Recent Coal Preparation in Japan and U.S.A.

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Gentlemen:

I consider it a privilege to be invited to appear in company with the distinguished coal technologists who are addressing you today on several phases of the general subject of coal preparation. The Fuel Society of Japan is to be congratulated for devoting an entire session to this topic, which is perhaps even more important in Japan, under prevailing conditions of economics and natural resources, than it is in the United States.

In the United States, coal preparation is considered to embrace all processes to which coal is subjected from pit mouth to consumer purchase. The subject is usually subdivided into: 1) Sizing (including crushing and dedusting); 2) removal of impurities (including drying); 3) surface treatment; and 4) mixing and blending. Carbonization and briquetting are sometimes, but not usually, included. My impression is that coal preparation in Japan is largely limited to sizing and cleaning processes. Relatively little attention is given to mixing and blending, and I do not believe that any surface treatments are applied. The emphasis is placed on coal cleaning to the extent that the terms preparation and cleaning seem to be nearly synonymous.

In my remarks I intend to cover recent trends in American mechanical cleaning, generally rather than in detail, following which I wish to discuss a number of specific points in which practices in our two countries differ.

Trends in mechanical cleaning in the United States.

The intensity of mechanical cleaning in the United States is increasing, although it is probably still much less than that in Japan. Latest available figures (1949) indicate that 35 percent of all American coal is mechanically cleaned, with an average recovery of 83 percent. Considering only mines with cleaning plants, 71 percent of production is mechanically cleaned, 29 percent being either handpicked or shipped without cleaning. The increase in mechanically cleaned coal has followed closely the increase in mechanically loaded coal, as is shown by figure 1 (note that figure 1 is drawn to a logarithmic scale on the vertical axis). Mechanical loading is highly desirable from the standpoint of saving of labor, but as it is less selective in coal quality than hand loading, it has emphasized the need for mechanical cleaning. Other factors tending toward increases in mechanical cleaning are 1) depletion of some of the better coals and consequent exploitation of lower grade coals; 2) decreased demand for sizes that are easily hand-picked; and 3) increased demand for uniformity in coal. Table 1 indicates that jigs continue to be the outstanding cleaning device for bituminous coal, in terms
TABLE 1

<table>
<thead>
<tr>
<th></th>
<th>1949</th>
<th>1946</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jigs</td>
<td>47.1</td>
<td>46.7</td>
</tr>
<tr>
<td>Dense-Media</td>
<td>11.6</td>
<td>10.2</td>
</tr>
<tr>
<td>Classifiers</td>
<td>9.7</td>
<td>10.0</td>
</tr>
<tr>
<td>Launderers</td>
<td>7.3</td>
<td>11.6</td>
</tr>
<tr>
<td>Tables</td>
<td>2.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Jigs and Tables</td>
<td>2.2</td>
<td>2.7</td>
</tr>
<tr>
<td>Other</td>
<td>11.1</td>
<td>5.8</td>
</tr>
<tr>
<td>Wet Methods, Combinations Total</td>
<td>91.6</td>
<td>88.0</td>
</tr>
<tr>
<td>Dry Methods</td>
<td>8.4</td>
<td>12.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

of tons treated. Over half of the bituminous coal cleaned was handled by jigs, when combinations are considered; and about three-quarters of the jig tonnage was cleaned by air-actuated (Baumtype) units. Comparable data for the mechanical cleaning of anthracite are not at hand; however, total production of anthracite is less than 10 percent of that of bituminous coal.

Dense media processes are those using liquids of high specific gravity as the means of separation either true liquids, as calcium chloride, or pseudo liquids, as sand, magnetite, or other solid in a finely divided state in water. The dense media processes are characterized by inherently good efficiency, but they are limited to sizes larger than about 6 mm and they do not usually produce a middling product. Calcium chloride and sand washers have been used for many years with good success, but the use of very finely divided (less than 100 mesh) solids as a media has until recently been difficult because of the problem of media cleaning and densifying in closed circuit. This problem has now been solved by magnetic means, patented and available under a royalty arrangement of one cent per cleaned ton. Several large plants employing this principle have recently been erected, and future data will probably show increased tonnage handled by dense media processes.

Very satisfactory experimentation has been conducted in the past few years on the use of crushed middlings as dense-media suspensions in standard jigs, operated with strong suction. Difficult washing problems are reported to have been handled with good efficiencies and without the extensive auxiliary equipment now required by the magnetic process. If further experience proves that the theoretical advantages of a dense media can be combined with the reliability and simplicity of a jig, a real advance will have been made.

Classifiers and launders are usually used for coals that are easily washed, while tables are used largely for especially thorough cleaning of minus 6-mm coal usually for coking. Dry methods have been given considerable attention in the past, but as is shown by table 1 and figure 2 they have been losing ground in recent years to wet methods. Several reasons account for this, in my opinion: (1) from theoretical considerations, water in superior to air as a separating fluid operating on density differences, just as dense liquids (or suspensions) are superior to water; (2) dry methods, requiring dry feed, are handicapped by the growing tendency to use water underground during mining; (3) dry methods are much more sensitive to changes in rate, size, quality, or moisture content of feed than are wet methods; and (4) no satisfactory automatic control methods have been developed.

One of the most interesting and potentially useful dev-
elopments of the last few years is the wet cyclone, one use of which was described by Mr. Aso this morning. By using forces stronger than gravitational for fine particle settling, new possibilities have become evident for fine coal cleaning, slurry densification, and water clarification. Laws regulating the dumping of washery waste water into streams are becoming much more strict, and wet cyclones have already been used, with other equipment, for eliminating all dumping of waste water by closing the plant water circuit.

Froth flotation processes are now treating a negligible tonnage of coal in the United States. On a percentage basis and perhaps even on a tonnage basis, more coal is being treated by froth flotation in Japan than in the United States. However, certain processes are under plant-scale development and trial to handle sizes as large as 8 or 10 mesh. Coal of this size is much more easily dewatered than is coal of the conventional 40-mesh size. The reagent used in the new processes is mainly a cheap kerosene. If these processes prove to be generally satisfactory, a steadily increasing tonnage will probably be treated by froth flotation.

In coal cleaning theory, the old problem of a satisfactory measure of efficiency is receiving renewed attention. Dr. Yancey, who studied coal preparation in Japan last year, presented a summary of efficiency measures at the International Conference on Coal Preparation in Paris last July, and several other papers have appeared recently. The French Government has prepared a particularly thorough study of the Problem.

*Points in which Japanese and American coal preparation practice differ*

Hoping that it will be of interest, I should like to turn now to a brief listing of specific points in which Japanese and American practice differ. If there are points of Japanese practice that I misunderstand, I hope you will correct me.

1. In the United States, coal is invariably sold by weight. Standard equipment at every mine served by a railroad includes track scales, over which every loaded car passes. Even at the smallest mines, without railroad connections, loaded trucks or wagons are weighed on the nearest city scales. In Japan, I observe that practically all coal is sold by volume, estimated by eye. As far as I know, no Japanese coal mine is equipped with track scales. My understanding of Japanese practice is that each of the several types of railroad cars has a rated capacity, in tons, and that each mine is more or less on its honor so to load its various sizes and grades of coal as to produce the rated load. I am told that during the days of the Coal Kodan extensive studies were made to develop for each mine in the country, for each of its normally produced coal a height and profile of loading that would suit each type of railroad car. Gaging sticks with built-in levels were distributed for use by especially trustworthy employees at the loading points, but I doubt if the sticks were much used. I understand that no coal is weighed except for an occasional random car that looks overweight to the railroad and is weighed at a railroad junction point to be sure that there is no overload on the car. A few of the large coal-consuming plants weigh the cars delivered to them for their internal records, but payments to the coal companies are always made on the basis of rated loads.

This custom is country-wide and apparently satisfactory, but it seems to me to be a virtual impossibility to maintain entire equity among producer, railroad, and consumer. An overloaded car penalizes the producer and the railroad, favoring the consumer, while an underloaded car does the reverse. There appears to be no way even of checking the work of the employee at the loading point, as the profile of a loaded car settle to indeterminate but significant extents as the car is switched and hauled. Furthermore, the quality of loaded coal is always undergoing slight modifications, as equipment wears or is temporarily removed from the circuit for repairs or as plant practice is modified. I do not see how the most elaborate volume system could compensate for these customary ch-
anges.

The Kodan sponsored the manufacture of a limited number of smell “one-pair-of-wheels-at-a-time” track scales, but I have never been a unit installed. They are probably discouragingly slow in use, and or doubt that they would be very accurate.

(2) Efforts to remove moisture from coal are relatively more intense in the United States than in Japan. Vibrating screens for dewatering slack sizes are standard American practice, and many plants also use centrifugal driers. Even heat drying — a relatively expensive operation — is becoming more popular. Reasons for this emphasis on dewatering may be two-fold: 1) The American coal industry has chronic overcapacity and nearly always is selling coal to buyers who are critical and do not favor buying any more water at coal prices than possible; and 2) the American coal mine sells coal by weight at the mine.

What has this latter point to do with dewatering? I shall try to explain my view.

Dewatering costs money, and a coal company nor really endeavors to reduce its costs to every possible extent, while maintaining sales. Extra weight in the form of water is not likely to have any effect on the bulk volume of coal as loaded, and in Japan no checking by weight is done, if at all, until the car reaches a main railroad junction, by which time drainage of water may be satisfactorily complete. Thus, by present Japanese practice, the railroad car acts as a dewatering machine for the coal company. Meanwhile the car had been overloaded, the railroad has borne the expense of hauling unrecorded water, road-beds have suffered from dripping water, and, in the colder areas, freezing may have begun. However, the customer receives coal that is essentially dewatered (if we overlook unavoidable snow or rain), at no expense to the coal company. The incentive for dewatering at the mine seems to lie principally with the railroad. The companies are moving toward improved dewatering practice, and the Hokkaido Coal Association is studying the entire problem, but as long as coal is sold by volume, with no favorable freight tariff established for dewatered coal, action will probably not be very fast.

(3) The American market is much more critical of sizing than is the Japanese market. This American custom leads to many complications in the preparation plant and results in considerably more attention to sizing than in Japan. Most students of coal agree that the large variety of special sizes in the United States is unnecessary and should be discouraged, but the custom persists. It is perhaps due in part to relatively more American coal going to domestic users, who judge by appearance, and relatively less to industrial users, who are more inclined to judge by analysis. Table 2 presents the data.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Japan (percent)</th>
<th>United States (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic and retail, including occupation used in Japan</td>
<td>8.2</td>
<td>20.1</td>
</tr>
<tr>
<td>Railroads</td>
<td>22.0</td>
<td>19.5</td>
</tr>
<tr>
<td>Electric power</td>
<td>7.6</td>
<td>18.0</td>
</tr>
<tr>
<td>Iron and Steel industry, including coking uses</td>
<td>17.4</td>
<td>22.0</td>
</tr>
<tr>
<td>Export</td>
<td>2.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Other industrial, mine use, and miscellaneous</td>
<td>42.5</td>
<td>23.8</td>
</tr>
<tr>
<td></td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

For whatever reason, sizing is regarded as an important process in the United States, and screens have been well studied. Sizing units vary widely, but general practice includes overhead-supported shaker screens for primary screening at larger sizes and tonnages, and vibrating screens for smaller
sizes and tonnages and for dewatering. Trommels and "zimmea" screens are relatively uncommon in the United States, although they are standard practice in Japan. I never saw or heard of a roller screen until I came to Japan.

The multiplicity of sizes in the American coal market and the fact that much of the critically-minded domestic market demand is for small closely-screened sizes have led to troublesome marketing complications. Special crushing, careful screening, special binning, and recombining of sizes to maintain uniformity of size distribution are often resorted to, but at all times a coal company maintain a balance between what its plant can produce and what the sales department can sell. Hence the closest of cooperation between the production and sales departments is vitally necessary. The interesting result is that a technically unnecessary feature — undue complexity of sizing — has led to a desirable feature — close cooperation between preparation plant and sales managements.

(4) Extensive efforts are made in the United States to reduce the dust nuisance incidental to handling coal, especially for the domestic market. In addition to careful screening, these efforts now include surface treatments, by which is meant the systematic application of a liquid of a solid to the surfaces of pieces of coal. The usual purpose of surface treatment is the control of dust, although other intended purposes sometimes include coal identification, modification of burning or coking characteristics or ash behavior, and freeze-proofing.

Years ago surface treatment was confined to water sprinkling, but at present oil is used almost exclusively and nearly all coal sold for domestic use is so treated. The oil is sprayed either hot or cold on the coal, in amounts and by methods that are adapted to kind and size of coal and desired results. Other methods of surface treatment to reduce dust include the use of wetting agents to improve water effectiveness and of calcium chloride to attract and retain moisture on coal. Practically every American mine that sells domestic coal has facilities for surface treatment, which is now usually recognized as a major subdivision of the general field of coal preparation.

Identification of coal is regularly done by a few large coal companies, by applying a distinctive color to enough coal to show clearly when distributed in normal piles. Surface treatment of this sort is thus a form of advertising.

Modifications of burning or caking characteristics by the application of chemicals have often been claimed, but scientific inquiry has no confirmed any economically useful result from any chemicals so far tried. However, ash behavior may sometimes be modified by controlled additions of sand, limestone, or other material that affects ash fusion temperature.

Freezing may be reduced application of calcium chloride or other salt, and this practice is fairly common in the United States. In less severe cases, oil treatment will also tend to reduce freezing.

(5) Practically all coal cleaning problems in the United States are discussed in terms of "difficulty" curves, and almost no washability data are prepared without them. I have not observed such curves in use in Japan, although they seem to me to be very useful in evaluating probable results.

(6) Heavy emphasis in American practice is laid on uniformity of plant output. Industrial users, power plant engineers, and coke oven men all agree that a coal of low but irregular ash content is less satisfactory than a coal of uniform quality and higher ash content. The purpose of coal preparation is generally regarded as being almost as much to obtain uniformity as it is to obtain higher quality. Figure 3 illustrates at a glance what is meant.

Efforts to maintain uniformity in plant output may be classified into three types: (1) prevention
of segregation in the handling processes; (2) close and intelligent control of the mechanical cleaning processes; and (3) proper design, operation, and maintenance of equipment to avoid overloads.

Segregation is insidious and must constantly be guarded against. It has no good measure but eyesight and no cure but common sense. Whenever moving coal changes direction, segregation of sizes sets in. Plant men are well aware of the tendency of the last coal from a bin to be larger than average. Care must be taken that cleaning equipment is not fed one-sidedly so that coarse coal tends to one side only. Baffles, spiral-lowering chutes, and other devices are often useful to reduce segregation, each problem being considered separately.

Much attention is given in the United States to control of the cleaning units. The preparation plant laboratory in the better cleaning plants is considered to have both a recording and a controlling function. I believe that in Japan the laboratory usually serves only a recording function, often on samples that are, I must say, inadequate. One shovelful per shift is not uncommon, and the time interval from sampling to final report may be several days or a week. For a laboratory to serve a control function, results of a sample must be back to the cleaning plant operator not longer than 60 minutes after sampling preferably less. This cannot be done by standard analytical methods, of course, but for control purposes short cuts may be made gravimetrically. By whatever means, the operator of a modern American cleaning unit receives prompt and frequent information as to the quality of coal being produced. Typical practice is hourly sampling.

The third means of maintaining uniformity is the prevention of overloads. Screening and cleaning units only do consistent work if they are operated within their design capacities, without surges of heavy feed. Good equipment has considerable flexibility, but efforts to minimize overloads always help in maintaining uniformity of results.

(7) In the United States coal preparation equipment manufacturers assume a substantial share of the responsibility for the performance of units of their manufacture. They maintain good inventories of spare parts, and they are usually anxious to assist in case of difficulty. By so doing, they become familiar with preparation plant needs, and they are constantly remodeling and improving the equipment they offer for sale in an endeavor to sell more units. They maintain contacts with research work in coal technology, and they are in position to judge when a new development is actually adapted to plant needs. They usually engage in cooperative studies with companies in experimenting with plant-scale equipment of new or modified design, and they sometimes do pilot-plant work themselves.

I am very pleased to note representatives of two equipment companies on today’s program, indicative of a healthy interest in coal preparation problems by these companies. I strongly believe that active interest by the manufacturers is good business for both them and the coal industry.

(8) My last point is not easy to explain, but I think that it is a clear point of distinction between Japanese and American coal technology. An American coal organization regards good man as its most valuable asset. It believes that good men are essential in responsible technical and managerial position; and whenever a vacancy exists in such a position, an American organization tries to fill it with the best possible man, preferably but not necessarily from the organization’s existing staff. Hence, experienced American engineers with good professional records are almost always in demand. When an American engineer is invited to accept, and does accept, a new position of increased responsibility in another organization (assuming that the proper ethics of protecting his former organization have been respected), he grows in professional respect in the eyes of others of his specialty. My understanding is that this is not true in Japan. A Japanese coal organization practically always fills a vacancy from within its own personnel and by seniority, I am told. A Japanese engineer
cannot consider accepting a position in another company, no matter how favorable the opportunity or how unfavorable his situation in his present company, without risking loss of the respect of others of his profession. In my opinion this custom, simple though it seems, will always be a bar to real leadership in Japanese technology. It prevents the companies from getting the best men; it prevents good men from being offered opportunities for advancement as a reward for meritorious work; and it prevents the coal industry from the extra measure of effort good men would make if they had adequate incentive.

In my remarks I have tried to cover briefly recent developments in American coal preparation, avoiding technical details because they are better studied in the literature. I have extended my remarks to cover specific points of difference in accepted practices in our two countries, as I have found in my 10½ months in Japan that many of these points are of particular interest to Japanese engineers. Some of them, like track scales, are so thoroughly accepted in the United States that they are almost never mentioned. Others, like technical personnel employment practices, are not equipment at all, but nevertheless they have important influences on plant practice. If any of my remarks have proved of interest to you, I shall feel that this, my last formal address before a Japanese technical organization, will have been worth delivering.

日本及び米国における最近の選炭

—昭和25年5月日燃料協会選炭特別講演会講演—

総司令部天然資源局

チョールス・シー・ポレイ

摘 要

米国において Coal preparation といえば、炭礦の坑口から消費者の購入に至るまでに、石炭の受けるすべての処置を含むので、（1）粒度の調整（粉砕と粉末除去を含む）、（2）不純物の除去（乾燥を含む）、（3）表面処理、（4）混合と配合、に分けられており、ときには乾燥と成型を含めることができる。

日本における Coal preparation は殆ど粒度調整と不純物除去に限られており、表面処理は全く行われておらずまた混合及び配合についてもあまり考慮されていない。

米国における機械選炭の傾向——米国における機械選炭は日本に較べれば古いが次第に増加しつつある。1949年は米国全出炭量の 35% が機械選炭にかかれており、平均収率は 83% である。選炭設備を持つ農耕地の農地のみについて見ると出炭 71% が機械的に選炭され、29%が手選または未選のまま選炭されている。

装置の機械選炭について選炭機の型式別各々の処理効数の割合を示せば次の表のようなである。

<table>
<thead>
<tr>
<th>選炭機</th>
<th>1949年</th>
<th>1945年</th>
</tr>
</thead>
<tbody>
<tr>
<td>ジグ</td>
<td>47.1%</td>
<td>46.7%</td>
</tr>
<tr>
<td>重液</td>
<td>11.6</td>
<td>10.2</td>
</tr>
<tr>
<td>分斜機</td>
<td>9.7</td>
<td>10.0</td>
</tr>
<tr>
<td>槽式</td>
<td>7.3</td>
<td>11.6</td>
</tr>
<tr>
<td>テープル</td>
<td>2.6</td>
<td>1.0</td>
</tr>
<tr>
<td>ジグとテーブル</td>
<td>2.2</td>
<td>2.7</td>
</tr>
<tr>
<td>其他</td>
<td>11.1</td>
<td>5.8</td>
</tr>
</tbody>
</table>
温式計 91.6 88.0
乾式計 8.4 12.0
合 計 100.0 100.0

（来館者の報告 第 7591 号より）

すなわち温式計の約半分がソクによって処理されている。そしてソク処理炭酸の4/5はパウム式によって処理されている。

蒸気蒸発の管路は塩化カルシウム溶液でもまたは微量の水で、磁鉄柵または他の物体を液中に浸漬したものでもよい。石炭の粒度は6mm 以上を制限する。塩化カルシウム溶液によるもの及び微量の水を蒸発したものを用いる。蒸気蒸発はすべてに長年の間非常にうまく行っている。しかし塩化鉄末（100 メッシュ以下）にした固形を使用した蒸気は最近まで困難があった。それは蒸気を澄清することと混練することとに問題があったからである。最近これにより磁鉄法によって解決された磁力法は特許となっているもので精炭 1 吨当 1 セントの特許使用料を支払えば使用できる。蒸気蒸発は将来発展をみるであろう。

ソクに蒸気を用いることがここ数年試験され、非常に満足な結果をえた。これは二号炭を粉砕して蒸気の媒質としたもので、サクションを強く行うようになった。

分級液と硫化水素蒸発は蒸気し易い炭種に使用する。テーブルは多く 6mm 以下のものを十分に還元する場合に用われる。普通ソウビュック用に適用される。乾式法は現在は湿式法に押されている。その理由は（1）分離流体として水の方が空気より比重が大きい。（2）乾式法は乾燥が要するため欠点である。（3）乾式法は乾燥した速度、粒度、合温度の変化により大きな影響を受ける。（4）満足すべき自働調整法がなかったことなどである。

最近数年間で最も興味を引いたものに湿式サイクロンがある。粉炭の沈降に重力よりも強い力を使うことにより粉炭の還元、炭岩の粉粂及び用水処理の可能性を明かにした。

浮遊還元法は現在米国では極性あるいは使用されている。しかし 8〜10 メッシュ炭素のものを安価な燃油で浮遊還元する方法が工場の規模で試験されている。これは通常の 40 メッシュ炭素のものに比べ、透過であり、ゼロ炭素の到達が可能であるから、将来発展を見込もう。

日本の還炭と米国の還炭との相違点——（1）米国では石炭が常に重量で売られている。鉄道の通じている炭礦にはすべて track scale が設備されてあって、貨率がその上を通るようになっている。鉄道のない炭礦では city scale でトラックや炭車ごと計量するようになっている。

日本では私の見たところでは、石炭は容積で売られ、しかも額で推測している。私の知る限りでは日本の炭礦には track scale を設備しているところはない。鉄道運送は型式により定まった倉数の容積をもとに炭礦はその倉数に合わせるためには異った粒度及び品質の炭を絡まなければならない。鉄道では通勤と想定される貨車以外は揮発されない。少数の大規模炭礦はその供給される車両について、都内記録をとるために揮発するが、しかし石炭会社との支払は常に定めた積量単位でなされる。この習慣は生産者、鉄道及び消費者の間に完全な公平を保つことは実質的に不可能であると私は思っているのである。

（2）石炭の脱水については米国の方も日本よりも、もっと努力している。粉炭の脱水のために揮発性を masih することは米国では常套であり、多くの工場が遠心乾燥機を用いている。さらにすり乾燥機さえ——これは比較的費用がかさかかかるが——第 2 に一般によりつつある。

日本では蒸気により焼却を行わない、鉄道で運んでいる間にかなり脱水される。鉄道運送は脱水殺として働いている。北海道石炭協会は脱水作業をしようと研究しているが、脱水炭に有利な販売がつかわれず、しかも石炭が容積で売られている限り、この動きはあまり進展しないであろう。

（3）米国の市場は石炭の粒度に対して日本よりも遥かにやさしい。これは米国の炭によって主要部の家庭消費であって、そこでは外観によって判断するからである。粒度調整には、大粒に対しては上部支持のシェーカー・スクリーンを、小粒には振動器を用いている。日本ではトロンメル及びジンマスクリーンが一般に用いられているが、米国にはない。

家庭向け需要には精密に分ける小さな粒度が望まれ、特別の粉砕、注意深い選別、特別な詰め方、均一な粒度分布をつくるために色々の混合かしばしば行われる。このためには、石炭会社の生産部門と販売部門が緊密に努力することが肝要であり、粒度調整ということによって、還炭工場と販売部門との密接な協調を必要とした。
（4）表面処理について。表面処理とは石炭の表面についての変化を除くことが最初の目的であつて、主として家庭用炭に対して行つたが更に石炭の識別、燃焼性、結着性の改善や灰の作用の調整などが行われる。表面処理の方法は水を散布することでもあつたが塩液法から、油も用いられる。現在では家庭用炭に最もとすべき表面処理を施されている。油は加熱するかまたはそのまま石炭に散布される。油の外に塩液剤や、塩化カルシウムが使用される。

二、三の大石炭会社は月々山田の石炭の明示に区別できるように適宜量の石炭に着色している。又化学薬品を附着させて燃焼性又は結着性を適宜に変えることがしばしば主張されるが通例である。灰の作用は灰の融点に影響する砂や石炭石や他の物質を適宜加えることによって調整できる。結着については塩化カルシウム又は他の薬剤を附着させることにより防止できる。この方法は来た来はかなり一般的である。又油処理によっても結着を防止している。

（5）難易曲線（Difficulty Curves）——石炭の可選成績を推定するには“難易曲線”で論ずることに極めて有効である。米国では殆どすべての炭がこの曲線で検討されているが、日本では行われているのを未だ見たことがある。

（6）米国では石炭の均質性ということに大へん重点がおかれており。消費側は皆一致して炭質の均一性を望んでいる。 PalecoalやLean型は多少はかかるが、米国では高くとも均一なものより、好ましくないとしている。

Coal preparation の目的は一般に商品の物を得ることと共に炭質の均一性や合るようにあると思われている。

石炭の均質性を保つためには次の 3つの要素が考えられる。すなわち、

(a) 取扱い工場におけるかたよりの防止——動いている石炭は方向を変えるときにいつも粒度にかたよりか起こる。パッフルやソノン型スリットはしごはかたよりを少なくするのに役立つ。

(b) 機械選炭工場の精密にした質問に乾燥——選炭工場の試験室は乾燥と調節の両方の役目を持つおられはならない。試験結果は試料採取から 60分以内で、これは若く選炭操作員に報告されなければならない。米国では操作員は迅速且つ頻繁に試料報告を受けつつ試業している。そして 1時間毎に試料調査を行っている。

(c) 過荷負を避けること——波動的に大量に給炭されることのないよう。その設計された範囲内で、過荷負を最小にするように努力することが大切である。

（7）米国では設備製造者の設備の作成成績について責任を分担する。彼らは責任を持つべき部分について明確な日程を得ている。彼らは選炭工場の要求を知り、そして販売する装置機械を絶えず改良し、より多くの装置を売りうる努力している。中間工場試験倉みやすから行う。

（8）最後に指摘したい明確な選択点は人の問題である。米国では優秀な人は最も価値ある財産とみており、石炭関係試験は或いはに在席があつた場合はその機関に所属している職員の中から最も有能な人を選ばばという。

日本ではそうない。在席は先任席次に従って議論されている。このことは日本の技術が真に指導的定位に達することを妨げていると思う。

石炭浮選に関する二、三の実験について

——昭和 26年 5月 12日时髦特別講演会講演——

早稲田大学理工学部 伏見 弘

要旨 燃油、油タール及びタール各種製品をそれぞれ試験として用い、種々の石炭の浮選試験を行うと共に試験の添加による石炭の捕集性の変化をも測定した。石炭としては平和、国川等が浮選選取率高く大河町、勿来等は低いた。また原炭の灰分が長い程度選取率が高いが灰分の分離が困難である。試験としてはクリソウロ、クレオソート及びケレンソート適当で、添加量を変えた場合の二つの曲線から灰分分離の良否を予測しうる。捕集性の変化を見るに、温度の上昇及び試験の