

# TUNGSTEN ORES

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## HEARINGS

BEFORE THE

COMMITTEE ON FINANCE

UNITED STATES SENATE

SIXTY-SIXTH CONGRESS.

FIRST SESSION

ON

### H. R. 4437

A BILL TO PROVIDE REVENUE FOR THE GOVERNMENT AND  
TO PROMOTE THE PRODUCTION OF TUNGSTEN ORES  
AND MANUFACTURE THEREOF IN THE  
UNITED STATES

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NOVEMBER 10 AND 11, 1919

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# TUNGSTEN ORES.

MONDAY, NOVEMBER 10, 1919.

UNITED STATES SENATE,  
SUBCOMMITTEE ON FINANCE,  
Washington, D. C.

The subcommittee met in committee room, Senate Office Building, at 10 o'clock a. m., Senator James E. Watson presiding.

Present: Senators Watson (chairman), McCumber, and Thomas.

Present also: Senators Phipps, Calder, and Representative Charles B. Timberlake, of Colorado.

The CHAIRMAN. We will hear Mr. Timberlake at this time.

## STATEMENT OF HON. CHARLES B. TIMBERLAKE, A REPRESENTATIVE FROM COLORADO.

Representative TIMBERLAKE. Mr. Chairman, and gentlemen of the committee, I will just make a very brief statement and take but a very few moments of your time. Here is the list of the parties that we desire to have heard, who represent the producers of the ore and also the manufacturing interests affected by the bill.

(The list submitted by Representative Timberlake is here printed in full, as follows:)

Nelson Franklin, of Denver, Colo.; vice president of the Rare Metals Ore Co., Rollinsville, Colo.

Frank W. Griffin, of San Francisco, Calif.; vice president and manager the Tungsten Mines Co., Bishop, Inyo County, Calif., and of Tungstonia Mines Corporation, Ely, Nev.

A. J. Clark, Los Angeles, Calif.; president the Standard Tungsten Co., Bishop, Calif., and president the Tungsten Reef Mines Co., Hereford, Ariz.

Cooper Shapley, manager Round Valley Tungsten Co., and Pino Creek Tungsten Co., of California.

Roy C. McKenna, president the Vanadium-Alloys Steel Co., Latrobe, Pa.

Representative TIMBERLAKE. Being the author of the bill and coming from a district in Colorado where the metal was first discovered in this country, I have a deep interest in the subject. We had very exhaustive hearings before the Ways and Means Committee of the House, and I presume the report of those hearings will be available to the members of this committee. In addition to that I desire to present for insertion in the record a copy of the bill as it was reported from the Ways and Means Committee of the House; also a copy of the bill as it passed the House on August 21, at which time there was a little change, as will be observed, from the original bill.

Further, I have prepared for this committee quite an elaborate brief, believing that it would be beneficial to the committee to have it prepared in a succinct and direct way, which would be convenient for the members to use, and I think it covers the ground very fully

as to the necessity for this tariff which has been asked for in this bill under the provisions of section 1, which provides a tariff that will enable the producers in this country to compete with the foreign production of this ore. For that purpose we have asked a tariff of \$10 per unit of tungstic trioxide,  $WO_3$ , contained in a short ton.

In subdivision 2 of section 1 of the bill there is a provision protecting the manufacturers using tungsten by a compensatory duty. After consultation with the producers and with the manufacturers of the finished product, we thought we had determined upon a proper compensatory duty, which is provided for in subdivision 2 of section 1 of the bill.

I would like to present to each member of the committee a copy of this brief, and will deliver to each member of the full committee a copy of the same, and would like to have a copy of the brief incorporated in the record.

Gentlemen, I recognize that your time is very precious, that you are very busy. As you will note, there are several parties representing these different interests who desire to be heard at this hearing, and I will not take your time further this morning, but would ask that those suggested on this list be called. I thank you, gentlemen.

(The documents submitted by Representative Timberlake are here printed in full, as follows:)

**A BILL** To provide revenue for the Government and to promote the production of tungsten ores and manufactures thereof in the United States.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That on and after the day following the passage of this act there shall be levied, collected, and paid upon the articles named herein, when imported from any foreign country into the United States or into any of its possessions, the rates of duties which are herein prescribed, namely:*

First. Crude tungsten, ores, and concentrates, \$10 per unit of tungsten tungstic trioxide therein contained, a unit being herein defined as 1 per centum of tungstic trioxide in a short ton of two thousand pounds, namely, twenty pounds of tungstic trioxide.

Second. Metallic tungsten, tungsten powder, ferrotungsten (lump and pulverized), ferrotungsten powder, commercial tungstic acid, calcium tungstate, sodium tungstate, and all other salts of tungsten and other manufactured materials containing tungsten, including high-speed tungsten steel, all alloy steels containing tungsten, and all other compounds containing tungsten not specifically provided for in this section, \$1 per pound of tungsten contained therein.

Sec. 2. That the provisions of this act shall not be deemed to repeal any tariff now existing upon any substances or materials mentioned in this act.

**AN ACT** To provide revenue for the Government and to promote the production of tungsten ores and manufactures thereof in the United States.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That on and after the day following the passage of this act there shall be levied, collected, and paid upon the articles named herein, when imported from any foreign country into the United States or into any of its possessions, the rates of duties which are herein prescribed, namely:*

First. Crude tungsten, ores, and concentrates, \$10 per unit of tungstic trioxide therein contained, a unit being herein defined as 1 per centum of a short ton of two thousand pounds, namely, twenty pounds of tungstic trioxide.

Second. Metallic tungsten, tungsten powder, ferrotungsten (lump and pulverized), ferrotungsten powder, commercial tungstic acid, calcium tungstate, sodium tungstate, and all other salts of tungsten and other manufactured materials containing tungsten, including high-speed tungsten steel, all alloy steels containing tungsten, and all other compounds containing tungsten not specifically provided for in this section, \$1 per pound of tungsten contained therein.

Sec. 2. That there shall be levied, assessed, and collected upon all tungsten ore and concentrates which have been imported prior to the passage of this act from any foreign country and held or kept within the United States, when such ore has been purchased by the owner thereof at a price less than \$17 per unit of tungsten trioxide therein contained, a tax equal to the difference between the purchase price so paid by the owner and the price named above in this section.

Sec. 3. That the provisions of this act shall not be deemed to repeal any tariff now existing upon any substances or materials mentioned in this act.

## TUNGSTEN.

CONDENSED STATEMENT RELATING TO H. R. 4437. A BILL FOR A PROTECTIVE TARIFF THEREON.

### TUNGSTEN.

Tungsten is a metallic element, and is never found native, but in combination with other materials in the form of ores, the only important commercially of which are scheelite (calcium tungstate), ferberite (iron tungstate), wolframite (iron-manganese tungstate), and hübnerite (manganese tungstate). The crude tungsten ores of commerce contain a large amount of foreign material, and as mined (with the exception of the rich surface float ores) are usually low grade, averaging a small percentage of tungstic trioxide ( $WO_3$ ). These ores have to be concentrated by machinery to a high grade product, averaging from 50 per cent to 65 per cent tungstic trioxide, one part tungsten (W) to three parts oxygen ( $O_3$ ). The standard concentrate of commerce contains 60 per cent  $WO_3$ . A unit is 1 per cent of a short ton of 2,000 pounds, namely, 20 pounds, of tungstic trioxide.

### USES OF TUNGSTEN AND ITS PRODUCTS.

This high-grade concentrate is used in the manufacture of ferrotungsten and other tungsten products, which in turn are used in high-speed tool steel making. The commercial tungsten products manufactured from tungsten concentrate consist of ferrotungsten, tungsten powder, tungstic acid, calcium tungstate, and sodium tungstate. These products are manufactured by metallurgical and chemical plants especially equipped with electric furnaces and scientific apparatus designed for the purpose.

By far the greatest use of manufactured tungsten (ferrotungsten and tungsten powder) is in the making of high-speed tool steel. From 13 per cent to 20 per cent of tungsten is used in high-speed steel. From 90 per cent to 95 per cent of the tungsten consumed is used for this purpose. Additions of tungsten impart to the steel the property of retaining its temper at very high rates of speed and at extremely high temperatures while tools made from simple carbon steels will not stand up under these severe conditions. This property is especially valuable in so-called high-speed cutting lathe tools, permitting the tools to operate a five or six times the cutting speed formerly attained when carbon steel tools were used, and at the same time permitting a much heavier, deeper cut to be made in the steel object or machined part on which the tool is working. In a day and age demanding speed, accuracy, production, efficiency, and economy of time and labor, the use of tungsten in the making of high-speed tools is imperative.

Ferrotungsten and tungsten powder are also used in the manufacture of special alloy steels such as permanent magnet steel (containing 5 per cent tungsten), and valve steel for automobile and aeroplane engines. Its use in high-speed tools enabled the speeding up of the shipbuilding and munition-making program and earned for it its title of the "Key War Mineral." Its use in the manufacture of electric-lamp filaments and wireless telephone amplifiers is well known.

Tungstic acid, calcium tungstate, and sodium tungstate are chiefly used in the dye and chemical industries.

### SOURCES.

The chief sources of tungsten in the world are southern China, Burma, the United States, and South America. The importance of these respective tungsten sources is in the order named. Deposits of minor importance occur in other countries.

## DOMESTIC PRODUCTION.

Tungsten ore was first discovered in quantity in the United States in the year 1900. The discovery was made in Boulder County, Colo. During the 14 years prior to 1914 this district produced fully 60 per cent of the total tungsten mined in the United States. Since 1914 the production of California has about balanced that of Colorado. Tungsten has been found in some 13 States of the Union and in Alaska.<sup>1</sup> The chief production outside of Colorado and California has been obtained in Nevada and Arizona. Discoveries made in Nevada during the latter part of 1918 bid fair to eclipse in extent the famous deposits of Colorado and California.

## FOREIGN PRODUCTION.

Outside of the United States the largest production in the world is obtained in southern China and Burma. These districts in 1918 produced over 50 per cent of the total world output. A large part of the Asiatic tungsten comes from new fields of high-grade float ore that can be gathered off the ground by coolie labor. In South America tungsten mining has been carried on for a number of years and some deep mining has been done. Portugal produces at least half of the tungsten ore mined in Europe. The Portuguese deposits are largely controlled by British capital.

## HISTORY.

As above stated, tungsten ore was first discovered in quantity in the United States in the year 1900. From 46 tons in that year the annual production rose to 1,500 tons at the beginning of 1914. Under the stimulus of higher prices and the demand of World War necessities, we produced from 5,000 to 6,000 tons of 60 per cent concentrate in each of the years 1916, 1917, and 1918. Old camps revived, and as the result of discovery after discovery and development after development, new and thriving towns grew up in Colorado, California, Nevada, Arizona, and many other places, giving investment to many millions of capital and employment to thousands of people, building up new communities.

At the present time all of the tungsten mines and concentrating plants throughout the country are closed down. The question presented is whether the domestic tungsten-mining industry shall be preserved as one of the units of the industrial independence of America, or whether it is going to be allowed to perish and disappear from the United States. Unless Congress intervenes the domestic production will be completely wiped out by the competition arising out of the condition of the ore deposits and the submerged labor of Asia. H. R. 4437, introduced by Congressman Timberlake, of Colorado, June 2, 1919, is designed to remedy this situation. This bill levies a tariff of \$10 per unit of 20 pounds tungstic trioxide on all importations of tungsten ore, and, while allowing the present tariff on the finished product to continue, adds a compensatory differential upon that product to equalize any increased cost caused by the tariff placed on the crude ore.

## GERMANY THE FORMER WORLD MARKET.

It is a striking fact in the history of tungsten that by far the greatest part of the world's tungsten ore was imported into Germany prior to the World War. Part of this tonnage was then re-exported as concentrate. The nations of the world were more or less taken by surprise when with the advent of the war they suddenly realized that Germany had completely controlled this vital essential of the war. Even the extensive British controlled deposits of Burma had been contributing to Germany's stores of tungsten. With the realization of the great sudden need for tungsten Great Britain placed an embargo on all shipments from British colonies and possessions, including Burma, except to herself. The high-speed tool steel manufacturers of the United States were suddenly confronted with a serious shortage of tungsten, because of the fact that our own mines had not been developed sufficiently to begin to supply the increased domestic requirements, and practically no concerns existed in the country to refine whatever domestic ore that was produced. By far the greatest part of the tungsten ore imported into Germany was manufactured into finished ferro-tungsten and tungsten powder, and then distributed to the nations of the world.

Germany, apparently, was the only nation in the world that seemed to realize fully the importance of tungsten during this period, for, although the United States

<sup>1</sup> Colorado, California, Nevada, Arizona, South Dakota, Missouri, Alaska, Utah, New Mexico, Idaho, Connecticut, Washington, Montana, Virginia. See the "Mineral Industry during 1917" by G. A. Rousch, authoritative.

was always one of the greatest users of the tungsten finished product, and was sometimes the largest, and always a comparatively large, producer of tungsten ore, the trading center of the tungsten industry was in Germany, and Germany's exports of ferrotungsten and tungsten powder went largely to England and the United States. With the advent of the World War, however, the same imperative demand which had built up the tungsten ore-mining towns and concentrating mills, and which set in motion the necessary machinery for perfecting the dye and chemical industry in the United States, accomplished magical development of the ferroalloy and tungsten metallurgical industry, giving to the American tungsten miner a market for his product in this country instead of Germany.

#### FUTURE DOMESTIC CONSUMPTION AND PRODUCTION.

An estimate of the peace needs of our country for the next few years has conservatively placed our requirements at about 6,000 or 7,000 tons of 60 per cent concentrate per year. With the placing upon tungsten ores of a tariff sufficient to assure the American tungsten miner reasonable protection against unfair competition the experience of the last three years has amply demonstrated the capacity of our domestic production to furnish a very large part—from 3,500 to 4,500 tons—of the tonnage required for domestic consumption.

#### COMPARATIVE COSTS OF PRODUCTION.

A careful analysis of mining conditions in the Orient furnishes ample evidence that 60 per cent ores may readily be delivered at our eastern seaboard from southern China at \$6 or \$7 per unit and still afford the Asiatic miner a fair profit, while twice that amount would not equal even the average cost of American production.

The labor employed in mining Asiatic tungsten ore is coolie labor, which is reported as being paid approximately 40 cents per day for men and 20 cents per day for women and children. Most of the deposits of South America are mined by native Indian laborers who are paid somewhat better than the coolie labor of China. In Portugal women and boys are used in the sorting of ore at a daily wage of from 16 cents to 20 cents. Mine labor, recruited from the peasant classes, is paid from 50 cents to 60 cents per day.

The difference is not due solely to the labor cost, moreover, but is due as well to the fact that the surface deposits can be gathered up very cheaply, and these deposits are almost always quite large and very high grade. In the average foreign float field it is not unusual to be able to gather up high-grade ore which will analyze 60 to 65 per cent tungstic trioxide. There are now no known American float fields. As mining operation on our American deposits extend downward into the ground and we get beyond the zone of surface enrichment, we have to mine low-grade ores, some of them analyzing as low as one-half of 1 per cent tungstic trioxide, and these ores then have to be concentrated by the miner to a high-grade product analyzing about 60 per cent tungstic trioxide. To illustrate the point, it would take 80 tons of 1 per cent ore to concentrate into 1 ton of 60 per cent ore, after making due allowance for the loss occurring in the process of concentration. The necessity of making this concentration compels the installation, equipment, management, and maintenance of large costly mills and concentration plants as an entire new element of cost in addition to the cost of development and extraction of the ore. Because of these facts the protection asked for is not due solely to the difference in labor cost between the countries. In addition thereto must be added the additional cost necessary to safeguard life and limb under our salutary industrial mining laws which are in conformity with the American standard. No tariff, therefore, would be fair to the producer which would be predicated upon any one of the factors alone instead of taking them all into consideration.

Against such conditions as these, competition under the standards of American labor is manifestly impossible. The American mining industry, together with the very large investments tied up in it, face destruction, unless such a measure of protection shall be accorded as will give the American tungsten miner at least an even break in the competition for the American market.

#### ARGUMENTS IN FAVOR OF PROTECTION TO TUNGSTEN ORE MINER.

No fair argument can be adduced in favor of the importation of foreign tungsten ores to the complete exclusion of the domestic product, and there are many reasons why a fair measure of protection should be extended to the production of the domestic material, to safeguard the existence and permanence of the industry, some of which may be briefly stated as follows:

1. In the first place, we are not embarrassed by any consideration of the necessity of furnishing tonnage for ships bringing the product from foreign countries, because the volume of tonnage of this particular material is so small as to be, for such purpose, practically negligible.

2. Any export trade to foreign countries desiring the manufactured finished product of ferro-tungsten or tungsten powder for export from the United States would not be necessarily in any way affected by the duty levied on the ore under the provisions of this bill, for no American ore is available therefor under present conditions, and the manufacture of such products from the ore of China or South America for such purpose could be carried on and conducted in bond, just as is now done in the case of the smelting-in-bond business of zinc and lead foreign ores.

3. It is better to afford such protection to the home industry as will make permanent the communities that have been built up and developed in connection with and because of them, thereby giving employment to thousands of our home people, and at the same time give to the finished product and steel concerns a supply of stabilized character upon which they can depend instead of having to rely upon the uncertainties and fluctuations in price incident to the importation of foreign products.

4. The wide range of the price of tungsten during the past 18 or 20 years would serve to demonstrate that an ad valorem tariff will not help our tungsten-mining industry or the stabilization of tungsten-ore prices. The greatest sources of such ore to-day outside of the United States are in countries which are not consumers. On an ad valorem basis our mine operations would fluctuate with the changes in the selling price of foreign ore at the point of export, and if the selling price of Asiatic ores should become low our mining industry, if operating under an ad valorem duty, would again have to be closed down. On the other hand, a tariff based on so much per unit tends to stabilize the value of ore mined regardless of price fluctuations in foreign countries, and this serves at least to guarantee to the miner that the market will not be cut out from underneath him completely.

5. Under the provisions of this bill while sufficient protection is given to the miners of tungsten ore, the provisions of paragraph "second" of the first section are intended to protect by a compensatory differential the interests of the finished product and high-speed tool steel men, without unduly raising the price of the product. As a matter of fact, if our tungsten mines are going to remain shut down, by the failure to pass such legislation as will revive and adequately aid them to continue in operation, the Chinese ore producer will raise the selling price of his ore to a figure just below what would sustain American production, and congressional inaction would then have succeeded in killing our mining industry without having conferred any real benefit on the consumer.

6. From the standpoint of conservation, particularly in reference to preparedness, as was pointed out by Mr. J. H. Holmes, jr., in the hearing before the Committee on Ways and Means, a duty of \$10 per unit will enable tungsten mine operators of our country to develop the tungsten resources, so that in case of a national emergency we could produce quickly tungsten ore at a rate sufficient to meet the requirements of the Nation in any critical period. It must be remembered that true conservation is not promoted by timidly sitting beside some isolated mine, already discovered and only partially developed, and refusing to open it up further. Only energetic and persistent mining has been responsible for the development of the present-known ore reserves of the country.

The known ore deposits at the beginning of 1918 were greatly increased during the year through new discoveries, particularly in Nevada. There is no reason why a permanent mining industry should not develop just as has been the case with gold, silver, copper, and other minerals in our Western States. New discoveries were constantly being made in States which heretofore were not supposed to contain tungsten in sufficient quantities to be of importance. To illustrate the growth of new fields, in 1917 it began to be rumored that Nevada had tungsten mineral wealth of great importance, and Nevada actually produced during that year 250 tons of concentrate containing 60 per cent tungstic trioxide. In 1918 Nevada produced 885 tons, and producers of that State now claim that they can equal the production of either Colorado or California out of entirely new properties discovered through the intensive prospecting and development that arose under war necessity.

We must remember that tungsten mining is a comparatively new industry, and that until the war there was no great incentive to discover the deposits of it which exist in the United States. The history of tungsten mining in this country presents thus far a remarkable parallel to the history of gold mining. When the abnormally rich gold diggings of the days of '49 were first discovered and mined there were timid prophets who feared that with the passing of these surface deposits the country would exhaust its resources of gold. The prospector and the miner, however, proved that



the real permanent gold resources of this country existed in lodes and veins in the ground, and that the surface deposits of all kinds had been merely erosions and deposits from these veins. It was only by his incessant digging, prospecting, development, and mining of these veins that the real permanent gold industry of the country that has been part of its history for the last 70 years was finally brought about. The miner knows that surface float ores are really indications of the presence of ores somewhere in the neighborhood in the more permanent form of lodes and veins. The prospecting and mining of tungsten made possible by the experience of the last four years, instead of causing any legitimate fear of how long our reserves will last, has resulted in the discovery of many entirely new fields and has demonstrated that the permanency of tungsten mining as an industry depends upon the continued development and mining of its deeper mines, lodes, and deposits.

7. As to American capital invested in tungsten mines in this country, this committee knows that the companies or individuals owning such mines have to bear their full share of all taxation. Profits made by American capital invested in foreign countries, on the other hand, however large, will never pay any part of the normal, excess profits, or war tax as applied to corporations under existing laws, and it is doubtful whether the Government would even be able to collect an income tax. But any American having capital invested in a foreign country that would oppose the present bill would be a poor sort of American; because, without a duty upon tungsten ore, he is in a position of getting his foreign ores into the country without paying to the Government a dollar of revenue upon its importation. In opposing this bill he would be advocating the continuance of a condition under which the investments already made of American capital in this country would become valueless, American communities would be wiped off the map, and American workmen driven to find employment elsewhere, in order that he might get his foreign ore into the country without paying any revenue on it to his Government.

8. This bill, moreover, has a distinct revenue-producing feature, for the reason that while \$10 per unit only covers a difference in cost of production of the average tungsten mines of the United States as against that of the low cost of production in foreign fields, the duty of \$10 per unit is not prohibitive, and is not intended to be prohibitive, but, on the contrary, would give a maximum of revenue to the Government from this mining industry. Competition from foreign ores would still continue under conditions that would nevertheless allow domestic production, and the best estimates are that under a duty of \$10 per unit the mines of the United States will produce only 60 per cent of home consumption, leaving 40 per cent to be imported, upon which a duty of \$10 per unit would be collected, and thus produce direct revenue to the Government, whereas at present the Government is getting no revenue whatsoever from this source. Upon the basis of an estimated importation of 3,000 tons of foreign tungsten ore this would mean a direct revenue of \$1,800,000 annually, and upon the basis of an estimated importation of 3,500 tons of foreign tungsten ore this would mean a direct revenue of over \$2,000,000 annually, all of which is now entirely lost to the Government. Furthermore, the domestic production of 60 per cent of the total domestic consumption of tungsten ore would furnish its quota of direct revenue to the Government upon normal, excess, and war-profit taxes, as well as upon the income tax of stockholders as individuals. Even if any mine can produce tungsten ore at considerably less than the average cost of producing tungsten ore, the Government would still receive a very large percentage of any such profits, under the present revenue laws, whereas at present, with our domestic mines closed down, there is no revenue to the Government from production from any of them.

9. This bill is, in addition, an emergency measure. Surely, whether this is a measure of protection with substantial incidental revenue, or a substantial revenue bill with incidental protection, is beside the point, because it may be based upon a higher consideration of public policy, namely, that the protection afforded by its provisions will go far to insure the rehabilitation and permanency, and the possibility of mobilization in war and peace, of an industry that will contribute in no small degree toward the industrial independence of America. Just as Germany, prior to the war, exercised and maintained a complete monopoly of the dyo and chemical industries, it is equally true that she controlled completely this most essential of all war minerals, tungsten, which was so indispensable in speeding up our ship and gun program. How far the increasing importance of future events in countries bordering on the shores of the Pacific may become, it is not vouchsafed us to know. If there should come upon us a war shutting out our present source of supply, with our tungsten mines all closed down, and filled with water or caved in, and their mills and concentration plants scrapped or gone to decay, we would be in no position to meet the emergency. Plainly the part of our tariff system which affects this mineral and its products is one which needs prompt attention. In this

connection, the following sentence from the President's message calling this special session of Congress is worthy of consideration:

"The experiences of the war have made it plain that in some cases too great reliance on foreign supply is dangerous, and that in determining certain parts of our tariff policy domestic considerations must be borne in mind which are political as well as economical."

Senator THOMAS. Mr. Chairman, if we are to hear all these gentlemen in an hour and a half, I would suggest that their time be divided.

Senator WATSON. Either that, or, if you are willing, we might give them one more day in order to hear what they have to say.

Senator THOMAS. I am perfectly willing to do that.

**STATEMENT OF MR. NELSON FRANKLIN, DENVER, COLO.,  
VICE PRESIDENT THE RARE METALS ORE CO., OF ROLLINSVILLE, COLO.**

Senator WATSON. Mr. Franklin, is there a difference in the quality of this ore as found in the different States?

Mr. FRANKLIN. In what way do you mean, sir?

Senator WATSON. Why is it necessary that you should have a man from your State and a man from California and a man from any other State? Doesn't the statement of one embrace the whole situation?

Mr. FRANKLIN. No, sir. Mining conditions are very different in Colorado from what they are in California.

Senator WATSON. As relates to the accessibility of the ore?

Mr. FRANKLIN. Yes, sir; there is a difference in the veins, and the ore deposits are very different in the two States.

Senator WATSON. But the ore itself is the same?

Mr. FRANKLIN. The ultimate ore? No; the ultimate ore is not the same. In Colorado we produce ferberite, which is an iron ore of tungsten. In California they produce scheelite and in Nevada and Arizona they produce scheelite, which is a calcium or lime tungstate.

Senator WATSON. But they are eventually used for the same purpose in manufacture?

Mr. FRANKLIN. For the same purpose; yes, sir.

Senator WATSON. Have you a statement of the amount produced in this country and the amount produced in the different competing countries in the world?

Mr. FRANKLIN. Yes, sir; that is all embraced in the House hearings, and it is in the Tariff Commission's report. The hearing was quite extensive, but we have some additional testimony which was not brought out there.

Senator WATSON. Does that pretend to give a statement of the cost of production of those ores in the different competing countries?

Senator THOMAS. I do not think so myself; it is not satisfactory. It does give it in general terms.

Mr. FRANKLIN. You are speaking of the Tariff Commission report, Senator?

Senator WATSON. Either the Tariff Commission report or the hearings before the Ways and Means Committee.

Senator THOMAS. Including the Tariff Commission report and the hearings before the House committee and Congressman Timberlake's statement.

Senator WATSON. Of course, the big thing in levying a tariff is to know what it costs to produce the ore here and what it costs to produce it in competing countries, and if those facts can be given it will simplify the matter.

Mr. FRANKLIN. If I may proceed with my testimony, Senator Watson, those questions will probably come up in what I have to say.

This bill before its passage by the House had an extensive hearing before the Ways and Means Committee, at which time a full history of tungsten was given. There was also much testimony given as to the deplorable condition of the industry at that time. Many letters and telegrams from western tungsten ore producing companies were before that committee.

I submit to you one telegram, which came from 22 companies of Colorado, covering the situation:

(The telegram referred to is here printed in full, as follows:)

DENVER, COLO., June 9, 1919.

HON. CHAS. B. TIMBERLAKE,

*House of Representatives, Washington, D. C.*

Having received the information from Washington that a hearing is to be held on Tuesday, June 10, before the Ways and Means Committee on your bill, H. R. 4437, a hurried meeting has been called for to-day of the principal tungsten producers of Boulder County, Colo., at which the tungsten interests were represented by 15 representatives of 22 producing companies. The early hearing precludes the possibility of personal representation at the hearing, therefore Mr. J. H. Holmes, jr., of the Tungsten Products Co., now in Washington, will attend the hearing in behalf of the producers who have signed this telegram. We beg to represent to you that the tungsten industry in Colorado is in a very critical condition. All mines and mills now closed down. Two of the largest properties are now being dismantled and others contemplating same action. Immediate relief is imperative, as the mines are rapidly filling with water, causing destruction of property. In this field there are 21 concentrating mills, which were erected at a cost of upward of \$1,000,000. In addition, there is invested in mines over \$2,000,000, all of which will be a total loss, unless we get relief from conditions which exist to-day, owing to competition from importations of foreign ores mined in cheap-labor countries. The industry in Colorado has employed for some years past an average of 1,500 men, representing upward of 6,000 persons dependent upon the industry. The average wage for 1918 was \$4.85 per day for eight hours' labor, representing a total pay roll for a year of 300 working days of over \$2,000,000. During the war 700 men entered the service from the industry, all of whom were promised their jobs back if fortunate enough to return after the conclusion of the war. A large number have returned and are asking for their jobs; others are daily returning. It is the consensus of opinion of the producers present that a minimum duty of \$10 per unit under present and expected improved conditions will result in a resumption of operations by a large percentage of the Colorado producers. The United States Tariff Commission at its hearing held in Denver in June, 1918, obtained exhaustive information regarding all phases of the industry in Colorado and this report, together with their conclusions thereon, are no doubt available to the Ways and Means Committee. This telegram is supplementary to a brief covering the industry which will be presented to the Ways and Means Committee prepared by Mr. Holmes and others.

Catastrophe Mine Co.; Boulder Tungsten Production Co.; Tungsten Mountain Mines Co.; Caribou Metals Co.; Barker Tract; Tungsten Mines Co.; Vasco Mine Co.; Wolfe-Tongue Mine Co.; Ebony Tungsten Co.; Chance Mining Co.; Geo. W. Teal Tungsten interest at the Tungsten Products Co.; Rogers Patent; Colorado Tungsten Corporation; Eagle Rock Mining & Milling Co.; Rare Metals Ore Co.; Black Metal Mines Co.; Tiptop Leasing Co.; Boulder Denver Tungsten Products Co.; Mojave-Boulder Tungsten Co.; April-Fool Mining Co.; Lord Byron Mining & Milling Co.

Mr. FRANKLIN. The United States Geological Survey and the United States Tariff Commission furnished a large amount of data and statistics on cost of production in the different States. They also, through witnesses from each of these departments of the Gov-

ornment, furnished much information as to the amount of ore in sight and the amount that could be developed.

A number of western tungsten ore producers are here to give testimony before your committee. It is not our purpose to occupy much of your valuable time; no more than will allow us to present the vital points to your committee and also present some important facts that have developed since that hearing by the Ways and Means Committee.

Senator WATSON. Do you regard the statements or information furnished by the Tariff Commission as accurate?

Mr. FRANKLIN. In many instances it is accurate. In some instances they seem to have a lack of information that is really reliable, but they did the best they could to gather it from the sources they had to gather it from.

The tungsten industry in the United States amounted to very little prior to the war. The tungsten ore that was mined was exported to Germany, which country prior to the war controlled the tungsten industry and exported to this country ferrotungsten and tungsten powder. Prior to the war there was little tungsten refined in this country. During the war the United States became the leading nation in the refining of tungsten and in the manufacture of tungsten steel products.

Tungsten is not only an essential war mineral but is just as essential as a peace mineral. The production of all finished steel on an economical basis is dependent on tungsten high-speed steel tools. In the manufacture of high-speed tool steel 90 to 95 per cent of the world's production of tungsten is consumed.

When referring to a ton of tungsten ore it means a ton of 60 per cent tungstic trioxide ( $WO_3$ ), which grade of ore is used as the basis of value in the market quotations.

Tungsten ore is sold at a price per unit of a ton. A unit is 1 per cent of a ton, or 20 pounds, of tungstic trioxide ( $WO_3$ ); 60 per cent ore means 60 units, or 1,200 pounds, tungstic trioxide ( $WO_3$ ) per ton of ore, or 951.6 pounds metallic tungsten (W) per ton of ore.

When a tungsten field is first discovered the ore is found as high-grade float on the surface and is cheaply produced. When the surface ore has all been gathered mining underground starts, and the cost of production increases as depth is attained. The surface ores are rich, frequently carrying 60 per cent and over tungstic trioxide. They have become rich by the erosion through centuries of the waste material from the ore. There is a definite limit to this class of ore. There is no definite limit to the quantity of ore to be mined from deep mining. I will quote from the United States Tariff Commission:

Although tungsten ore is widely distributed over the earth's surface, 80 per cent of the world's production comes from the United States, Burma, and Bolivia. Tungsten deposits are characteristically erratic. Three stages can be distinguished in their exploitation: (1) A stage when the ore can be picked up on the surface or gouged from the easily mined surface deposits; (2) a second stage in which the easily and cheaply obtained material has been largely exhausted and underground mining is in progress at only a few especially favored properties; and (3) the stage of production from developed underground mines.

There is no known substitute for tungsten, and it has been properly named the "key war mineral."

By the use of tungsten high-speed steel tools, one man and one machine can do the work of five men and five machines using carbon steel tools, with a resultant saving in the cost of finished steel.

The increase in efficiency by using tungsten in high-speed steel tools was not well known until the war period, and new uses are still being found for tungsten steel.

Senator WATSON. It was used before the war period?

Mr. FRANKLIN. Yes.

Senator WATSON. Was it used in this country?

Mr. FRANKLIN. Yes. Some high-speed steel was manufactured in this country prior to the war, but it did not become much of an industry until the beginning of the war in 1914.

The consumption of tungsten in the United States during the war showed a marked increase each year, reaching about 16,000 tons in 1918, of which amount there was produced in this country about 5,000 tons, the balance being imported.

The normal consumption of tungsten in the United States will be about 7,500 tons per year. I would say, Senator, as to that, that we have very carefully gone over the situation among the consumers of tungsten and it is the consensus of opinion that that is about the consumption in normal times.

About 5,000 tons per year can be produced in this country, on an average selling price of between \$22 and \$25 per unit.

About 4,000 tons per year can be produced in this country at an average selling price of \$15 to \$18 per unit.

The bill (H. R. 4437) provides for a duty of \$10 per unit of tungstic trioxide in ore. It provides for a duty of \$1 per pound metallic tungsten contained in the various finished products of tungsten.

Senator WATSON. Is that quantity sufficient to supply the American demand?

Mr. FRANKLIN. The American demand, as I have stated, would be 7,500 tons per year, and we can, under this bill produce 4,000 tons. We would then have to import 3,500 tons per year. I will cover that point in my testimony. It is a well-established fact that, owing to economic conditions in this country and the condition of deep mining in this country, we can not compete with the production of foreign countries, even in limited quantities, as not a single tungsten mine is capable of operating now in this country under the price for ore now prevailing. That is a fact, Senator. There is not a mine in operation to-day in the United States, even the most favored ones.

Senator WATSON. Do you mean by that that importation has begun?

Mr. FRANKLIN. Yes, sir. I will cover that point also.

Under a tariff of \$10 per unit, a maximum production would not be the result, but a production of 4,000 tons per year could be maintained.

Under a tariff of \$10 per unit, the mining of tungsten would be a stabilized industry and there would be an incentive to capital in the development of the very large low-grade contact metamorphic deposits now known to exist in California and Nevada.

In that connection I might say that I have personally examined every tungsten property in the United States. I did that during 1917 and 1918 in California and Nevada--those new tungsten deposits.

Senator THOMAS. What is the present market price of tungsten, Mr. Franklin?

Mr. FRANKLIN. About \$7.50 now, Senator Thomas, in New York.

Senator THOMAS. Are there no mines in the United States that can produce at that figure?

Mr. FRANKLIN. Not one, sir.

Senator THOMAS. How about the mines at Atolia?

Mr. FRANKLIN. The Atolia mine is the only large mine there, and their cost last year will be testified to by Mr. Griffin. I do not know the exact figure. He has the statement from them for last year. I assume they did produce at a very low price when they had the deposits nearer the surface. But he will testify fully as to Atolia. He has the statements from the company, and is authorized to present them here.

The average grade of ore that is mined in the fissure veins of Colorado and California is from one to five per cent. The veins in many instances are narrow, but many of them can be operated under a selling price of \$15 to \$18 per unit.

You are probably familiar, Senator Thomas, with the conditions in Colorado.

Senator THOMAS. I am familiar with them in a general way. I have not, however, visited any of them. I might say that we had hearings in 1913 before the Simmons Committee on the same subject.

Mr. FRANKLIN. The large contact metamorphic deposits of Nevada and California were not developed until 1917 and 1918. These deposits carry from one half to one and one half per cent ore and can be operated under a selling price of \$15 to \$18 per unit.

The Asiatic ores now being imported by this country are being sold at about \$7.50 per unit.

Senator THOMAS. You said a few minutes ago, quoting, I think, from the expert of the Tariff Commission, that the bulk of this ore came from Bolivia, Burma, and the United States. Burma is in Asia. Are there any other sources of supply in Asia?

Mr. FRANKLIN. Most of the ore now comes from China. Those are new deposits, discovered in 1916—surface deposits.

With a \$10 duty, that would bring the selling price of ore to \$17.50 per unit in this country.

The United States, at a selling price of \$17.50 per unit, can produce 4,000 tons of the requirement of 7,500 tons, and there would have to be imported 3,500 tons.

Senator WATSON. Do you think that is the limit of American production?

Mr. FRANKLIN. At that rate of duty; yes, sir.

Senator WATSON. Well, at any rate of duty?

Mr. FRANKLIN. The American production, as I have said, would be 5,000 tons. That is all we did produce during the war. Unless there are some new developments that will give us a larger amount of tungsten—

Senator WATSON. That are not in sight?

Mr. FRANKLIN. That are not absolutely in sight.

Senator WATSON. So it might be predicted that you never can supply the American demand?

Mr. FRANKLIN. I do not say we never can, but with our present knowledge, without further discoveries, and under our present estimates of future consumption, we can not.

The revenue that would be derived by the Government on this 3,500 tons would be approximately \$2,000,000.

We have been furnished by the United States Geological Survey with a tabulated statement showing the importations by the United States of tungsten ore for this year up to October 1. This statement shows by months the tungsten imported and gives the names of the countries from which the material originated. Since June there has been a rapid increase each month in the tonnage imported. In June the importations amounted to 410 short tons, whereas September reached the figure of 992 short tons. The total importations for the nine months of 1919 ending October 1 amounted to 7,090 short tons of 60 per cent ore, of which total 1,401 tons came from South America and 5,542 tons was Asiatic ore.

I will hand the Secretary a copy of the United States Geological Survey tabulated statement referred to in order that it may become a part of my testimony in the record.

(The statement referred to is here printed in full as follows:)

*Imports of tungsten-bearing ore into the United States from all countries during the months January to September, 1919.*

Countries.	January.		February.		March.		April.		May.	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Mexico.....	58	63,375							4	2,614
Argentina.....	15	26,907								
Chile.....	38	43,511	63	88,030	24	20,818	35	48,121	1	1,661
Colombia.....	1	1,312								
Peru.....	17	28,050	60	62,752	38	37,486	50	40,669	20	20,500
China.....	270	293,772	424	442,626	98	51,405	25	11,474	53	35,178
Hongkong.....	474	450,219	477	502,989	504	502,623	180	192,899	151	144,658
Panama.....				172						
Bolivia.....			14	9,984						
Chosen.....			46	58,375						
Japan.....			451	645,886	11	13,388				
Canada.....							18	12,750		
Straits Settlements.....									50	44,688
Total.....	873	913,146	1,335	1,810,964	675	625,620	314	305,913	285	255,299

Countries.	June.		July.		August.		September.	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Mexico.....			39	38,540				
Argentina.....	50	40,000			12	3,377	20	10,205
Chile.....	136	84,600	90	64,143	124	67,480	82	82,899
Peru.....	99	50,337	3	5,704	3	1,836	13	7,374
China.....			80	58,506	130	50,836	70	24,956
Hongkong.....			187	30,352	284	107,708	477	197,251
Bolivia.....			53	41,045			83	38,917
Japan.....			63	57,780			73	40,801
Total.....	338	232,717	452	241,350	553	231,037	818	408,403

Total for first nine months, 1919, 5,843 long tons, valued at \$5,027,349, probable WO<sub>3</sub> content, 65 per cent or more. Equivalent in short tons carrying 60 per cent WO<sub>3</sub>, 7,090.

Mr. FRANKLIN. The ore credited to Chile and part of the ore credited to Peru, in the above table, is of Bolivian origin. The 1,401 tons imported this year from South America has come into this country in competition with Asiatic ore and the duty contemplated in this bill would in no way affect the importations of that amount of ore from South America. The duty asked for would place domestic production only on a competitive basis with South American and Asiatic ores, and it is not a prohibitive duty.

Senator McCUMBER. What is the duty asked for?

Mr. FRANKLIN. \$10 per unit.

Senator THOMAS. According to your statement no duty would be prohibitive, because we can not produce as much as we consume.

Senator WATSON. Yes; that is what I had in mind all the time when I was asking about the possible American production.

Let me ask you this, in that connection. What is the amount of capital invested in this mining enterprise?

Mr. FRANKLIN. I imagine about \$20,000,000, as near as I can figure it. It may be greater than that. Of course, there has been considerable money lost in the mining of tungsten, but I mean the capital at the present time that might be recovered if they could operate their properties sufficiently. That does not take into account money that has been lost by companies that have gone out of business.

Senator THOMAS. Of course, you will find that in any mining industry.

Mr. FRANKLIN. The Western Tungsten Ore Producers are only asking that their industry in which there is invested many millions of dollars may continue to exist. We can by the stabilization of the industry develop the resources of tungsten in our country and continue the production of 60 per cent of our requirements and probably exceed that ratio of production in the event of an emergency. The Western Tungsten Ore Producers met the emergency in the present war. They can and will do it again if necessary.

Senator THOMAS. Do you mean by that that during the war America furnished all the tungsten that it consumed?

Mr. FRANKLIN. There were times during the war, Senator Thomas, that the only tungsten that could be had was obtained in this country, and it was scattered around among different consumers.

Senator THOMAS. I recall distinctly being applied to by a number of people to help them with the State Department in securing orders for the importation of tungsten as needed in our war industries.

Senator McCUMBER. I can not quite understand your proposition. Do you mean to be understood as saying that we could not produce in this country more than 60 per cent of the tungsten that we would use?

Senator WATSON. We asked him that some time ago, Senator.

Senator McCUMBER. Do you mean that there is not that amount in the country that could be developed under any circumstances?

Mr. FRANKLIN. I will answer that question, Senator McCumber, in this way. I do not say it could not be produced. I do say that with the present development of tungsten mines it is not in sight at this time in a quantity sufficient to produce 7,500 tons a year, which is the estimated normal requirement of the country.

Senator McCUMBER. Do you mean that the veins can not produce it, or that you have not got the machinery and developed mines to produce it?

Mr. FRANKLIN. There are lots of properties that are not as yet developed that might be developed and made to produce sufficient if it could be sold at a price that they could operate under. The tungsten is here, Senator, but it takes the price to develop and produce it.

The Western Tungsten Ore Producers when asking for legislation for their industry took into account the necessity of placing in the bill a compensatory duty covering the finished products of tungsten. It was not our intention to ask for any amount for the manufacturers



other than a compensatory duty sufficient to equalize the duty asked for on the raw material.

Since the passage of the bill by the House, we have learned that some members of one branch of the manufacturers of the finished products claim that \$1 per pound on the metallic tungsten is not a sufficient differential to compensate them for the \$10 duty on the raw material.

If the data gathered by us on which we fixed the compensatory rate of \$1 per pound of metallic tungsten was incorrect the bill might be so amended as to make it compensatory.

We have always realized the fact that should any undue burden be placed on the manufacturer leaving him in the position of not being able to compete with imported finished material, we would at the same time leave ourselves without a market for our ore and the legislation asked for by us would then be of no benefit to the ore producers.

The Western Tungsten Ore Producers are in no way responsible for section 2 of the bill, being the Green amendment, and are not in sympathy with that class of retroactive tax legislation. This amendment was introduced on the floor of the House during debate. You gentlemen understand that section; I presume you have seen it. That is the section that provides for an excise tax on the ore that is on hand in this country.

Senator THOMAS. That is designed to place the same duty upon tungsten in storage that is placed on other; otherwise that would be velvet to the owner.

Mr. FRANKLIN. In some cases it would not be. Much of it would have been purchased at a time when the price was high.

I would like to call the attention of the committee to a report of the United States Tariff Commission entitled: "Information concerning Tungsten Bearing Ores," which was printed for the use of the Committee on Ways and Means when we had our hearing before that committee a few months ago. In this report of the United States Tariff Commission there is an error on pages 1 and 33, where they report the average sale price per unit of 60 per cent tungstic trioxide for the year 1916 and the total value of the production for that year.

On page 33, they report the average sale price as being \$70 per unit, and it should have been reported as \$33.97 per unit.

On page 1, they give the total value of that year's production as \$24,780,000, and it should have been reported as being \$12,074,000.

During the debate on the bill, when it was being considered by the House, there were some statements made by the opponents of the bill that were not at all in accordance with the facts, neither were they in accordance with the testimony given at the hearing before the Ways and Means Committee.

Among the misstatements made it was argued that there was a monopoly in this country in the tungsten industry both in the production of ore and the production of ferrotungsten. If this contention was seriously made, it can be easily proven that no monopoly does exist in either branch of the industry. The largest producer of tungsten ore has been the Atolia Mining Co., which company did in the past—especially in 1916—produce about 30 per cent of the domestic output. Testimony will be presented before this committee to show that this ratio of production can no longer be maintained by that

company, and it will also show, owing to the present condition of the ore bodies of that mine, their cost of future production per unit will be much higher than in the past.

The credited production of two Colorado companies as referred to in that debate, and which appears in Government reports, does not truly represent the actual production by those two companies. Less than 50 per cent of the production credited to those two companies has been produced from their own mining operations. They, as well as my company, have large concentrating plants, and purchase in the market the ores produced by the operators who do not have concentrating plants on their own properties. To show this, I will quote from the report of the Tariff Commission, on page 24, on Colorado production:

Mining and development are done almost exclusively under the leasing system, the leaser being paid for the ore he extracts (after paying a royalty).

When the production of tungsten was at its highest in Boulder County, Colo., there were hundreds of properties being worked on which there were no concentrating plants, and the ore was sold by the operators to milling companies, which last-named companies in the Government report are accordingly credited with the production.

The third company making up the "Big Four" argument has not produced in its entire existence 100 tons of 60 per cent tungstic trioxide. There was no affiliation in any way between these four companies.

There was no semblance of truth in the argument that there was a monopoly in the manufacture of ferrotungsten. In September of 1917 a statement was prepared by one of the leading ore buyers and importers of the United States which showed that there were 16 companies engaged in the manufacture of ferrotungsten. The statement also showed that these 16 companies in the aggregate consumed 1,000 tons per month of 60 per cent ore. The highest consumption by any company being 180 tons per month and the lowest consumption being 30 tons per month.

The argument of very large profits having been made by the producers of ore was based entirely upon the error in the report of the United States Tariff Commission on the production of 1916, previously referred to, and it is common knowledge that there are only a very few producers of tungsten ore who have been returned a fair profit on their investment.

In debate the opposition to the bill in the House stated that no cost figures on production had been given by the western tungsten ore producers. This is not true, as testimony was given by Mr. Holmes, of Colorado; Mr. Hess, of the United States Geological Survey; Mr. Guy C. Riddell, metallurgist of the United States Tariff Commission; and Mr. Roy McKenna, at the hearing before the Ways and Means Committee, on the cost of production in Colorado and California, and we will at this hearing give further testimony on the cost of production.

Although tungsten is produced in 14 States of the Union, Colorado and California up to the present time have been the chief sources of domestic supply. Discoveries made in Nevada in 1917 and 1918 in the low grade contact metamorphic deposits give promise of an equal production in that State to the production of Colorado and California.

In connection with that I will say that their production has been negligible up to the present time, but they have some very promising deposits there.

The cost of production in Colorado ranges from \$14 per unit to \$25 per unit and over. Under a \$10 tariff, which would give a selling price of about \$17.50 per unit, the production of Colorado would be about 60 per cent of the production that could be maintained under a selling price of \$20 and over per unit. The rate of duty provided in the bill will not permit of production from the higher cost properties.

Colorado, under a tariff of \$10 per unit, can produce about 1,500 tons of 60 per cent ore per year.

Should the mining of tungsten ore in this country not be resumed, the exporters of Asiatic ore to this country will in time so regulate and curtail their shipments as to raise the market price of their ore up to a point just enough below the production cost in the United States as not to permit of any production in this country, with the result that the consumers of tungsten and the Government will not derive any benefit from the importations. There would be a further injury to the tungsten producing States and communities in loss of revenue. The large number of men who would have employment in the industry is also a matter of much importance.

I would like to call the attention of the committee to the testimony of Mr. Frank L. Hess, of the United States Geological Survey, which appears in the hearing on this bill before the Ways and Means Committee. Early in October a meeting was held in New York City which was claimed to be a representative one of tool-steel manufacturers and ferrotungsten manufacturers, when as a matter of fact there was only one domestic tool-steel manufacturer present and no manufacturer of ferrotungsten was present. The meeting was composed of importers of tungsten ore and importers of high-speed tool steel. This meeting adopted a resolution which was mailed to each member of your committee, and it was also given out to the public press. This resolution as adopted misquoted Mr. Hess's testimony and by so doing attempted to establish an incorrect estimate of the available tungsten ore supply of this country and the probable future supply, which misquotation Mr. Hess promptly refuted in the following letter:

OCTOBER 11, 1919.

MR. CHARLES HARDY,  
*Park Row Building, New York, N. Y.*

DEAR MR. HARDY: I have had my attention called to the statement attributed to me by the committee of gentlemen who recently met in New York to consider the proposed tariff on tungsten and tungsten ores.

It is extremely difficult to quote another correctly unless he is quoted verbatim and often unless one knows what has gone before and what is to follow. I do not think for a moment that these gentlemen intended to misquote me, but if you will turn to page 62 of the hearings before the Ways and Means Committee, House of Representatives, on H. R. 4437, June 13, 14, and 17, 1919, you will find that the statement I made before the committee was very different. In effect my statement was that so far as can be judged from the ore now in sight there can be mined in the United States under a price of \$20 per unit during the next three years about 3,000 tons of concentrates carrying 60 per cent WO<sub>3</sub> per annum. This statement makes no allowance for the discovery of new ores or new ore bodies, and undoubtedly such discoveries would be made if such a price were in effect.

Cordially,

FRANK L. HESS, *Geologist.*

Senator WATSON. How many men are employed in this industry?

Mr. FRANKLIN. Oh, I would say, Senator Watson, that there would be probably close to 10,000, I mean 10,000 dependent upon the industry.

Senator THOMAS. Does that include the employees of all the manufacturers of ferrotungsten?

Mr. FRANKLIN. No, sir; employed in the mining industry. I do not know how many there would be in the finished-products industry.

Senator WATSON. Can you state what are the average wages paid in this mining industry?

Mr. FRANKLIN. At the present time the average wage would be between \$4.60 and \$5.25 per day of eight hours. It varies in different sections, but it would be between those limits.

Senator THOMAS. Are you engaged in both mining and manufacturing the finished product?

Mr. FRANKLIN. Not in manufacturing. We are in the manufacturing business in another company which I am associated with, manufacturing other commodities.

Senator THOMAS. Of which tungsten is a component?

Mr. FRANKLIN. No, sir; not at this time. We did, some two years ago, make some ferrotungsten.

I shall be glad, gentlemen, to answer any questions if you are in doubt about any points.

Senator WATSON. Have you any questions, Senator Thomas?

Senator THOMAS. No.

Senator WATSON. Gentlemen, we will now be glad to hear Mr. McKenna.

#### STATEMENT OF MR. ROY C. M'KENNA, PRESIDENT THE VANADIUM-ALLOYS STEEL CO., LATROBE, PA.

Mr. McKENNA. Gentlemen, before I start I want to correct one statement of Mr. Franklin's, with his permission. Prior to the war, in 1914, the manufacture of high-speed steel in the United States was a considerable industry. The United States was the leader of all nations in the world in the manufacture of high-speed and tungsten-alloys steel. High-speed steel was discovered or invented in the year 1900. The year 1902 was practically the introduction of it, commercially, into the United States. The fact is that the automobile could not have been made commercially without high-speed steel, and Mr. Franklin undoubtedly did not think of that part of it.

Prior to the war we manufactured in this country about 70 per cent of what we used and about 30 per cent was imported from foreign countries—England and Germany.

Senator WATSON. That is, the high-speed steel?

Mr. McKENNA. High-speed steel; yes. And I have an opinion, first, as to the effect that the price has on the production of tungsten ore in the United States. I have followed the market of tungsten ore since 1902. Tungsten is one article where the production has followed the price. When you raise the price of tungsten ore, the production has always gone up. I tried to trace that price fluctuation before the Ways and Means Committee of the House. To me there is clearly shown—

Senator THOMAS (interposing). Are you sure of that? My recollection is that the Payne-Aldrich tariff bill imposed a very considerable duty on tungsten.

Mr. McKENNA. On tungsten?

Senator THOMAS. Yes; tungsten ore, which was then selling at about \$12, and within a year, or year and a half, the price fell to \$6.

Mr. McKENNA. Senator Thomas, the tungsten ore has fluctuated violently in price because every two or three years there has been discovered some place in the world a virgin field of tungsten ore.

Senator THOMAS. The point is that there is an exception to your general statement, if my recollection is correct.

Senator WATSON. After the imposition of the additional rate of duty under the Payne-Aldrich tariff bill the price increased.

Senator THOMAS. I think it increased some, but it was a remarkable fact that the price fell nearly 50 per cent.

Senator McCUMBER. Was that due to the increased production?

Senator THOMAS. I was going to ask that of this witness.

Mr. McKENNA. It is often difficult to separate cause and effect, but what I mean is that price and production have always gone together. When the production has gone up, the price has gone down. But I want to explain this, as following the market, on the basis of what it has been for the last three or four years from the American standpoint. When tungsten would get up to a price of \$26 a unit the American production was high, and when the price of tungsten fell down to \$17 per unit, the production would drop off.

Senator THOMAS. In 1915, the price of tungsten in this country went up to an exorbitant figure, perhaps \$200 or \$300 a unit.

Senator McCUMBER. Can you tell us which was the cause and which was the effect in the matter of its going up and down?

Mr. McKENNA. The reason it went up—I say this as a buyer of tungsten ores, Senator—was because we needed it, whatever price we had to pay for it.

Senator THOMAS. What was the maximum price it reached just before we entered the war?

Mr. McKENNA. The maximum price that we ever paid was \$78 per unit. We sold some of that very same ore at \$85.

Senator THOMAS. It reached a higher price than that.

Mr. FRANKLIN. The highest price it ever sold at was \$105 a unit, but only a small lot was sold at that price.

Senator THOMAS. I knew it was somewhere above \$100.

Mr. McKENNA. That was a very small amount. The highest price any quantity changed hands at was \$85.

Senator WATSON. How much did we produce before the war?

Mr. McKENNA. About 2,100 tons in the maximum year.

The principal business of the Vanadium Steel Co., of Latrobe, Pa., is the manufacture of high-speed steel. Our company manufactures a complete line of carbon and alloy steels, but our specialty is tungsten-alloy and high-speed steel.

Prior to the year 1914 we manufactured ferrotungsten for our use only, but due to the emergency created by the outbreak of the World War, we entered into the manufacture of ferrotungsten commercially. Estimates gathered and published by the United States Geological Survey show that our company was the largest manufacturer of ferrotungsten or tungsten powder in the United States in

1918. This is also undoubtedly true of the years 1915, 1916, and 1917.

Since the year 1902 I have been actively interested in tungsten ore markets and have kept informed as to American production, importation, and consumption of tungsten ore, as well as the world's production. That I was asked to appear as a witness before the Ways and Means Committee of the House of Representatives, and before this committee, is due to the business acquaintanceships made with western producers of tungsten ore, in my capacity as a buyer of their product. They knew that I had knowledge of tungsten mining conditions in America as well as in all other tungsten ore fields of the world, and anyone with a knowledge of the true conditions existing in the world's tungsten ore markets to-day must admit that the tariff provided for in H. R. 4437 is necessary if the tungsten mining industry of our country is to be rehabilitated.

The war has proven that tungsten is a mineral of utmost importance to a nation in war or peace, and it would be folly to allow the tungsten mining industry of our country to die on account of not granting sufficient protection against surface ore deposits located in countries where the labor cost is so low.

Senator WATSON. Purely as a manufacturer, eliminating any patriotic motives, what is the difference to you where you buy tungsten? If we had not tariff at all on tungsten, in time of peace and the free and uninterrupted flow of tungsten was permitted from all other countries, could you buy it at a lower price than you can in the American markets?

Mr. McKENNA. Yes: at a slightly lower price. The American tungsten ore is the best ore. The Colorado and the California ores are the only tungsten ores found in nonmineral bearing lands. The Burmah ores and the Chinese ores and the South American ores all have some impurity such as tin, antimony, copper, and bismuth.

Senator WATSON. This is a purer and higher quality?

Mr. McKENNA. It is purer ore.

Senator WATSON. And therefore it takes less of it, does it?

Mr. McKENNA. No; not less of it, but there is less chance of having it impure.

I have faith in our country's ability to produce a large percentage of our requirements of tungsten ore, provided sufficient capital will be invested in the tungsten mining industry to conduct it on a larger, more economical, and efficient basis than in the past. Capital will not be attracted to the tungsten mining industry unless House bill 4437 is approved by your committee and later becomes a law of the land.

Through an affiliated company, our company owns and operated a tungsten mine in Colorado. Our object in purchasing this mining property was to secure a permanent and certain source of supply for at least a part of our tungsten ore requirements, in event shipping conditions became such as to make the importation of tungsten ore impracticable.

Our company has always paid to its affiliated mining company a price higher than market, yet since our ownership of the mine, acquired in the fall of 1915, the properties have been operated without profit.

I have already stated at the hearing before the Ways and Means Committee my opinion as to why a tariff on tungsten ore is necessary to save the tungsten mining industry, and the importance of this industry to the welfare of our country. I consider H. R. 4437 a bill to protect Western producers of tungsten ore and not a bill that gives any protection to the manufacturers of products from tungsten ore.

The framers of this bill recognize that a compensatory tariff should be provided for on products manufactured from tungsten ore, but insist that the ratio be so conservative that there should be no ground for any opposition to contend that additional protection is given to the manufacturer. In fact all who are informed as to conditions surrounding the manufacture of high-speed steel recognize that the ratio between tariff provided on tungsten ore and tungsten contained in high-speed steel, namely, 1 cent per pound for each per cent of tungsten contained in high-speed steel, is not fully compensatory, and does not take into account losses inevitable in the conversion of tungsten from ore into tungsten in high-speed steel.

The provisions of H. R. 4437 do not promote the manufacture of products from tungsten ore, as the rate of duty on tungsten contained in tungsten alloy and high-speed steels is not compensatory. Western ore producers recognize that without a compensatory tariff on products manufactured therefrom it would be of no benefit to them, as it would leave them without a market for their product.

As a manufacturer of high-speed steel I am willing to allow such discrimination against high-speed steel as exists in H. R. 4437 to stand, believing it to be to our best interest that the tungsten mining industry of our country continue. I do not wish to jeopardize the passage of the bill by doing anything that might aid any contention that the bill gives any additional protection to the manufacturer of high-speed steel beyond present 15 per cent ad valorem.

Senator THOMAS. You are a manufacturer and you are also a miner?

Mr. McKENNA. In our mining industries, Senator Thomas, we have not 5 per cent of the capital that we have invested in the manufacture of high-speed steel.

Senator THOMAS. It is something; you are interested, whether to a greater or less degree. It is not to your discredit at all, but I am simply calling your attention to the fact that your interest is in both directions. So that your willingness to permit this as a manufacturer may also be considered in connection with your interests as a producer?

Mr. McKENNA. There are about half of the manufacturers of high-speed steel who take the same position as I do.

Senator THOMAS. Certainly. Do not misunderstand me—I am not criticising; I am simply giving the facts.

Representative TIMBERLAKE. May I ask the witness a question here, Mr. Chairman?

Senator WATSON. Certainly you may.

Representative TIMBERLAKE. The object being to create a suitable market and positive supply rather than to be an investment as a producer of tungsten, is that the case with you?

Senator THOMAS. I am glad to see you put your money in mines, as far as that is concerned. I am interested in that, but let me ask

you: You stated that in 1917 you ceased to make anything out of your mining industry?

Mr. McKENNA. Yes.

Senator THOMAS. What was your profit before then?

Mr. McKENNA. What do you mean?

Senator THOMAS. I mean, how much did you make on tungsten you mined prior to 1917?

Mr. McKENNA. I said 1915, that is when we owned the mines.

Senator THOMAS. I misunderstood the date. What period of time have you been engaged in the mining of tungsten?

Mr. McKENNA. From September, 1915.

Senator THOMAS. Up to what time?

Mr. McKENNA. Up to now.

Senator THOMAS. You are closed down, are you not?

Mr. McKENNA. We are closed down.

Senator THOMAS. You mentioned the time when you ceased to make profit.

Mr. McKENNA. I said we never made a profit since we bought the mining property. We bought the property when the price of tungsten was at a very high figure.

Senator THOMAS. I misunderstood you. Proceed.

Mr. McKENNA. I have been asked to justify a duty of \$1 per pound tungsten content in metallic tungsten powder and ferrotungsten as a compensatory duty of \$10 per unit of tungsten ore. This committee should bear in mind the manufacture of ferrotungsten was an industry prior to the year 1914, dominated by Germany. That the industry exists to-day is only due to the war-time emergency, ably met by our metallurgists. The ferrotungsten industry to-day stands in the same position as that of dyestuffs and chemical glassware, yet H. R. 4437 is not asking for any protective tariff in addition to that already provided, namely, 15 per cent ad valorem. The bill provides only for a compensatory duty to offset increased cost of tungsten ore.

It was evident from the debate in the House that many members did not understand what was meant by a unit of tungsten ore. A unit of tungsten ore is 1 per cent of 1 ton of 2,000 pounds of tungstic trioxide ( $WO_3$ ); that is, tungstic trioxide contains 3 atoms of the element oxygen to 1 atom of tungsten. There is contained in 20 pounds, or 1 unit of tungstic trioxide, only 15.86 pounds of metallic tungsten (or W). There is also contained 4.14 pounds of oxygen.

On account of the volatility of tungsten it is impossible to recover all the metallic tungsten from ore in the form of metallic tungsten powder, or ferrotungsten. Our records for the year 1918 show percentage of recovery at our plant of 82.50 per cent. Eighty-five per cent certainly is a high average recovery, and I have no doubt that records in the hands of the United States Tariff Commission and United States Geological Survey will bear out this statement.

Assuming 85 per cent recovery, there would be obtained from one unit, or 20 pounds tungstic trioxide ( $WO_3$ ) in the form of ore, 0.85 times the metallic content of 15.86, or 13.48 pounds metallic tungsten. Ten dollars per unit, divided by 13.48 pounds tungsten metal, gives a theoretical metallurgical compensatory duty of 74.4 cents per pound. This theoretical metallurgical compensatory duty does not, however, take into consideration any return on the additional



capital necessary to be invested in the business due to higher prices of ore. It is not economical and not efficient to conduct the manufacture of ferrotungsten with less than the equivalent of a six months' supply of tungsten ore on hand and in process of manufacture. Allowing only nominal interest of 6 per cent for the additional capital necessary to be invested in ore would mean an addition of 5 cents per pound to the cost.

The manufacture of ferrotungsten is a comparatively new and hazardous business. The seller of ferrotungsten must meet buyers' strict specifications; not only as to the tungsten content of its product but to be within limits as to carbon, manganese, silicon, sulphur, and phosphorus determinations, which are taken by sampling, weighing, and assaying by public chemists. The manufacturer of ferrotungsten must also guarantee his product to be free from detrimental metallic impurities, such as tin, copper, arsenic, antimony, bismuth, etc.

Excepting in a very few tungsten fields of the world, all tungsten ore contains more or less of these detrimental elements, which would compel chemical treatment of the ore. A very small percentage of the tungsten ore produced in the world is of such quality or purity as to allow it to be converted by electric-furnace process direct into ferrotungsten without the expense of chemical treatment, or without mixing with other tungsten ores absolutely free from detrimental elements present in original lot; that is, it is possible to obtain a suitable "mix" of tungsten ores for reduction and conversion by electric-furnace process by mixing tungsten ores of, say, six or more lots, each lot of which may contain excessive impurity of one detrimental element only. It is partly for this reason that the ferrotungsten manufacturer, to be successful, must operate on a comparatively large scale, carry large stocks of ore on hand, and assume the hazards of the fluctuating market for tungsten ore.

A tariff on tungsten ore which would normalize and stabilize the price would be of great help in allowing the manufacturer of ferrotungsten to conduct his business in an orderly and efficient manner. The manufacture of ferrotungsten is a hazardous business at the best; any mistakes by the chemist or the metallurgist, or by employees carrying out instructions of the metallurgical department, would cause a complete loss of two days' production. There is no known method of removing tin, copper, or arsenic from ferrotungsten, and any heat made of off-analysis of these elements is unmarketable.

Senator THOMAS. How are we going to protect you against that hazard in your business?

Mr. McKENNA. Why, there is a hazard in all business. If we make a mistake—

Senator THOMAS (interposing). Certainly. I do not see what that has got to do with the duty on tungsten. If you are going to produce a marketable quality of ferrotungsten, you have—

Senator McCUMBER (interposing). It has to do with the cost?

Mr. McKENNA. It has to do with the cost.

Senator THOMAS. Proceed.

Mr. McKENNA. But I will go on with this argument.

The difference between the theoretical compensatory tariff of 80 cents and that provided for in H. R. 4437 is 20 cents, or 25 per cent, which, considering the new and hazardous nature of the industry,

is not sufficient to interest any capital, but is probably sufficient to enable those manufacturers who gained experience during the past few years to continue. I feel that business men will recognize that a tariff of \$1 per pound content is only fair compensatory tariff, and to accept any less amount would jeopardize a new and large industry born to meet a war-time emergency, which now feels that they are able to hold their own provided their industry is in no way discriminated against.

The manufacture of high-speed steel is a well-established industry, and the provisions of H. R. 4437 which discriminate against it are not as serious as in the case of ferrotungsten manufacturers. It is to be admitted that there is a loss of tungsten through its introduction from ferrotungsten to high-speed steel. Our records show that we introduced 107.83 pounds of tungsten in our "mix" for every 100 pounds tungsten obtained in ingots cast. There is also a loss in hammering and rolling mill scale, which our company's records show to be 11.43 per cent during the past year.

There is some opposition by manufacturers of high-speed steel to H. R. 4437 on the ground of its failure to provide a fair compensatory tariff on their product. Many manufacturers of high-speed steel realize the importance to our national welfare of perpetuating the tungsten mining industry of the country and allowing it to continue. They would prefer a more stable market on tungsten ore and ferrotungsten and feel that these advantages offset any discrimination against them in the bill.

The Green amendment, to my knowledge, does not affect any manufacturer of high-speed steel, but as business men, they feel that it is questionable whether retroactive tax legislation is ever justifiable. I have no knowledge whether or not the Green amendment will affect any manufacturer of ferrotungsten or refiner of tungsten powder, but this amendment should not penalize any manufacturer of ferrotungsten or refiner of tungsten powder who purchased tungsten ores at low prices since the signing of the armistice in order to conduct the operation of their plants in an orderly and efficient manner, and to provide work necessary to carry their organizations during the transition period through which the country has just gone.

I understand that western ore producers are not responsible for the introduction of the Green amendment, which was added on the floor of the House during debate. The western ore producers have no sympathy for tungsten ore merchants who imported large quantities of ore since the signing of the armistice, yet they want to be fair and not to penalize any branch of the tungsten industry for conducting their business on recognized business lines.

With my knowledge of tungsten mining conditions in the West, I believe that H. R. 4437 is justifiable, and as a manufacturer of high-speed steel, I can approve of all its provisions.

Senator Thomas, you asked what the hazard of the business had to do with the tariff. The hazard of a business such as the manufacture of ferrotungsten is that in order to make your product marketable it has to be made without mistakes.

Senator THOMAS. I can understand that. But you go ahead with your business whether this tariff is put on tungsten ore, or not. You will get your material then from some other source?

Mr. McKENNA. Yes.

Senator THOMAS. And you will have to be just as careful to produce just as good a quality of ferrotungsten whether you operate on dutiable ores or undutiable ores. That is the idea I had in mind. I fail to see how it affects the question of your continuing to operate.

Mr. McKENNA. They are not asking any tariff on ferrotungsten unless there is a tariff on tungsten ore.

Senator THOMAS. I understand that.

Mr. McKENNA. Just enough to compensate them.

Senator THOMAS. But in either event, the hazard of the business is the same with you; you are the manufacturer?

Mr. McKENNA. Yes; but the hazard is in proportion to cost of the ore, and that there is a business hazard is proven by the fact that there were 16 in the business in 1918 and there are about 4 left to-day.

Senator WATSON. What kind of manufactures?

Mr. McKENNA. Manufacturers of ferrotungsten.

Senator McCUMBER. That is what I understood he had reference to, that the danger of mistakes was in the manufacture of tungsten and not in the production of its products by the steel manufacturer.

Senator THOMAS. That is about the proportion of failures in every business; 4 or 5 out of 15 or 20.

Senator McCUMBER. You speak of the losses due to a mistake of a workman. Were you referring then to the production of the tungsten or the production of your steel product?

Mr. McKENNA. The production of the ferrotungsten.

Senator McCUMBER. That is what I thought.

Mr. McKENNA. You see, there are three steps: There is the tungsten ore, and then the tungsten ore has to be converted into either metallic tungsten powder or ferrotungsten before it is used by the steel manufacturer.

Senator PHIPPS. I think it might enlighten the committee to have a little definite information as to the use of the tungsten powder and the ferrotungsten. That is not confined to the manufacture of high-speed tool steel, is it?

Mr. McKENNA. The use of ferrotungsten is confined to high-speed and tungsten alloyed steels; the metallic tungsten powder is in small quantities, as used for the manufacture of tungsten lamps, and also contact points for spark plugs and on X-ray apparatus, but the quantity is small.

Senator PHIPPS. As to the automobile industry, where highly resistant steel is needed in some of the wearing parts, is not that a tungsten alloy steel?

Mr. McKENNA. Tungsten is used by some automobile manufacturers for the valve stems. During the war there were large quantities of tungsten alloy steels bought by the United States Government for the valves in aeroplane motors; it contained from 13 to 15 per cent tungsten steel.

Senator PHIPPS. If the industry was stabilized and tungsten alloy steel could be used at reasonable prices, would not the use be very largely increased?

Mr. McKENNA. Senator Phipps, there is a difference of opinion. The trend of the automobile manufacturers to-day for valves is to use high chrome steel or stainless steel.

Senator PHIPPS. Assuming that the Congress should not see it way clear to make any change in the present tariff, which, as I understand it, is a small ad valorem on finished steel products, what, in

your judgment, would be the effect on the tungsten industry in this country?

Mr. McKENNA. The tungsten-mining industry would remain as it is—dead.

Senator PHIPPS. It is dead at the present time, in your judgment, is it?

Mr. McKENNA. Absolutely.

Senator PHIPPS. There is practically no production?

Mr. McKENNA. Yes; there is none.

Senator PHIPPS. Assuming that there were from any cause at any time an absolute stoppage of importations of  $WO_3$ , or tungsten in any other form, what would be the effect on our industries here? We had almost a stoppage during the war at one period, did we not, in 1917?

Mr. McKENNA. We did.

Senator PHIPPS. Would that be disastrous on the industry in this country, assuming we were to get into another war and our foreign supply were cut off?

Mr. McKENNA. It would take from one year to two years to reopen the mines and get production up. We purchased the mining property in September, 1915, and it was actually six months before we got out the first carload of tungsten ore, and that was a mine that had been running and had only been flooded and not in use for some time.

Senator WATSON. Could you run your present establishment without any tungsten—if you could not get any, could you run your plant?

Mr. McKENNA. We certainly could not.

Senator WATSON. I think that is what Senator Phipps is trying to get at.

Mr. McKENNA. We could run for six months, because we have to keep on hand at all times over six months' supply of tungsten.

Senator WATSON. Suppose there were no tungsten could you run your present business and manufacture your product?

Mr. McKENNA. We could not.

Senator WATSON. Then it absolutely depends on tungsten?

Mr. McKENNA. It depends on tungsten absolutely, and so do all manufacturing businesses now. They can not make an automobile, a tractor or a locomotive to-day without high-speed steel.

Senator WATSON. And high-speed steel can not be made without tungsten?

Senator THOMAS. And not without the use of chrome?

Mr. McKENNA. Chrome is just as important.

Senator THOMAS. Or nickel?

Mr. McKENNA. Nickel does not matter. There is no nickel in high-speed steel.

Senator McCUMBER. How about the price if our own mines were closed down and the foreign production had to be depended upon? In other words, are the foreigners so situated that they could immediately combine and fix any price they saw fit?

Mr. McKENNA. Senator, before the discovery of this very large deposit in south China, tungsten ore generally came to America practically only from South America. I believe that we could successfully compete against South America in tungsten ore with very much smaller tariff. It was the discovery of this Chinese field that upset the whole thing. The Chinese produced in the year 1918,

10,500 tons; that was more than what the world's production was in any year up to 1914, and they produced that at very low cost.

Senator McCUMBER. And they would produce such a quantity and there would be such a demand in this country that they could raise their prices then to meet the demand, could they not?

Mr. McKENNA. They did that. Mr. Frank Hess testified before the Ways and Means Committee of the House as to their system of squeeze, or the Chinese system of taxes, and they will base those taxes on what the traffic will bear. Before the armistice was signed the Chinese taxes amounted to over \$4 a unit.

Senator THOMAS. You mean an export tax?

Mr. McKENNA. No. Those were various taxes that take place from the producing of tungsten ore inland to the delivery of the ore at seaboard.

Senator WATSON. That is an internal tax?

Mr. McKENNA. Yes; they call them robbery taxes, as they go over the boundary line of each province. These are more or less robbery taxes. This [referring to paper] is a tabulation of actual costs of Chinese wolframite laid down in New York. This [referring to paper] is after the armistice, because it shows it can be laid down in New York at \$7.20 per unit, a long ton; that would be \$6.42 per short ton. It shows the mining charges per picul; that is, 133½ pounds of material at 10 Hongkong dollars. We will have to call that yens. But the tax is 2.40 for taxes Kiansi-Nanyu and local taxes 1.40, customs duty 0.15, another customs duty 1.00, bureau duty, 4.00, and so on. You see, these add up to be equal to what the mining charges were. At one time, before the armistice, these extra taxes amounted to as much as \$6 a unit.

Senator THOMAS. The Chinese have not yet got it down to a fine point, because there is no excess-profit tax.

Senator WATSON. This marked "Confidential." Can we not incorporate that in the record?

Mr. McKENNA. It is marked "Confidential" by me after its receipt, but it was sent out to every ore buyer in the United States.

Senator WATSON. Then it was not very confidential?

Mr. McKENNA. It was not very confidential.

(The table of wolframite costs submitted by Mr. McKenna is here printed in full as follows:)

*Tabulation of actual cost of Chinese wolframite laid down in New York.*

Mining charges, per picul.....	H\$10.00
Kiansi-Nanyu taxes.....	2.40
Kiansi-Nanyu forwarding charges.....	2.50
Kiansi war expense and Nanyu local taxes.....	1.40
Nanyu-Shoshu freight.....	1.00
Shoshu eastern customs duty.....	.15
Shoshu Tarhei customs duty.....	1.00
Hokko Maning bureau duty.....	4.00
Finance bureau expenses.....	4.37
Finance bureau customs duty.....	.15
Rail freight to Canton.....	1.15
Koshu-Canton.....	.10
Canton export duty.....	2.00
Canton Hongkong freight.....	.20
Total charges per picul.....	30.42
Per ton of 20 hundredweight.....	511.056

Ex. at 80.....	G\$408.85
Ocean freight to Pacific.....	20.00
Packing and insurance.....	5.00
<b>Total.....</b>	<b>G\$433.85</b>

On basis 60 per cent at \$7.20 unit long ton, G\$ represents gold dollars, H\$ represents Hongkong dollars.  
(Confidential.)

Senator PHIPPS. In your judgment, what would be the effect on the industry in the United States, assuming that Congress enacted this House bill and it became a law; what would be the effect on the development of production and the industry generally?

Mr. McKENNA. In the tungsten mining industry?

Senator PHIPPS. In the tungsten mining industry, particularly. Would that be an inducement to capital to develop present discoveries and perhaps new ones, and what effect would it have on the production that might be had from American mines?

Mr. McKENNA. The need of the tungsten mining industry in the United States is the investment of capital. Capital would not become interested in tungsten mining on account of the fact that every two or three years a new virgin field would come in and upset the market. The evidence gathered by the United States Tariff Commission shows the conditions of mining in Colorado. Practically the same conditions exist all over the world.

The owners of the mines, the company operating the mines, would not invest their own money in the development of the mines on a large scale. The mines are operated by leasers, men who take one particular vein in the property and follow that vein and make their wages on the ore which they are able to find; and between the company and the leaser new development work is done on a very small scale, and costs compromised or divided. But it is my opinion that if there is a suitable market and men felt sure that the price of tungsten would be maintained at a fair price that money would be invested, especially in the tungsten mining field in Nevada. I believe that Nevada alone, with sufficient capital, could produce 50 per cent of the requirements of the United States.

Senator PHIPPS. Do you believe the United States can produce its present requirements, with suitable legislation such as this, within a year or two? Do you believe that the development would enable the American producers to meet the American demand?

Mr. McKENNA. Well, there will always be some imported tungsten ore. We may produce 50 or 65 per cent, and that is as high as you would ever get.

Senator PHIPPS. Do you believe that the large investments that would be induced under this proposed tariff would result in great economy in the matter of production so as to reduce the cost of production?

Mr. McKENNA. Senator Phipps, I would prefer that you ask these questions of Mr. Griffin or some other man who is better informed as to the mining conditions in the West. My opinion on that will only be as an individual.

Senator THOMAS. Mr. McKenna, to what extent are uranium and vanadium used for hardening steel?

Mr. McKENNA. The standard high-speed steel has 1 per cent vanadium in it and 18 per cent tungsten.

Senator THOMAS. Is that used then in combination with tungsten?

Mr. McKENNA. No. Vanadium was first introduced into high-speed steel as a scavenger to eliminate oxygen and give the steel greater physical properties.

Senator THOMAS. Is it a combination with or a substitute for tungsten?

Mr. McKENNA. It is a combination with tungsten. Tungsten and chrome give the steel the property of maintaining its hardness at a red temperature, at high heat.

Vanadium gives to steel the property of greater strength, and in the case of high-speed steel the ability to wear longer between grindings.

Senator THOMAS. Then they are complements of each other in the manufacture of hard or tool steel?

Mr. McKENNA. Yes.

Senator THOMAS. Is uranium used also in conjunction with tungsten?

Mr. McKENNA. Only by one manufacturer.

Senator THOMAS. It can be used independently for hardening steel, can it not?

Mr. McKENNA. No. Chrome is the only element that gives the same properties as tungsten.

Senator THOMAS. Chrome and tungsten then, are the main, if not the only, metals that can be used for the hardening processes?

Mr. McKENNA. There is made what is known as tungstenless high-speed steel. Commercially, it does not amount to anything. It contains about 12 or 13 per cent chrome and some molybdenum—molybdenum has the same properties as tungsten to some extent.

Senator THOMAS. Then chrome, molybdenum, and tungsten are severally metals that can be used in the hardening processes in making steel?

Mr. McKENNA. Yes; but every manufacturer has tried to use molybdenum, and not one has ever succeeded in making a good high-speed steel by the use of molybdenum.

Senator THOMAS. A great deal of molybdenum is being produced in my State.

Senator McCUMBER. As I understand you, only about 1 per cent of the ore is extracted. In other words, suppose you take 100 pounds of tungsten ore, how much tungsten would you secure from that?

Mr. McKENNA. The tungsten ore that comes from China contains 60 per cent  $WO_3$ . Mr. Franklin, I think, stated that the average tungsten ore mined underground in Colorado contains from 1 to 5 per cent tungstic trioxide. The Bishop fields—Mr. Griffin will probably bring that out—are down as low as 0.3 of 1 per cent  $WO_3$ , and they have to mill many hundreds of tons of tungsten ore to get 1 ton of tungsten concentrate or commercial ore such as we buy in the East—60 per cent  $WO_3$ . Two hundred tons of ore will be milled to produce 1 ton of 60 per cent ore such as would be shipped East to the manufacturer of ferrotungsten. Then the manufacturer of ferrotungsten buys the ore and makes it into ferrotungsten and the ferrotungsten is used by the manufacturer of high-speed steel.

Senator WATSON. The representatives of the Tariff Commission are here, and the committee will now be glad to hear them.

**STATEMENT OF MR. GUY C. RIDDELL, UNITED STATES  
TARIFF COMMISSION.**

Senator WATSON. You represent the Tariff Commission?

Mr. RIDDELL. Yes, sir.

Senator WATSON. In what capacity?

Mr. RIDDELL. Mr. Costigan is here representing the commission, and I merely desire to hand the chairman a letter from the commission calling attention to an amendment necessary in the Tariff Commission's report on the tungsten industry, made for the Ways and Means Committee. In that report figures from "Mineral Industry" were quoted which are now found to have been in error, and for your present deliberations you should have the corrected statement of valuation of tungsten concentrates during the year 1916.

Senator WATSON. Will you be kind enough to read?

Mr. RIDDELL. I will first read the letter of transmittal [reading]:

UNITED STATES TARIFF COMMISSION,  
Washington, November 10, 1919.

DEAR SENATOR WATSON: We transmit herewith for your information a copy of our letter of even date to the Committee on Ways and Means concerning an amendment of certain statements in the Tariff Commission's report on tungsten bearing ores, as quoted from Mineral Industry.

This is sent for the use of the Senate Finance Committee's subcommittee on tungsten, of which, we understand, you have been appointed chairman.

Very truly yours,

UNITED STATES TARIFF COMMISSION.  
By JOHN F. BETHUNE, *Secretary*.

HON. JAMES E. WATSON,  
*United States Senate.*

I will now read the letter addressed by the Commission to the Committee on Ways and Means of the House of Representatives.[reading]:

NOVEMBER 10, 1919.

GENTLEMEN: It has just come to our attention that certain figures in Mineral Industry, utilized by the Tariff Commission in its "Information concerning tungsten-bearing ores," printed for the use of the Committee on Ways and Means, are in error. Amendments are, therefore, necessary in the Tariff Commission's report, on page 33, under table showing "Production of tungsten concentrate in the United States."

The figures—

Year.	Production.	Average price per unit.
1916.....	7,469	\$70.00
1917.....	5,313	21.67

should be amended to read:

Year.	Production.	Average price per unit.
1916.....	5,923	\$33.97
1917.....	6,144	18.40

Mineral Industry—Volume XXV, page 721, and Volume XXVI, page 698—quotes the Geological Survey in its presentation of the original figures. The Tariff Commission's report on page 33 quotes Mineral Industry, and on page 23 the Geologica-



Survey figures, on tonnage, and calls attention in footnote under the Mineral Industry table, page 33, to the discrepancy existing between the two.

In the matter of values, however, the Tariff Commission quoted Mineral Industry figures only, the table made use of from the Geological Survey, page 23 of the Tariff Commission report, showing no values for the years 1916 and 1917. Mineral Industry prices for both 1916 and 1917 are now known to be in error, and the text of the commission's report on page 9 must be amended accordingly. The first paragraph, under "Domestic Production," which reads under "Quantity:" "The maximum domestic production of tungsten ore, expressed in terms of concentrates containing 60 per cent  $WO_3$ , was 5,900 short tons, in 1916. The 1917 output was 4,633 short tons. The valuations for the respective years were \$24,780,000 and \$5,932,000. Preliminary reports indicate that the 1918 output was 5,046 short tons," should be changed to read: "The maximum domestic production of tungsten ore, expressed in terms of concentrates containing 60 per cent  $WO_3$ , was 6,144 short tons, in 1917. The 1916 output was 5,923 short tons. The valuations for the respective years were \$6,782,976 and \$12,072,258. The 1918 output was 5,041 short tons."

Similarly, on page 34 of the commission's report, the statement that 5,243 (long) tons of tungsten concentrate were produced in 1916, valued at \$25,000,000 must be changed to show 5,923 short tons, with a value of \$12,072,258.60.

Yours, very truly,

UNITED STATES TARIFF COMMISSION,  
By THOMAS WALKER PAGE, *Acting Chairman.*

The COMMITTEE ON WAYS AND MEANS,  
*House of Representatives.*

Senator WATSON. In 1918 you give 5,041 short tons. What was the average value per unit that year; can you give that?

Mr. RIDDELL. I have not that figure at hand.

Senator WATSON. I notice there is a blank here, but there is also a blank as to production of 1918. That you now supply, but you can not supply the average price per unit?

Mr. RIDDELL. No.

Senator WATSON. The committee will now adjourn until half past 9 to-morrow morning.

(Thereupon, at 11.55 o'clock a. m., the subcommittee adjourned to meet to-morrow, Tuesday, November 11, 1919. At 9.30 o'clock a. m.)

# TUNGSTEN ORES.

TUESDAY, NOVEMBER 11, 1919.

UNITED STATES SENATE,  
SUBCOMMITTEE ON FINANCE,  
Washington, D. C.

The subcommittee met in the committee room, Senate Office Building, at 9.30 a. m., pursuant to adjournment, Senator James E. Watson presiding.

Present: Senators Watson (chairman), McCumber, and Thomas. Also present Senator Henderson of Nevada, Senator Phipps of Colorado, and Representative Timberlake of Colorado.

Senator WATSON. Mr. Griffin, you may proceed with your statement.

**STATEMENT OF MR. FRANK W. GRIFFIN, OF SAN FRANCISCO, CALIF., VICE PRESIDENT AND MANAGER THE TUNGSTEN MINES CO., OF BISHOP, INYO COUNTY, CALIF., AND OF TUNGSTONIA MINES CORPORATION, OF ELY, NEV.**

Mr. GRIFFIN. Gentlemen of the committee, before discussing costs of producing tungsten I would like to read an extract from the Tariff Commission's report, printed by the Government Printing Office in 1919, that gives a picture of the situation as it is at present I think better than anything else.

Introductory statement, page 7:

Tungsten mining was an industry profoundly affected by the war. \* \* \* The domestic production of tungsten-bearing ores increased under the stress of war necessity to nearly five times the output before the war. The signing of the armistice found large accumulations of ore and ferrotungsten in this and foreign countries; and the closing of munition plants, which had been the largest consumers of tungsten steel, caused a temporary reduction in the demand for tungsten products. The result of these circumstances was a chaotic condition of the market which was aggravated by heavy importations of foreign ore. \* \* \*

Tungsten mines throughout the United States have been closed down and domestic production is at a standstill, but the influx of foreign supplies has continued unabated and has inhibited readjustment of the American industry to a peace basis. Consumption is becoming adjusted, but prices are at a level that does not permit the successful operation of American mines. Reports indicate the discovery of large new supplies of ore in southern China, and that the flood of ore from that section is partly present production, and not merely a liquidation of stocks accumulated during the war period.

I would say here that the above condition continues in an aggravated form. A normal year's consumption has been imported in the first nine months of this year. The reported discoveries have been confirmed, and we are facing a destructive competition from China.

To quote further, page 12:

The chief factor regulating price in the United States has been the amount and convenience of importation. \* \* \*

## Page 14:

A considerable duty on tungsten ore would encourage the investment of capital in tungsten mining and a continuance of production from American mines. Under the present free importation of tungsten ore the domestic production will remain dormant and can not be expected to recover until the deposits of foreign countries are depleted to at least the same extent as those in the United States. \* \* \* An important result of the duty would be the development of the comparatively low-grade, but probably extensive, deposits in the Southwest.

The domestic production can not be expected to indefinitely supply the domestic needs. It must be supplemented by imported ore. \* \* \*

Another factor that must not be lost sight of is the necessity of placing a compensatory duty on imports of tungsten metal, powder, and salts, ferrotungsten, high-speed steel, and other tungsten products, in case a duty be placed upon the ore.

## Page 40:

The United States has never produced sufficient tungsten to satisfy the domestic demand \* \* \*. This relatively greater increase in consumption as compared with the domestic supply is not confined to the war period, but was in progress for several years preceding the outbreak of the great war.

## Page 41:

In California the depletion is not so far advanced, but the exploitation of the large low-grade deposits upon which must depend the bulk of future production is delayed by the necessity of heavy capital expenditure. \* \* \*

The fear of a great influx of cheap foreign tungsten has been the deterrent to the investment of the requisite capital in many of the low-grade deposits of the United States. \* \* \*

It is generally believed that there is an adequate supply of tungsten in these low-grade deposits, although it has not yet been fully demonstrated.

In the digest of opinions of the United States Tariff Commission, 1918, published on pages 14 and 15 of this same report, we find, on page 15, this statement:

It was claimed that if domestic producers are not protected from foreign supplies that are likely to flood the country as soon as embargoes and other war limitations to shipping are removed, many of them would be forced to shut down their properties and allow them to deteriorate to such an extent that resumption of production would be difficult in the extreme.

This prophecy has since been fulfilled.

No standardization in precious metal mining cost is possible. That problem has been stated by Mr. Herbert C. Hoover in his "Principles of Mining," as follows:

The wide variations in physical and economical environment are so likely to vitiate conclusions from comparisons of statistics from two mines, or from two detailed works of the same mine, or even from two different months on the same work, that the greatest care and discrimination are demanded in their application.

In discussing the average cost of producing a unit of tungsten trioxide, in all statistics of the Tariff Commission and the Geological Survey, and those given at a hearing before the Ways and Means Committee of the House on this bill, only one element of cost seems to have been considered, and that is the working or operating costs.

The amount of capital invested in the mine, the construction and equipment accounts, and the redemption of development are all elements which must be considered and must be written off during the life of the mine. All these elements must be weighed when a contemplated investment in a mine is to be made; and when the price of the product of the mine is subject to the extreme variation which has characterized the tungsten market, the hazard is increased beyond the limit of safe investment, and the business becomes so

highly speculative that an orderly development of tungsten deposits is impossible.

If we are to develop tungsten mining and put it on the plane of sound business, we can not have the determining factor of price dependent upon "the amount and convenience of importation."

All statistics relative to tungsten before the year 1915 must be entirely disregarded if we are to get a clear understanding of the present and future position of tungsten.

The world production from 1909 to 1915 averaged 7,810 tons per year, of which the United States furnished 1,406 tons.

Senator WATSON. What year was that?

Mr. GRIFFIN. The production from 1909 to 1915, making an average production per year of 7,810 tons for the entire world, of which the United States furnished 1,406 tons.

Mr. NELSON FRANKLIN. I would like to interject right there, if I may, that Mr. Roy C. McKenna made a mistake on yesterday in saying that 2,100 tons were produced a year before the war. There was an error in his figures.

Senator WATSON. Which is right?

Mr. FRANKLIN. One thousand six hundred tons is the highest.

Mr. GRIFFIN. I think you are mistaken there, Mr. Franklin; one year—1910—it was 1,821 tons.

Mr. FRANKLIN. All right. I had understood that the highest was 1,600 tons.

Senator WATSON. You may proceed with your statement, Mr. Griffin.

Mr. GRIFFIN. The only mines then operating in this country were those that had such high-grade ore that they could compete with the rest of the world. Tungsten ore was known to but few miners. The market requirements were fully met and there was no incentive to stimulate the discovery or development of new properties.

As a result of the outbreak of the war a world-wide search was made for tungsten, and the world production increased to about 12,400 tons in 1915; 22,200 tons in 1916; 28,500 tons in 1917; and 36,500 tons in 1918. Of the above production the United States furnished the following tonnages in the respective years above mentioned: 2,332, 5,923, 6,144, and 5,041.

Senator WATSON. You say the United States' production was 6,144 tons in what year?

Mr. GRIFFIN. In 1917, which was our largest production.

The rich surface ores of the United States were quickly exhausted, but discoveries of large contact deposits were made on which the future of the industry depends.

Broadly speaking, the present important tungsten deposits of California, Nevada, and Arizona may be divided into three types:

(1) Deep high-grade veins.

(2) Large contact deposits of undetermined depths with recoveries ranging from three-fourths of 1 per cent  $WO_3$  to  $1\frac{1}{2}$  per cent  $WO_3$ .

(3) Large low-grade contact metamorphic deposits with recoveries from three-tenths of 1 per cent to three-fourths of 1 per cent.

The Atolia mine is the only example of the first class. So much has been said of this remarkable mine that an entirely erroneous value has been given to its present position in the tungsten production of the United States.

Senator WATSON. That Atolia mine is in Colorado?

Mr. GRIFFIN. No; it is in California. I am simply touching on California, Nevada, and Arizona.

Senator WATSON. All right. You may continue your statement.

Mr. GRIFFIN. Up to 1915, the Atolia mine was practically the only real producer of tungsten in California. The ore was rich, so they could sell at a small profit at the low prices that existed before 1915. The company was in bad financial condition in 1914, but when the prices soared in 1915 and 1916 they were at the peak of their production—when the frantic search for tungsten, which resulted in the discovery of the large low-grade bodies, was being made.

While the Atolia in 1918 produced 1,079 tons of concentrate, or 20 per cent of the United States' total, at an average operating cost of \$8.91 per unit, exclusive of depreciation or depletion, yet the latter part of the year the production fell off to such an extent that the output from Atolia, if it again starts, will not be greater than 750 tons of 60 per cent  $WO_3$  concentrates per year, with cost ranging from \$11 to \$12 per unit.

In that regard I should like to read a statement from the superintendent of the Atolia Mining Co., made to its stockholders in the last annual report.

Senator THOMAS. What is the date of it?

Mr. GRIFFIN. The 1918 annual report.

In his statement he said:

While sinking No. 1 shaft water was encountered. At the date when operations were discontinued the shaft was making about 1,500 gallons of water per day of 24 hours.

I estimate there is about eight months' ore in sight, based on the average daily tonnage milled during 1918. There are reasonable grounds to suppose that considerably more ore can be produced, but it is not actually in sight. The grade of ore to be developed will probably be 25 per cent lower than the average grade milled during 1918.

CHARLES S. TAYLOR, *Superintendent.*

I quote from the annual report of the president of the Atolia Mining Co. for the year 1918: "The production of the mine for the year 1918 was a great deal less than in the two previous years, owing to lower grade of ore in all parts of the mine. Average cost per unit of 1918 production, \$8.91."

The average cost of \$8.91 per unit for 1918 production is not representative of the costs of the latter part of 1918 when production fell off, due to 25 per cent drop in grade of ore. The actual mining costs are increasing with depth and additional water. The treatment costs will be higher, as the sulphur and phosphorus content of the ore is increasing, and these deleterious elements must be removed before concentrates can be marketed. On basis of 1918 expenditures and reduction in production, on account of 25 per cent drop in grade of ore to 50,000 units, the future actual operating costs will be \$11 to \$12 per unit. These facts are all certified to me in writing by the president of the company.

And I have the statement of operating costs of the Atolia Co. that I would like to put into the record.

Senator WATSON. You may do so.

Mr. GRIFFIN. The low-grade deposits that have been equipped with mills which only ran for an average of about two months before the armistice was signed will very much more than take the place of the reduction in the Atolia output.

Of Class 2 the important examples are the Nevada Humbolt mine and the Pacific Tungsten mine of Nevada. These properties were developed in 1918, but their mills began operating only in November of that year, when they were forced to close down by the break in the market.

The management of the former mine believed they could produce tungsten at a profit of \$10 per unit and a contract was made whereby this amount was to be advanced against concentrates produced. The mine worked about seven months in 1919. But essential elements of cost were evidently overlooked, as the property became so involved the creditors had to step in, and the mine was closed down. Under the proposed duty this mine can produce about 400 to 500 tons of concentrate per year.

The Pacific Tungsten Co. handled in 1918, 12,586 tons of ore, yielding a recovery of 1.6 per cent  $WO_3$ ; 290.74 tons of 70 per cent  $WO_3$  concentrates were produced, or 20,352 units. During the construction of the mill, covering 10 months of 1918, ore was hauled by motor truck to a custom mill, and the company's mill ran only two months and was then forced to close down.

Based on mining costs and two months' operation of the mill, the total cost per ton of ore milled was \$12.80. The mill will treat 36,000 tons of ore per year, so with an estimated recovery of 1 per cent, 36,000 units or 600 tons of 60 per cent concentrates will be produced at an operating cost of \$461,000, or \$12.80 per unit. The company has invested \$583,500 and to amortize this investment in eight years, allowing only 10 per cent on the investment and replacing capital by reinvestment of \$160,000 annually at 4 per cent, will require a selling price of \$17.25 per unit.

Senator THOMAS. Let me ask you right there before I forget it: The last Congress passed an act appropriating some millions of dollars for reimbursement of men and corporations engaged under the encouragement the Government gave in the production of unusual metals during the war. Have any of those companies made application for relief under that act?

Mr. GRIFFIN. Some of them have, Senator. My own company could not, because—

Senator THOMAS (interposing). Which is your company?

Mr. GRIFFIN. The Tungsten Mines Co. Because during the period covered by that act, which was from April, 1917, to November, 1918, we made a profit. The result of all operations by the Tungsten Mines Co. would leave us a considerable sum still in debt, however.

Senator THOMAS. Do you know of any companies who have made application under that act?

Mr. GRIFFIN. Yes, sir; a number of them have made application. And this one I am just speaking of now has made application.

Senator THOMAS. Have they gotten any relief?

Mr. GRIFFIN. They have not; and I do not know to what extent there is a possibility of their getting relief.

Senator HENDERSON. In connection with that question, Senator Thomas, you have read, have you not, the letter from the Attorney General interpreting that act?

Senator THOMAS. Yes, sir.

Senator HENDERSON. And that has cut out, has it not, a good many claims of various companies and prevented them from getting any relief?

Mr. GRIFFIN. Oh, yes; a great many could not meet the conditions stated in that opinion.

Mr. FRANKLIN. We have a claim in which has not as yet been passed upon.

Senator THOMAS. That letter of the Attorney General was due to the fact that a great many very extravagant claims were filed, and it had then a reaction, of course.

Mr. GRIFFIN. I understand the commission did not take into consideration the value of your properties, or what you had paid for your mine.

Senator THOMAS. I am not familiar with the procedure which the commission have adopted. I merely wanted to get into the record the fact, if it was a fact, that some of these concerns had applied for relief under that act.

Mr. GRIFFIN. Yes; but they are not allowing for property investment.

Senator WATSON. You may proceed with your statement.

Mr. GRIFFIN. Class 3: The large low-grade deposits are illustrated by the Tungsten Mines Co. at Bishop, Calif., the Pine Creek tungsten mine and the Tungsten Reef Mines Co. of Arizona.

The Tungsten Mines Co., of which I am the managing director, has worked on ore that yielded the extremely small amount of three-tenths of 1 per cent  $WO_3$ , at a cost of \$12.83 per unit, not including depreciation and depletion. The physical character of our deposit makes it possible to mine and mill this ore at a cost of \$3.77 per ton of ore. The ore body is 75 feet to 100 feet wide, with the tungsten fairly evenly distributed through the mass, so large tonnages can be mined and milled daily. We work in what is known as a "glory hole" which has reached the dimensions of 275 feet long by 75 feet wide by 190 feet deep. The ore is broken down in large masses at small relative expense. In 1918 we milled 71,125 tons of ore to produce 337.35 tons of 62 per cent  $WO_3$  concentrates, or 210 tons of ore to produce one ton of concentrates. The character of our ore body is such that development work has not been carried far ahead.

We never have been able to see more than 10,000 tons of ore, but we have milled 167,000 tons, and there is fully as much ore in sight as there ever was.

The Pine Creek tungsten mine has the largest tonnage of low-grade ore yet discovered. The ore is somewhat higher grade than that of the Tungsten Mines Co., so although the cost per ton of milling the ore is higher, on account of the inaccessible location of the mine, the unit operating cost, exclusive of depreciation and depletion, is practically the same as that of Tungsten Mines Co., namely, \$12.11 per unit. The 200-ton mill ran only six weeks when forced to close down.

I have a statement signed by the general manager of that company, Mr. Cooper Shapley. He came on here with us from Bishop, Calif., but after we had been here about a week he was forced to return home, and so will not be able to appear before you gentlemen, and therefore asked me to present his figures, which I would like to put into the record as a part of my testimony.

Senator WATSON. That may be done.

Mr. GRIFFIN. Mr. Shapley is also the manager of the Round Valley Tungsten Mine, Bishop, Calif. This company has a 150-ton mill and handled 31,678 tons of ore in 1918 with a recovery of three-tenths of 1 per cent, and an operating cost of \$14.09 per unit.

The Standard tungsten mines of Bishop, Calif., milled 44,000 tons in two years, recovering slightly under three-tenths of 1 per cent. It was a pioneer mill, and there were additional costs from experimentation. The operating costs were \$13.82 per unit, excluding depreciation and depletion.

At the Tungsten Reef Mines Co.'s property, located at Huachuca Mountain, near Hereford, Ariz., an extremely large tonnage of ore is exposed and developed. The average grade is about one-half of 1 per cent. The property is equipped with a small mill. The machinery for a 200-ton mill is on the ground but was not erected. Judging from the data gathered from operating the small mill tungsten can be produced for about \$11 per unit.

I have certified statements of costs that I would like to put into the record with reference to the Standard Tungsten Co., of Bishop, Calif.; Tungsten Mines Co., of Bishop, Calif.; and the Pacific Tungsten Co.

Senator WATSON. All right. Hand them to the reporter.

Mr. GRIFFIN. It will be seen from the foregoing outline of production and cost that there is a large supply of tungsten, much of which was just coming into production when the market failed. The costs given in every case cover only direct operating charges and do not take into consideration amortization of the investment. These costs vary from \$11 to \$14 per unit at the mines.

I have made no attempt to cover all the mines but simply those that are equipped with large mills in order to show the average cost. There are a good many mines of course in California and Nevada that can not operate on an \$11 to \$14 cost.

With the single exception of the Atolia Co., every company I have mentioned has not only made no money, but it is probably from \$50,000 to \$500,000 behind.

Senator THOMAS. Was there any period in their operation when they did make any money?

Mr. GRIFFIN. Yes, sir; I made money in 1918.

Senator THOMAS. What per cent upon your investment did you make as profit?

Mr. GRIFFIN. Probably 25 per cent.

Senator THOMAS. Is that just for one year?

Mr. GRIFFIN. That was for the one year.

Senator THOMAS. What was your capital?

Mr. GRIFFIN. About \$400,000.

Senator THOMAS. The Atolia Co., as I remember, declared quite a number of large dividends?

Mr. GRIFFIN. Yes; you see they were at the peak of their production during the two years of high prices.

Senator THOMAS. Do you remember what their total profits were?

Mr. GRIFFIN. I do not know, Senator. I have not seen their statements for those two years. But their position now, of course, is the question really to be considered. They are in no better position now than the other larger mines, and they can not produce anything like the tonnage they did. Their costs will be proportionately higher.



Senator THOMAS. I understand that, but I recall that in 1917, when Mr. Baruch, before he took the chairmanship of the War Industries Board, got out of what he thought was every interest that would conflict with his duties, he received something over \$200,000 as a dividend, much to his surprise, and he donated it among the Young Men's Christian Association, the Young Woman's Christian Association, the Knights of Columbus, and the Jewish Relief Association, who were doing war work. That is the reason why I asked if one of the companies did not make enormous profits during the war.

Mr. GRIFFIN. They did during 1916 and 1917. The mines referred to could, in my judgment, produce 3,000 tons of 60 per cent  $WO_3$  concentrates a year at an operating cost of between \$11 and \$14 a unit, probably averaging about \$13.00. The Chinese ore costs on an average, laid down in this country, about \$6 to \$7 a unit.

Senator THOMAS. What is the source of those figures; or what is the source of your information?

Mr. GRIFFIN. The source of my information is the testimony of Mr. Frank L. Hess, geologist of the United States Geological Survey, given before the Ways and Means Committee of the House, which took in not only Burma but the Chinese ores, which I think can be laid down in this country at less than \$7 per unit at a profit.

Senator McCUMBER. Laid down in New York.

Mr. GRIFFIN. Yes; laid down in New York.

Mr. Hess said:

In Burma they are mining both veins and placer deposits and their costs have been very low. They have a lot of rich deposits. The Kaubank mine has published a cost of less than 9 shillings per long ton unit \* \* \* something like \$1.92 per short ton unit. The Mawchie mine \* \* \* can lay down tungsten ores in London at \$7 a unit at a profit. Now, you can get all sorts of prices between these in that country. \* \* \* Chinese ore can be brought to this country for less than \$7 a unit; when the price was \$25 and upward, before the armistice was signed, the steel companies sent men scurrying all over the world to buy tungsten ores. Of course they went to China. The officials there—every man who got a chance at it—got a squeeze out of it—and those squeezes were all paid on the basis of \$25, the price in New York City. Now, those officials are not going to let anybody get ore out unless they pay something like that squeeze.

Mr. F. W. Horton, former manager of the Chemical Products Co., and one of the best known authorities in the tungsten industry, is my authority for the following statements:

The Burma deposits will continue to produce large quantities of cheap tungsten ores, and if England allows them to be exported to this country a large part of the ore can be laid down in New York for less than \$5 per short ton unit for concentrates carrying 65 per cent  $WO_3$ , and reasonably free from tin and other harmful impurities."

Chinese ore can be mined for from \$1.25 to \$2 a short ton unit and can be laid down in New York for \$5 to \$6 a short ton unit.

Mr. Hess corroborates this statement also.

I think the fact of the great importation of Chinese ores during the present year, when the selling price has been from \$6 to \$7, is a good commentary on the cost there. On yesterday there was presented by Mr. McKenna to your committee a tabulation of the actual cost of tungsten wolframite in China, a detailed tabulated cost.

Senator THOMAS. Yes; I saw that.

Mr. GRIFFIN. I should like to amplify that with the letter of transmittal which went with it. It was a circular letter from Mitsui & Co. (Ltd.), Japanese importers, who practically control the importation of Chinese ores. I should like to read this letter.

Senator WATSON. That letter is from Mitsui & Co. (Ltd.)?

Mr. GRIFFIN. Yes, sir; and it is a circular letter sent out to their trade.

Senator WATSON. You may read it.

Mr. GRIFFIN. The letter is as follows:

Cable address for all offices: Mitsui.

Telephone Bowling Green 7520

MITSUI & CO. (LTD.),  
(MITSUI, BASSAN, KAISHA, (LTD.),

[Tokyo, Yokohama, Kobe, Osaka, Nagasaki, Moji, Nagoya, Kuchinotsu, Milke, Wakamatsu, Karatsu, Muroan, Sunagawa, Hakodate, Otaru, Falpeh, Tai'en, Canton, Hongkong, Shanghai, Newchwang, Chang Chun, Harbin, Vladivostok, Dalny, Tientsin, Cheloo, Hankow, Swatow, Airoy, Foochow, Tsingtau, Peking, Girin, Moukden, Seoul, Chemulpo, Antung, Kwanchintu, Bankok, Rangoon, Sourabaya, Semarang, Batavia, Calcutta, Sydney, Melbourne, London, Lyon, Marseille, Petrograd, Dallas, San Francisco, Portland, Seattle, Cancouer, Manila, Bombay, Singapore, Buenos Aires, etc.)

65 Broadway, New York, June 13, 1919.

TUNGSTEN WOLFRAMITE ORE.

GENTLEMEN: During the past month or two, we have frequently been keeping you informed as to the wolframite ore market both at New York and China, at the same time placing before you various offers as cabled by our Hongkong office. However, we regret to note these offers have not resulted in any business due to our presumably high quotations.

Generally speaking, we believe it safe to say that the ore market at the present time is in a settled state, and we understand business has successfully been closed on basis of \$8.75 short ton unit, 65 per cent guaranteed. While this price may appear somewhat too high at the present time, still it is our contention that wolframite ore purchased at present is cheap and circumstances permitting, orders should be placed.

As consumers as well as producers, we believe you undoubtedly may be interested in the attached statement conveying the exact cost of producing ore as arranged for our own reference by our Hongkong office. The inclosed statement will furnish you in detail with exact cost of material to our foreign offer exclusive of other incidental charges such as interest, transportation, and cable charges. These figures are, however, naturally subject to change in order to take care of any differences in exchange, ocean freight rates also provincial state taxes which are based on value of ore at time material is forwarded from interior to shipping port.

It may appear peculiar but can be safely guaranteed that the price of wolfram ore is purely compounded on actual cost of extracting the ore from the mines plus cartage and incidental duties and taxes for which China is distinctively noted, deriving most of its revenue from such sources.

Senator THOMAS. That must have been written before we passed our last revenue act.

Mr. GRIFFIN. Perhaps so.

Senator WATSON. You may finish reading the letter.

Mr. GRIFFIN. And the letter goes on to state:

In conclusion we believe as consumers, the inclosed statement will be of interest to you as indicative of \$7.20 per long ton unit Pacific Coast as being about minimum price at which wolframite ore can be produced at the cheapest market, namely, China.

We trust the inclosed information will be of service to you in determining your future operations.

Very truly yours,

JAM.MM.

METAL DEPARTMENT,  
Fumio Tone.

Tabulation of actual cost of tungsten wolframite ore in China.

Mining charges per picul.....	H\$10. 00
Kiansi-Nanyu taxes.....	2. 40
Kiansi-Nanyu forwarding charges.....	2. 50
Kiansi war expense and Nanyu local taxes.....	1. 40
Nanyu-Shoshu freight.....	1. 00
Shoshu eastern customs duty.....	. 15
Shushu Tarhei customs duty.....	1. 00
Hokko Maning bureau duty.....	1. 00
Finance bureau expenses.....	4. 37
Finance bureau customs duty.....	. 15
Rail freight to Canton.....	1. 15
Koshu-Canton.....	. 10
Canton export duty.....	2. 00
Canton-Hongkong freight.....	. 20
<b>Total charges per picul.....</b>	<b>H\$30. 42</b>
<b>Per ton, 20 cwt.....</b>	<b>H\$111. 056</b>
<b>Ex. at 80.....</b>	<b>G\$408. 85</b>
Ocean freight to Pacific.....	20 00
Packing and insurance.....	5. 00
	<b>G\$433. 85</b>

On basis 60 per cent at \$7.20 unit long ton. G\$ representing gold dollars, H\$ representing Hongkong dollars.

Mr. GRIFFIN. On basis 60 per cent at \$7.20 unit long ton is the equivalent of \$6.42 unit short ton. I have prepared a memorandum explaining the above data as follows:

Picul=13 $\frac{3}{4}$  pounds.

16.8 piculs=1 long ton.

Total charge, H\$30.42 per picul,  $\times 16.8 = H\$511.56$  per long ton.

Exchange at 80,  $511.056 \times 80 = \$408.85$  per long ton, at Chinese port.

On basis 60 per cent  $WO_3$  content=60 units long ton.

	Per unit long ton.	Per unit short ton.
408 85+60.....	\$0.81	\$6.08
Freight and packing, \$25 per ton, 25+60.....	.41	.36
<b>Total.....</b>	<b>7.22</b>	<b>6.44</b>

22.4 pounds  $WO_3 = 1$  unit long ton.

$7.22 \div 22.4 = 0.322$  per pound.

20 pounds  $WO_3 = 1$  unit short ton.

$0.322 \times 20 = 6.44$  per unit short ton.

	Per picul.	Percentage of cost per picul.	Per unit, long ton.	Per unit, short ton.
Mining.....	H\$10. 00	0.3267 $\times$ 6.81	\$2.24	\$2.00
Taxes.....	15. 57	.6115 $\times$ 6.81	3.48	3.11
Freight.....	4. 85	.1594 $\times$ 6.81	1.09	.97
<b>Total.....</b>	<b>30.42</b>		<b>6.81</b>	<b>6.08</b>

Mr. GRIFFIN. Mitsui & Co. offered this ore for sale at 6.75 per unit short ton. All this pretty definitely fixes the cost of Chinese ores.

That statement shows that the mining charge is only \$2 per short ton unit, the taxes are \$3.11 per short ton unit, and freight 97 cents, making a total of \$6.08 per short ton unit, in China.

Senator THOMAS. Is there any data in your possession of the character of this deposit; that is, as to its size, and the ease or difficulty of its development, or anything of that sort?

Mr. GRIFFIN. I had a report made on the China situation by Mr. F. W. Horton, that gives a good deal of information on the Chinese ore situation. I have the report here, and could read extracts from it if you wish, or can tell you in general what it contains.

Senator THOMAS. No; never mind. I assure that if this is a new discovery at the present is a surface working, and of course the cost of extraction would be very different from the cost involved in operations that have been developed some distance underground.

Mr. GRIFFIN. Oh, yes. It is a very large field, and not alone confined to the placers where thousands of Chinamen and their families flock. In one of these new discoveries they have very small claims, and pick it out, because there is nothing to do but shovel it and pick out the heavy pieces of ore—you can pick them out by the weight of the material, Senator. And they have to sell it for anything they can get. They have no money, and have to sell it. They will keep on producing that ore just as long as they can sell it.

Then there have been uncovered outcrops and disintegrated schist veins that have eroded and are soft; they can be worked without any drilling, without any tools other than the primitive shovel and pick. From the best information obtainable by the Geological Survey and by private sources, these deposits are of great extent.

The Burma deposits, which have been worked for a much longer time, are also on a low-production cost, about the same as China.

Senator THOMAS. On what?

Mr. GRIFFIN. On a low-production cost.

Senator THOMAS. Are they scientifically worked?

Mr. GRIFFIN. The most of them are placers; some are hydraulicked, but no machinery is employed in mining these Burma deposits, but some crude milling is done.

Senator THOMAS. What might be called quarry deposits?

Mr. GRIFFIN. Perhaps; that is, those outcrop deposits as differentiated from placer. The fact that they are easily worked without mills or other expensive equipment is the reason that they will keep on with production for a very long time.

Senator THOMAS. You have a similar deposit in Nevada that you have been working?

Mr. GRIFFIN. No; our mine is in California.

Senator THOMAS. Yes; in California.

Mr. GRIFFIN. No; the deposits are not similar; our deposits are lodes; the rock is hard, and must be milled and concentrated.

Senator THOMAS. I mean as to extent.

Mr. GRIFFIN. No, not nearly as expensive.

Senator THOMAS. Any deposits that admit of a "glory hole" is a pretty big deposit in the West.

Senator WATSON. What do you mean by a "glory hole"?

Senator THOMAS. It is a name given by miners to certain conditions in connection with mining.

Mr. GRIFFIN. Our deposit is comparatively large and easily mined, but the difference is that it is a lode, the ore is hard, and has to be milled, and contains only about three-tenths of 1 per cent, whereas the Chinaman——

Senator THOMAS. This has to be milled also.

Mr. GRIFFIN. Oh, no, sir; it does not have to be milled at all.

Senator THOMAS. That continues for only a matter of time?

Mr. GRIFFIN. The gold placer fields of California have lasted for a great many years.

Senator THOMAS. But the time came when they had to dredge from old river beds.

Mr. GRIFFIN. Yes, sir. I have been gold dredging for 20 years, and there is something like 15 years more of it. Referring to placer deposits, while you can definitely determine what their extent is, and they are limited in that way, still it may be a very large extent.

Mr. FRANKLIN. If I may interject some information on that point I would say that the Chinese tungsten ore deposits are about 300 miles in extent.

Senator THOMAS. Almost anybody could discover that kind of a deposit.

Mr. GRIFFIN. Yes.

Now, gentlemen of the committee, the competition we are facing is the Chinese competition, and competition of Burma and South America. There are about 1,200 to 1,500 tons of Bolivian ore that can compete strictly with China and Burma.

Senator THOMAS. It might comfort you gentlemen to know that there is a provision in our treaty of peace which is designed to produce strict uniformity of working conditions all over the world, and doubtless just as soon as they are established your difficulties and trials and tribulations will be over.

Senator WATSON. Oh, yes; they will all be over then. [Laughter on the part of those present.]

Mr. GRIFFIN. The production cost of the rest of the South American ores above this 1,200 to 1,500 tons is from \$9 to \$12 per unit; that is, the other ores have to be mined and concentrated and their cost will be just about the same as the American costs.

Senator HENDERSON. Does much Burma tungsten ore come to the United States?

Mr. GRIFFIN. Yes; but it did not come to the United States during the war time, because it is entirely an English possession and under British control, and during the war there was an embargo on the exportation of any ores from any of the British possessions. Great Britain fixed a price of about \$13 a unit and kept it there during the whole of the war period, and I think that is about the best evidence of control when our market was over double that during the time those restrictions were on.

Furthermore, the English control a good deal of the South American deposits, of the Bolivian deposits; the Peruvian and Argentine deposits are very largely still under German control.

Senator THOMAS. Were there not some tungsten-producing mines in Spain during the war?

Mr. GRIFFIN. Yes; a small amount; the production of ore in Europe has been pretty constant, and in the neighborhood of 1,500 tons a year, the most of it from Portugal. There is very little tungsten

mined in England, and there it is a by-product of the tin mines. There is a production of tungsten in Spain, and I can give you those figures if you want them.

Senator THOMAS. Oh, no.

Mr. GRIFFIN. The most of the production is in Portugal. Tungsten is a very widely distributed mineral; almost every country produces some, but the only large deposits are the Asiatic, South American, Portugal, and the United States.

Senator WATSON. Can you give the committee a table showing the amount of production in the different countries and the average cost of production in each country?

Mr. GRIFFIN. Yes, sir.

The United States Geological Survey has supplied me with the following as to the production of tungsten in 1918: United States produced 5,020 tons, Burma produced 5,500 tons, China produced 10,000 tons, Bolivia produced 4,500 tons.

The Geological Survey also reports that in this year, 1919, up to the 1st of October, imports of tungsten have been made into this country as follows: From Asia, 5,542 tons; from South America, 1,401 tons; and that a couple of weeks ago 450 tons of tungsten were sold at \$6 per unit in New York. Costs per unit: United States, \$13; Burma, \$2 to \$4; China, \$1.50 to \$2; South America, \$6 to \$7 for 1,500 tons; \$8 to \$9 for 4,000 tons.

Senator WATSON. You see that is the big thing for us to know—what is the difference in the cost of production at home and abroad, and what is the production in tonnage, and what is the cost of production, because the whole theory of a tariff is based on that difference.

Mr. GRIFFIN. Our large competition is from Asia. I think I have demonstrated that the bare operating cost in the large mines of California, Nevada, and Arizona are not less than \$13 per unit at the mine; freight from mines to New York, 75 cents per unit. The Colorado costs are higher. The proved Asiatic production costs, on the other hand, do not exceed \$2 per unit. After paying taxes, freight, brokerage, etc., the Asiatic tungsten ores can be and are to-day being sold in New York at \$6 a unit. This figure presumably carries a satisfactory profit to all the handlers of this foreign ore, as imports are arriving in New York at the rate of 47,250 units per month.

The Chinaman is a very keen trader, and the price of Chinese ore follows almost exactly the price of ore in New York. I mean by that that when the Asiatics were producing just as cheaply during the war as they are now, and when they were producing it at an actual mining cost of less than \$1.35 a unit, they were selling it here for \$25 a unit. Then their taxes over there increased to over \$15 a picul, but when the price broke here in 1919 their tax was reduced to \$2 a picul. There they regulate the taxes, including every squeeze that comes in the Chinese game, so as to approximate the price on our markets. But they will not continue to sell their tungsten ore at a low price if the mines in this country are not permitted to work; there is no question at all in my mind that the price of foreign ores will increase to probably just below our production cost or even up to our production cost.

Senator McCUMBER. I would like to ask right there for information as to whether we export any great quantity of hardened steel; and if so, what the effect of a raise of \$10 per unit would have in the matter of being able to export to foreign countries in competition

with those manufacturers who get their tungsten for from \$6 to \$7 per unit?

Mr. GRIFFIN. As a matter of fact, Senator, there is very little high-speed steel exported. At the time of the war England went just as we did very extensively into the refining of tungsten and the making of high-speed steel. I do not think that our exports of high-speed steel would ever be very much of a factor. Under the terms of this bill ore can be shipped here in bond, smelted in bond here for use in foreign countries, just as zinc ores can to-day.

Mr. FRANKLIN. And the same is done in the case of lead.

Mr. GRIFFIN. Yes. They can ship ore in here and smelt it and export it.

Senator McCUMBER. We do not export any material quantity of high-grade steel?

Mr. GRIFFIN. No, sir; we do not.

Senator WATSON. Senator Henderson, do you wish to ask any questions before we adjourn in order to go to the Senate at 11 o'clock?

Senator HENDERSON. No, sir.

Senator PHIPPS. Mr. Chairman, I think the witness can give you some information as to what percentage of tungsten alloys is required to manufacture a ton of high-grade tool steel, and what will \$10 additional cost per unit in tungsten mean in the finished product of tool steel. You have that worked out, haven't you?

Mr. GRIFFIN. Yes. I do not believe as a practical matter it would influence the price of high-speed steel at all, because I do not believe that they could continue to get the ore at anything like the present price if no tariff is put upon it.

Senator PHIPPS. That is not an answer to my question. You may have misunderstood me. I mean whatever may be the market price of tungsten per unit to-day, adding \$10 per unit to that price, how would it affect the price of the finished high-speed tool steel? That was stated in the hearings before the House Committee on Ways and Means, and as I recollect it was a very small figure, infinitesimal, on this question of its bearing on the duty asked here.

Mr. GRIFFIN. If you carry out the high-speed steel to the ultimate consumer—that is, to the man who buys the finished product—this \$10 duty would run out into so many decimals of a cent that you could not find it. The consumer of our product for high-speed steel would——

Senator McCUMBER (interposing). What percentage of tungsten is used in high-grade steel?

Mr. GRIFFIN. About 90 to 95 per cent of the tungsten is used in high-speed steel.

Senator McCUMBER. Do you mean that only 5 per cent of ordinary steel is used?

Senator THOMAS. Oh, no, Senator McCumber; he means that of the total product of tungsten, 95 per cent of it goes into the product of high-speed steel.

Senator McCUMBER. That is not what I mean. What percentage of a ton of steel is tungsten?

Mr. GRIFFIN. High-speed steels carry about 18 per cent to 20 per cent of tungsten.

Senator McCUMBER. Nearly one-fifth.

Mr. GRIFFIN. Yes; about one-fifth.

Of course, there are metallurgical losses. Every time you touch tungsten you have a loss—a smelting loss and slag losses, etc. There is about that proportion of tungsten in high-speed steel.

Senator THOMAS. Of course, that means that there need not be any material advance to the consumer in the case of tools made from high-speed steel, but it might afford a good basis for an extra profit; because, to illustrate, we had a trader in the early days in Colorado, and he is still living, who used to sell needles at 10 cents apiece, justifying his charge upon the ground that everything had to be freighted by bull teams from the Missouri River.

Mr. GRIFFIN. The first consumer of high-speed tool steel is the shop man who uses it to finish his other steel. Now, the very high service performed by high-speed steel, and the long life it has, means that the cost of that tool is small as figured into a pound of finished material. It is so infinitesimally small that it does not make any appreciable difference in the price of the finished steel to the ultimate consumer. But the point I would like to make, and which seems to me is the determining factor in the matter, is, that you are not going by this duty to do any injury, and if the duty is not placed on tungsten you are not going to keep on getting these cheap foreign ores. If our mines continue closed down the price of tungsten ore is bound to go up, and it will go up to just under the level of a price at which we can produce it. So that the consumer of high-speed steel is not going to get any benefit if no tariff is placed on this ore sufficient to protect us, and without such a tariff we would be ruined.

Senator THOMAS. Do not you think the consumers of this product will sooner or later get control of the sources of supply anyway?

Mr. GRIFFIN. I do not, because tungsten mining is a pretty highly speculative business, and one that takes a great deal of capital, and they do not want to put it into the business.

Senator THOMAS. They have it in it.

Mr. GRIFFIN. Very few of them. The high-speed steel manufacturer does not even want to make his own ferrotungsten. Some of them are equipped to refine tungsten ores so that they may not be entirely dependent on ferrotungsten manufacturers, but many of them will buy their ferrotungsten rather than refine it themselves. There is an exceptional hazard in the making of ferrotungsten, so that they would rather let the other fellow buy and carry the ore and do the making of it than do it themselves.

I think that the point we want to keep in mind is, that during the war England placed an embargo on all shipments of tungsten ore. The distribution of Asiatic ores is entirely controlled by Japan and England. And if we do have another occasion for using this ore in an emergency, we must be in a position to get it. If our mines close down—and you know what it means to close a mine down and scrap the machinery—they go to ruin. If a mine is going to be closed down for any length of time it can not easily be reopened. In fact, very many of the mines could not be reopened at all, and those that could be opened again would require a long time to get back into production.

There is no substitute that has as yet been found for tungsten, although experiments are being made, and they are at it constantly, and may get some substitute at any time, and if they do our mines would become worthless. However, tungsten was the key



war material, and without its production in this country our production of various kinds of finished steel products could not have been kept up. Our surface deposits of ore are all exhausted, and we are depending entirely on the mines, so that if our mines are abandoned and mills scrapped, we could not get back into production in time to meet an emergency.

The duty that we ask for will save this industry and also bring in a substantial revenue. It will not, as I see it, injure the consumer in any way, for if our production is stopped, or very greatly curtailed, foreign ores will rise in price to just under our production price without a duty. If the duty is on we will get to going and will have this industry, which certainly is a very important one both in war and peace.

Senator THOMAS. During our investigation of aviation last year we were told in Detroit by the engineering force of the Ford Motor Car Co. that while the duplication of the Mercedes engine used by the Germans in their airplanes was possible, yet it was impossible for them to duplicate the endurance and life of the Mercedes engine. In other words, the steel used by the Germans had an alloy that was superior to anything else, so that the life of the Mercedes engine, no matter how well duplicated in France or England, was very much longer when made by the Germans. Mr. Ford himself stated that he had instructed his engineers to ascertain, if they could, what the alloy was that the Germans used. Among their investigations they discovered that in 1912 the German exports of a metal called zirconium, which exists in large quantities in Brazil, and which had been exported to Germany in very small quantities up to that time, in 1913 and the first half of 1914, became prodigious. They therefore began experimenting on it.

Senator WATSON. That is the metal that you mean was imported into Germany from Brazil?

Senator THOMAS. Yes; and it was their conclusion that that was the material used as an alloy. These engineers were making experiments at that time with very great success and thought they would solve the problem; and it was thought that probably zirconium would take the place of the other metal.

Mr. GRIFFIN. Zirconium was called to our attention during the war, and we had a lot of samples just before the armistice was signed to try to find out whether it could be secured here. The Electro Metallurgical Co., at Niagara Falls, was experimenting. As I understand, it was expected that the properties of zirconium would so harden steel that half an inch would resist a projectile as much as some of our present heavy armor plate. But it was more as a resisting metal than as a substitute for tungsten in the quality of holding temper.

Mr. FRANKLIN. I think I can answer that question. I talked with Mr. Smith, the chief metallurgist of the Ford Motor Car Co., in May, in fact I had several conversations with him, and he told me that their experiments with zirconium were not successful.

Senator HENDERSON. Didn't they use it for tank steel in their tanks?

Mr. GRIFFIN. They did use it for tank steel, yes; and that was one of the great uses for which we were trying to develop it.

Senator WATSON. Mr. Griffin, have you finished your statement?

Mr. GRIFFIN. I think so.

Senator WATSON. What else do you wish to present?

Mr. GRIFFIN. I think we have no more witnesses except Mr. Clark, whose testimony will be short.

Senator WATSON. Then it is possible that he might make his statement and we can get through.

(Mr. Griffin furnished the committee with the following memorandum as an extension of his oral remarks:)

Mr. Franklin told the committee yesterday that since the hearing on this bill in the House some members of one branch of the manufacturers of the finished product had claimed that the differential provided in subdivision second of the first section of the bill was not fully compensatory. It has been fully explained to you gentlemen by Mr. Franklin and myself that the raw material—that is, the tungsten—ore is first mined and then concentrated so that it contains practically 60 per cent of tungstic trioxide ( $WO_3$ ). But the steps intervening between the ore and the steel, it seems to me, have not been set forth clearly. Now, there are three distinct processes in transferring the tungstic trioxide from the ore to the finished steel. First, the ore must be refined either by the electric furnace or chemical process and the tungstic trioxide content of the ore put into the form of ferrotungsten or tungsten powder. This involves a large loss. Second, the tungsten contained in the ferrotungsten or tungsten powder must be introduced into steel to make the alloy steels by another process, either crucible or electric furnace, with slag and other large losses. Third, the steel ingot must then be hammered and ground, causing scale loss and grinding loss. Also much of the steel is rejected through flaws and has to be remelted. Every time tungsten is handled there is a loss. It would seem, therefore, that high-speed steel and alloy steels are entitled to a greater compensation than a rate which is determined to be fair for the other products.

Testimony was given before the committee in support of the rate of \$1 per pound for the contained tungsten in ferrotungsten as being compensatory, or, in other words, a rate of 1 cent per pound of ferrotungsten for each per cent of tungsten contained therein. I am informed that the manufacturers of tool steel maintain that, in order to afford a proper compensation as far as their industry is concerned, a rate of  $1\frac{1}{2}$  cents per pound of steel for each per cent or fraction thereof of tungsten contained in tungsten alloy steel or high-speed steel should be inserted in place of the rate on those products provided in the bill. Tungsten enters into alloy steels in percentages ranging from 3 to 18 per cent. I am giving this supplemental statement so that the committee will have complete information as to the position of the different branches of the industry when considering this feature of the bill.

**STATEMENT OF MR. A. J. CLARK, PRESIDENT OF THE STANDARD TUNGSTEN CO., OF BISHOP, CALIF., AND PRESIDENT OF THE TUNGSTEN REEF MINES CO., OF HEREFORD, ARIZ.; RESIDENCE, LOS ANGELES, CALIF.**

Mr. CLARK. I was one of the pioneers in the development of large low-grade tungsten deposits at Bishop, Calif. Our cost at Bishop, without considering depreciation or depletion, was \$13.82 per unit.

The costs were high on account of expensive changes made at the mill in the experimental period. We milled 44,000 tons and produced 202 tons of tungsten concentrate, averaging 62 per cent tungstic trioxide, or 12,544 units. This is equivalent to a saving of less than three-tenths of 1 per cent  $WO_3$ . The operating cost was \$3.93 per ton of ore, or \$13.82 per unit.

The Tungsten Reef Mines Co., in Arizona, I acquired in May, 1918. This is one of the largest tonnage properties in the country. It is equipped with a small mill and shows a recovery of about one-half of 1 per cent. I have the machinery for a 250-ton mill on the ground, but did not erect it as the tungsten market went to pieces at the time of the armistice.

A recovery of one-half of 1 per cent on an estimated tonnage of 6,000 tons per month, which the mine can easily furnish, would produce 10 pounds of  $WO_3$  per ton, or 60,000 pounds a month, or 3,000 units. With this new mill the cost of mining and milling will be \$5.50 per ton, or \$33,000 per month, or \$11 per unit.

Senator WATSON. I understand, gentlemen, that this will conclude the hearing before the subcommittee.

It is understood that each of the witnesses will have the right to extend his remarks.

The committee will now stand adjourned.

(The statements furnished by the witness are here printed in full in the record, as follows:)

*Mining and milling costs at the Pine Creek tungsten mine, from Dec. 12, 1918, to Feb. 9, 1919.*

Total number tons milled, 4,371.

	Total cost.	Cost per ton.		Total cost.	Cost per ton.
Ore breaking.....	\$4,764.29	\$1.090	Water supply.....	196.69	\$0.045
Development.....	1,792.11	.410	Marketing product (estimate).....	743.07	.170
Tramming.....	1,639.12	.375	Mess house (loss).....	218.55	.049
Timbering.....	174.84	.040	Truck maintenance.....	240.40	.055
Milling.....	4,414.71	1.010	Engineering, maps, plans.....	388.64	.088
Mill maintenance.....	1,180.17	.270	General expense <sup>1</sup> .....	2,666.31	.630
Mine equipment.....	546.37	.125			
Surface improvements.....	1,005.33	.230	Cost of milling one ton crude ore.....		4.808
Taxes, insurance.....	1,005.33	.230			

<sup>1</sup> General expense include: office, manager's salary, sampling, assaying, fuel, telephone, postage, telegrams, entertainment, and charity.

Per cent  $WO_3$ .

Average assay of ore milled..... 0.613

Average loss in milling..... .216

Recovered  $WO_3$ ..... .397

0.397 per cent  $WO_3=7.94$  pounds  $WO_3$ , which cost \$4.808; therefore 1 pound cost \$0.6055, or for 20 pounds, or one unit, the cost is \$12.11.

COOPER SHAPLEY,  
Manager Pine Creek Tungsten Co.

UNITED STATES OF AMERICA,  
EASTERN DISTRICT OF PENNSYLVANIA, } ss:  
City and County of Philadelphia,

Cooper Shapley, above named, being duly sworn according to law, deposes and says that he is the general manager of the Pine Creek Tungsten Co., and that the foregoing statement of mining and milling costs is correct and true to the best of his knowledge and belief.

COOPER SHAPLEY.

Sworn to and subscribed before me this 7th day of November, A. D. 1919.

[SEAL.]

FRANK B. STOCKLEY,  
Notary Public.

*Mining and milling costs at the Round Valley Tungsten mine, 1918.*

(Total number of tons milled during 1918, 31,678.)

	Total cost.	Cost per ton.		Total cost.	Cost per ton.
Ore breaking.....	\$22,420.18	\$0.709	Water supply.....	\$1,267.12	\$0.040
Development.....	16,556.10	.523	Marketing product.....	5,385.26	.170
Tramming.....	5,910.51	.185	Mess-house expense (loss)....	1,267.12	.040
Prospecting.....	875.43	.028	Auto maintenance.....	1,423.51	.045
Timbering.....	280.63	.008	Engineering, maps, and plans.....	2,217.46	.070
Milling.....	31,200.30	.985	General expense <sup>1</sup> .....	16,630.95	.525
Mill maintenance.....	13,929.95	.439			
Mine equipment.....	3,767.76	.118	Cost of milling 1 ton crude ore.....		4.242
Surface improvements.....	6,251.88	.197			
Taxes, insurance.....	4,679.50	.160			

<sup>1</sup> General expense includes office, manager's salary, sampling, assaying, postage, telegrams, fuel, entertainment, charity, and telephone.

Per cent  $WO_3$ .

Average assay of ore milled..... 0.395  
Average loss in milling..... .0936  
Recovered  $WO_3$ ..... .301

\$0.301 per cent  $WO_3=6.02$  pounds  $WO_3$ , which cost \$4.242; therefore 1 pound costs \$0.7043, or for 20 pounds, or one unit, the cost is \$14.09.

COOPER SHAPLEY,  
General Manager Round Valley Tungsten Co.

UNITED STATES OF AMERICA,  
EASTERN DISTRICT OF PENNSYLVANIA, } ss:  
City and county of Philadelphia,

Cooper Shapley, above named, being duly sworn according to law, deposes and says that he is the general manager of the Round Valley Tungsten Co., and that the foregoing statement of mining and milling costs is correct and true to the best of his knowledge and belief.

COOPER SHAPLEY.

Sworn to and subscribed before me this 7th day of November, A. D. 1919.

[SEAL.]

FRANK B. STOCKLEY,  
Notary Public.

*Schedule of cost 1917 and 1918, Standard Tungsten Co.*

Ore mined..... tons.. 44,000  
Scheelite produced..... units... 12,544  
Average assay..... per cent  $WO_3$ .. 62  
Tons..... 202

## Labor and superintendence:

	Amount.	Per unit.
Materials, supplies, power, and repairs.....	\$137,770.06	\$10.991
Mine office expense.....	2,283.69	.182
Miscellaneous.....	3,159.71	.252
Insurance, F., and L.....	4,186.84	.334
Taxes.....	303.13	.024
Interest paid.....	6,693.10	.533
Marketing product.....	4,797.36	.382
General office.....	14,075.00	1.122
<b>Total.....</b>	<b>173,268.89</b>	<b>13.82</b>

STANDARD TUNGSTEN CO.,  
By A. J. CLARK, President.

*Production and costs, 1918, Tungsten Mines Co, Bishop, Calif.*

Tons of ore milled.....	71,125
Tons of concentrates produced.....	337.5
Average percentage WO <sub>3</sub> content.....	62.044
Number of units produced.....	20.930
Operating costs.....	\$223,796.37
Overhead costs.....	44,867.72
<b>Total.....</b>	<b>268,664.09</b>

	Average per ton of ore milled.	Average per unit of WO <sub>3</sub> .
Operating costs.....	\$3.14	\$10.69
Overhead costs.....	.63	2.14
<b>Total.....</b>	<b>3.77</b>	<b>12.83</b>

*Production and costs, 1918, Tungsten Mines Co.*

## PRODUCTION.

	Ore milled (tons).	Concentrates produced per ton of ore (pounds).	Concentrates produced. (pounds).	Mine assays (per cent WO <sub>3</sub> ).	Extractions (per cent).
January.....	5,843	12.5	73,400	62.15	64.00
February.....	5,289	14.2	72,300	61.70	62.70
March.....	5,765	12.5	72,000	63.59	71.00
April.....	5,418	10.9	59,300	59.11	70.63
May.....	5,929	10.1	60,300	63.80	64.37
June.....	5,818	8.8	51,500	60.60	65.90
July.....	6,356	8.2	52,300	62.60	62.93
August.....	6,580	6.8	45,100	62.28	58.49
September.....	5,470	8.8	48,200	63.79	60.43
October.....	5,500	8.8	48,500	61.70	59.11
November.....	6,165	7.0	43,300	60.16	61.07
December.....	6,992	6.9	48,500	61.30	61.09
<b>Total.....</b>	<b>71,125</b>	<b>10.5</b>	<b>674,700</b>	<b>61.80</b>	<b>.....</b>

† Average.

## COST.

<b>Bishop direct:</b>	
Labor.....	\$133,224.54
Supplies.....	64,183.58
Light and power.....	12,841.90
Workmen's compensation insurance.....	6,534.59
Fire insurance.....	2,895.52
Taxes on property.....	1,691.42
Property surveys.....	215.00
Hospital service.....	300.00
Water assessments.....	112.00
Traveling expense.....	1,707.82
	<u>\$223,796.37</u>
<b>San Francisco office:</b>	
Interest paid on notes.....	7,321.83
Interest paid on bond issue.....	18,061.10
United States tax on bond interest.....	99.20
General overhead, salaries, rent, legal, and general expenses of administration..	18,205.32
Office expense, miscellaneous.....	1,180.27
	<u>44,807.72</u>
<b>Total.....</b>	<b>268,604.09</b>

NOTE.—Depreciation and depletion excluded.

I hereby certify that the foregoing statement represents the actual production of tungsten ore mined, milled, and concentrated during the year 1918 by the undersigned corporation and the actual cost thereof in accordance with reports and data on file in this office.

TUNGSTEN MINES CO.,  
By R. A. ORRETT, *Secretary.*

SAN FRANCISCO, CALIF., *October 27, 1919.*

*Capital invested and operating cost per ton, Pacific Tungsten Co.*

<b>Investments:</b>	
Purchase of properties.....	} \$312,300.00
Purchase of three-fourths interest in property.....	
Mill construction and equipment.....	\$138,675.46
Power line construction.....	32,245.59
Railroad construction.....	11,814.40
Railroad equipment.....	8,341.60
Water system pipe line.....	3,756.25
Mine equipment.....	18,373.69
Machinery, plant, and buildings.....	57,993.02
	<u>271,200.01</u>
<b>Total.....</b>	<b>583,500.01</b>

**Details of costs of mining and milling aggregating \$12.80 per ton of ore:**

Labor.....	5.96
Compensatory insurance.....	.31
Explosives.....	.30
Timber.....	.29
Tools.....	.12
Repairs.....	.52
Power.....	.83
Pumping.....	.51
Transport and tramway.....	.61
Freight and hauling.....	.91
Mill supplies.....	.93
General supplies.....	1.31
Office expenses.....	.20
	<u>12.80</u>
<b>Total.....</b>	<b>12.80</b>

This statement was compiled by me from the books of the Pacific Tungsten Co.  
FRANK W. GRIFFIN.

*Atolia Mining Co., 1918.*

Ore milled, 28,070.687 tons; average, 3.3775 per cent WO<sub>3</sub>.  
 Concentrate produced, 1,079 tons.  
 Units produced, 66,644.0515.

## Costs:

Mining.....	\$248,539.75
Milling.....	154,620.62
Boarding house loss.....	6,251.32
Direct overhead.....	66,165.62
Indirect overhead.....	2,091.65
Taxes and insurance.....	59,775.96
San Francisco office expenses.....	15,950.15
Legal, contingent, interest, laboratory, etc.....	5,926.24

	Total.	Per unit.
Total normal operating expenses.....	\$559,321.11	\$8.393
Marketing expense, including freight.....	31,774.15	.517
<b>Total.....</b>	<b>591,095.26</b>	<b>8.91</b>

No depreciation nor depletion is included in the above figures.

I have examined the books of the Atolia Mining Co. and certify that the above statement of cost is in accord therewith.

FRANK W. GRIFFIN.

(Thereupon at 10.55 o'clock a. m. the subcommittee adjourned.)

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