-	29	-	29	100.0
1968-----	***	61	-	***	***
1969-----	30	91	1	120	75.8
1970-----	30	76	1	105	72.3
1971-----	39	75	4	110	68.2

Source: Compiled from confidential data submitted to the Tariff Commission by individual domestic and foreign producers of electron microscopes.

Table 2.--Electron microscopes and parts: Dutiable U.S. imports for consumption, Aug. 31-Dec. 31, 1963, and 1964-71

(In thousands of dollars)		
Period	: Electron, proton, and similar : microscopes and diffraction : apparatus (TSUS item 708.78)	: Frames, mountings, : and parts thereof : (TSUS item 708.82)
1963 (Aug. 31- Dec. 31)-----	467	102
1964-----	1,381	286
1965-----	837	312
1966-----	1,282	424
1967-----	2,529	610
1968-----	3,830	1,105
1969-----	4,370	1,160
1970-----	3,423	1,019
1971-----	3,363	1,535

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Scientific instruments and apparatus and repair parts for scientific instruments and apparatus: Duty-free U.S. imports for consumption, Aug. 31-Dec. 31, 1963, and 1964-71

(In thousands of dollars)		
Period	: Scientific : instruments : and apparatus : (TSUS item 851.60)	: Repair parts for scien- : tific instruments and : apparatus (TSUS item : 851.65)
1963 (Aug. 31-Dec. 31)---	1/ 1,024	
1964-----	1/ 4,013	
1965-----	1/ 4,417	
1966-----	1/ 5,435	
1967-----	2/ 6,704	
1968-----	7,142	49
1969-----	7,699	51
1970-----	8,398	13
1971-----	9,231	90

1/ Effective Aug. 31, 1963, scientific instruments, apparatus, and repair parts imported duty free by nonprofit institutions for educational or scientific purposes were entered under TSUS item 854.10.

2/ Includes imports entered in January under TSUS item 854.10 and those entered from Feb. 1 (following passage of Public Law 89-651) through Dec. 31 under TSUS items 851.60 and 851.65.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 4.--Profit-and-loss experience of 6 U.S. producers of electron microscopes on their total operations and on electron microscopes operations only, 1967-71

Product and year	Number of producers	Net sales	Cost of goods sold	Gross profit or (loss)	Administrative and selling expenses	Net operating profit or (loss) before income taxes	Ratio of net operating profit or (loss) to net sales
		<u>1,000 dollars</u>	<u>1,000 dollars</u>	<u>1,000 dollars</u>	<u>1,000 dollars</u>	<u>1,000 dollars</u>	<u>Percent</u>
All products:							
1967-----	***	***	***	***	***	***	***
1968-----	***	***	***	***	***	***	***
1969-----	4	8,150	5,682	2,468	3,104	(636)	(7.8)
1970-----	5	7,271	6,132	1,139	2,519	(1,380)	(19.0)
1971-----	5	4,673	4,424	249	2,097	(1,848)	(39.5)
Electron microscopes:							
1967-----	***	***	***	***	***	***	***
1968-----	***	***	***	***	***	***	***
1969-----	4	2,039	1,953	86	891	(805)	(39.5)
1970-----	5	2,048	2,078	(30)	939	(969)	(47.3)
1971-----	5	3,108	2,921	187	1,658	(1,471)	(47.3)

Source: Compiled from data submitted by the U.S. producers.

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