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Washington and New York

September 4 to 13, 1912

SECTION XI*a*.—LAW AND LEGISLATION AFFECTING CHEMICAL INDUSTRY

VOL. XXIII

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SECTION XI*a*.—LAW AND LEGISLATION AFFECTING CHEMICAL INDUSTRY

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SECTION XI*a*.—LAW AND LEGISLATION AFFECTING CHEMICAL INDUSTRY

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THE TRANSPORTATION OF DANGEROUS GOODS BY WATER

By Dr. Julius Aeby
Antwerp, Belgium

In the two preceding Congresses, at Rome in 1906 and London in 1909, the question of the transportation of dangerous goods by water has already been treated by Dr. C. A. von Martius of Berlin. I therefore deem it unnecessary to particularly insist on the reasons in favor of the solution of a problem equally interesting to chemical factories, navigation companies, underwriters and, last but not least, the passengers and crews of steamers and sailing ships. It will be sufficient to study the two mentioned reports,[1] but what I wish first of all to point out is that, as far as I know, Dr. von Martius' appeal for an international regulation of the question, and the summoning of a conference to this effect, has not obtained even the commencement of a solution, whilst, on the other hand, the number of accidents increases, and the difficulties between manufacturers and shippers are augmenting. This is forcibly brought to my notice in the course of a regular practice with the shipping companies in Antwerp.

To fully comprehend the question, it will be necessary, first of all, to briefly enumerate the principal authors who have occupied themselves with it, and the publications relating to same.

In chronological order:

1. "*Die Selbstentzündung von Schiffsladungen, Baumwolle und anderen Faserstoffen, Steinkohlen, Heuhaufen, Tabak, etc., sowie deren Verhütung.*"

   "The spontaneous combustion of cargos, cotton and other fibrous material, coal, haystacks, tobacco, etc., and the means

[1] (1) Report of the Sixth International Congress of Applied Chemistry at Rome, 1906, "International Regulation of prescriptions on the transport by post, railway and sea, of explosive, easily combustible, corrosive, etc., products."

(2) Report of the Seventh International Congress of Applied Chemistry at London, 1909, "On the Transportation of Dangerous Goods by Merchant Ships."

of prevention." By Dr. L. Häpke. (Bremen, Publisher, C. Ed. Müller, 1893.)

2. "*The Handling of Dangerous Goods.*"
   By H. Joshua Philips. (London, Crosby Lockwood and Son, 1896.)
3. *Abgeänderte Unfallverhütungsvorschriften der Seeberufsgenossenschaft für Dampfer.*
   "Modified prescriptions for the prevention of accidents, laid down by the Professional Marine Association for steamers." (Hamburg, H. O. Persiehl, 1903.)
4. *Memorandum relating to the carriage of dangerous goods and explosives in ships.*
   Board of Trade. (London, Wyman and Sons, 1907.)
5. *Reports of the Bureau for the safe transportation of explosives and other dangerous articles.*
   (New York, 1908-1909-1910-1911 and 1912.)
6. *Eisenbahn Verkehrsordnung.*
   "Rules for carriage by railway." (Berlin, Julius Springer, 1909.)
7. *Marchandises Dangereuses.*
   "Dangerous Goods." By Dr. Julius Aeby. (Antwerp, 1910.)
8. "*Polizei-Verordnung betroffend die Beförderung gefährlicher Gegenstände mit Kauffahrteischiffen.*"
   "Police rules, concerning the transport of dangerous goods by merchant ships." (Berlin, 1912.)

Finally, I must say that in the "Repertorium" of the "Chemiker Zeitung," chapter "Hygiene-prevention of Accidents," records are sometimes given of damage occurring in the transportation of dangerous goods.

All these studies are certainly very interesting and useful, but they do not give entire satisfaction to the shippers, for the following reasons:

(1) They are only published in one language.

(2) They are not complete, and, in some cases, lack a convenient index.

(3) They do not indicate in a sufficiently clear and concise manner those properties of goods with which shippers ought to be familiar.

In my book "Dangerous Goods" (quoted under N°7) published in 1910, I have endeavored to comply with the above-mentioned points, and the fact that it is now used regularly by many shipping companies in Europe, may be counted as a proof of its utility to this side of the interested parties. From the other side, *i.e.*, the chemical industry, I have been sharply criticized on this work by certain German parties (Chemische Industrie, 1911, pp. 146-238 and 605) and this appears to me an additional reason for urging that the representatives of the chemical industry of all countries here present should not underestimate the importance of this question.

As a result of the last annual meeting at Stuttgart, in 1911, of the "Union for the protection of the interests of the chemical industry in Germany," a commission was appointed of three members in order to study the question of the transportation of dangerous objects. This is a beginning, and with confidence we may await the results. But in the great country whose hospitality we are at present enjoying, there exists a perfected institution, too little known in Europe, and to which I wish to draw attention; I mean the "Bureau for the safe transportation of explosives and other dangerous articles" at Washington.

Great benefit would be derived from a study of the organization and the publications of this Bureau.

I have mentioned at the beginning of this report that the importance of the question of the transportation of dangerous merchandise can no longer be ignored. If I cite a few examples hereafter, it is only because nothing else would more forcibly justify the conclusions and resolutions which I desire to put before this Congress.

1. *Bleaching Powder.* Cases of decomposition accompanied by elevation of temperature have been observed, and fires on board of ships attributed to them. Bleaching powder, according to information from manufacturers, is capable of decomposition when freshly prepared, but, they say, only for three days after fabrication. Under these circumstances it will easily be understood that bleaching powder cannot be classified among the absolutely safe products, and it is only just to demand that the manufacturers should take necessary measures to avoid accidents.

2. *Permanganate of Potassium.* This compound was considered absolutely dangerless until the occurring of the following case: some of this salt, escaping from the packing, and mixing with dust of a combustible nature, caused the beginning of a fire under the influence of friction. In this respect, permanganate of potassium resembles peroxide of barium. The natural conclusion to be drawn from this fact is that the packing of this product should be very carefully supervised.

3. *Arsenic Acid.* This is a liquid regularly transported in iron drums to America, and one could hardly have foreseen the accident which happened at New York about a year ago. The explanation was found in the fact that the arsenic acid in question still contained traces of nitric acid. The latter burst the iron drums, and the contents sprayed over the men, causing the death of one of them. It will be necessary in future, therefore, to ensure that the arsenic acid does not contain an excess of nitric acid, and that it should be preserved against heat and the rays of the sun.

4. *Metallic Sodium.* In contact with water, this product is inflammable, and it is therefore quite evident that it should never be loaded on deck. The ignoring of this fact has, this year, caused the loss of a vessel, and the death of two of the crew.

5. *Cyanamide of Calcium.* Three years ago I already called attention to the danger of this manure, because, when badly manufactured, it still contains carbide of calcium, which, by the moisture in the air, gives off acetylene. My previsions have recently (in May last) received a sad confirmation in the blowing up of a Norwegian steamer loaded with cyanamide of calcium. Eight men were killed in this catastrophe, which would have been prevented if it had been known that the approach of a naked flame had to be strictly avoided.

It is useless to prolong the list of these examples. They prove sufficiently, I think, that no one, more so than the manufacturer himself, should indicate the necessary precautions to be taken in the transportation of certain goods. If the manufacturers do not themselves consider this question in an efficacious manner, it is probable that the shipping companies will have to take measures, or else the authorities whose duty it is to safeguard the public security. In the interest of all, I therefore propose the following resolutions:

1. It is desirable that this Congress should appoint an international commission of representatives of the chemical industry, in order to establish, and keep up to date, a list of dangerous goods; to centralize all communications on this subject; to study the special literature; to collect and examine samples; and, perhaps, organize an information service for governments, shipping companies, insurance companies, etc.

2. It is further desirable that this commission should invite to join them authorized representatives of shipping companies.

DENOMINATIONS DES PRODUITS PHARMACEUTIQUES

PAR ANDRE ALLART

Docteur en Droit. Avocat à la Cour de Paris

I

L'association médicale américaine a adressé dans le courant de mars 1912 aux fabricants et marchands de produits pharmaceutiques une circulaire dans laquelle elle propose l'établissement, pour la désignation des remèdes et médicaments, des règles suivantes:

I° Les noms des préparations pharmaceutiques devront indiquer les éléments les plus actifs entrant dans leur composition.

2° Les noms susceptibles de créer une confusion sur la nature du produit ne seront pas reçus comme marques.

3° Les noms qui suggèrent l'idée d'une maladie ou d'une vertu thérapeutique ne seront pas reçus comme marques.

C'est une réglementation nouvelle de la matière des marques qui se trouve proposée dans ces quelques articles. Elle se trouve même, par certains points, en antinomie complète avec les principes le plus communément admis sur ce sujet, et aboutit à créer dans le régime des marques de fabrique une division radicale entre les marques apposées sur des produits thérapeutiques et celles destinées aux autres objets du commerce.

En effet le principe fondamental et qui se retrouve dans la plupart des législations, est que la marque, pour faire l'objet d'un droit de propriété exclusive, doit être arbitraire et de fantaisie. Si elle est descriptive et indique la nature et l'objet du produit qu'elle recouvre, elle n'est plus protégée. Enfin, si elle est déceptive, c'est à dire si elle suggére l'idée d'une qualité du produit qui n'existe pas dans la réalité, elle peut être déclarée illicite.

Les propositions de l'Association médicale bannissent en quelque sorte la marque de fantaisie et la marque déceptive et la rendent obligatoirement descriptive.

Elles limitent même d'une façon étroite l'usage de cette dernière.

II

La première proposition exige que la marque indique les éléments les plus actifs entrant dans la composition du produit. C'est la marque descriptive rendue obligatoire. Elle est de nature à engendrer bon nombre de difficultés, sans utilité correspondante bien nettement établie.

Tout d'abord, pour un produit complexe, elle rend nécessaire une marque complexe difficile à retenir pour le public.

Elle crée entre toutes les marques relatives à un même produit, une similitude d'où peuvent résulter nombre de confusions. On propose, pour y remédier, l'adjonction d'une désinence de fantaisie ou d'un nom patronymique. Mais l'expérience montre que de telles adjonctions ne sont pas toujours suffisantes pour prévenir les confusions. L'acheteur placé devant une dénomination compliquée qui ne se différencie des autres dénominations appliquées au même produit que par l'adjonction d'une syllabe ,ou d'un nom, ou par une simple modification d'orthographe, ne sera pas toujours frappé par cette différence de façon suffisante pour les distinguer avec certitude.

Au contraire, la marque de pure fantaisie peut être concise et caractéristique, frapper l'esprit et s'imposer à la mémoire. Par là toute chance d'erreur est évitée. C'est pour cela que la dénomination arbitraire est devenue, dans la pratique, la marque par excellence. La supprimer est fort dangereux.

Comme contrepartie à ce danger, aucun avantage bien précis n'apparait.

L'indication de la composition du produit ne sera souvent que très insuffisante pour éclairer l'acheteur. Il faudrait que cette indication fût absolument complète et rappelât tous les éléments composants du produit, ce qui en fait, est impossible. Il faudrait, en outre, préciser les proportions dans lesquelles ils se trouvent dans le produit. Autrement on ne donne au public qu'une sécurité trompeuse: il croit connaitre la composition du produit qu'il acquiert, et dans la réalité il n'a qu'une indication insuffisante, propre à la tromper.

Ne vaut-il pas mieux ne pas le renseigner du tout que de le renseigner de cette façon? S'il sait que la marque qu'on lui offre, ne signifie rien, quant à la composition du produit, il ne sera pas amené à y attacher d'autre valeur qu'une valeur de référence, ce qui est, d'ailleurs, conforme à son objet.

La marque ne doit être qu'une indication d'origine; c'est une chose dangereuse que de la faire sortir de son objet pour en faire une indication de la composition et de la nature du produit qu'elle recouvre. Cela ne peut qu'engendrer l'erreur et la confusion.

III

La seconde proposition prohibe les marques déceptives pour les produits pharmaceutiques.

Pendant longtemps on ne s'est guère préoccupé des marques de cette nature. Il semblait au contraire qu'elles réalisaient un maximum de fantaisie et qu'il n'y avait aucune raison de révoquer en doute leur validité. Mais un revirement s'est produit dans la plupart des législations. On a voulu poursuivre et détruire la fraude en quelque manière qu'elle se produisît. On a ambitionné d'assurer à l'acheteur une sécurité complète en le prémunissant contre toute possibilité d'erreur. Les lois sur les fraudes sont devenues de plus en plus strictes et rigoureuses.

Dans cette voie, l'attention devait nécessairement se porter sur les marques qui paraissent indiquer la nature du produit qu'elles recouvrent, mais qui se réfèrent à des qualités qui ne lui appartiennent pas dans la réalité. Devait-on en interdire l'usage, comme étante de nature à tromper l'acheteur sur les qualités de la marchandise qui lui était offerte? C'est ce à quoi on s'est peu à peu acheminé, et nous ne pensons pas qu'il y ait lieu de le regretter.

Pour se rendre compte de l'évolution accomplie sur ce point, il faudrait suivre dans la jurisprudence de chaque pays, la façon dont ce genre de fraude a été de plus en plus rigoureusement réprimé par une application plus stricte des lois existantes. Il faudrait suivre le mouvement législatif lui-même, constamment plus sévère à cet endroit.

Il suffit de constater la généralité de cette tendance, pour se convaincre que la proposition que nous examinons n'en est qu'une étape particulière. Elle concorde avec un mouvement indiscutable qui s'accuse dans toutes les législations. Son adoption ne saurait à nos yeux soulever de sérieuse critique. Il restera toujours un nombre suffisant de dénominations de pure fantaisie pour que les commerçants ne soient pas en peine d'en trouver pour en faire leur marque de fabrique.

IV

La troisième proposition tend à refuser l'acceptation, comme marques, des noms suggérant l'idée d'une destination possible du produit. Elle a pour but d'éviter que le public croyant trouver, dans la dénomination apposée sur le produit, l'indication de ses vertus thérapeutiques ou des maladies auxquelles il peut servir de remède, ne se croie, par là, suffisamment éclairé pour en faire usage, sans se renseigner plus amplement sur l'opportunité de son utilisation.

Est-ce là une crainte bien fondée N'est-ce pas prêter à l'acheteur une légèreté bien grande que de supposer que, sur le vu d'une dénomination équivoque, il pourra être conduit à se faire son propre médecin?

D'un autre côté, cette disposition ne serait-elle pas en contradiction avec cette autre proposition selon laquelle la dénomination doit indiquer les éléments les plus actifs entrant dans la composition du produit? Une semblable indication, s'il est vrai qu'il existe des acheteurs assez imprudents pour se faire à eux-mêmes l'application d'un remède sur le seul vu de l'indication de ses vertus thérapeutiques, ne suffira-t-elle pas à conduire certains consommateurs à faire du produit qu'ils acquièrcent, un usage inconsidéré? Le public n'est pas sans savoir, au moins vaguement, que tel produit est un remède à telle affection? Cette connaissance sommaire ne suffira-t-elle pas à l'amener à se passer du médecin, tout comme le pourrait faire l'indication ou la simple allusion(car la proposition va jusqu' à interdire une simple allusion) à la vertu thérapeutique du produit?

Quant à nous, cette crainte nous parait chimérique et nous ne voyons qu'une inutile entrave au choix de la marque, dans la disposition que nous examinons.

V

En résumé, seule la proposition relative à la prohibition des marques déceptives, c'est à dire de celles susceptibles de créer une confusion sur la nature du produit nous parait utile et bonne dans son principe.

Mais son adoption, au moins pour bon nombre de législations, serait chose superflue car elle est déjà contenue implicitement dans des prohibitions plus larges et qui s'appliqient aux produits de toute nature.

LEGISLATION INTERNATIONALE SUR L'IMPORTATION DES PRODUITS REVETUS D'UNE MARQUE DE COMMERCE

PAR ANDRE ALLART

Docteur en Droit, Avocat à la Cour d'Appel de Paris

I

Voici comment se pose pratiquement la question: un commerçant qui fait fabriquer les produits qu'il met en vente, dans un Etat autre que celui où est situé son établissement, peut-il y faire apposer sa propre marque de commerce par le fabricant étranger, sans y faire figurer en même temps l'indication du lieu de fabrication de ces objets? Pour prendre de suite un exemple qui éclaire d'un mot la position de la question, un magasin de vente français, tel que *le Louvre*, qui fait fabriquer en Angleterre, certains produits qu'il offre au public, en France, peut-il faire apposer sur ceux-ci par le fabricant étranger, ou apposer lui-même, la marque, "Au Louvre-Paris," sans y joindre la mention *importé d'Angleterre, fabrique en Angleterre,* ou toute autre équivalente?

On sait que la plupart des législations prohibent actuellement les fausses indications de provenance et que les conventions internationales en matière de propriété industrielle ont consacré cette prohibition.

Doit-on considérer une simple marque de commerce, comme pouvant constituer une fausse indication de provenance? A prendre la réalité des choses, il faudrait répondre négativement: car la marque de commerce n'est point le signe du fabricant, mais uniquement celui du vendeur. Son apposition ne devrait donc avoir aucune signification en ce qui touche la provenance des produits qui en sont revêtus. Cependant, dans un désir, peut-être excessif, de sauvegarder le public contre toute confusion, on en est venu, dans la plupart des pays, à considérer comme illicite l'apposition d'une marque de commerce sur des produits de fabrication étrangère.

II

Au point de vue international, la question trouve sa solution dans la Convention d'Union du 20 mars 1883, article 10, qui dispose: "Les dispositions de l'article précédent (saisie à l'importation) seront applicables à tout produit portant faussement, comme indication de provenance le nom d'une localité déterminée, lorsque cette indication sera jointe à un nom commercial fictif ou emprunté dans une intention frauduleuse." Ainsi, il faut, pour que le produit revêtu d'une fausse indication de provenance soit saisi en vertu de cette disposition, ou bien qu'il porte un nom commercial fictif, c'est à dire un nom autre que celui du fabricant ou du vendeur, ou un nom emprunté dans une intention frauduleuse.

Par suite le fait qui nous préoccupe ne rentre pas dans les prévisions de cet article, puisque nous supposons par hypothèse que la marque de commerce apposée sur le produit est bien celle de celui qui le met en vente. On ne peut donc dire qu'il y ait, en l'espèce, apposition d'un nom commercial fictif ou emprunté dans une intention frauduleuse. Ainsi l'importation n'est point prohibée dans ce cas aux termes de la Convention.

Mais il faut noter que la Convention constitue un minimum de protection qui laisse libre champ à l'application de la loi intérieure de chaque pays. Les objets fabriqués à l'étranger et revêtus seulement d'une marque de commerce pourront être saisis à l'importation, si la législation du pays où a lieu cette dernière, considère le fait comme illicite. Notons qu'il en est ainsi en France et en Angleterre, pour ne citer que des exemples.

La Convention de Washington en 1911 n'a rien ajouté au texte de l'article 10 sur ce point.

III

Parmi les Etats signataires de la Convention d'Union, un certain nombre se sont groupés en une Union restrainte et ont signé un arrangement à Madrid le 15 Avril 1891 relatif aux fausses indications de provenance.[1]

[1]Font partie de l'Union restreinte: Le Brésil, Cuba, L'Espagne, la France, la Grande-Bretagne, Le Portugal, la Suisse et la Tunisie.

L'article 3 de cet arrangement vise expressément notre question en disposant: "*Les présentes dispositions ne font pas obstacle a ce que le vendeur indique son nom ou son adresse sur les produits provenant d'un pays différent de celui de la vente; mais dans ce cas l'adresse ou le nom doit-être accompagné de l'indication precise et en caractères apparents, du pays ou du lieu de fabrication ou de production.*"

Ainsi, aux termes de cette disposition, l'importation de produits fabriqués à l'étranger et revêtus de la marque de commerce d'un vendeur établi dans un autre pays; n'est licite qu'à la condition que le lieu de provenance figure en même temps sur le produit.

La sanction de cette disposition est la saisie du produit à l'importation ou la prohibition d'importation (Art. 1.).

IV

Ainsi il existe, au point de vue intern tional, deux systèmes. L'un établi par la Convention d'Union du 20 mars 1883 qui ne s'oppose aucunement à l'introduction des produits revêtus de la marque de commerce d'un négociant établi dans un autre pays que celui d'origine. L'autre édicté par l'arrangement de Madrid, exigeant l'indication du lieu de provenance. Au premier l'on peut reprocher d'être trop large et au second de ne l'être pas assez.

Ce qui rend particulièrement délicate la solution de cette question, c'est que les espèces dans lesquelles elle se présente pratiquement sont des plus variables et ne comportent que difficilement une solution uniforme.

En soi, l'apposition d'une marque de commerce sur un produit ne prouve aucunement que le lieu de provenance du produit soit le lieu indiqué par cette marque. Celle-ci ne se réfère en effet qu'à l'établissement où est vendu le produit et non à celui où il est fabriqué. D'où il suit que la marque de commerce étant tout-à-fait étrangère à la fabrication de l'objet, ne peut en raison être considérée comme une indication de provenance.

On doit en outre observer que beaucoup d'acheteurs ne se préoccupent en aucune façon de l'origine du produit qu'ils achètent. Ils font confiance à un établissement commercial qui leur offre toute garantie que les produits mis en vente par lui sont de bonne qualité. Peu leur importe dès lors que ces produits soient d'une provenance ou d'une autre: le public se trouve suffisamment protégé par la réputation de la maison qui les met en vente. Il ne court donc aucun danger et on le protège malgré lui quand on impose au vendeur l'obligation d'indiquer sur chaque objet quelle en est l'origine.

Obliger le commerçant à mettre cette indication, n'est-ce pas dès lors une entrave inutile à sa liberté? N'est-ce pas vouloir attacher à chaque objet qu'il met en vente, comme un signe destiné à le discréditer, en éveillant les suspicions du public, cette indication de provenance qui souvent lui est si indifférente?

Cela est-il conforme à la liberté des transactions internationales?

Par contre, on fait observer que tous les acheteurs ne manifestent pas ce désintéressement quant à la provenance des produits qui leur sont offerts. La marque de commerce ne se différencie par aucun signe visible de la marque de fabrique: elles pourront-être aisément prises l'une pour l'autre. Si pour certains établissements dont la réputation est considérable, on sait qu'ils sont seulement des établissements de vente mais qu'ils ne fabriquent pas eux-mêmes, et si pour les objets revêtus de leur marque de commerce aucune erreur ne peut naître dans l'esprit du public, il n'en est pas toujours ainsi.

Il existe même des établissements mixtes qui ne fabriquent qu'une partie des objets qu'ils offrent au public, faisant venir les autres de fabriques étrangères. Ici, la confusion n'est-elle pas à redouter de la part des acheteurs et n'est-il pas bon d'avertir ces derniers des origines diverses des objets que leur offre l'établissement auquel ils s'adressent? Comme on peut s'en rendre compte, par ce très bref aperçu, la question demeure fort délicate à résoudre en un principe unique.

V

En ce qui concerne les préparations chimiques une difficulté nouvelle surgit. Fort souvent, les produits mis dans le commerce sont d'une composition complexe et renferment plusieurs éléments. Il arrive que tous n'aient pas la même provenance: l'un est préparé dans un pays, l'autre dans un autre. En cet état ils sont expédiés à un industriel qui leur donne une forme définitive, les combine entre eux et les offre ensuite au public.

Exigera-t-on que celui-ci, outre sa marque propre, indique sur ces produits le lieu d'origine de chacun des éléments entrant dans leur composition? On devrait le faire, si l'on voulait appliquer à la lettre le texte de l'article 3 de l'arrangement de Madrid.

Mais n'y a-t-il pas dans une pareille obligation une entrave excessive à la liberté du commerce et une source de difficultés sans nombre?

VI

En présence de ces diverses considérations, nous inclinerions à émettre un voeu qui constitue un moyen terme entre le système, peut-être trop large, de la Convention de 1883 et celui, trop rigoureux, de l'arrangement de Madrid. Le but de la répression des fausses indications de provenance est la sauvegarde du public. Il faut que celui-ci soit préservé contre la tromperie. Lorsqu on ne cherche pas à la tromper, il n'a besoin d'aucune protection. Le commerçant qui appose sa marque sur un produit de provenance étrangère, ne commet aucune tromperie, car la marque qu'il appose n'est pas l'indication d'une provenance, mais celle d'une maison de vente. Le public, s'il a un doute, et s'il veut s'assurer de manière précise de la provenance du produit qu'il acquiert, aura pour le faire de faciles moyens d'investigation. Il pourra tout d'abord rechercher, s'il ne le sait déja, s'il se trouve en présence d'une marque de fabrique ou d'une marque de commerce. Il pourra ensuite, s'il subsiste un doute dans son esprit, s'enquérir de la provenance du produit et, au besoin, se la faire certifier. S'il ne le fait pas, c'est que la chose lui est indifférente, et alors il n'y a pas lieu d'être plus prévoyant pour lui qu'il ne l'est lui-même.

Nous émettons donc ce voeu:

"que l'apposition d'une marque de commerce sans aucune indication de provenance, par un établissement qui fait venir ses produits de l'étranger, soit déclarée licite, d'une part toutes les fois que cette marque est celle d'un établissement exclusivement commercial et qui ne fabrique aucun produit; d'autre part toutes les fois que cette marque ne porte aucune indication trompeuse destinée à créer une erreur dans l'esprit de l'acheteur."

NECESSITE D'ACTIVER LA SOLUTION DES PROCES CONCERNANT LA PROPRIETE INDUSTRIELLE

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Depuis longtemps on se préoccupe beaucoup de la situation déplorable que fait, aux industriels comme aux commerçants, l'excessive durée des procès concernant la Propriété Industrielle. Se prolonger pendant quatre ou cinq années, du jour de l'assignation à celui d'une décision définitive, ce n'est point, pour un débat judiciaire visant cette propriété, quelque chose d'extraordinaire. Or, c'est évidemment beaucoup trop; surtout en matière de brevets: car un brevet n'a qu'une existence assez courte et, d'ordinaire, son exploitation n'est guère productive pendant les premières années. Aussi, a-t-on pu dire, avec raison, que les procès nécessités pour la défense d'un brevet durent souvent, pour le breveté, plus longtemps que le brevet lui-même.

Ces préoccupations existent-elles au même degré dans tous les pays? Nous ne connaissons pas assez les différents systèmes de procédure usités dans certaines contrées pour pouvoir l'affirmer. Mais il nous semble qu'en général les brevetés ne sont pas, dans les principaux pays, mieux partagés qu'en France. C'est ainsi que déja, en Allemagne, d'excellents eprits ont préconisé l'organisation de tribunaux mixtes offrant aux plaideurs, avec la garantie d'une compétence plus éclairée, l'assurance d'une parfaite rapidité.

Cette question est d'un intérêt pratique tel que l'Association Française pour la protection de la Propriété Industrielle s'en est déja, plusieurs fois, occupée.

Fondée depuis 1899, comprenant comme adhérents des industriels, des commerçants, des ingénieurs-conseils en matière de propriété industrielle, des avocats spécialistes, des sénateurs, des députés, des Chambres de Commerce, des Chambres Syndicales, etc., cette association a su conquérir rapidement, auprès des Pouvoirs Publics Français, une très sérieuse influence.

Ce qu'elle a fait intéressera donc ceux qui s'occupent de la question générale que nous traitons ici.

Tout d'abord, au cours de différentes réunions de l'Association Française, on parla de créer des tribunaux purement techniques. Mais cette réforme parut trop radicale.

Plus tard, en 1909, au Congrès de Nancy, la question fut l'objet de deux rapports également intéressants.

L'un, de Mr. Armengaud jeune, ingénieur-conseil, soumettait l'examen des procès de contrefaçon à un tribunal composé de jurés techniques, sous la présidence d'un magistrat délégué par le président du tribunal civil. Mais, très original, ce projet bouleversait trop l'ordre de choses établis.

L'autre, de Mr. Moret, avocat à la Cour de Cassation, se contentait d'une réforme plus modeste. Il maintenait l'organisation judiciaire actuelle; mais donnait à la procédure une plus grande rapidité, notamment en ce qui concerne la nomination des experts et la durée de leur expertise. Il est vrai qu'il avait le tort de proclamer l'expertise obligatoire par cela seul que l'une des parties en cause l'eût demandée. C'était une mesure évidemment fâcheuse; car le contrefacteur, pour gagner du temps, n'aurait jamais manqué, même dans le cas d'une indisoutable contrefaçon, de solliciter l'expertise.

Finalement, s'inspirant du projet de Mr. Moret, l'Association Française pour la Protection de la Propriété Industrielle adopta (non pas au Congrès de Nancy où la question resta sans solution définitive, mais dans une Assemblée générale du 22 février 1910) le projet de réforme suivant:

1° "Dans toutes les affaires relatives aux brevets, le Président du Tribunal, ou celui de la Chambre saisie de l'affaire, peut, sur la demande de l'une des parties, statuant en état de référé et en audience publique, nommer un ou trois experts; cette demande devra être formée dans les trois mois de l'assignation."

2° "S'il n'est pas ordonné d'expertise, l'affaire doit être jugée dans les six mois de l'assignation. Le tribunal conserve la faculté d'ordonner, après les débats, une expertise."

3° "Les experts sont choisis sur une liste dressée par la commission technique de l'Office National de la Propriété Industrielle sur la présentation faite par la réunion annuelle des présidents des Chambres de Commerce, et par les corps de professeurs des Universités et des grandes écoles techniques; cette liste sera revisée chaque année et comprendra au moins dix personnalités compétentes dans chacune des spécialités adoptées pour la classification des brevets; un règlement d'administration publique déterminera les mode et conditions suivant lesquels la liste des experts sera dressée."

4° "La décision qui ordonne l'expertise désigne un magistrat pour assister aux séances et diriger les opérations; elle fixe la date à laquelle il sera plaidé au fond dans un délai maximum de six mois. Les rapports où seront consignés les dires des parties et les pièces annexes devront être déposés un mois au plus tard avant la date fixée pour la plaidoirie; les dires et les pièces annexes sont dispensés du timbre et de l'enregistrement; ils sont visés ne varietur par les experts et sont déposés au greffe en même temps que le rapport; une copie sur papier libre peut en être délivrée aux parties. Le magistrat directeur peut, soit d'office, soit sur la demande des parties ou des experts, impartir pour le dépôt du rapport un nouveau délai qui, en aucun cas, ne peut dépasser six mois."

5° "Au cas où le rapport n'aurait pas été déposé en temps utile, le tribunal pourra déclarer les experts dessaisis et ordonner qu'il soit passé outre aux débats."

6° "Lorsque le rapport a été déposé, le Tribunal doit, sur la demande d'une des parties, et peut d'office, ordonner l'audition des experts à l'audience. L'audition des experts peut encore avoir lieu, même s'il n'y a pas eu encore de rapport déposé."

7° "Les frais et honoraires des experts sont liquidés par le jugement qui statue au fond, sans qu'il y ait toutefois solidarité de ce chef entre les parties. Mais la décision nommant les experts, ou une ordonnance du président sur demande motivée des experts, pourront obliger le demandeur à fournir caution pour le paiement des dits frais et honoraires."

8° "L'arrêt à intervenir sur l'appel d'un jugement relatif à une question de brevet d'invention devra être rendu dans les six mois de l'acte d'appel; à moins qu'il n'ait été ordonné par la Cour une mesure d'instruction complémentaire, auquel cas le délai sera prolongé de trois mois."

Enfin, en juillet 1911, à Roubaix, dans le Congrès tenu par la susdite Association Française, sous le patronage du Ministre du Commerce et ceux de la Chambre de Commerce de Paris et de la Chambre de Commerce de Roubaix, fut voté le voeu suivant:

"Le Congrès émet le voeu que le Projet de réforme de la Loi Française de 1844 sur les brevets d'invention, déposé par le Gouvernement et impatiemment attendu par les intéressés, soit complété par l'organisation de la procédure d'expertise, conformément au projet établi par l'Association et soit discuté par le Parlement dans un délai aussi rapproché que possible."

Nous aurions voulu pouvoir enregistrer le vote d'un voeu quelconque formulé par l'Association *Internationale* pour la Protection de cette Propriété (Association qui groupe, dans ses Congrès annuel , un grand nombre d'adhérents et d'Associations Nationales, parmi lesquelles, précisément l'Association Française susnommée); mais la question qui nous occupe n'a point encore, jusqu'à ce jour, fixé son attention.

Peut-être, au surplus, avisée elle l'est de toutes les motions discutées dans les différents Congrès Internationaux, au point de vue législation, nous saura-t-elle gré d'avoir pris, *internationalement*, l'initiative de cette réforme et la fera-t-elle entrer, bientôt, dans le programme de toutes celles qu'elle poursuit?

Quoi qu'il en soit, revenons au voeu formulé par l'Association Française et dégageons en les idées gênérales qui nous paraissent devoir répondre aux désiderata de quiconque, Allemand, Américain, Anglais, Espagnol, Français, Italien, Russe, ou autre, plaide pour la défense de la Propriété Industrielle.

Ces idées générales se résument en des mesures que toute législation sur la matière nous semble pouvoir adopter. Ces mesures ont, en effet, pour objet:

d'enlever aux plaideurs la faculté (dont ils abusent trop souvent) de ne demander une expertise qu'après avoir, par des incidents multiples, prolongé les débats inutilement;

de contraindre en outre ces plaideurs à garantir, d'avance, le paiement des dépenses occasionnées par l'expertise qu'ils sollicitent;

d'obliger l'expert, l'avocat, le tribunal, et même la Cour en cas d'appel, à hâter, chacun dans sa sphère, la solution des débats engagés;

de donner à l'expertise plus d'autorité, en permettant la comparution de l'expert à l'audience;

d'assurer enfin plus régulièrement la taxe des frais et honoraires de cet expert.

Inutile, pensons nous, d'insister sur l'avantage de pareilles mesures. Nous souhaiterions seulement:

1° que le dépôt d'une caution par la partie qui requiert l'expertise fût obligatoire et non pas seulement facultatif:

2° que, dans le cas d'appel, l'appelant fût obligé de déposer au greffe de la Cour une somme déterminée par le Président de celle-ci, somme garantissant, tout au moins, le paiement des nouveaux frais dont cet appel va grever la procédure. Mais peut-être pensera-t-on que la proposition de cette mesure, apportant une véritable restriction au droit d'appel, risquerait de compromettre l'adoption du voeu plus modeste formulé par l'Association Française et dont nous proposons au Congrès d'adopter internationalement les idées générales.

En conséquence, nous avons l'honneur de soumettre au vote du Congrès la proposition suivante:

a. Dans tout procès intéressant la Propriété Industrielle, le plaideur qui désire une expertise doit la demander dans les 3 mois qui suivent l'assignation.

b. En l'absence d'expertise, le Tribunal doit statuer dans les 6 mois de l'assignation. Mais il est libre d'en ordonner une, après les débats, s'il n'est pas suffisamment éclairé.

c. En cas d'expertise, les parties doivent plaider au fond dans les 6 mois du jugement qui a ordonné celle-ci (délai maximum).

d. Sous peine de dessaisissement, l'expert doit déposer son rapport 1 mois, au plus tard, avant la date fixée pour les plaidoiries. Cependant, le Tribunal peut lui accorder un sursis de 6 mois (délai maximum).

e. Obligé d'ordonner (avant ou après le dépôt de leur rapport) l'audition des experts à la barre, si elle est requise par une des parties, le Tribunal est libre de l'ordonner d'office s'il le juge nécessaire.

f. Le plaideur qui requiert une expertise est obligé de garantir par une caution le paiement des frais de l'expertise (y compris les honoraires de l'expert).

g. En cas d'appel, la Cour doit statuer dans les 6 mois de celui-ci (sauf prorogation de 3 mois si elle a ordonné quelque mesure supplémentaire d'instruction).

LA FABRICATION DANS UN PAYS DE LA CONVENTION INTERNATIONALE DE LA PROPRIETE INDUSTRIELLE PROTEGE LE POSSESSEUR D'UN BREVET DANS TOUTES LES NATIONS FAISANT PARTIE DE LA CONVENTION

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Aux termes de l'Article 2 du texte encore actuellement en vigueur de la Convention d'Union de 1883 et de l'Acte additionnel de 1900: "Les sujets ou citoyens de chacun des Etats contractants jouiront, dans tous les autres Etats de l'Union, en ce qui concerne les Brevets d'invention.......des avantages que les lois respectives accordent actuellement ou accorderont par la suite aux nationaux. En conséquence, ils auront la même protection que ceux-ci et le même recours légal contre toute atteinte portée à leurs droits sous réserve de l'accomplissement des formalités et des conditions imposées aux Nationaux par la législation intérieure de chaque Etat."

D'autre part l'Article 5 édicte que: "L'introduction par le Breveté, dans le pays où le brevet a été délivré, d'objets fabriqués dans l'un ou l'autre des Etats de l'Union, n'entraînera pas la déchéance. Toutefois, le breveté restera soumis à l'obligation d'exploiter son brevet conformémént aux lois du pays où il introduit les objets brevetés."

Il semblerait donc, à cette simple lecture du texte de la Convention que l'exploitation dans un pays unioniste devrait en principe suffire pour empêcher la déchéance du brevet pour défaut d'exploitation dans les autres pays de l'union où il possède des brevets! Toute la difficulté consisterait alors à savoir ce que veut expressément dire la Convention par le mot "exploitation". Or depuis longtemps la jurisprudence est fixée sur le sens exact à donner au mot "exploitation"; elle considère d'une façon constante qu'il faut entendre par là, non pas une *exploitation commerciale,* mais une *fabrication industrielle!*

Par conséquent, la seule cause de déchéance pour défaut d'exploitation pouvant survenir à l'égard d'un breveté unioniste, ne serait possible que s'il faisait fabriquer totalement ou partiellement (élément essentiel de son invention) dans un pays non unioniste, et se contentait d'exploiter commercialement sur le territoire de l'Union!

Mais l'Article 5 précité, dans son 2° paragraphe, apporte une réserve importante au principe du paragraphe 1°, en déclarant que toutefois le breveté restera soumis à l'obligation d'exploiter son brevet conformément aux lois du pays où il introduit les objets brevetés."

Les conséquences de ce deuxième paragraphe peuvent être considérables et, à l'égard de certaines législations particulières, elles peuvent faire échec complètement au principe général de l'exploitation suffisante dans un seul des pays de l'Union.

C'est ainsi que la Loi Anglaise de 1907 impose, même à l'égard d'un unioniste étranger, l'exploitation principale sur le territoire du Royaume-Uni. La plupart des autres pays imposent également un minimum d'exploitation dans le pays. La Belgique prononce la déchéance (art. 23 de sa loi de 1854) par défaut d'exploitation dans l'année de la mise en exploitation à l'étranger, ou pour interruption pendant un an de l'exploitation en Belgique. Le Brésil rend possible, en cas de fourniture insuffisante pour la consommation interne, la réduction du monopole accordée par le brevet, à une certaine zone. D'autres pays, comme l'Italie, le Pérou, la Roumanie, la Russie, se réservent d'accorder des excuses et des délais de prolongation, etc.....En France, la jurisprudence exige que l'inventeur, pour éviter la déchéance pour non-exploitation, fasse en sorte qu'il n'existe pas une disproportion manifeste entre l'importance de la fabrication effectuée sur le territoire français et celle des introductions de l'étranger, et surtout, s'il s'agit d'un étranger, breveté simultanément en France et à l'étranger, qu'il n'existe pas un contraste trop grand entre l'effort fait à l'étranger pour assurer le développement industriel de l'invention et l'effort corrélatif en France (notamment: Tribunal de la Seine, 30 juin 1897, Bartlett (Jantes métalliques), Annales de la Propriété Industrielle (Recueil Pataille), 1900, p. 275).

Pour conclure: malgré le principe de la Convention (art. 2 et 5 § 1°) l'exploitation, ou plus exactement la fabrication industrielle, dans un des pays de l'Union n'est pas suffisante en général, pour empêcher la déchéance pour défaut d'exploitation dans les autres pays unionistes; car il faut, pour chaque pays, s'en rapporter aux prescriptions expresses de la loi intérieure qui peuvent réduire considérablement et même supprimer en fait le principe libéral du paragraphe 1° de l'article 5.

C'est pourquoi il est désirable de poursuivre dans les divers Congrès l'unification progressive des lois sur les brevets d'invention. En attendant de pouvoir réaliser le brevet international qui mettrait fin à toutes les incertitudes et mieux encore que les réformes successives dans un sens unitaire imposées à force de propagande par les grandes associations spécialistes internationales ou nationales ayant en vue la protection de la propriété industrielle.

Il est donc indispensable que tous les congrès qui, à un point de vue quelconque, s'intéressent à la propriété industrielle, émettent des voeux formels pour la suppression progressive des divergences des législations intérieures, éminemment nocives à l'excercice de plus en plus international du commerce et de l'industrie, et s'efforcent, par une propagande personnelle de leurs membres basée sur un programme commun, d'aider à la réalisation, la plus prochaine possible, de leurs voeux.

LEGISLATION INTERNATIONALE UNIFORME POUR LES BREVETS ET LES MARQUES

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Il faut d'abord interpréter le sens exact du sujet proposé; il ne peut être évidemment question d'une législation uniforme à la fois pour les brevets et les marques mais simplement du désir de réaliser éventuellement deux séries de législations internationalement uniformes, l'une pour les brevets et l'autre pour les marques.

En effet si les brevets et les marques constituent deux modes essentiels de la protection de la propriété industrielle et commerciale, ils sont par contre très différents quant à leur domaine et à leur genre d'application. C'est ainsi que le brevet d'invention vise la protection essentiellement technique de procédés d'ordre industriel, tandis que la marque de fabrique, qui n'est, la plupart du temps, qu'un adjuvant du nom du fabricant, est exclusivement d'ordre commercial et protège en quelque sorte extrinsèquement le produit qu'elle recouvre.

On se rend facilement compte d'autre part, à priori, qu'au point de vue économique, la protection obtenue par un brevet d'invention est plus importante et plus délicate que celle octroyée par les marques. Par conséquent, il ne peut être à aucun point de vue question d'essayer de réaliser une loi générale uniforme de la protection de la propriété industrielle englobant à la fois les brevets et les marques; mais il est tout à fait désirable de se proposer comme but, peut-être lointain, mais assurément très possible, deux lois internationales uniques: l'une instituant un brevet d'invention international, et l'autre un statut également international des marques de fabrique.

Pour le brevet d'invention international le rapporteur renvoie à ses conclusions développées sous les questions B et 8 mises à l'ordre du jour du Congrès.

En ce qui concerne l'uniformisation des législations en matière de Marques, la Conférence de Washington de mai 1911 a quelque peu amélioré le régime de la Convention d'Union et des Arrangements Internationaux qui l'ont suivie.

Il n'apparaît pas nécessaire, en dehors de certaines définitions et prescriptions essentielles, de faire une loi internationale uniforme de la marque de fabrique. Il suffit, et c'est l'œuvre progressive des Conférences Internationales, de définir nettement le statut international de la marque, d'uniformiser les formalités d'enregistrement en les réduisant au minimum de publicité nécessaire, de réglementer uniformément les effets du dépôt pour parvenir à réaliser une législation internationale suffisamment uniforme et pratiquement satisfaisante de la marque de fabrique.

Sans s'attacher trop servilement à la terminologie, il faut essentiellement considérer qu'en fait la protection accordée aux marques de fabrique a surtout pour but d'empêcher, sous l'une de ses principales formes, la concurrence déloyale, qui sévit de plus en plus, et qui, au fur et à mesure de l'internationalisation du commerce, devient de plus en plus difficile à réprimer.

Aussi partageons-nous complètement l'avis de l'éminent Secrétaire général de l'Association Internationale pour la Protection de la Propriété Industrielle, le professeur Osterrieth, qui déclare dans son rapport "sur la protection internationale des marques de Fabrique" présenté au Congrès de Londres des 3–8 juin 1912: "Quiconque introduit dans un pays une marque doit être protégé contre toute concurrence déloyale commise au moyen de la contrefaçon de cette marque. L'enregistrement ne sert qu'à faciliter et à renforcer cette protection; refuser la protection à une marque en raison du fait qu'elle n'a pas été enregistrée au pays d'origine, a pour effet de tolérer et même de favoriser la concurrence déloyale. Nous pensons donc que, lorsqu'on reconnaîtra, comme véritable point de départ de la protection des marques, la nécessité de réprimer la concurrence déloyale, on arrivera à admettre qu'il n'est ni nécessaire ni utile de subordonner la protection de la marque à l'accomplissement dans un autre pays d'une formalité, qui n'a aucun intérêt, pour statuer sur des faits de concurrence déloyale."

Il faut donc prendre pour critérium de la protection internationale efficace de la propriété des marques de fabrique tout ce qui est susceptible de réprimer en même temps la concurrence déloyale.

Il suffira par conséqueut à la loi uniforme qui régira éventuellement les marques de fabrique, de porter essentiellement sur les points suivants:

1° Définition internationale unique de la Marque.

2° Indépendance des marques internationales.

3° Modalité uniforme du dépôt (dépôt déclaratif, de préférence à dépôt attributif).

4° Droit de priorité pour le dépôt successif des marques dans chaque pays étendu à un an, comme pour les brevets d'invention, au lieu des 4 mois actuels.

5° Enregistrement international unique suffisant.

6° Protection de la marque telle qu'elle est déposée au pays d'origine.

Il serait excessif de développer ici les raisons qui militent en faveur de l'adoption dans le texte de la Convention d'Union des 6 paragraphes sus-énoncés. Les industriels et commerçants savent par expérience la grande difficulté qu'ils éprouvent actuellement à faire protéger à l'étranger leurs marques personnelles tant à cause des différences du domaine de la marque dans chaque pays, du système de dépôt (attributif ou déclaratif) que des délais d'enregistrement, pour conserver un droit certain de priorité.

La conférence de Washington, malgré les efforts faits par les différents Congrès de la propriété industrielle pour obtenir satisfaction sur ces différents points n'a, à vrai dire, réalisé de progrès que sur la question de la définition de la marque. (Article 6 de la Convention.)

L'article 6 nouveau, en remaniant l'ancien texte, et notamment en supprimant le chiffre 4 de l'ancien Protocole de clôture a réalisé tout au moins implicitement et, pourrait-on dire négativement, la définition internationale de la marque. Or c'est là un résultat considérable, qui constitue un pas décisif franchi dans la voie de l'unification internationale de la législation. C'est un progrès dont les conséquences se feront vraisemblablement prochainement sentir; car, s'il est vrai que la définition implicitement donnée par l'alinéa 2, ne vise que la protection internationale, il est cependant logique d'espérer que les divers pays, grâce a mouvement évolutif constant de la législation, adapteront leurs dispositions internes aux résolutions de la Conférence.

La Conférence, qui ne pouvait adopter que les dispositions présentées à l'unanimité, s'est montrée, dans sa majorité, favorable à d'autres questions importantes, qui sont donc mûres pour une prochaine réunion.

Or, si à la prochaine Conférence on parvient, comme c'est probable, à l'adoption d'un texte encore plus précis, donnant une définition vraiment complète de la marque (c'est à dire protection de tous signes ne *constituant pas la désignation nécessaire* d'un produit et présentant un *caractère distinctif* quelconque), on aura franchi une étape essentielle et décisive de la route vers l'unification complète de la législation.

Toutes les autres questions viendront nécessairement ensuite et en tous cas perdront immédiatement de leur importance, sauf cependant la question de l'effet du dépôt, qui est l'une des plus délicates à résoudre. Sur ce point encore il faut espérer que la logique, aidée des leçons de l'expérience, déterminera les pays à dépôt attributif à abandonner un système injuste et particulièrement défavorable à la loyauté commerciale. Quant à la question du délai de priorité il est vraiment inconcevable que la récente Conférence de Washington ne l'ait pas résolue dans le sens proposé par l'Association Internationale; ce sera certainement fait la prochaine fois.

En résumé, si la réalisation, tout à fait souhaitable, d'une loi instaurant un système de brevet international est encore malheureusement assez lointaine, il en est tout autrement en ce qui concerne l'uniformisation de la législation sur les marques de fabrique; un pas décisif a été franchi par la dernière Conférence Internationale, il appartient aux divers Congrès intéressés de faire la propagande nécessaire pour obliger la prochaine Conférence à réaliser complètement une réforme que l'internationalisation, de plus en plus complète du commerce, réclame impérieusement

LES BREVETS INTERNATIONAUX SONT-ILS DESIRABLES OU NON?

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Quand on a commencé à s'intéresser internationalement à la question de la protection des brevets d'invention, la première idée qui est venue à l'esprit des ingénieurs et des jurisconsultes compétents a été de chercher à élaborer une loi unique, internationale, organisant la protection des inventions brevetées.

A Vienne, en 1873, le premier Congrès de la propriété industrielle a émis un voeu dans ce sens; le Congrès de Paris de 1878 a cherché lui aussi, à élaborer les bases d'un avant-projet portant sur l'instauration d'un brevet international. Un orateur autorisé du Congrès, M. Armengaud jeune, fit alors remarquer que l'idée, judicieuse en elle-même, lui apparaissait tout au moins prématurée quant à sa réalisation; il proposait, en conséquence, de chercher plutôt à établir une protection internationale efficace, des inventions brevetées par la conclusion de traités spéciaux ou mieux d'un traité général entre les Etats intéressés, tout en réservant à chaque pays la faculté d'organiser cette protection conformément à ses vues économiques et juridiques personnelles. La motion de M. Armengaud obtint les suffrages du Congrès qui décida la conclusion prochaine d'une union internationale, réalisée en effet postérieurement en 1883, sous le vocable de Convention internationale de Paris.

Depuis, les propositions de création d'un système de brevet international, reprises officieusement aux divers Congrès successifs pour la protection de la propriété industrielle se heurtèrent au scepticisme de la majorité des congressistes, qui voyaient dans la diversité des lois nationales l'antagonisme des intérêts économiques et l'évolution inégale du développement industriel et commercial dans les divers pays, un obstacle de plus en plus insurmontable à l'établissement d'une loi internationale unique organisant le régime des brevets d'invention.

Le huitième Congrès international de chimie appliquée, tenu à Londres en juin 1909, repris, sur la proposition de plusieurs de ses membres, l'idée du brevet international et décida de nommer une commission chargée d'étudier la question d'une manière approfondie et de présenter un avant-projet, qui pût être discuté au prochain Congrès de chimie appliquée, prévu pour juin 1912 à Washington. La même année, le 13° Congrès de propriété industrielle réuni en Octobre à Nancy, reprit à son tour, sur l'initiative du professeur Osterrieth de Berlin, l'idée du brevet international.[1] M. Osterrieth signalait, en effet, la nécessité d'uniformiser progressivement, et sur les points essentiels tout au moins, le régime de la protection industrielle notamment en ce qui concerne les brevets d'invention. Le Congrès, disait-il, a demandé la suppression internationale de l'obligation d'exploiter, mais il faudrait également uniformiser le mode de délivrance des brevets. Or, c'est une tache ardue et délicate; les principaux pays, en effet, pratiquent à cet égard les modes les plus différents. La France n'a pas d'examen préalable; l'Allemagne, au contraire, a créé un office d'examen très sévère, le "Patentamt"; l'Angleterre a adopté le système de l'avis préalable; quel système choisir pour l'imposer internationalement? La question est d'autant plus troublante qu'un mouvement semble se dessiner en France (proposition Astier) en faveur de l'instauration d'un régime d'examen préalable. Cependant, le mouvement en faveur de la création d'un Office d'examen préalable est plus apparent que réel; il n'a de partisans déterminés que dans certains milieux, où il est de principe de trouver toujours plus parfaite l'organisation des autres: l'immense majorité des gens compétents y est formellement opposée; et, en Allemagne, les personnalités les plus compétentes manifestent une hostilité grandissante contre l'organisation du "Patentamt," d'autre part, abandonnant son libéralisme traditionnel, l'Angleterre vient d'adopter le régime de l'avis préalable! En Amérique, enfin, il est indéniable qu'une réaction progressive se dessine contre le système de l'examen préalable.

Le professeur Osterrieth proposait en conséquence de laisser subsister les Cours d'examen existantes (Patentamt, Patent-Offices) comme institutions scientifiques techniques (examinant

[1]V. Annuaire de l'Ass. int., 1909, p. 159 et suiv.

facultativement et postérieurement à leur délivrance le merite des inventions) et de les considérer comme des institutions dépendant d'une Cour suprême internationale d'examen à créer éventuellement.

Il concluait en demandant la nomination d'une commission d'études chargée d'examiner et de comparer les diverses lois des divers pays, dans leur évolution historique et au triple point de vue économique, social et jurdique, afin de pouvoir rédiger, tout au moins sur les questions essentielles, un projet susceptible de recueillir l'agrément unanime. La proposition Osterrieth fut adoptée à l'unanimité et inscrite à l'ordre du jour du Congrès de Bruxelles de juin 1910. La question fit l'objet de deux intéressants rapports, l'un de M. de Snyers, l'autre de M. de Laire, tous deux ingénieurs, favorables au brevet international;[1] et le Congrès chargea en conséquence une commission d'études d'entreprendre l'examen appronfondi d'un projet de brevet international sur un programme très détaillé.[2]

Dans le même esprit, et en vue de centraliser internationalement les services de la propriété industrielle, le professeur Osterrieth, rappelant le voeu exprimé par le Congrès de chimie appliquée réuni à Rome en 1906, faisait adopter par le Congrès de Bruxelles le voeu suivant:

Que la conférence de Washington rappelle au Etats signataires leur obligation contractuelle de mettre leur législation en accord avec la convention, notamment l'obligation pour chacun d'eux, de créer un service spécial de la propriété industrielle dans les conditions prévues par l'Article 12 de la Convention d'Union; que en outre, la Conférence de Washington émet le voeu que les descriptions et dessins des brevets dans tous les Etats de l'Union soient publiés sous forme de fascicules séparés et mis en vente à un prix modique.

D'autre part, M. Schwaerbsch, ingénieur-conseil, directeur du Bureau d'informations pour la protection de la propriété industrielle à la "Royal Wurtembergische Zentralstelle für Gewerbe

[1]V. Annuaire d'Ass. int., 1910 p. 236 et 242.

[2]Au mois de Septembre suivant, le Congrès international des Associations d'Inventeurs et des Associations d'Artistes industriels décidait également l'étude, par une Commission compétente de la question du brevet international. V. Annuaire Ass. Inter. p. 248.

und Handel" à Stuttgart, signalant la nécessité de créer un office international susceptible de renseigner économiquement les intéressés sur les diverses questions se rapportant aux brevets d'inventions, indiquait que le premier essai de création d'une institution officielle de ce genre avait été fait en octobre 1908 par la "Royal Wurtembergische Zentralstelle für Gewerbe and Handel," laquelle fonda un Bureau public d'informations pour la protection de la propriété industrielle, ce Bureau étant organisé et dirigé au début par un agent de brevets. La création de ce Bureau avait, en effet, paru indispensable à la suite des plaintes nombreuses de personnes peu fortunées, qui tombaient fréquemment entre les mains d'individus malhonnêtes, lesquels abusaient d'elles, soit en obtenant leurs brevets, soit en négociant à leur insuleurs droits privilégiés. Au début, on avait pensé à donner des conseils entièrement gratuits, sans se soucier de la situation personnelle des intéressés, puis on réclama des subsides modérés aux industriels aisés. Ce fut un succès: l'institution en une année à peine répondit, en effet, oralement à 80 demandes et par écrit à 672; c'était la preuve du besoin longtemps ressenti auquel elle venait de donner satisfaction.

Puis l'Office fut obligé d'étendre son champ d'action en s'adjoignant un jurisconsulte, de façon à pouvoir assister les personnes inexpérimentées et à leur procurer la protection de la loi, soit en réclamant la restitution de l'argent indûment perçu, soit en réprimant le tort qui leur avait été fait, soit enfin, au commencement de l'année 1910, le Bureau d'informations avec le concours d'un grand nombre d'agents de brevets organisa une exposition universelle d'inventions pour faciliter aux brevetés la vente de leurs brevets ou la concession de licences d'exploitation.

Dans l'état actuel des choses, tant en Allemagne qu'ailleurs, il serait désirable de généraliser l'arrangement réalisé par la "Royal Zentralstelle de Wurtemberg", conformément aux circonstances et exigences spéciales de chaque pays, en instituant un office quelconque, soit dépendant, soit indépendant d'un service gouvernemental, dans le but de fournir des informations et des conseils en matière de propriété industrielle et dont la direction serait confiée à des personnes expérimentées.

Indépendamment de son but philanthrotopique, cette organisation généralisée constituerait un véritable Office de brevets susceptible de rendre de grands services et d'aider, par l'étroite solidarité des bureaux entre eux, à la centralisation internationale des services de la propriété industrielle et, par conséquent, à la préparation à l'unification de la législation.

La commission instaurée par le Congrès de Bruxelles s'est mise immédiatement à l'œuvre, elle s'est divisée en un certain nombre de sous-commissions, dans chacun des principaux pays reliées entre elles par un comité central destiné à centraliser les documents et à préparer éventuellement un avant-projet, mais la besogne est ardue et l'on ne peut prévoir de résultats avant plusieurs années de laborieuses études.

En dehors de cette activité en quelque sorte officielle, il y a eu des initiatives particulières. C'est ainsi que, tout récemment, un industriel, M. Julien Bernard saisissait le ministère du Commerce d'une proposition (d'ailleurs déjà présentée à maintes reprises) visant l'institution du brevet international. Le système préconisé par M. Julien Bernard consiste à organiser le dépôt unique par voie postale à ce qu'il appelle un "Central Mondial." L'inventeur, désireux d'être protégé internationalement, adresserait une demande accompagnée d'une note explicative au Bureau international compétent, lequel procéderait à l'examen de la demande; cet examen unique serait limité à la nouveauté de l'invention et effectué par une commission internationale; une patente de propriété, valable dans tous les pays, serait accordée à l'inventeur (brevet international), mais ce brevet n'attribuerait pas à son propriétaire de monopole exclusif d'exploitation et ne pourrait faire obstacle à la libre exploitation de son invention dans l'industrie, il percevrait seulement sur les objets fabriqués une redevance déterminée et à charge encore d'en remettre partie à l'Etat (probablement du pays d'origine du demandeur).

M. Julien Bernard prévoit, en outre, pour la perception de cette redevance l'apposition de poinçons et marques sur les objets fabriqués, et la création, pour assurer cette perception, d'une association mondiale de défense des auteurs industriels.

En dehors des difficultés matérielles d'organisation, il est à peine besoin de faire remarquer ce qu'a d'utopique et même de dangereux la conception de M. J. Bernard. Elle lèse intérêts mêmes qu'elle prétend défendre, puisqu'elle dépouille l'inventeur du droit de disposer librement de son invention et accepte sans réserves le fonctionnement automatique ce la licence obligatoire qui constitue une atteinte considérable au droit de l'inventeur et en est en quelque sorte la négation.

Le projet de M. J. Bernard, si intéressant qu'il soit comme tentative de principe pour réaliser une protection internationale à la fois plus facile, plus rapide et moins coûteuse des inventions, qu'apparemment compétent pour résoudre une question aussi complexe.

Le brevet unique international est assurément le but que doivent se proposer tous ceux qui s'intéressent à la propriété industrielle, mais il y a loin de la coupe aux lèvres! Il y a des difficultés considérables à vaincre. Il faut d'abord s'astreindre à diminuer les divergences considérables des législations, qui portent sur des points importants du régime des brevets; il y en a d'anodines, mais il y en a aussi de presque insurmontables. C'est ainsi qu'en ce qui concerne le caractère de brevetabilité, les différences de conception et de définition ne présentent qu'un intérêt secondaire, et l'on pourrait facilement arriver à l'admission d'un principe commun; d'ailleurs, à cet égard, les conventions internationales peuvent réaliser immédiatement l'unification.[1] Par contre, il existe des divergences profondes, notamment dans la conception du mode de délivrance des brevets.

Le brevet international se comprendrait assez facilement dans le système de non examen préalable; au contraire avec le système de l'examen préalable, il faudrait constituer pour cet examen un organisme central extrêmement compliqué et coûteux, et dont les décisions risqueraient fort de ne pas être acceptées sans appel par les différents intéressés.

Le Patentamt allemand, malgré sa puissante organisation, son perfectionnement continu, les énormes crédits dont il dispose, se montre chaque jour plus impuissant à remplir la tâche qui lui est imposée, et celà suffit à souligner les difficultés qu'il y aurait à

[1] Les diverses Conventions internationales ont en effet unifié déjà, sur des points importants, le lois des divers pays sur les brevets et tout récemment encore la Conférence de Washington.

établir un organe unique d'examen pour les inventions du monde entier.

Il n'y a donc pas lieu pour le moment de tenter la réalisation immédiate du brevet international, ce serait aller à un échec certain; mais, loin cependant d'en abandonner le principe, il faut tout au contraire encourager les associations spéciales, s'occupant de la question, dans le travail d'unification des lois internes qu'elles poursuivent déjà depuis de longues années. Cette unification par étapes successives conduira fatalement au système du brevet international.

Il faut aussi attendre avec intérêt le résultat des travaux de la Commission d'études de l'Association internationale pour la protection de la propriété industrielle: ce n'est donc pas avant plusieurs années que l'on pourra, semble-t-il, parler avec quelque précision, de projets de brevet international et il faudra alors les discuter internationalement et se mettre d'accord sur ces textes; on peut dire sans crainte que la réforme est encore d'une réalisation lointaine.

MISE EN OEUVRE OBLIGATOIRE DES INVENTIONS ET LICENCE OBLIGATOIRE

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Aux termes de l'art. 32, §2, de la loi du 5 juillet 1844, modifié par la loi du 20 Mai 1856, le breveté "qui n'a pas mis en exploitation sa découverte ou invention en France dans le délai de 2 ans, à dater du jour de la signature du brevet, ou qui a cessé de l'exploiter pendant deux années consécutives, à moins que, dans l'un ou l'autre cas, il ne justifie des causes de son inaction" est déchu de ses droits privatifs; la loi du 1° juillet 1906 (pour rendre possible l'application de la Convention d'Union de 1883 (protocole de clôture, art. 3 bis) auquel la France avait adhéré, et qui étend le délai à trois années) a décidé que les Français pourraient revendiquer l'application à leur profit des dispositions de la Convention... dans tous les cas où ces dispositions sont plus favorables à l'inventeur que la loi française et notamment...en ce qui concerne les délais d'exploitation en matière de brevets d'inventions.

La déchéance pour défaut d'exploitation dans un délai maximum variant de 2 à 5 ans, existe dans la plupart des législations, elle a été diversement appréciée depuis qu'elle fonctionne, mais, malgré les critiques nombreuses auxquelles elle a donné lieu, elle a été généralement maintenue dans les divers pays qui ont adhéré à la Convention d'Union de 1883.[1]

[1]Cette assertion n'est toutefois rigoureuse que dans sa généralité; jusqu'en 1907, l'Angleterre n'admettait pas la déchéance pour défaut d'exploitation, elle se bornait à décider que le breveté, qui s'abstenait d'exploiter, devait être soumis à la licence obligatoire. Rompant brusquement avec son passé libéral, et contrairement aux principes admis par l'Association Internationale industrielle, le Parlement Anglais a voté, le 28 août 1907, une loi nouvelle qui décide, art. 27 que: "chacun peut, en tout temps, après qu'il se sera écoulé quatre ans depuis la date d'un brevet ou un an au moins après l'adoption de la présente loi, adresser au contrôleur une demande de révocationde ce brevet, basée sur le fait que l'article ou le procédé breveté est exclusivement ou principalement fabriqué ou exploité hors du Royaume-Uni." Par contre le Reichstag Allemand par une loi en date du 6 juin 1911, entrée en vigueur le 1° juillet suivant, dispose que "lorsque le breveté se refusera à accorder à un tiers le droit d'employer l'invention même moyennant une rémunération convenable

C'est pour la première fois, semble-t-il, au Congrès International de la propriété industrielle tenu en 1897 à Vienne que s'est posée avec intérêt la question de la suppression de l'obligation d'exploiter. Le Congrès se termina après une longue discussion par l'adoption, à une caractéristique majorité, d'un voeu demandant sa suppression.[1] Repris en 1898 au Congrès de Londres, le voeu émis par le Congrès de Vienne recueillit cette fois des suffrages unanimes[2] mais c'est à Paris, au Congrès tenu du 23 au 28 juillet 1900 que a question de la suppression de l'obligation d'exploiter donna lieu à la plus intéressante discussion.

Deux rapports remarquables[3] l'un de M. G. Huard, avocat à la Cour de Paris, l'autre de M. Von Schütz, directeur de la Fried Krupp Gruson Werk, concluaient nettement à la suppression de l'obligation d'exploiter quelle qu'en fût la sanction, déchéance pure et simple ou licence obligatoire, et le rapporteur gènèral G. Maillard, adoptant les conclusions Huard et Von Schütz faisait adopter à l'unanimité le principe précédemment admis à Vienne et à Londres: "Il est nécessaire dans l'avenir d'abandonner en principe l'obligation d'exploiter." Puis ajoutant aux conclusions des rapporteurs il indiquait, pour remédier à l'inconvénient qui lui semblait résulter de la liberté de ne pas exploiter, (notamment dans la crainte qu'un inventeur étranger, venant se faire breveter en France et ne voulant pas exploiter ne pût interdire à l'industrie française de profiter d'un progrès réalisé à l'extérieur) il proposait d'organiser un système de licences obligatoires, dont le principe était également admis par le Congrès, mais sans préciser le mode d'application.

et une garantie suffisante, l'on pourra, si l'intérêt public paraît l'exiger, concéder à ce tiers le droit d'utiliser l'invention (licence obligatoire). . . le brevet pourra être révoqué quand l'invention aura été exécutée exclusivement ou principalement hors de territoire du l'Empire Allemand." L'Allemagne reprend donc en quelque sorte à l'Angleterre, qui l'abandonne, le système de la licence obligatoire qui atténue les conséquences de la déchéance pure et simple pour non-exploitation. La Finlande et la Suède corrigent la rigueur de la déchéance pour non-exploitation dans le délai imparti par la concession de licences obligatoires à des tiers. Le Mexique n'exige pas l'exploitation par le breveté, mais organise le fonctionnement automatique, à l'expiration du terme prévu, de la licence obligatoire. Le Venezuela n' exige qu'une exploitation unique, soit à l'intérieur, soit à l'extérieur de la République. Aux Etats-Unis, l'obligation d'exploiter n'existe pas.

[1] V. *Annuaire de l'Assoc. Int. Ind.* 1897, p. 65–69.

[2] V. *Ibid.* 1898, p. 54 et suivantes.

[3] V. *Bull. de l'Assoc. franç. pour la protection de la propriété industrielle* 1902, p. 84 et suiv.; V. aussi *Ibid.* la discussion de ces rapports, p. 262 et suiv.

Une sous-commission fut chargée d'étudier la rédaction d'un texte plus explicite. L'un des membres de cette sous-commission M. Moulton, célèbre avocat Anglais, y vint déclarer que, si la licence obligatoire était excellente en théorie, elle rencontrait dans l'application des difficultés considérables; que notamment en Angleterre on avait essayé d'établir un système de licences obligatoires plus complet que celui alors en vigueur dans ce pays, et qu'aprés une étude et des discussions minutieuses on avait abandonné le projet. Un autre membre de la sous-commission, le Professeur Bernthesen, délégué de la Badische Anilin und Soda Fabrick se déclara également très partisan du principe de la licence obligatoire, mais il considérait comme très difficile, de déterminer dans quelles conditions le prix de ces licences serait fixé, et de trouver un tribunal présentant une compétence suffisante pour apprécier la valeur d'une invention et contraindre la breveté à accorder licence à un concurrent avec lequel il n'avait pu préalablement s'entendre. Aussi la sous-commission jugeat-elle à propos de ne voter que la mise à l'étude de la licence obligatoire et de maintenir dans sa généralité et son imprécision voulues le voeu émis par le Congrès.

Les Congrès Internationaux postérieurs (successivement tenus à Düsseldorf, Amsterdam, Turin, Stockholm, Liège, Berlin, Cologne, Copenhague) ont toujours maintenu avec la même unanimité le principe de la suppression de l'obligation d'exploiter, sans arriver par contre à se mettre d'accord sur un système définitif de licence obligatoire.

Au Congrès de Nancy de 1909, au lendemain de la nouvelle loi anglaise, qui rétablissait l'obligation d'exploiter, la question prit un caractère prépondérant. Si intéressante qu'en fût la discussion, il serait excessif de la prétendre consigner ici, même succintement analysée;[1] il suffira de rappeler les conclusions du rapporteur général G. Maillard:

"Depuis le Congrès de Vienne de 1897, déclarait-il, il y a accord unanime pour supprimer l'obligation d'exploiter avec cette constatation qu'elle ne peut avoir comme sanction pratique l'obligation d'exploiter, mais il a été impossible d'établir un projet international pour organiser judicieusement son fonctionnement."

[1]V. *Bull. de l'Assoc. Intern. Industr.* 1909, p. 104 et suiv.

En France, la question, très soigneusement étudiée, a été l'objet d'un projet de loi[1] préparé par M. A. Taillefer, avocat à la Cour de Paris et voté à l'unanimité par l'Association Française pour la protection de la propriété industrielle, mais le projet n'a pas été agréé par le Gouvernement français.[2] Il semble cependant que les critiques qu'a soulevées l'application de la nouvelle loi anglaise conseille de persister plus que jamais dans la suppression de l'obligation d'exploiter et il convient de profiter de la prochaine réunion de la Conférence de Washington pour la révision de la Convention d'Union[3] pour que cette question soit reprise à la Conférence et enfin solutionnée, il serait donc indispensable de se mettre d'accord sur un texte unique acceptable par tous les pays de l'Union, ce qui devrait être relativement facile puisque la plupart des pays unionistes ont engagé entre eux des pourparlers à ce sujet.

Il faudrait chercher à obtenir à défaut de la suppression pure et simple de l'obligation d'exploiter le correctif de la licence obligatoire; et, subsidiairement, on pourrait tout au moins demander, qu'il soit bien précisé que, celui qui aura fait des propositions raisonnables de licence aux industriels que le brevet peut intéresser, ne pourra jamais être considéré comme n'ayant pas exploité, et qu'il y aura là en tous cas, une justification des causes de son inaction; plus subsidiairement encore, en cas d'opposition intransigeante de l'Angleterre, il faudrait demander tout au moins à la Conférence de dire que l'exploitation dans un pays, quand elle aura vraiment lieu, devra être considérée comme suffisante, non pas quand elle sera principale ou presque principale, mais quand l'importation dans le pays ne l'emportera pas sur la fabrication. Telles étaient les conclusions du rapporteur général, et comme terme à la discussion, le Congrès de Nancy émit le voeu suivant:

"Le Congrès émet à nouveau le voeu que l'obligation d'exploiter soit supprimée dans les rapports internationaux; qu'en tout cas, à la prochaine conférence de révision, l'unification des lois sur cette matière soit obtenue."

[1]V. *Bull. de l'Assoc. franç. ind.* déjà cité, N° I, 2° série, p. 16, avec la lettre accompagnant la communication du projet au ministre, le 2 mars 1907.

[2]V. annexe au procès-verbal de la séance du 18 fév. 1909. Projet de loi N° 2320, renvoyé à la Comm. du Commerce et de l'industrie.

[3]Cette Conférence a eu lieu en Mai 1911. Elle a maintenu le système de la déchéance pour défaut d'exploitation.

"Il serait à souhaiter dans ce cas, que l'exploitation dans un des pays de l'Union vaille exploitation dans tous les autres; subsidiairement, que le défaut d'exploitation ne puisse avoir pour sanction que la concession de licence obligatoire, et non la déchéance; qu'en tout cas, la déchéance ne puisse être prononcée lorsque le breveté établira avoir envoyé aux industriels pouvant s'intéresser aux brevets des offres de licence à des conditions raisonnables que ceux-ci n'ont pas agréés."

"Qu'enfin, l'exploitation soit considérée comme suffisante quand le breveté fabriquera dans chaque pays au moins autant d'objets brevetés qu'il en importera dans le pays."

Ce voeu fut renouvelé au Congrès de Bruxelles de 1910, qui chargea l'Association Internationale de l'incorporer dans le projet de réforme présenté à la Conférence de Washington de mai 1911.

Le Bureau International de Berne et le Gouvernement des Etats-Unis, sans accepter intégralement le texte du voeu émis avec tant de persévérance que les Congrès Internationaux proposèrent cependant dans leur avant-projet (art. 7 & 9)[1] de substituer à la vieille règle de l'obligation d'exploiter principalement dans le pays d'origine à peine de déchéance[2] le principe de l'exploitation commerciale avec autorisation de fabriquer dans l'un ou l'autre des pays unionistes ce qui constituait tout au moins un progrès libéral et préparait pour l'avenir la suppression sous condition de l'obligation d'exploiter.

La résistance intransigeante de certains délégués, et notamment des délégués anglais, empêcha la prise en considération du voeu unanime cependant des Congrès Internationaux, et ne rendit même pas possible le vote des propositions du Bureau de Berne (art. 7 & 8). L'art. 5 nouveau de la Convention de Washington maintient la déchéance pour non-exploitation dans le délai de trois ans.[3]

Il est profondément regrettable qu'en dépit de l'opinion unanime des jurisconsultes, ingénieurs et industriels de tous les pays, et

[1] V. *Bull. de l'Assoc. fr. ind.* déjà cité, N° 5, 2° Série, 1909–1910, p. 129.

[2] Règle absurde d'ailleurs, puisque, dans le cas d'un brevet pris dans divers pays de l'Union, elle est inapplicable; on ne peut en effet exploiter principalement dans plus d'un pays à la fois.

[3] Il convient de remarquer que le texte de la Convention de Washington n'a encore été ratifié par aucun des pays représentés.

malgré les leçons d'une longue expérience, on puisse maintenir une disposition aussi inutile sinon dangereuse que celle de l'obligation d'exploiter, même corrigée par l'autorisation d'introduire de l'étranger unioniste.

On avait cru trouver dans la nécessité de protéger le travail national la raison d'obliger le breveté à exploiter l'invention, dont l'Etat lui garantissait la protection. Malgré la prédominance encore persistante du régime protectionniste, le prétexte, jadis donné pour légitimer l'obligation d'exploiter les brevets, n'est aujourd'hui pris au sérieux par personne, et les arguments qui militent en faveur de la suppression de l'obligation d'exploiter (en dehors même de l'impression que peut causer l'unanimité persistante des Congrès compétents) sont trop connus pour qu'il soit nécessaire d'y insister.

Il apparaît donc bien incontestablement aujourd'hui que l'obligation d'exploiter doive disparaître prochainement des lois sur les brevets d'inventions; toute la question est de savoir si elle doit disparaître sans condition ou avec l'organisation de licences obligatoires. A cet égard, les opinions sont trop contradictoires pour que l'on puisse être aussi absolu qu'au sujet de la suppression du principe même de l'obligation d'exploiter.

Quoiqu'il en soit l'Association Française pour la Protection de la Propriété Industrielle, dans son Assemblée Générale du 17 mai dernier, a approuvé à l'unanimité un rapport de M. Henri Allart, destiné à être présenté au Congrès tenu à Londres du 3 au 8 juin sur l'initiative de l'Association Internationale Industrielle, lequel rapport conclut au maintien intégral des voeux et du projet voté au Congrès de Bruxelles de 1910, et demande à la prochaine Conférence Internationale, qui reprendra les travaux de la Conférence de Washington, de supprimer définitivement l'obligation d'exploiter et de la remplacer par l'institution d'un système de licences obligatoires.

Le Congrès de Londres, à son tour, confirmant les résolutions du Congrès de Bruxelles et le vote de l'Association française, vient d'émettre à l'unanimité le voeu présenté par M. H. Allart.

Devant la persistance des intéressés, particulièrement compétents à réclamer une telle réforme, il y a lieu de croire, que la prochaine Conférence Internationale sera obligée de se prononcer expressément sur une question mûre pour une solution, et qu'à défaut de pouvoir voter un texte formel, elle émettra un voeu caractéristique et préparatoire d'une solution prochaine.

Donc les voeux persistants des Congrès comme les considérations économiques semblent imposer l'institution de licences obligatoires, mais, si l'on examine de près dans quel cas il y aura lieu d'imposer la concession de licences, quelle juridiction les distribuera, dans quelles conditions et à qui seront-elles octroyées, on se heurte à des difficultés pratiques énormes. Aussi a-t-on envisagé un autre système: l'expropriation; mais il n'existe à cet égard aucun projet précis, et, si ce mode de solutionner la question de l'exploitation, dans l'intérêt général, de certains brevets particulièrement utiles, est à priori séduisant, il comporte, en consacrant le principe d'une intervention, selon les cas du pouvoir exécutif, administratif ou judiciaire, un élément de danger pour la liberté commerciale et industrielle. C'est en tous cas une question à examiner de très près et sur le mérite de laquelle on ne pourra se prononcer que lorsqu'on se trouvera en face de textes précis.

La question de la suppression de l'obligation d'exploiter unanimement désirée apparaît donc comme autant justifiée dans son principe que difficilement réalisable dans la pratique; il faudrait d'abord prévoir un mode de licences obligatoires ou d'expropriation pour cause d'utilité publique ou privée, ou tout autre système susceptible d'être accueilli unanimement: c'est sans doute sous l'influence de ces considérations d'intérêt pratique que la Conférence de Washington a maintenu, an quelque sorte, malgré elle, l'obligation d'exploiter les brevets d'invention à peine de déchéance.

BREVET INTERNATIONAL PERMETTANT DE SIMPLIFIER LES CONTESTATIONS ENTRE ETRANGERS

PAR ED. DE LAIRE
President de la Section Française XI[a]
Industrielle, Paris, France

En 1909, au VII° Congrès de Chimie Appliquée, à Londres, j'ai émis quelques idées sur la nécessité d'un brevet international destiné à remplacer les brevets nationaux dans les contestations entre étrangers.

En 1910, a Bruxelles, l'Association Internationale pour la protection de la Propriété Industrielle avait inscrit à son programme "L'Unification des Lois sur les brevets d'invention dans chaque pays". Mais cette question ne fut pas traitée: lorsque son tour vint, le Congrès touchait à sa fin et l'assemblée ne paraissait pas préparée à la discuter. Mr. le Pr. Osterrieth exposa donc simplement ce qu'il croyait utile de faire pour réunir les indications et renseignements qui, selon lui, devaient servir de point de départ à une discussion dans un prochain Congrès.

Quelques jours plus tard, Mr. Couhin, Avocat français très distingué, mort malheureusement depuis, fit adopter au 3° Congrès International des Associations d'inventeurs (Bruxelles, Septembre 1910) un voeu tendant, lui aussi, à la création de brevets internationaux.

Cette idée de la simplifications et de l'unification des lois sur les brevets est du reste déjà ancienne. MM. Pouillet, Maillard, Amengaud, et d'autres, en ont parlé en France, à plusieurs reprises; mais ils l'ont fait d'une façon générale, sans entrer dans les détails et en paraissant craindre que le moment ne fût pas encore venu de la proposer à une discussion internationale.

Je crois que Mr. le Pr. Osterrieth était aussi un peu de cette opinion jusqu'à ces derniers temps.

Le programme qu'il a soumis, il y a 2 ans, au Congrès de la Propriété Industrielle à Bruxelles me fait cependant espérer qu'il voudra bien, un jour, consacrer à ce sujet un péu de son activité, de son expérience, et de son autorité. Je dois dire, toutefois, que son programme me semble un peu vaste et que je crains que beaucoup d'années ne se passent encore avant que soit accompli le travail considérable qu'il nécessitera.

Or, ce que je viens faire ici, Messieurs, c'est précisément, vous demander si l'étude de cette question ne pourrait pas aller un peu plus vite, et vous montrer qu'elle n'est pas aussi compliquée qu'on le croit généralement.

D'abord, est-il nécessaire d'envisager, dés maintenant, la réforme générale des lois de chaque pays sur les brevets, et l'adoption par les principaux Etats, d'une seule et même législation?

C'est là un idéal très tentant, et je serais le premier à le défendre si je croyais sa réalisation possible dans un délai suffisamment rapproché.

Malheureusement, les législations des principaux pays sont souvent, en matière de propriété industrielle, si différentes, on peut même dire si contradictoires, qu'il est à craindre qu'on ne puisse, avant longtemps, obtenir leur unification. C'est cette crainte d'entreprendre une chose trop longue et trop difficile qui m'a fait penser à la combinaison que j'ai exposée plusieurs fois déjà, depuis 3 ans, soit dans des Congrès, soit dans des articles de journaux, et que j'appellerai:

"Le brevet pour contestations entre étrangers."

Cette idée ne m'est du reste venue que parce que j'ai, personnellement, beaucoup souffert de l'état de chose actuel; et je m'excuse de me citer moi-même, ici, comme exemple de l'utilité de ce que je demande.

J'ai participé, il y a quelques années à la défense de 2 séries de brevets qui ont donné naissance à de nombreux procès, en France, en Allemagne, Angleterre, Belgique, Etats-Unis. C'était le brevet de l'Ionone (Violette Artificielle) et ceux du Musc Artificiel. Pour le Musc, les procès ont duré un peu moins de 15 ans; mais ceux de l'Ionone ont duré plus longtemps car ils ont continué aux Etats-Unis, alors que les brevets étaient déjà expirés en Europe. Dans toutes ces affaires, nous avons eu gain de cause contre les personnes que nous poursuivions comme contrefacteurs. Mais: tantôt, nous avons dû prouver à nouveau, dans un pays, ce qui l'avait été plusieurs fois déjà dans les autres; tantôt, nous avons dû, pour tenir compte de certaines jurisprudences, changer absolument la forme de notre argumentation. Partout nous avons dû recommencer de nouvelles expertises qui n'étaient que la répétition de celles déjà faites ailleurs.

Au cours de ces 15 années de procès dans 5 pays différents, j'ai été amené à voir combien une simplification de la législation internationale des brevets serait utile aux inventeurs et à ceux qui exploitent des inventions.

Il me semble tout naturel que chaque pays reste maître de faire chez lui ce qu'il croit convenable et il n'est pas nécessaire de demander à un Etat de changer les lois qui régissent ses nationaux dans les contestations qu'ils ont entre eux. Mais le procès fait à l'étranger est une chose qui présente des difficultés pour tout le monde: l'Americain, ou l'Anglais qui viennent plaider en France, les éprouvent aussi bien que l'Allemand qui doit se défendre en Angleterre, ou le Belge, ou le Français qui se présentent devant des juges allemands.

Pourquoi alors ne pas dire "Tout différend entre étrangers, à l'occasion d'un brevet, pourra être porté devant un tribunal international; il suffira pour cela que le breveté, après avoir pris et obtenu son brevet dans son pays, l'ait également obtenu devant le bureau international des brevets."

Le 3° Congrès International des Inventeurs (Bruxelles 1910) disait dans son voeu:

"*Article 1.* Les sujets et citoyens de chacun des pays contractants qui auront régulièrement déposé dans l'un de ces pays une demande de brevet pourront s'assurer, dans les autres pays, la protection éventuelle de l'invention moyennant un 2° dépot au bureau international (à Berne), fait par l'entremise du pays de demande."

Cette formule est bonne et on pourrait, en l'appliquant, arriver à un résultat pratique sans toucher aux diverses législations, qui toutes, en réalité n'ont été faites que pour les différends entre nationaux.

Il suffirait, pour cela, de rédiger un réglement, créer un office et constituer un Tribunal; le tout au point de vus uniquement international des brevets.

S'il était institué (en Suisse, par exemple) un Office chargé de délivrer un brevet qui équivaudrait, pour les différents pays qui seront d'accord sur ce principe, à un brevet ordinaire dans les cas de contestations entre étrangers;

Si les procès entre étrangers se rattachant à ce brevet international, pouvaient être soumis à un Tribunal International (à deux degrès) devant lequel on pourrait plaider en déposant des rapports écrits, signés par les avocats nationaux des parties;

Si surtout, les arrêts de ce Tribunal étaient exécutoires, sans autre formalité, dans tous les pays ayant admis le brevet international;

Alors il ne serait plus exact de dire que le brevet international est rendu impossible par la diversité des législations. Chaque législation pourrait rester maitresse chez elle, et les lois nationales devraient, seules, être invoquées dans les différends entre nationaux; mais rien ne s'opposerait a ce que le brevet international, comme les décisions du tribunal international, aient, dans les contestations entre étrangers, une autorité reconnue par les divers états: et la défense de la propriété de l'invention dans le domaine international, cesserait d'être une chose aussi difficile, lente et coûteuse.

Lorsqu'il est fait un contrat d'affaires entre 2 particuliers habitant des pays différents, il est d'usage de stipuler, qu'en cas de procès, tels arbitres ou tels juges, seront compétents. Il suffirait de procéder de même pour créer le brevet international. Les délégués autorisés de plusieurs nations pourraient décider qu'en cas de différends entre étrangers appartenant à ces divers pays, les affaires devraient être portées devant un tribunal convenu d'avance (Tribunal International), lorsque le propriétaire de l'invention mise en cause par le procès prouverait qu'il est muni d'un titre (brevet international) établissant ses droits, et obligeant celui qui l'invoque à s'en rapporter à un réglement spécial (réglement des brevets internationaux).

Tout cela pourrait donc s'orgaiser sans qu'il soit rien changé à la législation intérieure d'aucun Etat et sans que personne puisse y trouver à redire, puisque la demande d'un brevet international ne serait pas obligatoire, mais facultative pour l'inventeur. Enfin, il n'y aurait pas à craindre que la création de cette organisation internationale change rien au fonctionnement du brevet national propre à chaque pays, dans ce qui concerne son exploitation nationale. Deux nationaux n'auraient pas plus à s'inquiéter dans leurs différends du brevet international, que deux habitants de la même ville ne peuvent aller plaider devant un tribunal autre que celui de leur judiriction naturelle.

J'ai indiqué, dans le rapport qui a été imprimé au Compterendu du Congrès de Bruxelles, les principaux détails de l'organisation de ce bureau international des brevets, je ne les répèterai donc pas ici. Du reste ce ne sont pas les détails qui sont en cause aujourd'hui, mais le principe même de l'institution. Le jour où l'on se décidera à discuter sérieusement cette question, l'organisation sera facile à concevoir. L'important est d'être, d'abord, d'accord sur le principe.

Je montrerai tout—à l'heure, Messieurs, dans un 2° rapport, que la création d'un office International des brevets rendrait de grands services à un autre point de vue, celui de la simplification et unification de l'examen préalable des brevets. Je vous demanderai, après ce 2° rapport, d'émettre un voeu en faveur de l'étude et de la discussion plus approfondie de ces questions, en les fusionnant avec celles du présent rapport.

EXAMEN PREALABLE DES BREVETS

Simplification a apporter a son fonctionnement

Par Ed. de Laire
Industriel, Paris, France

La discussion entre partisans et adversaires de l'examen préalable devient chaque jour plus compliquée et ce qui en ressort de plus clair, c'est que personne ne trouve parfait le régime auquel il est soumis.

Les inventeurs font remarquer, en France, que, quand ils veulent vendre une invention on leur demande tout d'abord s'ils ont le brevet allemand ou le brevet américain qui étant soumis à l'examen préalable peuvent seuls donner une garantie du brevet.

Par contre, dans des pays comme l'Allemagne et les Etats-Unis, jusqu'à présent partisans absolus de l'examen préalable, des personnes autorisées commencent à signaler publiquement les inconvénients de la façon dont se fait l'examen officiel. On raconte même que certains employés des bureaux des brevets sont découragés par le nombre toujours croissant des demandes (il y a chaque année plus de 60.000 demandes de brevets aux Etats-Unis), la complication de la littérature scientifique et industrielle, la mauvaise foi et la ruse de certains inventeurs peu scrupuleux.

Avant de rechercher les causes de ces opinions opposées, voyons d'abord ce que désirent avoir les gens de bonne foi lorsqu'ils demandent un brevet sérieux.

Evidemment, ils veulent un titre officiel pour: 1° pouvoir prouver ce qu'était exactement leur invention à une date précise;

2° Pouvoir faire respecter cette invention en s'adressent aux tribunaux lorsque des atteintes sont portées contre elle.

A ces 2 points de vue, l'examen préalable n'est pas indispensable. Par contre, cet examen est évidemment très utile quand on veut montrer à un industriel ou un capitaliste qu'on a une invention ayant de la valeur, ou faire comprendre à des gens trop entreprenants que, s'ils commençaient une contrefaçon, ils devraient courir les risques d'un procés où les chances seraient contre eux.

Mais pour une invention capable de vie et d'avenir, combien y en a-t-il qui disparaissent sans avoir jamais fait l'objet d'aucune tentative d'application! Jusqu'à présent, le législateur considérant que tous les brevets devaient acquitter la même taxe, et étaient, par cela même, égaux devant la Loi, a envisagé de la même façon toutes les demandes.

On peut cependant se demander s'il est utile, pour l'intérêt public, de soumettre à un examen officiel obligatoire un brevet que son propriétaire a pris sans conviction et qui n'intéressera jamais personne. Par contre, on doit désirer que tout brevet sérieux puisse se présenter rapidement devant le public avec un certificat de nouveauté réelle et contrôlée.

Tout industriel qui a exploité des inventions ayant une certaine valeur sait bien qu'une découverte vraie ne peut éviter d'être attaquée qu'à la condition de donner l'impression qu'elle est inattaquable.

Si la discussion ne se fait pas à fond dès la prise du brevet devant un Office officiel, elle sera vite portée devant des juges par des concurrents. De telle sorte que s'il n'y avait que des brevets capables de faire la fortune de ceux qui les exploitent, l'examen obligatoire serait une chose d'utilité indiscutable, et la seule question que l'on aurait à étudier serait celle de savoir comment on pourrait arriver à ce que l'examen du brevet soit le plus rapide, le plus juste et le plus définitif possible.

Mais si l'examen est utile aux inventions sérieuses, peut-on dire que (en dehors de la question d'économie administrative) il y ait des inconvénients à appliquer cet examen indistinctement à toutes les demandes?

Oui; car

1° Cet examen entraine des frais considérables, surtout si on considère que ces frais se renouvellent chaque fois que, pour la même invention, on demande un brevet dans un nouveau pays où existe l'examen préalable légal.

2° Il retarde beaucoup la délivrance du titre officiel. Or, souvent, on ne demande un brevet que pour prendre date et montrer rapidement qu'une route est fermée à recherche de nouveaux arrivants.

3° Avec son organisation actuelle, il est incapable de donner ne garantie réelle à personne. Les employés chargés d'examiner les brevets ont souvent trop à faire, ou ne sont pas assez documentés, pour pouvoir poursuivre à fond leur examen. Du reste, ils n'y sont pas obligés; car ils ne sont pas, à proprement parler, responsables des arrêts qu'ils rendent et en réalité ce n'est pas eux, mais les tribunaux, qui tranchent les différends sérieux soulevés par leurs décisions.

Ces différentes considérations m'amènent à vous demander, Messieurs, s'il est vraiment utile que l'examen préalable soit obligatoire pour tous, et s'il faut l'appliquer à ceux qui sont prêts à déclarer qu'ils n'en ont pas besoin?

N'a-t-on pas su tort de concevoir l'organisation actuelle de l'examen préalable comme une règle absolue devant être exactement la même pour tous les brevets; pour ceux qui sont pris hâtivement par des inventeurs peu sérieux et ne seront pas maintenus plus de I an ou deux, comme pour ceux qui n'intéressent personne et ne seront jamais attaqués?

Le bureau officiel des brevets ne devrait-il pas plutôt enregistrer toute demande qui lui est adressée, mais ne soumettre l'invention à l'examen que lorsque l'inventeur le spécifie?

En un mot, ne veudrait-il pas mieux remplacer le brevet actuel par 2 titres:

1° Le brevet comme il existe en France; c'est-à-dire un certificat de dépôt avec prise de date, description de l'invention, etc.

2° Le certificat d'examen, c'est-à-dire la déclaration de nouveauté et, jusqu'à preuve du contraire, de validité de l'invention.

Le brevet devrait-être bon marché, le certificat d'examen pourrait-être plus cher. Si la taxe était beaucoup moins forte lorsqu' il n'y a pas d'examen, cela aurait l'avantage d'aider à ce qu'il se fasse, dès l'origine, une première sélection entre les demandes, et le nombre des inventions soumises à l'examen se trouverait, de cette façon, réduit de beaucoup.

Bien-entendu, la demande d'examen devrait pouvoir se faire aussi bien après la prise du brevet, qu'au moment de son dépôt. Il n'y aurait pas de raison de refuser l'examen à quelqu'un qui ne l'aurait pas sollicité tout d'abord, mais qui, quelques mois plus tard, le trouverait nécessaire à la mise en valeur de son invention.

Il nous semble aussi qu'il faudrait que la demande d'examen puisse être faite par les adversaires du brevet, aussi bien que par le breveté lui-même. Dans ce cas, il parait juste que la taxe soit acquittée par celui qui attaque; mais à la condition qu'elle lui soit, ensuite, remboursée par le propriétaire du brevet, si le brevet était déclaré nul, après révision des objections faites.

On pourrait aussi donner aux examinateurs le droit d'infliger une amende aux personnes qui auraient soumis à leur étude une chose que ces personnes auraient manifestement su ne pas être nouvelle, ou être inexacte.

Un autre perfectionnement auquel on peut aussi penser, c'est celui qui consisterait à faire faire l'examen non pas par un bureau national, mais par un bureau international.

Et ici ma proposition se rattache à celle que j'ai faite précédemment pour le brevet international.

S'il était créé, dans un pays neutre, un comité d'examen des brevets, et si les Etats qui le veulent pouvaient envoyer à ce bureau toutes les demandes pour lesquelles on réclame un certificat d'examen préalable, il y aurait une grande économie de temps et d'argent.

Actuellement, tout brevet sérieux est demandé dans au moins 5 ou 6 pays. Il est donc soumis à plusieurs examens successifs, pendant lesquels le même travail de recherches bibliographiques ou autres, est fait en double ou triple.

Si, d'une part, vous ne soumettiez à l'examen que les demandes qui le désirent; si, d'autre part, cet examen était le même pour tous les brevets de tous les pays qui accepteraient cette combinaison, alors une des grandes objections que certains Etats font contre l'examen préalable disparaitrait.

Lorsqu'une invention a été examinée à fond dans un pays, elle devrait pouvoir être reconnue comme valide par d'autres pays, sans être obligée de subir de nouveaux examens identiques à celui, ou ceux, qu'elle a déja subis.

De plus, les experts officiels, qui auraient fait le Ier examen devraient-être chargés de le complêter lorsque de nouveaux faits seraient opposés au brevet, de telle façon que le travail déja fait soit acquis et puisse être simplement complêté, perfectionné, mais non recommencé continuellement.

Le contrôle des inventions aurait en effet de grands avantages pour l'inventeur, si les difficultés soulevées contre le brevet après sa délivrance pouvaient être soumises au bureau international d'examen au lieu d'être éparpillées, comme elles le sont actuellement, devant une foule de gens différents qui ignorent le travail d'examen déja fait par d'autres avant eux. L'étude de ces faits nouveaux (antériorités, nullités, etc. nouvellement découvertes) serait facile pour des gens connaissant déja à fond la question et ne demanderait, par suite, que peu de temps et peu de frais.

En Résumé

Il semble qu'il y aurait intérêt pour tout le monde à mettre à la disposition de l'inventeur 2 catégories de demandes de brevet:

1° Le brevet simple.

2° Le certificat d'examen; on laissant à l'inventeur le choix de demander le 1er seul, ou les 2 ensemble, ou le brevet d'abord et le certificat plus tard.

On ne peut, dans ce rapport, forcément court, prévoir toutes les questions de détail qui se rattacheraient à cette organisation. Mais tout cela serait facile à régler plus tard en s'inspirant des lois très bien faites qui régissent les brevets dans différents pays. Je dirai simplement qu'il me paraitrait bon de conserver pour la publication des brevets, le secret facultatif d'un an tel qu'il existe actuellement en France.

On pourrait aussi voir si le certificat d'examen ne devrait pas suivant le choix de l'inventeur comprendre soit la simple déclaration du résultat de l'examen, soit l'énumération succincte des recherches faites, et des épreuves et contestations aux quelles aurait été soumis le brevet.—Dans ce cas, ce 2° certificat devrait naturellement faire l'objet d'une taxe plus élevée que celle du premier.

Quand un brevet serait publié, tous ceux qui ont quelque chose à dire contre lui pourraient en référer immédiatement au Bureau des brevets, et le prévenir qu'ils ont une objection à formuler. Cela pourrait être fait soit sous forme d'une espèce de demande en nullité, soit sous toute autre forme, comme cela se passe actuellement avec le Patent Amt ou le Patent Office.

Lorsqu'un brevet est important, il importe pour tout le monde d'être fixé le plus rapidement, le plus sûrement et le plus économiquement possible, sur la valeur qu'il a comme invention nouvelle.

Cela ne peut être fait qu'en provoquant une enquête sérieuse sur tout point douteux se rattachant à cette invention.

Nul ne sera mieux placé, pour procéder à cette étude, que des spécialistes entendant les parties, et faisant, au besoin, contrôler les opinions contraires. Il y a donc lieu de désirer que ce bureau d'examen soit international (c'est-à-dire le même pour les pays qui l'accepteront) et composé de membres appartenant à ces diverses nationalités.

Bien-entendu, les résultats de cet examen sérieux, impartial, contradictoire, devraient pouvoir être soumis à un appel devant un tribunal supérieur international ayant une mission analogue à celle du 1er, mais composé d'autres personnes.

Messieurs, il est bien évident que nos réunions triennales sont trop espacées et trop courtes pour que nous puissions pousser rapidement l'étude de l'idée que je viens de défendre devant vous en vue de la création d'un bureau international de brevets et d'examen des demandes.

Je vous demanderai donc si vous croyez que la discussion approfondie de ces idées soit chose utile de vouloir bien émettre le voeu que:

les associations compétentes (par exemple l'Association pour la Protection Internationale de la Propriété Industrielle) veuillent bien inscrire ces questions au programme de leurs prochaines études, et en saisir, ensuite, s'il y a lieu, les gouvernements intéressés.

EXPERT TESTIMONY

By Edward J. McDermott
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In answer to the Materialists who said that we know nothing of the soul — that we know only of matter — Bishop Berkeley, two hundred years ago, answered that we know nothing of matter except what God tells us through the senses and the mind; that all our knowledge is due entirely to our mental inferences from experience and thought. It is true that what we ordinarily call "*facts*" are only deductions or inductions from the observations or experiences of ourselves or others. Speaking literally, therefore, all evidence is "opinion evidence"; but speaking practically, all legal evidence, other than the "real evidence" which things themselves afford, may be conveniently divided into (1) evidence of facts by laymen who tell what they have observed in the ordinary transactions of life, and (2) opinion evidence by experts who are persons skilled in matters requiring special or peculiar study or experience.

Neither ordinary witnesses nor experts are allowed to give opinions on matters of common knowledge which jurors may be presumed to understand, and an ordinary witness is generally confined to a statement of facts which he has observed, and will not be permitted to testify to his opinions, inferences or conclusions, based on facts within his knowledge, or based on the testimony of others; and yet the border line between fact and opinion is often very indistinct. Generally, an ordinary witness is allowed to tell only what he has observed, but may sometimes give his opinion as to those facts, appearances and conditions which cannot be satisfactorily described or be otherwise made plain to a jury. It is often hard, if not impossible, for an ordinary witness — from inability to remember all occurrences distinctly, or to describe accurately what he has seen or heard — to tell in detail all the necessary facts to enable an expert witness or a jury to form an opinion on such a statement, and, therefore, the law, from necessity, sometimes allows such an ordinary witness, know-ing the real situation better than it can be described by him, to give his own opinion as to causes, results and conditions.

In the State of Georgia there is a statute which allows an ordinary witness to give his opinion freely, if he can also give the reasons for his opinion. In Utah and Washington it is held that an ordinary witness may give his opinion (1) if he gives his reasons, so that the jury may judge of the value of his opinion; (2) if the subject matter cannot be described precisely as it appeared to the witness at the time; and (3) if the facts are such as men in general are capable of understanding.

In Hardy vs. Merrill 56 N. H. 227 the Court said:

"Opinions of (ordinary) witnesses, derived from observation, are admissible in evidence when, from the nature of the subject under investigation, no better evidence can be obtained."

For this reason ordinary witnesses are allowed to testify to their opinion on the subjects of age, solvency, time, distance, health, size, speed, identity, handwriting and sanity, etc.; but in all such cases the witness must show that his opinion is founded on his personal knowledge, and he is usually required to give the facts and reasons on which his opinion rests. The ordinary witness is not allowed to give his mere conjectures, surmises, suppositions or suspicions. He may describe conduct, demeanor, manner, appearance and looks. He cannot give an opinion as to the probability, possibility or feasibility of an act, cause or result, unless all the facts relating thereto cannot be satisfactorily described to the jurors for their own opinion.

In addition to the ordinary witness, the courts must now and then resort to an expert — to one who, by special study and experience, or by special study alone, or by special experience alone, in some business, profession or calling, or in some matter in which he has had unusual opportunities for knowledge, has acquired more skill or knowledge than ordinary men have, or than a jury or a judge may fairly be presumed to have. The opinion of a carpenter, brick mason, sailor, civil engineer, chemist, physician or surgeon must sometimes be used to aid a jury or judge in determining something concerning his own specialty, and beyond the knowledge or experience of ordinary men. The farmer may smile at the city merchant's ignorance of crops, and the merchant may smile at the farmer's ignorance of the methods of handling commercial affairs. In unfamiliar surroundings or callings, each of us is at times like a fish out of water.

The experts most often used, and of whom there is most complaint at present, are the medical and surgical experts, who testify (1) in criminal trials; (2) in suits for damages for personal injuries; and (3) in will cases where the sanity of a testator is disputed. As such experts are used so much more than all other experts, they may be appropriately treated as a separate class. Unless otherwise indicated, I shall confine my observations to medical, surgical and chemical experts. As the practice and rulings of the various courts in the American States on the subject of experts are not well known to laymen, it may be well to mention briefly the more important rulings in order to see what remedies are needed.

It is for the court, in the exercise of a large judicial discretion, to say whether a man is or is not an expert on any subject, but the court usually passes on the qualifications of the expert perfunctorily, and if the witness has had, or says he has had, any special training or experience, he is usually admitted as an expert, however mediocre or inferior his knowledge or ability. If his opinion is of "some value," though really of little value, the poor jury, with little chance of hastily reaching a just estimate of his ability, must determine the weight of his testimony on the most superficial appearances or statements. He must have had, or say he has had, some special experience, learning or training that would seem to make his knowledge superior to that of an ordinary person, even though he may have long abandoned the practice of his calling. In some States he may be admitted as a professional expert, even though he has never received a diploma from a college, or is not licensed to practise his calling. As a rule, his qualifications are proven only by his own flattering testimony of himself. After he has once been allowed by the court to testify, he cannot be shown by others to be or not to be an expert. A case will not be reversed by a higher court for a mistake in admitting an expert, unless there was a manifest abuse of discretion on the part of the lower court.

Lately, in a court in my city, several medical experts testified in a damage suit that they had removed the female plaintiff's right ovary and part of the left ovary and also the fallopian tubes and that she could never become a mother. Heavy damages for the unhappy plaintiff. That was in March, 1912. But the sad predictions of her physicians were, after the verdict, disproved by REAL evidence — by the birth of a baby — in June, 1912. The indignant defendant naturally wants a new trial.

A doctor when testifying as to personal injuries may relate the clinical history given him by the patient, but, in fact, he generally repeats and seems to confirm the magnified complaints of the patient. In many respects the doctor must rely on the plaintiff for a fair statement of his or her pains, symptoms and ailments. They are usually grossly exaggerated, and yet generally make a deep impression on the jury.

On direct examination, a doctor cannot be asked what the medical books or authorities teach; but, on cross-examination, he may be asked that question to test the accuracy of his knowledge. Books can be referred to in order to contradict what he says is in them, but not to prove a theory contradictory to his. In Davis V. U. S., 165 U. S. 573, it was said that after an expert has expressed his opinion, it is not allowable to interrogate him as to "what other scientific men have said upon such matters, or in respect to the general teachings of science thereon, or to permit books of science to be offered in evidence." In other words, an ignorant doctor or surgeon is fairly well protected from any exposure of his ignorance of the best authorities on the subjects on which he testifies.

It is true that the court allows attorneys to ask an expert questions likely to show his skill, knowledge or experience, and to show what sort of practice he has had, and along what lines his work has been done. He may be required to state the facts on which his opinion is based, and to give the reasons for his opinion. His opinion may be based (1) on his acquaintance with the person or thing under investigation; (2) on a special, medical or surgical examination for the purpose of testifying; and (3) on a hypothetical question in which an attorney is supposed to state the main facts proven by other witnesses, and on which the expert is to give his opinion. When the hypothetical question is asked, only such facts may be stated as the evidence proves or tends to prove; but the questioner need not set out important facts relied upon by his opponent; and yet, the value of the opinion depends mainly upon the completeness and fairness of that statement.

As I have said, expert testimony is absolutely indispensable in many cases, especially where the suit or prosecution involves the subject of murder or personal injury, or sanity. Expert evidence may sometimes show that the testimony of ordinary witnesses is false, and cannot possibly be true; and yet, not only theoretical writers, but the courts themselves, have sometimes strongly condemned the abuses of expert testimony.

In Parker v. Johnson, 25 Ga., 576, Justice McDonald in a dissenting opinion said:

"The rule which admits professional opinions to be received in evidence, a kind of evidence so little reliable, and so fraught with danger to those whose rights and interests it is to affect or control, ought not to be extended."

Justice Daniels said in Templeton v. People, 3 Hun. (N. Y.) 357:

"They (experts) are produced not to swear to facts observed by them, but to express their judgment as to the effect of those detailed by others, and they are selected on account of their ability to express a favorable opinion, which there is great reason to believe, is, in many instances, the result alone of employment and the bias arising out of it. Such evidence should be cautiously accepted as the foundation of a verdict, and it forms a very proper subject for the expression of a reasonable, guarded opinion by the court."

Efforts to regulate expert testimony are generally opposed and obstructed by such lawyers as often appear for defendants in criminal trials, or for plaintiffs in suits for damages for personal injuries; but there are also disinterested lawyers, judges and legal writers who object to proposed statutory reforms on this subject. The unselfish objectors may be divided into two classes:

(1) Those who think that the legal practice now is as good as we can make it, and that any reasonable dissatisfaction is due

to the inefficiency or ignorance of lawyers that examine or cross-examine experts, or to the lack of proper moral or professional standards in the callings of the experts, and that the medical and surgical and other professional societies must simply persuade all their associates to be good; (2) those who think that expert testimony — especially the testimony of medical, surgical or other similar experts — is of very little value anyhow, and is given little weight by juries, and cannot be materially improved by legislation.

These views are inconsistent, and both are unsound. Lawyers are, by habit and training, conservative, many of them too conservative; the law, even in its mere procedure, was changed slowly in England, until 1873, when long needed but radical procedural reforms were happily made. Since then radical but scientific reforms have been made in Germany. Her new codes have been highly praised by great men. In America it seems almost impossible to get us out of the ruinous ruts of a bygone age. Medicine, surgery and chemistry are experimental sciences which have made wonderful progress in the past century, and their students and practitioners in America have far outstripped the lawyers here in meeting the demands of the time. Though a few of our ablest lawyers want a reform of expert testimony to make it more useful in criminal trials, in will cases involving the question of insanity and in suits for damages for personal injuries, the most urgent demands come from the ablest and most scholarly physicians, surgeons and chemists, who chafe under the odium brought on them by the abuses and criticisms due to the present system. It would be absurd to exclude or longer degrade espert testimony in the classes of cases mentioned, and yet that testimony is often ridiculous and sometimes scandalous. It is patent that seemingly respectable, self-styled experts can be gotten for a big fee to testify strongly in favor of almost any extravagant opinion or theory. Errors of judgment or opinion are more likely to occur than errors of observation. Medical or scientific experts do not differ more on the difficult questions of their callings than lawyers and courts differ on hard questions of law; but unless a lawyer is called as an expert witness to prove the law of his State for use in some other State, he does not swear to the correctness of his theories and conclusions. We ought, therefore, to be careful to allow only real experts to testify, and should be more indulgent in our criticisms when they do testify, but the right to cross-examine experts, the indispensable safeguard against falsehood or error, must always be preserved. The lawyer that makes a corrupt use of corrupt expert testimony is as blamable as the experts that help him. The abuse is brought out most plainly in spectacular murder cases, like the cases of Thaw, Haines and Hyde. In all three cases, there has been a miscarriage of justice, for which the courts, the lawyers, the experts and the sensational section of the press were responsible.

THE COURTS SHOULD HAVE MORE CONTROL OVER THE SELECTION OF EXPERTS

A partisan witness is a bad witness who generally cannot or will not tell the plain truth. A party to a suit is allowed to pick his ordinary witnesses, though biased; but usually his range of selection is necessarily limited, because few have seen or heard or know the facts involved. The courts cannot undertake the burden of selecting such witnesses. That must be left to the industrious litigants concerned. In selecting expert witnesses, the litigant has a much wider range of selection. He can pick and test one expert after another, until he finds one who will, for a big fee, swear just what is wanted, and will become a zealous partisan. A court or jury should always prefer an unbiased, non-partisan witness, as everybody prefers an unbiased juror, or an unbiased judge. When only biased witnesses appear, the facts are distorted or suppressed, and a judge or jury can only give a hap-hazard guess at the truth.

Ordinary witnesses, however partisan, are to some extent held in check by the dread of public condemnation, and by the fear of being punished for perjury. An expert witness, when he is only giving his opinion, is practically free from any fear of punishment for perjury, and known that the public cannot well understand, or confidently criticize, his professional theories. There is usually not much ground for complaint when an expert merely proves the settled axions or principles, or even probable theories of his science; but when he begins to apply those theories, for a fee, to a particular case, the glaring evils of partisanship appear. Cæsar said: "Omnes homines fere libenter id quod volunt, credunt." The Germans say: "Man glaubt leicht was man wünscht."

Perjury is far more frequent than the average man believes. If ordinary witnesses — who are allowed only a petty, fixed sum for their attendance in court, who only swear to what they are supposed to have seen with their own eyes, or heard with their own ears, and who will be confronted by actual observers of the same facts — if these ordinary witnesses will swear falsely in spite of the law and its penalties, and public opinion, how much greater is the danger of false testimony from expert witnesses who are paid large sums of money to make their theories fit the needs of their employer, as Procrustes tortured or mangled his victims to make them fit his iron bed. The large compensation of such witnesses is often contingent upon the success of their efforts to manufacture a special scientific theory for that case; and, while they are spinning fine theories and expressing false but plausible opinions, they are practically free from any danger of legal punishment for perjury.

Generally a long list of jurors are selected each term or year by the courts without reference to any particular case. A judge is appointed or elected for a long time, and will try many cases. Hence, any litigant has a reasonable chance of having an unbiased judge and unbiased jurors to try his case. An expert witness is often allowed to express an opinion on the very question which the judge or jury must try. To some extent, such opinion-witnesses are themselves performing the functions of a judge or jury. They ought not to be hired partisans with a contingent or tempting fee. As their opinions may sometimes have almost a controlling weight with a jury, especially in criminal cases, in will contests, and in speculative damage suits involving personal injuries, they ought generally to be selected, like jurors, from lists carefully prepared by the courts long in advance for the trial of cases generally, not selected as partisans for a specific case.

A list of experts should be made up by each Court from the most honorable and most competent men within its jurisdiction, after consultation with such eminent men of the profession as would be able to know who were real experts. They should then, after having had a reasonable opportunity to examine the question, person or thing under investigation, testify in Court and be subject to cross-examination under the careful control of the Court in order to protect them from indignity or badgering, and, as far as possible, to protect the jury from imposition, or plausible pretenses, or gross exaggerations, or personal, extravagant theories.

It is said that the best experts would probably not act as witnesses for the scant compensation likely to be allowed by the court. The court could compel them to serve, but most experts would be willing to serve for the sake of truth, and for the sake of their calling. Many people must serve in office for a compensation far below what they could make in private business. Under existing conditions, a real expert dislikes to be put forward in competition with the charlatan, or a dishonest member of the profession, before a jury that cannot easily discriminate. It is said that the judge cannot be assumed to have special knowledge of the qualifications of experts. It surely may be assumed that men intelligent enough, and well enough acquainted in the community, to become judges, will, at their leisure, and with outside advice, be more likely than a jury to discover who are genuine experts. A judge may, from time to time, hear different experts as witnesses, and may learn of their work and reputation from others, and so may form a fair estimate of their qualifications; but the jury, in the hurry and excitement of a trial, with no previous knowledge of the men, and with no disinterested advice, are compelled to decide quickly on the merits of the conflicting experts, and on the weight to be given them respectively. It is no wonder that they are often deceived. When insanity or a hidden internal injury is feigned by a party, or when the condition or behavior of a dead testator is unintentionally or purposely misrepresented, and when some shrewd but unqualified or dishonest physician or surgeon has spun nice theories and given plausible reasons for his opinion, it is not surprising that a jury, ignorant of his nature and qualifications, may give him more weight than they give to a superior exper of a different opinion.

It may be well to allow parties interested in a legal controversy to have the right to summon experts in addition to those taken from the court's list; but, if that be allowed, then, to prevent surprise to the other side, the party callng them should be compelled to state to the court, before the trial, who his experts are, and where they live, and to state briefly what is to be the general nature of their testimony. With such notice, the opposite party can be prepared to meet incompetent or untrustworthy experts, and their false or doubtful, though plausible, theories. In olden times the court did not try to prevent a meritorious litigant from being beaten by a mere surprise; but the legislatures and the courts now try to prevent such an undeserved overthrow by a surprise. If truth or justice is to be our aim, no advantage should be allowed to unnecessary concealments or mere tricks.

It is also said that, if a list of eligible men be appointed by the court, and that if the parties, nevertheless, be allowed to call their own experts, the parties will continue to select only their own partisan experts. Not when it is observed by lawyers, as it will be, that juries will not give to unaccredited experts, selected and paid by a party for partisan testimony, as much attention or weight as is given to experts long before approved by the court without reference to the controversy on trial. The difference will be apparent to the jury. If the question be so clear that all the impartial experts on the court's list are against one of the parties in the legal controversy, he ought not to be heard to complain. If the question be doubtful or complicated, experts on the court's list will differ. It is said that no distinction, in the selection or in the method of compensation, should be made between medical and other similar experts, and ordinary witnesses and ordinary experts; and yet we are also told (as experience tells us), that medical and scientific experts are needed far oftener than all other professional experts put together. Here is a valid reason for a difference of treatment.

Wherever experts are to testify as to any living person or existing thing, there should always be afforded to the experts a reasonable opportunity to study the question involved, and to examine the person or thing under investigation. If a living man's sanity is being considered, the experts should have a chance to watch him in a suitable place when he is not conscious of being observed. In my city a few years ago, a man who claimed to be seriously and permanently injured in an accident, said he could not stand erect, and maintained a stooping posture for several years; and, while his case was in the Court of Appeals, he was observed one day to straighten himself up unconsciously when the horse in his wagon started to run away, while the plaintiff was standing on the sidewalk. Unmindful for the moment of his lawsuit, he ran and overtook the horse, and stopped him, before remembering that he had long pretended that he was unable to straighten himself up, or to walk with ease. When his attorney learned that this strange occurrence had been observed by several witnesses, the case was compromised. In St. Louis, the jail physician, and several other physicians who voluntarily aided him, have made it a rule to secretly watch prisoners who plead insanity to escape the punishment of a crime. In that way, the mental unsoundness of several prisoners was made apparent, and the shamming of others was easily detected.

The courts in this country have generally held that the legislature has general power to regulate evidence, subject only to a few constitutional limitations. The legislature and the courts can, and in some respects do, limit the number of witnesses allowed on questions before a jury. In order to protect a poor litigant from being overwhelmed by the money of a rich opponent, and in order to prevent a criminal trial from being unduly protracted and made farcical by the great number of experts called by rich criminals, the number of experts ought to be limited by statute, or by judicial regulations.

Under no circumstances should an expert be allowed to have a contingent fee. It ought not to be possible for an expert to have a secret monetary interest in the result of his testimony. Temptation to commit perjury is thus made too strong for ordinary men. In the words of the great prayer we cannot too often repeat: "Et ne nos inducas in tentationem." In all cases the compensation of an expert, whether called from the list of the court or selected by the parties alone, should be controlled by the court, and the expert should be criminally punished if he attempts to collect, or contracts for, any compensation other than that allowed by the court or the statutes. I once saw, by accident, the private ledger of a physician who frequently appeared as an expert witness in court, and his books showed that in cases in which he testified, he got no fee if his employer lost, and he got a big percentage of the amount recovered in case of victory. Such a practice must produce perjury and corruption.

The whole world is interested in this topic. Whenever Courts administer justice — one of the foremost objects of every civilized state — there must be an effort to improve legal procedure and so to regulate trials as to save costs and time and to avoid any technicalities or tricks or false testimony that may prevent a right decision or bring about a miscarriage of justice.

DE LA BREVETABILITE DES PRODUITS PHARMACEUTIQUES

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La plupart des Lois prohibent, en dehors des inventions contraires au bonnes moeurs et à l'ordre public, la brevetabilité des compositions pharmaceutiques, des remèdes et médicaments, et aussi parfois des produits alimentaires et des produits chimiques. C'est ainsi que les médicaments ne peuvent être brevetés en Allemagne, dans la République Argentine, en Autriche, (y compris les désinfectants) en Belgique, Danemark, Espagne, France, Hongrie, Italie, Japon, Norvège, Portugal, Roumanie, Russie (y compris les procédés pour les obtenir) Suède, Suisse Tunisie, etc.

Cette exception est étendue aux produits alimentaires par les Lois d'Allemagne, d'Autriche (exclusivement pour les produits alimentaires destinés à l'homme) Danemark, (y compris les procédés) Hongrie, Japon, Norvège, Roumanie, Russie, (y compris les procédés) Suède, Suisse, etc. Enfin, la brevetabilité est refusée aux produits chimiques, indépendamment des procédés de préparation par l'Allemagne, l'Autriche, la Hongrie, le Mexique, le Portugal, la Russie (y compris les procédés) la Suède, la Suisse, etc.

Aux Etats-Unis, il ne semble pas qu'il existe de restrictions de cette nature. On justifie l'exclusion de la brevetabilité des compositions pharmaceutiques et des remèdes, par la crainte qu'en pareille matière, le brevet devienne une arme entre les mains de charlatans, et aussi qu'un inventeur ne puisse de la sorte accaparer un remède nouveau en spéculant sur la santé publique.

Des raisons analogues sont mises en avant pour justifier l'exclusion de la brevetabilité des produits alimentaires; quant aux produits chimiques, les législations qui les excluent estiment que autoriser la brevetabilité des produits chimiques en dehors des procédés de fabrication, c'est risquer de paralyser l'industrie et la condamner à la stagnation; lorsqu'un produit étant breveté comme tel, un tiers découvre presque tout de suite après la prise du brevet, un procédé de préparation beaucoup plus simple, plus pratique, et plus économique.

Certaines personnes ont cru voir, dans cette particularité de la Loi Allemande notamment, l'une des causes du grand développement de l'industrie chimique dans ce pays.

On peut se demander si les diverses raisons invoquées pour justifier les restrictions de la brevetabilité sont fondées; il est permis de penser le contraire, spécialement l'argument invoqué pour exclure de la brevetabilité les produits pharmaceutiques consistant à vouloir empêcher un inventeur de monopoliser abusivement entre ses mains des médicaments essentiels à l'humanité, parait quelque peu puéril.

D'abord, malheureusement, les médicaments d'utilité et d'efficacité primordiale sont encore à trouver, et en tous cas très rares, et viendraient-ils à être découverts, il est tellement de l'intérêt de l'inventeur d'exploiter une pareille découverte et de la mettre par conséquent à la disposition des consommateurs, qu'il n'y aurait guère lieu de craindre qu'il en réservât le bénéfice aux seuls privilégiés de la fortune. D'autre part, on peut remarquer que ces restrictions sont la source de difficultés et d'incertitude, et surtout n'ont qu'une efficacité restreinte. En France par exemple, où la Loi exclut les compositions pharmaceutiques et les remèdes considérés comme tels, en laissant le droit de brevetér les procédés de fabrication, souvent la brevetabilité du procédé assure indirectement le monopole du produit si ce procédé est unique. Il faudrait alors interdire même la brevetabilité du procédé qui peut être général et utile pour l'obtention d'autres produits non médicinaux.

D'autre part, la Loi Française autorisant la prise d'un brevet pour les produits chimiques, il suffit, lorsque le remède, comme cela a lieu dans la plupart des cas, est un produit chimique susceptible d'applications industrielles, de prendre le brevet pour le produit chimique en ayant bien soin de passer sous silence les applications thérapeutiques: dans ces conditions, l'Administration se trouve désarmée et le brevet est délivré.

Il semble que la solution de beaucoup la plus sage serait de faire disparaitre tous ces obstacles qui se dressent devant l'inventeur et d'admettre la brevetabilité de tout ce qui peut constituer une invention, sauf, le cas échéant, s'il apparaissait que l'invention a une portée spéciale d'utilité générale, à lui appliquer les règles qui existent dans la plupart des pays pour l'expropriation pour cause d'utilité publique et à donner au Gouvernement le droit d'exproprier l'invention.

Dans beaucoup de législations, et c'est là encore une exception qui aurait dû s'ajouter aux autres énumérées plus haut, une situation spéciale est faite aux inventions intéressant la défense nationale, les Administrations sont autorisées à ne pas délivrer de brevets pris pour de telles inventions, et l'Etat s'arroge le droit de s'en emparer moyennant indemnité. La plupart du temps, cette indemnité est fixée de gré à gré entre l'Etat et l'inventeur; faute d'entente, elle est déterminée par arbitres.

Il suffirait de généraliser ces principes et d'organiser dans les différents pays une procédure générale d'expropriation pour cause d'utilité publique pour qu'immédiatement et sans le moindre inconvénient, toutes les exceptions à la brevetabilité inscrites dans les diverses Lois puissent disparaître.

Ce serait là une simplification et aussi une oeuvre de justice; il n'est pas juste en soi qu'une catégorie d'inventeurs, se livrant à des travaux essentiellement utiles, se trouvent, par la nature même de ces travaux, exclus du droit d'obtenir, par la prise d'un brevet, la juste récompense de leurs peines.

Le Congrès pourrait émettre le voeu de voir disparaitre des Lois nationales les différentes restrictions apportées à la brevetabilité, notamment en matière de produits pharmaceutiques, sous réserves d'organiser avec des garanties suffisantes pour les inventeurs, une procédure générale d'expropriation des brevets.

DE L'UTILITE D'UN ENREGISTREMENT INTERNATIONAL DE PLIS CACHETES

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L'utilité pour les créateurs de la pensée, quels qu'ils soient, d'avoir à leur disposition un moyen simple d'assurer une date certaine à leurs idées ne saurait être discutée.

L'industrie est soumise à des transformations incessantes. Les inventions se succèdent tous les jours, et il n'est guère possible de breveter tout ce qui s'y fait de nouveau. La prise d'un brevet entraine des frais relativement considérables, et a en outre le défaut de révéler à tous l'invention qui en est l'objet. Par contre, il est fort utile de pouvoir se réserver le moyen d'établir de façon non contestable que tel perfectionnement ou tel procédé a été imaginé à un jour déterminé.

Cette précaution est indispenésable pour pouvoir, le cas échéant, invoquer contre un tiers qui réaliserait la même invention et la breveterait, le droit de possession personnelle et même si un brevet doit être pris, elle reste utile pour se préserver contre les usurpations qui peuvent provenir de tiers appelés à un titre quelconque à participer à la mise au point de l'invention avant le moment où elle peut être brevétée.

De même, et peut-être encore plus, celui qui crée des dessins ou des modèles, et qui, pour l'exécution matérielle de ses objets, a presque toujours besoin de recourir à de nombreux intermédiaires spécialistes, risque fort d'être dépouillé de ses droits s'il n'a à sa disposition un moyen facile et peu coûteux de prendre date et d'établir l'époque à laquelle est née la conception qui n'a pu être matériellement réalisée que plus tard. De même encore, le savant qui fait une découverte dans son laboratoire, même s'il n'entend pas en tirer un profit pécuniaire, peut du moins prétendre ne pas être dépouillé de la gloire d'être le premier à l'avoir faite, et a lui aussi, intérêt à pouvoir en fixer la date.

L'avantage est le même pour le littérateur qui concoit le titre d'un ouvrage et en règle dans son esprit les scènes principales avant de lui donner la forme définitive.

Comment la date de ces créations peut-être être prouvée? Le procédé usité qui varie suivant les législations et les habitudes des différents pays, est le dépôt de plis cachetés dans les Archives, soit de notaires publics, soit de Sociétés scienfifiques ou industrielles, ou quelquefois encore l'enregistrement fiscal d'un document comportant une description de l'invention ou de la création; ces moyens assurément utiles comme preuves de droit commun manquent tous plus ou moins de certitude et peuvent être discutés. Il y aurait grand intérêt à les perfectionner.

L'association Française pour la protection de la propriété industrielle s'est, à l'instigation de son Président Mr. Soleau, préoccupée de cette question depuis longtemps, et elle propose à cet effet l'emploi de deux enveloppes géminées contenant chacune un exemplaire identique du document dont l'inventeur désire établir la priorité. Ces enveloppes comportent des ouvertures analogues à celles que présentent certaines enveloppes destinées spécialement à l'envoi des cartes postales, et permettant l'apposition du titre d'affranchissement sur le document même, et aussi, par suite, des cachets d'oblitération postale. Ces enveloppes seraient envoyées à une administration d'Etat; les Offices nationaux de propriété industrielle dans les différents pays paraissent tout indiqués à cet effet.

A leur arrivée, elles seraient revêtues d'un numéro, répertoriées sur un registre, et perforées à la date et à l'heure de leur arrivée.

L'un des exemplaires serait conservé par l'établissement et l'autre renvoyé l'inventeur qui aurait ainsi entre les mains une preuve dont l'importance pour lui n'a pas besoin d'être soulignée. La perforation, si elle couvre toute la surface du document a pour effet si l'on proscrit l'usage de l'impression, de rendre pratiquement impossible toute modification ultérieure à ce document; les modifications ou additions apparaissant à un examen tant soit peu attentif.

Si, en outre, cet envoyeur prenait soin de copier au copie-lettres le document mis sous enveloppe avante de l'envoyer, il semblerait très difficile, lorsque la teneur du document et celle du copie de lettres seront concordantes de texte, d'en discuter la date.

La plupart du temps, cet enregistrement national serait pour lui suffisant, mais on conçoit que le moyen proposé se prête immédiatement à un enregistrement international; il suffirait que l'établissement récepteur, au; lieu de garder l'une des enveloppes géminées, après avoir envoyé l'autre à l'expéditeur, et expédié l'enveloppe gardée à un établissement choisi ayant un caractère international, ce pourrait être par exemple, le Bureau de la Propriété intellectuelle à Berne, qui, si nous sommes bien renseignés, serait tout disposé à accepter cette tâche.

Cette enveloppe subirait à son arrivée à Berne un enregistrement à un répertoire, serait classée dans les archives et deviendrait ainsi un titre irréfragable en faveur de l'envoyeur. Les établissements chargés de recevoir, conserver et réexpédier les plis cachetés, seraient rémunérés au moyen de timbres spéciaux, émis par eux, qu'il serait facile à tous de se procurer et qui seraient apposés au verso du pli à eux expédié. Ces timbres seraient détachés et détruits par chaque établissement lors de la réception de l'envoi.

Tel est, dans ses grandes lignes, le procédé imaginé par l'Association Française pour la protection de la propriété industrielle, et qui parait à la veille d'entrer dans la pratique en France.

Si le Congrès estime qu'un tel procédé soit de nature, et ceci parait difficilement contestable, à rendre service aux divers créateurs de la pensée, il pourrait émettre un voeu en faveur de son adoption par les différents Etats.

Ce voeu pourrait être ainsi formule:

"Le Congrès estime que le système d'enregistrement national et international d'enveloppes proposé par l'Association Française pour la protection de la propriété industrielle, serait de nature à rendre les plus grands services à tous les créateurs de la pensée et émet le voeu que ce système soit adopté, tant au point de vue national qu'au point de vue international, par les différents Etats."

ORIGINAL COMMUNICATIONS

EIGHTH INTERNATIONAL

CONGRESS OF APPLIED CHEMISTRY

Washington and New York

September 4 to 13, 1912

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SECTION XIb: POLITICAL ECONOMY AND CONSERVATION OF NATURAL RESOURCES

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THE CHEMICAL INDUSTRIES OF CANADA

J. Watson Bain

Introduction

The manufacture of chemical products occupies a late chapter in the history of the industrial development of a state. Not until the arts have made very substantial progress does there arise a demand, either for those materials which it is the province of the chemist to supply, or for the assistance which he can offer towards the improvement and control of manufacturing processes. The capitalist who studies the growth of industry in a young country, perceives that there is only a small market for chemical products, that the equipment and some, at least, of the raw materials are costly, and that labor is dear; and concludes that another form of investment is preferable.

With a powerful and prosperous nation to the south, highly skilled in manufacturing processes and seeking eagerly for markets for its surplus production, Canada has developed more slowly from an industrial point of view than if she occupied a more isolated position geographically. The products of Europe and of the United States have long been familiar to the Canadian people, and the manufacturers of British North America have had a difficult struggle to establish the good name of their wares. But this day is past. All over the Dominion new factories are building, new articles are being manufactured and new plans for the future are being evolved.

Under conditions such as these, it may readily be understood that until comparatively recently, chemical industry in Canada was of very minor importance. The situation today can only be conveyed with the help of statistics, and the following paper embodies the efforts which have been made by the Canadian Section of the Society of Chemical Industry to place before the Congress a survey of the conditions of the present.

In the preparation of this report, the various manufacturers throughout the country were asked to supply the information desired, and the Canadian Section of the Society of Chemical Industry desire to express their appreciation of the kindly manner in which their requests were answered. In some instances, the manufacturers felt that for business reasons, they could not furnish the data in question, and in such cases, the deficiency has been met by consulting the latest trade or government reports, or by estimates furnished by individuals whose business affiliations lend a high degree of probability to their figures. It must not, therefore, be considered that the statistics herewith presented have the authority of a census return; they are as accurate as it has been possible to make them, and may be accepted as very close approximation to the true figures, which only a government can supply.

Within the confines of the Dominion is to be found a plentiful supply of most of the raw materials of the chemical industry. On the eastern and western coasts and in the Rocky Mountains, excellent coal is at hand; the provinces of Ontario and Quebec have unfortunately no stores of this most valuable mineral. Water power is abundant in all districts, and an electrochemical industry is growing rapidly in the vicinity of the larger water falls. To discuss these various points is the function of the following pages, and this may now be commenced without further preliminaries.

Products of Wood Distillation

The destructive distillation of wood flourishes in certain parts of Canada where there is an abundant supply of hard wood, maple and beech being preferred. The wood is charred in long horizontal retorts holding six cords each, as is usual in American practice. The crude pyroligneous acid is distilled to remove the tar, the distillate is then treated with lime and redistilled, yielding alcohol, acetone, etc., and a solution of calcium acetate. The alcoholic distillate is fractionated, and is then shipped to the central refinery for a further rectification. Some of the alcohol is oxidized to formaldehyde, for which there is a considerable demand. A portion of the calcium acetate is used in the manufacture of acetone, which is marketed in England for the smokeless powder industry.

Four companies are engaged in this branch of manufacturing. The oldest and largest of these is the Standard Chemical Iron and Lumber Co., Ltd., head office at Toronto, which operates plants at Sault Ste. Marie, South River, Longford and Parry Sound in Ontario; and at Fassett, Cookshire and Mont Tremblant in Quebec. This company has a refinery in Montreal and treats the output of all the other producers; acetone and formaldehyde are likewise manufactured. In order to utilize the surplus charcoal, the Company runs a charcoal iron furnace at Deseronto, Ont. The Wood Products Co. of Canada, Ltd., head office at Toronto, has a plant at Donald, Ontario; and the Thornbury Reduction and Transportation Co., Ltd., head office at Thornbury, Ont., have just commenced operations. The Dominion Chemical Co., Ltd., head office at Weedon, Que., have been carrying on the distillation of wood for the past two years.

These companies have an aggregate capital of $5,965,000, and employ about 2300 men. The amount and value of each of the products in the aggregate is given below:

Charcoal	8,000,000 bushels of 20 lb	$560,000
Acetate of Lime	14,000 tons	465,000
Wood alcohol	1,019,000 Imperial gals	489,000
Acetone	400 tons	110,000
Formaldehyde	1,400 barrels	50,000
		$1,674,000
Pig Iron	18,000 tons	325,000
		$1,999,000

PRODUCTS OF WOOD DISTILLATION

Plants

Standard Chemical Iron & Lumber Co.

Ontario—Sault Ste. Marie	112	cords
South River	48	"
Longford	48	"
Parry Sound	48	"

Quebec—Fasset	36	"
Cookshire	48	"
Mont Tremblant	36	"

Wood Products Co.	
Donald, Ontario	48 cords
Thornbury Reduction Co.	
Thornbury, Ontario	24 cords
Dominion Chemical Co.	
Weedon, Quebec	24 cords

Products of Coal Tar Distillation

In connection with gas works and coke ovens, tar and sulphate of ammonia are being produced at a number of points as specified below; a number of smaller producers have made no returns.

Until five years ago, no coal tar was distilled in Canada for lack of market. No dyestuffs are manufactured in the Dominion, and in consequence the products of tar distillation have to be exported except for small quantities for domestic use. The creosote oils have found extended employment in the United States for the preservation of timber, and large quantities have been imported annually from Great Britain. The corresponding demand in Candaa is being met by home manufacturers and a development of the industry is for this and other reasons, quite probable.

Five companies are engaged in this branch of chemical manufacture. The Canadian Ammonia Co., capital $250,000, head office at Detroit, Michigan, has a plant in Toronto in connection with the Consumers' Gas Co., and produces ammonia in its various forms. The Dominion Tar & Ammonia Co., Ltd., capital $25,000, head office at Hamilton, Ont., operate in connection with the Hamilton Gas Co., and produce ammonia as well as the various tar distillates. The Algoma Steel Co., Ltd., head office and works at Sault Ste. Marie, Ontario, operates two batteries of 55 ovens each, of the Kopper type. Each charge is 12¾ tons of coal, and the gas is cooled, filtered, superheated and passed through sulphuric acid in Wilton saturators; the plant was started in March, 1911. The Dominion Iron and Steel Co., Ltd., capital $25,000,000, head office and works at Sydney, Nova Scotia, also carries on the coking of coal mined by a subsidiary company, the Dominion Coal Co., Ltd. Ammonium sulphate is produced in considerable quantity, and the tar is sold to the Dominion Tar and Chemical Company, Ltd., head office at London, Eng., who have their works on the property of the Dominion Steel Co. By distillation are produced the following products: refined tar, soft pitch, briquetting pitch, black varnish, roofing cement, soluble disinfectant or sheep dip, crude benzole, rectified benzole, creosote oil, liquid creosote, creosote stain, crude carbolic acid, purified carbolic acid, crude naptha, purified naptha, emulsion (germicidal), ammoniacal liquor and light oil.

At these plants a total of 706,700 tons of coke, 7100 tons of ammonium sulphate and about 5,000,000,000 gallons of tar are produced. The value of these is approximately $4,600,000.

Fertilizers

The use of commercial fertilizers in Canada has scarcely passed the infantile stage, although in the Maritime provinces, more especially in the fruit and potato-growing districts, fertilizers have been popular for years. Ontario and Quebec have, during the past five years, been giving the subject more attention and may be expected to rapidly increase their consumption from this stage.

British Columbia quickly learned the value of fertilizers and takes high rank as a consumer. This year a Victoria firm shipped a carload of fertilizer to Dawson City in the Yukon.

The provinces of the middle-west will not be heavy consumers for many years to come, although the use of fertilizers there has commenced, chiefly among market gardeners and potato growers, but they are also being used to a small extent by grain growers. The prevailing high freight rates necessarily add greatly to the cost of the fertilizer and this aggravates the difficulties of pioneer work.

In the younger provinces of Alberta and Saskatchewan, the interest in the fertilizer question seems greater than in Manitoba. This may be explained by the fact that within recent years there has been a very large emigration of United States and European farmers to Alberta and Saskatchewan, men who already were familiar with the use of fertilizers.

The following table shows the principal fertilizer materials imported into Canada during the years ending June 30th, 1904, and February 29th, 1912, respectively, and a comparison of the two years indicates the increase which has taken place in the intervening period:

	12 Months ending June 30, 1904		12 Months ending Feb. 29, 1912	
	lbs.	$	lbs.	$
Fertilizers (manufactured) . . .		134,063		413,905
" (unmanufactured) .		19,155		3,151
Muriate and Sulphate of Potash	1,836,315	33,740	6,840,138	125,849
Kainit and other crude Potash Salts	726,917	5,868	985,750	9,252
Acid Phosphate	285,707	15,248	1,348,422	61,554
Phosphate Rock		8,000		43,774
Blast Furnace Slag		6,808		119,141
Sulphate of Ammonia	186,084	5,485	520,863	16,156
Nitrate of Soda	12,849,769	258,578	58,711,867	873,766
Nitrate of Potash	1,978,972	86,308	2,273,437	107,313

In the case of "manufactured" fertilizers and a few other items it has been impossible to get the quantities, the value only being given. "Unmanufactured" fertilizers represent those materials which could not be properly identified, and the decrease in the amount of these would indicate better classification facilities in recent years.

Acid Phosphate (non-medicinal) would seem to include a large proportion, not used for fertilizer purposes, since the value given is much in excess of the price of this material as a fertilizer.

Nitrate of soda is at present the most popular form of nitrogenous fertilizer, but the bulk of this material imported is used for manufacturing purposes, and it is yet impossible to even approximately estimate the amount used for fertilizer purposes.

Nitrate of potash is also almost entirely used for industrial purposes, its use as a fertilizer being very limited.

Unfortunately, no figures are available to show the production of fertilizers in Canada itself, but most of the slaughter house tankage and bone, formerly exported, is now, by the addition of potash, being converted into mixed-fertilizer for home consumption.

The importation of other fertilizer materials gives, however, a sufficient indication of Canada's increasing fertilizer consumption.

Pulp and Paper

In response to the growing demand for paper and pulp, Canada's output of these materials is growing rapidly. Stretching unbroken from the Atlantic to the Pacific are immense forests of spruce and balsam, the woods which are to-day most commonly used in this branch of manufacturing. When it is noted that numerous rivers and lakes throughout this territory offer at the same time, the means of transport and the supply of power, the present and future importance of Canada in the production of pulp and paper can be appreciated. The pulp mills are usually situated on rivers near the edge of civilization while the paper mills are as a rule near the industrial centres. The products are exported largely to the United States which is the best customer, and also to the United Kingdom. It is impossible to deal with so large an industry in detail, and some statistics are appended which will give an idea of the trade. No figures regarding paper are available.

1910	Quebec	Ontario	Nova Scotia	New Brunswick	British Columbia	Total
Pulp production ..	282,938	156,076	25,955	9,285	350	474,604
Mechanical pulp ..	235,889	108,351	25,955	....	....	370,195
Sulphite pulp	40,681	47,271	....	7685	350	95,987
Soda Pulp	6368	454	....	1600	....	8422
Spruce used, cords.	239,824	189,196	25,636	15,134	440	470,230
Balsam " "	96,474	20,256	3745	....	....	120,475
Plants	25	15	6	4	1	51

Wood pulp exported—328,977 tons, value $5,694,896.

1911.

Mechanical pulp produced, tons	362,321
Sulphite " " "	110,391
Soda " " "	24,121

The Rubber Industry

The manufacture of rubber goods is carried on by three companies:

The Gutta Percha & Rubber Mfg. Co. of Toronto,

The Dunlop Tire & Rubber Co. of Toronto,

The Canadian Consolidated Rubber Co. of Montreal.

The last named Company is a merger of a large number of smaller companies with plants at Bowmanville, Port Dalhousie, and Berlin in Ontario, and Granby, Quebec. The capital invested is about $8,800,000, and the number of employees is approximately 4,000. The output for 1911 was over $18,500,000.

The products manufactured include a large range of rubber goods, such as rubber footwear, mechanical rubber goods of almost every description, automobile tires, and so forth.

A recent development which may be mentioned under this heading is the manufacture of Bakelite by Plastics, Limited, of Toronto. As is well known, this is a condensation product of phenol and formaldehyde, the preparation of which is the invention of Dr. L. H. Baekeland. His patents in America are controlled by the American Bakelite Company, of New York, which has sold its rights in Canada to the above Company. The plant has not been in operation very long, but it is already manufacturing a large number of products which have hitherto been made of ebonite or fiber, such as parts for motors, switches, and high tension apparatus in general, as well as insulating varnishes, etc.

Compressed and Liquefied Gases

The most important product of this class is liquid carbon dioxide. The Canadian Carbonate Company, of Montreal, and the Dominion Carbonic Company, of Toronto, are the only firms engaged in the manufacture of this gas. The former utilizes the calcination of magnesite rock, and the latter, the combustion of coke. In each case, the gas is purified and compressed into steel cylinders for shipment to bottlers, brewers, and soda fountains. The combined output of the two plants for 1912 has been estimated at 2,500,000 pounds of liquid gas, with a gross value of about $150,000.

Liquefied ammonia is produced on a commercial scale by the Dominion Tar and Ammonia Co., Hamilton, but there has been a notable extension in recent years of the compressor system of artificial refrigeration and a large amount of the liquefied gas is being utilized in the manufacture of ice and in many cold storage plants. No data are, however, available as to the actual extent of the industry.

Starch

The manufacture of starch and starch products is carried on by two companies:

The St. Lawrence Starch Co., of Port Credit,

The Canada Starch Works, of Montreal.

The latter has one factory at Cardinal (known as the Edwardsburg plant) and another at Brantford. The Cardinal plant is said to be the largest in the British Empire, its output corresponding to about 2500 bushels of corn, or 75,000 pounds of starch, per day.

The combined output of both companies is about 1,000,000 pounds of starch, glucose and syrup per day. About 60 percent. of this output is syrup, the remainder consisting of starch and starch products. The process of manufacture presents no special features; a description of the practice at these plants will be found in a paper by Dr. Kaufmann which was presented about two years ago before the Society of Chemical Industry. The by-products obtained are cattle foods and oil which is used in the manufacture of linoleums, etc.

EXTRACTION AND REFINING OF METALS

The metallurgical industry of Canada is as yet only in its beginning, although it has grown very rapidly during the past twenty-five years. In 1886, the total metallurgical production of Canada was valued at approximately $8,000,000; in 1893 it had grown to double this amount, and in 1910 it amounted to nearly $50,000,000. The production of the more important metals during 1910 and 1911 is shown in the following tabulated statement:[1]

	1910		1911	
	Quantity.	Value.	Quantity.	Value.
		$		$
Copper..............Lbs.	55,692,369	7,094,094	55,848,665	6,911,831
Gold................Ozs.	493,707	10,205,835	....	9,762,096
Pig iron.............Tons.	800,797	11,245,622	917,535	12,306,860
Lead................Lbs.	32,987,508	1,216,249	23,525,050	818,672
Nickel.............. "	37,271,033	11,181,310	34,098,744	10,229,623
Silver...............Ozs.	32,869,264	17,580,455	32,740,748	17,452,128
Other metallic prodcuts	....	510,081	....	409,674
Total................	....	59,033,646	....	57,890,884
Less pig iron credited to imported ores.............	695,891	9,594,773	875,349	11,693,456
Total metallic.........	....	49,438,873	....	46,197,428

The subdivision of the mineral production in 1910 and 1911, by provinces, was approximately as follows:[2]

[1] Bulletin No. 150, Department of Mines; Preliminary Report on the Mineral Production of Canada during 1911.

[2] Ibid, p. 6.

Province	1910		1911	
	Value of Production.	Per cent of Total.	Value of Production.	Per cent of Total.
	$	%	$	%
Nova Scotia	14,195,730	13.29	15,354,928	15.01
New Brunswick	581,942	0.54	611,597	0.60
Quebec	8,270,136	7.74	9,087,698	8.88
Ontario	43,538,078	40.76	42,672,904	41.72
Manitoba	1,500,359	1.40	1,684,677	1.65
Saskatchewan	498,122	0.47	618,379	0.60
Alberta	8,996,210	8.42	6,404,110	6.26
British Columbia	24,478,572	22.92	21,237,801	20.76
North West Territories	4,764,474	4.46	4,619,592	4.52
Dominion	106,823,623	100.00	102,291,686	100.00

Gold. The history of gold mining in Canada has been somewhat similar to that in California and Australia. Simultaneously with the exploitation of the gold fields of California, placer mining received a great impetus in British Columbia, and at one time a considerable amount of gold was derived from this region. Later on, about 1896, the Klondike was found to contain gold and the gold production rose rapidly, attaining a maximum value in 1900. As the placer deposits of this district became exhausted, the total production of the Dominion fell off from over $27,000,000, in 1900, to $8,000,000, in 1909. Within the past two years, however, the gold production of the Yukon has been increasing, and it is reasonable to suppose that it will continue to increase, owing to the extensive scale on which dredging and hydraulic mining are being carried on.[1]

While the Yukon territory yields about half the total gold production of Canada, British Columbia supplies almost the whole

[1] Commission on Conservation, Canada. Report on Lands, Fisheries and Games, p. 407.

of the remainder. Most of the gold produced in the latter province is derived from auriferous copper pyrites ores in the Nelson and Rossland districts, only about ten per cent. being obtained from placer deposits.

Both Ontario and Nova Scotia were at one time important producers of gold. In the former province the production rose as high as $421,591 in 1899, and then fell steadily to $188,036 in 1903. Since that year the production has rarely exceeded $66,000, and in 1911 it amounted to approximately $38,000. The production of Nova Scotia has decreased from over $600,000, in 1899 to $142,000 in 1910.[1]

The following table gives the production for 1909, 1910 and 1911, by provinces:

Province.	1909.	1910	1911. (estimated)
Nova Scotia	$210,711	$163,891	$142,000
Quebec	3,990	2,565	12,443
Ontario (b)	32,425	63,849	37,929
Alberta (a)	525	1,850	
British Columbia (c)	1,174,579	5,403,318	4,989,524
Yukon (a)	3,960,000	4,570,362	4,580,000
Total	9,382,020	10,205,835	9,761,896

(a) Placer gold.
(b) Gold from vein mining.
(c) Gold from placer and vein mining.

That the gold resources of the Yukon and British Columbia have only been skimmed, as it were, is evident from the fact that the mountain ranges of this territory in which gold deposits have been found so far form the northern extremity of the "western or Cordilleran belt which, extending from South America to Alaska, is recognized as one of the greatest mining regions in the

[1] Bulletin No. 88, Department of Mines; Annual Report on the Mineral Production of Canada for 1909, pp. 44–48.

world—noted principally for its wealth in gold, silver, copper, and lead." In both Mexico and the United States this mountain range has yielded about $3,000,000 per mile of its length, and it is only reasonable to expect that Canada, which possesses over 1,300 miles of this range, will yield enormous amounts of the precious metals in the future. The resources of placer gold in the Klondike alone have been estimated at $100,000,000. Up to the present probably not one-twentieth of this vast area has been prospected in detail.[1]

Silver and Cobalt

The total silver production of the Dominion for 1911 is estimated at 32,740,748 ounces, valued at $17,452,128 of which 30,761,690 ounces were from Ontario, 1,910,323 ounces from British Columbia, 50,300 ounces from the Yukon and 18,435 ounces from Quebec.

Since the discovery of the deposits at Cobalt, Ontario, in 1904, the production of the country has grown rapidly, and Canada now ranks third among the silver-producing countries of the world. Ores from the Cobalt district are at present being treated at three metallurgical works, operated by the following companies:

The Canadian Copper Co., at Copper Cliff, Ont.,

The Deloro Mining and Reduction Co., at Deloro, Ont.,

The Coniagas Reduction Co., at Thorold, Ont.

"These three smelting works receive most of the high grade ores produced by the mines, as well as a considerable proportion of the concentrates, the shipments of low grade ores continuing for the most part to go to smelters in the United States, where their siliceous contents render them desirable for mixing with more basic material."[2]

Silver bullion of fineness varying from 850 to 998.2 is produced at the works, other products being white arsenic, and in the case of the Coniagas plant, nickel and cobalt oxides. During 1910 these three companies combined treated 9,466 tons of ore and concentrates, the silver recovered amounting to 14,574,837 fine

[1] S. Dushman, Trans. Am. Electrochem. Soc. 20, p. 430.

[2] Report of Bureau of Mines, Ontario, 1910, p. 15.

ounces. "The remainder of the output, consisting of 24,893 tons of ore and concentrates, yielding 16,076,580 ounces of silver, was exported mainly to the United States. The material sent abroad for treatment thus contained on an average 645 ounces per ton, while that refined at home carried an average of 1,539 ounces per ton."[1]

The ores of the cobalt district are extremely complex and the problem of treating them so as to economically extract the silver, cobalt, nickel, and arsenic, is still awaiting a solution. At the present time the elements other than silver in these ores are of comparatively slight value, at any rate to the miners of the ore.[2] The demand for cobalt and arsenic is not great enough to keep pace with the amount produced as by-product during the extraction of the silver. "In fact, one year's operation of the cobalt mines will produce ore enough to meet the present consumption of cobaltic oxide for several years.[3] Some idea of the extent of this over-production of both cobalt and arsenic may be gathered from the fact that the ore contains on the average 6.76 percent. cobalt, 3.72 percent. nickel, and 30 percent. arsenic.[4]

Both the Canadian Government and the miners have consequently attempted to devise and encourage methods for utilizing these constituents. As a result of the bounty on cobalt oxide of 6 cents per pound of metallic cobalt content, both the Deloro Mining and Reduction Co. and the Coniagas Reduction Co. made shipments of the oxide in 1910.[5] The cobalt oxide, mixed with nickel oxide, is exported to Europe for use in the manufacture of china ware. The quantity of oxide, however, consumed in this manner is believed not to exceed 300 or 350 tons per annum, which is much below the equivalent of ore produced by the silver mines of Cobalt.

Attempts have been made to find an application of cobalt as a constituent of alloys, and a recent report would seem to point to the alloy with chromium as possessing a number of useful

[1] Ib, 1911, p. 13.
[2] Ib, 1909, p. 13.
[3] Ib, 1910, p. 24.
[4] Ib, 1911, p. 17.
[5] Ib, 1911, p. 25.

properties. According to this report, an alloy containing 25 percent. chromium and 75 percent. cobalt is superior to steel for knife blades and is very resistant to corrosion. "It is equalled in this respect only by gold and the metals of the platinum group." Mr. Haynes, the inventor of the alloy, regards it as particularly suitable for the manufacture of small cutting instruments, since it takes an edge comparable to that of tempered steel. He also suggests its use in the chemical and physical laboratory in place of platinum. It may therefore be that in this or similar directions an outlet will be found for the cobalt which the mines of the district of that name are now forcing upon an unwilling market.[1]

Arsenic

At one time all the arsenic manufactured in Canada was obtained from auriferous arsenic pyrites in Hastings County, Ontario.[2] But in recent years the reduction works at Copper Cliff, Deloro and Thorold have supplied the total demand for this product. During 1910 these plants recovered and marketed 1,524 tons of white arsenic, valued at $70,709, an average of 2.31 cents per pound.[3] As in the case of cobalt, the consumption of arsenic has not kept pace with the enforced increase in supply, and since the opening of the cobalt mines the price has fallen from six or seven cents per pound to less than three cents.

Copper and Nickel

Copper in the refined state is not produced in Canada. The ores are smelted to a matte containing gold and silver as the valuable constituents, which is then exported to the United States for refining. The production of the Dominion is derived from the provinces of British Columbia and Ontario.

In the former province, "gold-copper" ores occur in the Rossland and Boundary districts. "The average content of these ores is rather less than 30 pounds per ton; but with present treatment facilities, it is possible to smelt 9,000 tons of ore daily,

[1] Ib, 1911, p. 25.

[2] W. R. Lang, The Chemical Industries of the Dominion, Trans. Can. Institute, *8*, 151–190 (1905); Journ. Soc. Chem. Ind. 1904.

[3] Report of Bureau of Mines, Ontario, 1911, p. 33.

while with the smelter improvements and additions now being made, or contemplated, this output will probably be increased within the next two years to 10,500 tons, or a possible production of 100,000,000 pounds of copper per annum."[1] At the present time the following smelting companies are established:

The Brittania Copper Syndicate, Limited.
Head Office—Brittania Beach, B. C.,
Smelter—Crofton, Vancouver Island;

The British Columbia Copper Company, Limited.
Head Office—New York,
Smelter—Greenwood.

"The works comprise a thoroughly modern well-equipped plant of three furnaces, having a capacity of 2000 tons of ore daily, and two converters, equal to a capacity of about 2500 pounds of copper per hour, working on matte of 45 percent. copper content."[2] The product from the converter is blister copper and is sent to the Nicholls Chemical Company, New York, to be refined.[3]

The Consolidated Mining and Smelting Company, of Canada, Limited.
Head Office—Toronto, Ont.
Smelter—Trail, B. C.

"The present works is a completely equipped and modern plant, designed to treat all grades of copper and lead ores, and includes a refinery for producing pig lead, as well as refined silver, gold, and antimony, with copper sulphate as a by-product."[4]

Dominion Copper Company.
Head Office—New York.
Smelter—Boundary Falls, near Greenwood, B. C.

[1] Bulletin No. 24, Department of Mines; Report on the Mining and Metallurgical Industries of Canada, 1907–8, p. 137.

[2] Ib., p. 232.

[3] W. R. Lang, loc. cit., p. 157.

[4] Bulletin No. 24, Department of Mines, p. 235.

The Granby Consolidated Mining, Smelting, and Power Company, Limited.
Head Office—Grand Forks, B. C.
Smelter— " " "

This is the largest of the smelting works in British Columbia. It employs about 300 men at the smelter, besides 500 men at the mine. The plant is capable of treating 4000 tons of copper ore daily. Both matte and blister copper are produced. The former averages between 40 and 44 percent. copper; 10 to 15 ounces of silver, 1.6 and 2.6 ounces of gold per ton, while the latter carries 99.5 to 99.6 percent. copper, 25 to 37 ounces of silver, and 4 to 6.5 ounces of gold per ton.[1]

During 1910 this company produced 11,407,351 pounds of blister copper, containing 30,945 ounces of gold and 227,445 ounces of silver.[2]

The total capitalization of the above smelters is about $30,000,000 and the aggregate number of men employed by them is about 1100. The production of blister and matte copper from the province during 1911 was approximately 35,500,000 pounds.[3]

The copper production of Ontario is mainly derived from the nickel-copper ores of Sudbury. "At present there are only two companies, the Canadian Copper Company, and the Mond Nickel Company, engaged in active smelting operations. Both these companies produce a nickel-copper matte from a nickeliferous pyrrhotite ore, which carries in addition values in copper. The matte is shipped to refining works in the United States and England for subsequent treatment."[4]

The Canadian Copper Company is an American corporation, with head office at Cleveland, Ohio. The smelting works are located at Copper Cliff, near Sudbury, and constitute "one of the largest and best-equipped plants of the kind to be found anywhere, costing in the neighborhood of $4,000,000. Power for operating the mines and works is developed at High Falls on the

[1] Ib, p. 252.
[2] Private communication.
[3] Bulletin No. 150, Department of Mines, p. 11.
[4] Bulletin No. 24, Department of Mines, p. 383.

Spanish river, about 28 miles from Copper Cliff, where there is a natural drop of about 65 feet, increased by damming to 85 feet. About 12,000 horse power can be obtained here, and costs delivered at Copper Cliff about $15. per horse power-year. Ore is taken for the most part from the Creighton mine, which furnished 391,575 tons out of the 508,404 tons raised by the Company in 1910. This ore contains about 1.5 percent. copper, and 4.5 percent. nickel."[1] After many years of experience, a very efficient method of treating these complex nickel ores has been developed and a matte is produced containing about 35 percent. copper-nickel, 27 percent. sulphur, and the balance iron. Through subsequent bessemerizing this matte is reduced to about 40 to 49 percent. nickel, 26 to 49 percent. copper, 12 to 23 percent. sulphur, and 0.5 to 2 percent. iron. The smelter treats about 1000 tons of ore per day. All the copper-nickel matte produced is sent to the refinery of the Orford Copper Company, of New Jersey, U. S. A.[2]

The Mond Nickel Company's smelting plant is at Victoria Mines on the Sault branch of the Canadian Pacific Railway. The Company owns altogether 7000 acres of mining lands, partly leased and partly in fee simple. The average analysis of the run of mine ore is about 2½ percent. nickel, and 2½ percent. copper. The capacity of the smelter was about 310 tons of high grade matte per month in 1908.[3] "The bessemer matte produced contains about 40 percent. copper and 40 percent. nickel, about 15 percent. iron, and the balance sulphur and impurities. This matte is put up in barrels and shipped to Swansea, England, to the Mond Refining Works."[4]

The discovery of the copper-nickel ores in the Sudbury district has placed Ontario in the position of being the largest producer of nickel in the world, these deposits now supplying about 75 percent. of the world's total. The production of nickel-copper matte for 1909 and 1910 is contained in the following table:[5]

[1] Report of Bureau of Mines, Ontario, 1911, p. 26.

[2] Bulletin No. 24, Department of Mines, p. 389.

[3] Ib., p. 398.

[4] W. R. Lang, loc. cit., p. 158. Also contains description of Mond's process for extracting nickel from its ores.

[5] Report of Bureau of Mines, Ontario, 1911, p. 27.

		1909	1910
Ore raised	Tons	451,892	652,392
" smelted	"	462,336	628,947
Bessemer matte produced	"	25,845	35,033
Nickel contents	"	13,141	18,636
Copper "	"	7,873	9,630
Value of nickel		$2,790,798	$4,005,961
" copper		1,122,219	1,374,103
Wages paid		1,234,904	1,698,184
Men employed		1,796	2,156

The statistics for 1911 are not yet completed, but it is estimated that the production is about the same as for 1910.

An interesting development in connection with this industry is the production of "Monel Metal," an alloy of nickel and copper which has been placed on the market by the Canadian Copper Company, and which is produced by that Company directly from the matte. "In fact, it is asserted that the proportions in which the nickel and copper occur in the Canadian Copper Company's ores are almost precisely those required for the alloy, which are about 67 percent. nickel, and 37 percent. copper, and that by careful attention to the furnace charge a Bessemer matte can be produced within one percent. of that required in making Monel metal. Considerable quantities of this alloy are now coming into use. It is claimed to possess great strength and to be practically non-corrodible."[1]

Iron

"The Canadian iron industry dates back to the establishment of the St. Maurice forges by the French Government in 1737. Many other minor plants were subsequently built, but they all failed in consequence of the competition of Great Britain and the United States. This early failure was due as much as anything else to lack of enterprise, capital, and proper shipping facilities. The modern development of the industry may be said to date from the introduction of a protective duty on iron in 1887. The

[1] Ib, p. 28.

granting of bounties by the Dominion and Ontario governments has also assisted largely in bringing about the present condition of the iron and steel industries."[1]

The production of pig iron by provinces in 1910 and 1911 was as follows:

PRODUCTION OF PIG IRON BY PROVINCES, 1910 AND 1911

Provinces	1910			1911		
	Tons	Value $	Value per Ton $	Tons	Value $	Value per Ton $
Nova Scotia..	350,287	4,203,444	12.00	390,242	4,682,901	12.00
Quebec......	3,237	85,255	26.34	658	17,282	26.34
Ontario......	447,273	6,956,923	15.55	526,635	7,606,674	14.44
Total....	800,797	11,245,622	14.04	917,535	12,306,860	13.41

The following table shows the origin of the raw materials utilized in producing this iron in 1911.[2]

Material	Domestic	Imported
Ore..................................	67,434	1,628,368
Coke.................................	543,933	577,388
Limestone............................	625,216	

It is thus seen that this industry is to a large extent dependent upon imported raw materials. Nearly all the ore used in Nova Scotia is imported from Newfoundland, while a great deal of that used in Ontario is derived from the south shore of Lake Superior.

[1] W. R. Lang, loc. cit., p. 153.

Dominion bounty on pig iron, $3 per ton produced. Ontario bounty $1 per ton on pig iron produced from Ontario ores, and 50 cents on ores not obtained in the Province; the rate of $1 to be only paid up to 25,000 tons.

[2] Bulletin No. 150, Department of Mines, p. 15.

The classification of the production according to the purpose for which it was intended was as follows:

Bessemer 208,626 tons; basic 464,220 tons; foundry and miscellaneous 244,686 tons.

The history of the iron and steel industry in Ontario forms an attractive chapter in the evolution of Canadian industry. The story down to 1904 has been told interestingly by Prof. W. R. Lang.[1] A detailed account of the industry, not only from an historical but from an economical, geological and metallurgical point of view, is to be found in the Report of the Bureau of Mines of Ontario, 1908, pp. 190–342, from which source a great deal of the information has been derived regarding the individual plants.

At the present time there are eight furnaces producing pig iron in Ontario, distributed as follows: Algoma Steel Company, Sault Ste. Marie, two; Hamilton Steel and Iron Company, Hamilton, two; Atikokan Iron Company, Port Arthur, one; Canada Iron Corporation, Midland, two; Standard Chemical Company, Deseronto, one. The combined production of these plants in 1911 was 526,610 tons of pig iron. Of the ore smelted, 67,631 tons were of domestic and 848,814 of foreign origin.[2]

The Hamilton Steel and Iron Company and the Algoma Steel Company were also producers of steel. The steel produced in 1910 (the last year for which data are available) amounted to 331,321 tons, valued at $7,855,407. The total number of workmen employed in the iron and steel industry in Ontario was 2,120 in 1910, over $1,400,000 being paid in wages.[3]

The plant of the Algoma Steel Company, which is owned and operated by the Lake Superior Power Corporation, is situated at Sault Ste. Marie on the St. Mary's River, and consists of two blast furnaces, of 250 tons capacity per day, with all necessary modern stock handling machinery, two acid bessemer converters, two basic open hearth furnaces and a rail mill with an annual capacity of 225,000 tons. The ores used are obtained almost

[1] W. R. Lang, loc. cit., pp. 153–4.

[2] Bureau of Mines, Ontario; Preliminary Report on the Mineral Production of Ontario for 1911.

[3] Report of Bureau of Mines, Ontario, 1911, p. 29.

entirely from the Lake Superior American ranges, and the coke used is derived from the West Virginia fields. The limestone is quarried in Michigan about 40 miles from the Sault. The company also has under construction a 400 ton furnace, a 12″ and 18″ merchant mill, and a complete installation of by-product coking ovens (110 ovens, Koppers type, with capacity of 1,100 tons of coke per day).

"The works of the Hamilton Steel and Iron Company, Limited, are located in Hamilton, on the shores of Burlington Bay, Lake Ontario, and in point of size and investment come next to those of the Algoma Steel Company. The plant consists at present of two coke blast furnaces, four basic open hearth furnaces, puddling furnaces, rolling mills and a forging department, also a small spike mill. . . . Latterly, all ores have been secured from the Lake Superior American ranges and from the Helen mine in Michipicoten, Ontario. Coke is obtained from the Pennsylvania Connellsville district. Limestone is obtained from several localities not far from Hamilton. Dolomite from the Dundas quarries is used for the blast furnaces, and from the St. Mary's quarries in Perth and Port Colborne quarries in Welland are obtained the limestones for open hearth work." The two blast furnaces have a combined capacity of over 525 tons per day. Two of the open hearth furnaces are of 40 tons and two of 20 tons capacity, all are of the stationary type and are fired with natural gas. The whole plant produces annually over 180,000 gross tons of pig iron, 100,000 net tons of steel ingots, and 100,000 gross tons of rolled iron and steel, besides forgings, railing car axles, and track spikes.

The Canada Iron Corporation has a plant situated on the shore of Midland Harbor. About 50 to 75 percent. of the ore used is imported from the Lake Superior district; coke is brought in from the Connellsville district in Pennsylvania, while the limestone is quarried about five miles from the furnace on the eastern shore of Midland Bay. The capacity of the two furnaces in operation is 375 tons.

The blast furnace at Deseronto was formerly blown with charcoal as fuel, this being supplied by the Standard Chemical Company, Limited, which manufactures charcoal and its by-products. In 1907, owing to failure of the wood supply, it was decided to manufacture coke iron and at the present time part of the fuel is imported from Connellsville. The ores are obtained mainly from the American Lake Superior ranges, arriving via the Welland Canal. Limestone is obtained from quarries along the Bay of Quinté railway, Ontario. The output of the furnace is about 35 gross tons of iron per day.

"Of late years considerable attention has been given to the deposits of iron ores that are found in the Thunder Bay and Rainy River districts of northwestern Ontario. Various projects were put forward for the utilization of these ores, but it remained for the Atikokan Iron Company, organized in 1905, to demonstrate the practicability of roasting and smelting the high sulfur magnetites of the Atikokan range for the production of foundry iron."[1] The plant located in Port Arthur comprises a blast furnace of maximum capacity of 200 tons per 24 hours, an ore roaster operated by the blast furnace gas, and a battery of 100 beehive coke ovens. The coal for the coke is obtained from the West Virginia fields, and the limestone is obtained from Kelly Island in Lake Erie.

This completes the survey of the plants at work in Ontario. Turning to the province of Nova Scotia, we find that there are three plants in operation.

The Dominion Iron and Steel Company was organized in 1899, with the intention of providing a larger market for the output of the Dominion Coal Company. The works are situated at Sydney, N. S., and include five blast furnaces of 280 tons capacity each, ten 50 ton open hearth furnaces of the H. H. Campbell tilting type, a 26″ blooming mill and pit furnaces, a 28″ rail mill, 1000 tons capacity, a rod mill of over 7000 tons capacity monthly, a continuous billet mill, of 600 tons daily capacity 500 coke ovens, coal-washing, sulphuric acid plants, and by-product plant. The erection of a sixth furnace has been arranged for, the completion of which will give this company a capacity of over 400,000 tons per annum.

The principal source of the iron ore supply is Wabana mine, Bell Island, Newfoundland, some 400 miles from Sydney. This

[1] Ib, 1908, p. 319.

mine is estimated to contain 28 million tons of available ore, besides areas under the sea which are believed to be very extensive. It is estimated that the cost of this ore in stock bins at Sydney, C. B., is \$0.817 per ton.[1] "Analyses of the ore show it to contain fifty percent. of iron, little sulphur, but rather too much silica, aluminum, and phosphorus. The result is a pig iron too high in phosphorus, but during the subsequent conversion of the pig iron into steel in open-hearth furnaces, this impurity is eliminated, and a fine quality of steel produced. For the best kind of pig iron, it is necessary to mix other ores with it, and for this purpose Cuban, Spanish, and Swedish ores are used, the result being a low phosphorus pig."[2]

Limestone is obtained from the Company's quarries at Bras d'Or Lakes, about 85 miles by water from the works. It analyses about 94.6 percent. $CaCO_3$, with about 3 percent. $MgCO_3$. The supply of dolomite is derived from the Company's quarry at Scotch Lake, about 16 miles from Sydney.

Coal is obtained from the Dominion Coal Company's fields near at hand, at a cost of \$1.24 per ton. The coke oven plant consists of ten batteries of fifty ovens each, of the Otto-Hoffman by-product type. The total capacity is rated at 1,200 tons of 37 hour coke per day of 24 hours. These ovens are of the latest type and are provided with a condensing house, a cistern, and the necessary coolers, scrubber, sieve washer, etc., for cooling and cleansing the gas and extracting from it the tar and ammonia. The latter is converted into sulphate of ammonium by neutralizing it with sulphuric acid. The greater part of this product is exported to the West Indies, where it is used as a fertilizer on the sugar plantations. The acid plant, which has a capacity of 40 tons per day, is a modification of the old chamber system, pyrites and sulphur being used as raw materials. The tar is pumped to storage tanks, and sold to the Dominion Tar and Chemical Company, Ltd., who have their works on the Dominion Steel Company's property, and near the coke ovens.

The number of men employed on the works of the Dominion

[1] Bulletin No. 24, Department of Mines, p. 537.
[2] W. R. Lang, loc. cit., p. 155.

Iron and Steel Company at Sydney, and at Bras d'Or Lakes, is over 4,000.

The Londonderry Iron and Mining Company, Limited, situated in Colchester County, N. S., has the oldest plant in Nova Scotia, having begun operations in 1850. Only one furnace of 100 tons capacity is in operation. The ore is obtained from the Company's mines near at hand and consists of hematite, siderite, specular ore and ochrey ore. The coke is obtained from 97 coking ovens, having a total capacity of 150 tons per day.

The Nova Scotia Steel and Coal Company, Limited, operates one blast furnace having a capacity of 200 tons per day, at Ferrona, near New Glasgow, N. S., and three 40 ton open hearth steel furnaces and one 50 ton open hearth rolling furnace at New Glasgow. The latter are all of the Wellman-Seaver-Morgan Company type, arranged in one row, and the Siemens-Martin process is used. The product of the furnace, which averages 240 tons per day, is tapped into 50 ton ladles, from which it is poured into molds in a pit. Electric power is utilized by the works and is generated from steam.

The iron ore is mainly derived from the Wabana mine, on Bell Island, Newfoundland. It is a red hematite containing about 55 percent. metallic iron, 3.7 percent. alumina, about 1 percent. phosphorus, and only the slightest trace of sulphur. Limestone is obtained from the Company's quarry at Point Edward, Cape Breton. The Company also owns its own coal colleries in Pictou County. About 1800 men are employed at the Works and 2400 more at the mines and quarries.[1]

According to the report of the Department of Mines of Canada, there were 12 furnaces in blast December 31, 1911, out of a total number of 18. The aggregate capacity of the furnaces actually constructed throughout the Dominion is about 3600 tons per day.

Lead

The production of lead in Canada is almost entirely from British Columbia mines. Lead smelting in this province dates practically from 1894, when a smelter was erected at Pilot Bay, on Kootenay Lake, by the Kootenay Mining and Smelting

[1] Bulletin No. 24, Department of Mines.

Company. Two years later the Hall Mines, Limited, commenced operations at Nelson, B. C., and then followed in rapid succession the installation of smelters at Grand Forks, Greenwood, and Trail. In most of these plants the Huntington-Heberlein process for treatment of lead ores has been adopted, with more or less modification.

The Consolidated Mining and Smelting Company also operate an electrolytic lead refinery at Trail, using Betts' process. As a full description of the plant and process is readily available in numerous publications, it is unnecessary to go into details in this connection. Since 1902, when the plant was first installed, its capacity has grown from 50 tons to 100 tons per day, and it is now treating practically all the British Columbia lead ores. Pig lead, fine gold, fine silver, refined antimony, copper sulphate, and babbitt metal are produced at the refinery, and lead pipe also is manufactured there. The refined lead finds a market in Canada, the United States and the Orient. The Carter White Lead Company, of Canada, with works at Montreal, uses Trail lead exclusively.[1] The total value of the refinery output for 1910 and 1911, as well as detailed statistics of the individual products, is given in the following table:[2]

	1910	1911
Total Refinery Output	$2,160,911	1,731,874
Gold, ounces	13,298	15,260
Silver, "	1,798,960	1,325,294
Lead, tons	16,493	11,763

Structural Materials

With the enormous increase in population there has naturally occurred a rapid growth in the production of structural materials.

The most important of the materials which come under this heading is Portland Cement. The value of the production has grown from $18,000 in 1890 to over $7,500,000 in 1911, during

[1] Bulletin No. 88, Department of Mines, p. 88.

[2] Private communication.

which year 5,677,539 barrels (of 350 pounds net) were produced at an average price of $1.34 at the works.[1] This was an increase of 29 percent. over the production in 1910. Furthermore, the amount imported has decreased from 64 percent. of the total consumption in 1901 to only 7 percent. in 1910.

According to returns to the Department of Mines in 1911 there were 22 plants operating in 1910, with a total daily capacity of 25,835 barrels.[2] These plants are distributed as follows: one in Nova Scotia, using blast furnace slag; one in Manitoba, making a natural Portland Cement; one in British Columbia, two in Alberta and three in Quebec, using limestone and clay; and fourteen in Ontario of which eleven use marl and three limestone.

The use of shell marl as the source of lime was the prevailing tendency at the outset of the industry. But more recently the tendency is strongly towards the use of solid rock, as "it has been found more economical to raise and grind the rock than to dredge the marl and handle the large proportion of water accompanying it."[3] This is well shown by the following statistics:

Year.	Cement from marl	Cement from limestone
1908	1,573,090	1,922,871
1909	810,706	3,336,002
1910	1,214,479	3,181,803

The method of manufacture is in most cases the standard American practice, involving the use of rotary kilns in preference to those of the stationary type.

The number of men employed in the cement industry is over 2200, and the wages paid about $1,300,000 per annum.

About 80 firms are engaged in the manufacture of lime throughout the Dominion. The average number of men employed

[1] Bulletin No. 150, Department of Mines, p. 20.

[2] Bulletin No. 114, Department of Mines; The Production of Cement, Lime, Clay Products, Stone and other Structural Materials in Canada, 1910.

[3] Report of Bureau of Mines, Ontario, 1911, p. 32.

in 1910 was reported as 976, and wages paid \$466,876.[1] The annual production for 1909, 1910, and 1911 has been about 5 to 6 million bushels at an average value of 19 to 20 cents per bushel. About 50 percent. of this production is derived from Ontario.

The manufacture of sand-lime brick was first started about six years ago. Since that time the number of operating plants has increased rapidly. In 1910 there were at least 13 firms producing sand-lime brick, the total annual production amounting to approximately 45 million, at an average value of \$8.34 per thousand. Both vertical and horizontal presses are in use.

As the cost of producing this class of brick is much below that of clay brick, their manufacture forms a very profitable undertaking. When made from fine white sand, the product has a neat and clean appearance equal to that of the best pressed clay brick, and may be made with a crushing strength which is well over 2500 pounds per square inch.

Gypsum is found in considerable quantities in the provinces of Nova Scotia and New Brunswick. The tonnage of gypsum mined or quarried in 1910 was 548,019 tons, and the quantity calcined 69,889 tons.[2] "At Windsor, N. S., there are immense deposits; the beds found in the vicinity of Hillsborough, N. B., are, however, very large and of great purity, and form the basis of the most extensive operations. In manufacturing plaster of Paris, the stone is first dried in the air and ground—not burned in lumps as is still done to a considerable extent in England and on the Continent; and the pulverized materials subjected to a process of calcination in kettles, of a capacity of sixty barrels of 300 pounds of the calcined plaster, furnished with lids and stirring arms which keep the material in constant motion. When the required temperature has been reached (285°F.), the plaster is removed and packed in paper-lined barrels for market. Analysis of the Hillsborough gypsum shows it to be 99.88 percent. $CaSO_4 . 2 H_2O$."[3]

There is also a plant at Paris, Ontario, manufacturing plaster

[1] Bulletin No. 114, Department of Mines, p. 40.

[2] Bulletin No. 117, Department of Mines; Summary of the Mineral Production of Canada, 1910, p. 17.

[3] W. R. Lang, loc. cit., p. 174.

of Paris and various alabaster products from gypsum mined at Caledonia, Ontario.

Petroleum

Petroleum occurs in commercial quantities in the counties of Kent and Lambton, in the province of Ontario; but the supply has been decreasing during the last few years. While in 1907 there were produced nearly 800,000 barrels of crude petroleum, the production had diminished to about 300,000 barrels in 1910. This decrease is due largely to the gradual diminution in the yield of the wells of the Lambton County field. The wells at Petrolea and Oil Springs have been producing oil for over forty years, and the average production per well is now very small, being not over eight or nine gallons per day.[1]

In 1905 oil was first struck in the new Tilbury field in the county of Kent, and later on oil was also drilled for in the Romney field. During the next two years the wells of these fields produced an average of about 30,000 barrels per month, which was about half of the total production for Ontario.[2] Subsequently the production fell off very rapidly, and in 1910 it amounted to only 5000 barrels (of 35 gallons) per month.

Petroleum has also been found in Quebec, Nova Scotia, New Brunswick and Alberta. The hopes which were at one time entertained that the North West would provide a supply that would counteract the diminution of the Ontario supply have so far not materialized.[3]

Crude oil is refined in Ontario by three companies:

The Imperial Oil Company, Sarnia.
The Canadian Oil Companies, Limited, Petrolea.
The British American Oil Company, Toronto.

The plant of the Imperial Oil Company has a capacity of 900,000 barrels of crude oil per annum. The oil, as it is received from the producers, is stored at the works in large reservoirs, from which the supply for the crude oil stills is drawn. These

[1] Report of Bureau of Mines, Ontario, 1909, p. 33.
[2] Ib., 1907, p. 92.
[3] W. R. Lang, loc. cit., p. 180–1. See also Bulletin No. 88. Department of Mines, for report on Alberta oil fields.

stills contain approximately 640 barrels of oil each, and produce as distillates benzine, gasoline, and refined oil.[1] It is interesting to note that it was in this plant that Frasch first worked out the copper oxide process for refining crude oil containing sulphur. Before this process was devised the Petrolea oils could only be sold for fuel purposes.

The tar which collects at the bottom of the stills is further treated for the manufacture of lubricants and paraffin wax.

The Canadian Oil Companies have erected a very modern plant at Petrolea and obtain a large number of products by the refining of the crude oil.

As the output of domestic crude oil is quite inadequate to meet the requirements of these refineries, the deficiency is made up by imports from the oil fields of the United States. Thus the quantity of Canadian oil distilled in the above refineries in 1910 was nearly 14 million gallons, while of imported crude oil over 17 million gallons were distilled. The following statistics give details of the operations carried on by oil refining works at Sarnia and Petrolea.[2]

PETROLEUM AND PETROLEUM PRODUCTS

1909–1910

	1909	1910
Crude produced.................Imp. gal.	14,723,105	11,004,357
" distilled.................. "	35,530,918	36,171,032
Value crude produced....................	$559,478	$368,153
" distilled products..................	$2,501,384	$2,511,368
Illuminating oil.................Imp. gal.	17,902,254	18,983,357
Lubricating " .... "	3,856,778	4,469,038
Benzine and naptha......................	3,930,691	4,297,615
Gas and fuel oils and tar.................	4,687,588	5,876,498
Paraffin wax and candles ....lb.	7,092,278	5,179,391
Workmen employed ....No.	436	428
Wages paid..............................	$261,014	$280,485

[1] Bulletin No. 24, Department of Mines, p. 439.

[2] Report of Bureau of Mines, Ontario, 1911, p. 38.

Refined Chemicals and Drugs

At the present time there are three firms in Canada which devote part of their time to the manufacture of fine chemicals. In two of these cases this line of manufacturing is a side issue in the manufacturing of pharmacopoeie preparations and pharmaceutical products, while in the third case it is part of a general chemical business. The sale of fine chemicals so manufactured is estimated at $175,000 per year.

The following are the principal lines manufactured at the present time: Iodides and Iodine Preparations, Silver and Gold Salts, Salts of Mercury, Hydrogen Peroxide, Phosphates of Soda, Sulphites and Bisulphites, Amyl Acetate.

On account of the exigencies of the Canadian market, which demands a very wide range of material, a number of smaller lines are made which will not be enumerated here, their manufacture taking place from time to time, and not continuously, as a rule, on a steady scale.

The greater proportion of what may be classed as fine chemicals used in Canada at the present time is imported. The principal countries of origin are Great Britain, which enjoys preferential duty, Germany, United States, and France.

The Canadian market for products coming in, of this class, is, however, increasing rapidly, and it seems reasonable to suppose that the manufacture of the same will be undertaken with greater energy as the market develops.

The manufacture of pharmaceutical products in Canada is being carried on aggressively at the present time by a number of firms, some of whom, as their names will indicate, are branches of houses having headquarters in other countries. From the number of firms operating, it will be seen that this field is fairly well occupied at the present time. The steady growth of the different firms interested in this line of manufacture is an evidence of a growing market for the products which they make.

The following is a list of the principal firms operating in Canada:

Park Davis & Co., Limited, Walkerville, Ont.
Frederick Stearns & Co., Ltd., Windsor, Ont.
Lyman Bros. & Co., Ltd., Toronto

Toronto Pharmacal Co., Ltd., Toronto
Moyes Chemical Co., Ltd., Toronto
H. K. Wampole & Co., Limited, Perth, Ont.
National Drug & Chemical Co. of Canada, Ltd. Head Office, Montreal, with branches in the principal cities of Canada
Chas. H. Frosst & Co., Montreal
Shuttleworth Chemical Co., Toronto
Ingram & Bell, Toronto
United Drug Co., Toronto
Wyeth & Co., Montreal.

The enumeration of the lines manufactured is far too long for this publication. It is sufficient to say that the firms mentioned above confine their activities to three general classes of pharmaceutical products. In the first class we may include the standard preparations of the pharmacopoea. In the second class we may include standard preparation of a non-secret character. The third class consists of proprietary and other preparations made by the above named firms, but not always sold by them direct.

Sulphuric, Nitric and Hydrochloric acids, etc.

Canada manufactures practically all her acids, the amount imported being very small. While the demand for these and similar heavy chemical products has been moderate in the past, it is increasing very rapidly, and there is every reason to suppose that the future will see an enormous expansion in this line of manufacture. But even at the present time the manufacture of the heavy acids may be said to be the most important, as far as the chemical industry is concerned in this country.

The manufacture of these products is carried on both by companies of which the capital is purely Canadian and also by others which are branches of large foreign concerns. It is impossible, therefore, to state accurately the amount of capital which is employed in this business in Canada.

The following is a list of companies with their branches which are operating along these lines in this country:

The Nichols Chemical Company. Head Office for Canada, Montreal. Works situated at Sulphide, Ont., Capleton, Quebec, and Barnet, B. C. Products manufactured Sulphuric, Nitric and Hydrochloric Acids, Mixed Acids, Salt Coke and Glauber Salt.

Victoria Chemical Company, Victoria, B. C. The products manufactured include the above acids, Glauber Salt, and Lime Sulphur Spray.

Grasselli Chemical Co., Hamilton, Ont. This Company manufactures the heavy acids, arsenate of lead and lime sulphur spray.

Algoma Steel Co., Sault Ste. Marie, Ont. Manfacturers of sulphuric acid and ammonium sulphate.

Explosives

While this is not a large business in Canada, it is carried on mostly by three companies. There have been a number of factories built by other companies which were in the nature of experimental plants for the manufacture of explosives, but so far they have not been approved by the consuming public. No attempt has been made to enumerate the latter. The following firms are the principal manufacturers at the present time:

Canadian Explosives, Limited. Head Office, Montreal. Branches at Belle Isle Province, Quebec, Baudreul, P. Q., Vancouver, B. C.

Curtis Harvey, Limited, Rigaud, P. Q.

Dominion Explosives, Limited, Sand Point, Ont.

Electrolytic Alkali and Chlorine

"An electrolytic alkali industry was attempted about twelve yeas ago by the Lake Superior Power Co. Among the many subsidiary organizations initiated by this Company was the Canadian Electrochemical Company, for the electrolytic manufacture of caustic soda and bleaching powder. One hundred and twenty cells of the Rhodin mercury type were installed, each cell utilizing 1000 amperes at 5.5 volts. The total capacity of the plant was 4.5 tons of caustic and 9 tons of bleaching powder per day. The salt was obtained from wells in the county of

Huron. The work was discontinued at the time when it became necessary to reorganize the whole Lake Superior corporation, and has not been renewed since then. There was then, as now, no protection for caustic soda."[1]

At the present time the Canadian Salt Co., of Windsor, Ont., has an electrolytic alkali plant at Sandwich. The Gibbs cell is said to be used, but no further data are available.

Electric Furnace Products

The low cost at which hydro-electric power may be obtained in a large number of localities throughout the country has led to the establishment of a number of electrochemical industries, especially in Ontario and Quebec, where both raw materials and water power facilities are readily available.

Calcium Carbide

This constitutes the oldest electrochemical industry in Canada. Very recently the three plants operating at Thorold, Ont., at Ottawa, Ont., and at Shawinigan Falls, Que., have amalgamated as the Canada Carbide Company, Limited, with a capitalization of $2,000,000. The plant at Thorold has been in operation since 1897. Six furnaces are in operation, each requiring from 2500 to 3000 amperes at 75 volts. The voltage is regulated automatically by special devices. After fusion of the charge, which consists of lime, coke and coal, the furnace is dumped and the unfused material re-treated. The carbide is obtained in the form of a solid fused mass, which is crushed and bolted and finally packed into steel receptacles, each containing 100 pounds. Power is obtained from three power stations on the Welland Canal, near by. The total capacity of the plant is about 1200 tons of carbide per annum.

The plant at Ottawa is located on Victoria Island, the power being supplied by the Ottawa Power Company. The capacity of the plant is 3000 to 4000 tons per annum.

Shawinigan Falls, situated about 85 miles east of Montreal on the St. Maurice River, supplies about 25,000 H.P., most of

[1] S. Dushman, loc. cit., p. 423.

which is transmitted to Montreal at 50,000 volts. Part of this power is, however, utilized locally by the carbide plant and that of the Northern Aluminium Company.

The former is situated at a distance of two miles from the power house of the Shawinigan Water and Power Company. "The electric furnaces operate continuously: the manufactured carbide is drawn off in pots, and the fused mass, after cooling, is broken up and granulated in mills. Eight furnaces have been installed, two of which require each 1,500 H.P. for their operation. The combined capacity of the furnaces is 25 tons of carbide per day, requiring a total of 7500 H.P." [1]

The three plants produced over 8000 tons of carbide during 1911, and it is estimated that the production for 1912 will attain 10,000 tons. The carbide is sold for $65 per ton of 2000 lbs. at the Works, and the consumption of the product is increasing rapidly, especially for domestic lighting in different rural districts. About 185 men are employed in the different plants.

Cyanamid. "The American Cyanamid Company, located near Niagara Falls, Ont., manufactures calcium cyanamide by the process of Frank and Caro, the nitrogen being obtained by passing air over heated copper, which is then regenerated by natural gas. The power is obtained from the Ontario Power Co. The Company commenced operations in January, 1910, with a 10,000 ton plant. This is at present producing to its full capacity, and a large extension is contemplated. The cyanamide is not sold as such, but is previously mixed with Chili Saltpeter. The whole output is shipped to the United States." [2]

Silicon Carbide and Graphite. "The Norton Company, of Niagara Falls, N. Y., has a plant at Chippewa for the manufacture of crystolon. The latter is a trade name for carbide of silicon. The raw materials used are two different grades of coke (a metallurgical coke with 92 percent or more fixed carbon and 5 percent ash, and a petroleum coke, containing about 91 percent fixed carbon with less than 1 percent ash), a very pure silica sand, and sawdust. Two grades of product are manufactured, green and steel gray. The power is derived from the Ontario

[1] S. Dushman, Trans. Am. Electrochem. Soc. *20*, p. 425.

[2] S. Dushman, loc. cit., p. 423.

Power Co., and amounts at present to 2,000 h.p., which is received at 12,000 volts and transformed to 145 volts, after which it passes through induction regulators which buck or boost the voltage to 70 and 215.

The whole of the production, which amounts to over 5 tons per day, is shipped to the Company's main works at Worcester, Mass., where it is manufactured into different abrasive articles."[1]

The International Acheson Graphite Company has also established a small 1000 Kw. plant near Niagara Falls. The number of men employed is about 30, and the output of the plant during 1910 and 1911 has been over 2,000,000 pounds of Acheson graphite in bulk and powder form as well as electrodes.

Ferro-Alloys. The work of the Department of Mines, in connection with electric processes for the production of iron and steel, has had the direct effect of stimulating at least two companies to embark upon the manufacture of ferro-alloys by the electric process.

After the completion, in 1907, of the Government experiments at Sault Ste. Marie, the Lake Superior Power Co. bought the experimental plant from the Government and used it for the manufacture of ferro-nickel pig from pyrrhotite.[2] At the present time it is utilizing the furnace to produce ferro-silicon for its own consumption.[3]

The other company which is engaged in the manufacture of ferro-silicon is the Electro-Metals Co., at Welland. The company owns about 40 acres of land to the south of the town, on the east side of the Welland canal. The iron ore is imported from the United States, and silica in the form of rock or flint is brought from Frontenac or Parry Sound district.[4] The company has four furnaces of 1,000 to 1,500 h.p. each, the daily production being 5 to 8 tons. The power is obtained from the Ontario Power Co. About 115 men are employed, and the product consists of ferro alloys and carbon electrodes for electric furnaces.

[1] S. Dushman, loc. cit., p. 423.

[2] Report 16, p. 93–94. Pring, p. 73–74.

[3] Report 88, p. 68.

[4] O. B. 1910, p. 30. Report 88, p. 68.

Aluminum, etc. The Northern Aluminium Co., a branch of the Aluminium Co. of America, was the first industry to establish itself at Shawinigan Falls. Owing to the necessity of using direct current at low voltage, "it was considered better to generate the power as direct current. The company therefore take their supply of water from one of the penstocks leading from the canal of the Shawinigan Water & Power Co., and are expected to take the capacity of another penstock. The plant covers an area of about 10 acres."[1] The process used is the well-known reduction process of Chas. M. Hall, the alumina being prepared from bauxite in the East St. Louis (Ill.) plant of the parent company. "There are 340 cells in operation, each producing, on an average, 150 pounds of aluminium, 99.4 percent fine, per day."[2] The total capacity of the works is 25 tons of aluminium per day, about 500 men being employed when the plant is running at full capacity.

The Electro-Reduction Company of Buckingham, Que., manufactures phosphorus and ferro-phosphorus from apatite. No details are available as to the nature of the plant.

Sugar

The annual consumption of sugar in Canada amounts to about 400,000,000 lbs., most of which is imported. The raw sugar comes from the West Indies and is refined at Halifax and Montreal chiefly; the beet sugar factories also carry on the refining business to a certain extent during their slack season. The beet sugar industry is not a very large one in Canada; the difficulty has been, as at other points on this continent, that the labor is scarce and costly, while, as is well known, the cultivation of the beet requires constant care and attention. No statistics are available at present as to the number of men employed or the output of the various plants, but the geographical distribution of the various refineries may be gathered from the list appended.

The Canada Sugar Refining Co., Montreal;
The St Lawrence Sugar Refinery, Ltd., Montreal;
The Acadia Sugar Refining Co., Halifax;

[1] Bulletin 24, p. 434.
[2] Bulletin 88, p. 133.

The Dominion Sugar Co., Wallaceburg and Berlin, Ontario;
The Raymond Sugar Co., Raymond, Alberta;
The British Columbia Sugar Refining Co., Vancouver, B. C.

Paints and Varnishes

The principal manufacturers of Paints and Varnishes are the following companies:

The Sherwin Williams Co., of Canada, Ltd.,
Head Office—Montreal,
Works—Montreal, Toronto, Winnipeg, St. Malo;
The Carter White Lead Co., of Canada, Ltd.,
Head Office—Montreal,
Works— Montreal;
The Imperial Varnish & Color Co., Ltd.,
Head Office—Toronto,
Works—Toronto;
The Brandram-Henderson Co., Ltd.,
Head Office—Montreal
Works—Montreal and Halifax, N. S.;
The Martin- Co., Ltd.,
Head Office—Montreal,
Works—Montreal;
Moore, Benjamin & Co., Ltd.,
Head Office and Works—Toronto;
The Canada Paint Co. Ltd.,
Head Office and Works—Montreal;
The Standard Paint & Varnish Works,
Head Office and Works—Windsor, Ont.

The total amount of capital invested in this industry is over $10,000,000 and the annual output is approximately $6,000,000. About 800 to 1000 men are employed in the different plants. The standard products are white lead, red lead, litharge, etc., and different lines of paints and varnishes.

SYNOPSIS

John Birkenbine

Philadelphia, Pa.

The production of over 27 million tons of pig-iron, and 26 million tons of steel in the United States in the year 1910, is greater than the annual record of any country; a result which is not accounted for by the number and size of blast furnaces, but rather to the combined efforts of the metallurgist, chemist and engineer.

Seventy-five years ago isolated furnaces smelted iron ore with charcoal and produced a few tons of pig iron per day—the modern furnace, using coke as fuel, has a daily output 100 times as great as its prototype, and uses less fuel per ton of metal made.

Individual iron ore mines produce one million tons or more of ore, and one mine averaged for five consecutive years three million tons annually.

The ore, fuel and flux are handled in quantity by mechanical appliances, and much of the ore is never touched by the hand of man until the finished products pass from mills, nor in the various processes, is the metal flowing from the blast furnaces allowed to become cold.

While the mechanician and the engineer have been responsible for the physical development of the iron and steel industry, the chemist was equally essential, and the laboratory is in demand at all stages of manufacture, from the winning of the ore to the production of multitudinous forms of merchantable iron and steel. Selection of ores, the theory of the smelting process, the composition of metal for specified uses, the utilization of gas and other waste products, the production of ferric alloys, are guided by the chemist.

General descriptions of the early, intermediate and present types of blast furnaces and their equipment illustrate the eras of development, and the conversion of most of the pig iron into steel of definite composition and test, demonstrate that the phenomenal growth is to be mainly credited to theoretical investigation.

The intimate association of chemistry in all departments of iron and steel manufacture has resulted in placing at the head of many important works men who commenced their business life in the laboratory.

WHAT THE STATES ARE DOING TOWARD THE CONSERVATION AND IMPROVEMENT OF SOIL FERTILITY

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Part I

In preparing this paper, the writer has depended for his information upon the various publications of the United States Department of Agriculture, the Bulletins of the experiment stations located in the various states, pamphlets and bulletins issued by the agricultural colleges, the Report of the National Conservation Commission of 1909, supplemented by a somewhat elaborate correspondence with the directors of experiment stations, professors in agricultural colleges, secretaries of state boards of agriculture, and others.

The scope of the inquiry and its subdivisions are indicated in the accompanying chart, and may be easily understood by a brief glance at the headings of the various columns. Though the paper has to do with the work of the various states in preserving the fertility of the soil, and though the International Association of Applied Chemistry is interested primarily in the chemical elements of soil fertility, yet it seems desirable to include in the scope of this inquiry certain enterprises which have to do directly with physical rather than chemical conditions. The reason for this is that under certain conditions the chemical elements of fertility are in the soil, but they are prevented from operating productively by bad physical conditions. Where, for example, the soil is too dry, no amount of chemical fertility, in the absence of water, will enable the soil to produce crops; or where the soil is so wet as to prevent the air from permeating it, or where the land is so stony as to interfere with its cultivation, the presence of sufficient supplies of nitrogen, phosphorous, and potash is of no avail. This, therefore, is my excuse for including in the first part of this paper some account of the activities of the states in improving three classes of physical conditions in the soil, which may be described as too dry, too wet, too stony.

I have been unable to find that any state is exercising itself in any way toward the encouragement of the clearing of stony land. However, it has seemed expedient to include this column in the table merely to show by contrast how much the states are not doing in this important field. It may be said in explanation, however, that there is very little in the way of clearing stones from the land which cannot be done as well or perhaps better by private enterprise than by public enterprise.

Probably no phase of public enterprise has attracted more attention or appealed more strongly to the imagination than the irrigation of the dry lands of the Far West. So far as the writer has been able to learn, however, none of the states, with the possible exception of Utah, is at the present time carrying on any direct work in the field of irrigation. That is to say, none of them is actually building irrigation works under public management except Utah. A letter to the director of the experiment station at Logan states that Utah as a state is using her funds derived from the sale of lands in the construction of some large reservoirs, thus increasing the amount of irrigated lands. This land is again sold, and the money returned to a fund to build still more reservoirs. The larger part, however, of reservoir building is through government agencies (i. e., federal government), or private corporations under the Carey Act. Mr. R. P. Teele, in the Report of the National Conservation Commission (Vol. II, p. 76), states that Colorado and Montana at one time attempted to manage as a public enterprise the building of irrigation works, but in both instances the policy was abandoned.

It appears, therefore, that the greater part of the work of the states in the matter of irrigation has been in the way of encouraging private enterprise. Private enterprise may be encouraged in several ways,—particularly by means of instruction through the experiment stations and agricultural colleges; by total or partial exemption from taxation; or other favorable legislation, such as the formation of irrigation districts under a special law, the lending of the state's credit to districts or private corporations for the purpose of construction. Practically all the experiment stations and agricultural colleges in the arid section have given attention to problems of irrigation, and furnished instruction to farmers and others interested in irrigation enterprises. It may be surprising to some to learn that even in the humid states this subject has received attention. For example, the state of Massachusetts is carrying on experiments in irrigation for the benefit of market gardeners and cranberry growers. So also are Louisiana and South Carolina in the rice industry. So far as I have been able to discover, no state is modifying its tax system in order to favor irrigation enterprises.

There are two leading methods by which states do by favorable legislation encourage these enterprises. The first is through the formation of irrigation districts in sections already settled. In these cases the land owners in a district take the initiative. If a sufficient number desire it, and if the enterprise meets the approval of the state authorities, then the state lends its aid principally in two ways. The first is by making the scheme compulsory upon all land owners within the district. It simply lends its authority as a territorial sovereign, thus preventing a minority of unwilling owners from standing in the way of the project. The state also exercises its taxing power as a territorial sovereign and raises the funds for the carrying on of the enterprise by taxing the land to be benefited. The second characteristic method by which the states encourage irrigation enterprises is by the acceptance of the terms of the Carey Act of 1894, and its later supplementary acts. This applies primarily to land not yet settled or brought under cultivation. In this case the initiative is taken not by the land owners, but by an irrigation company or corporation, which petitions the state for authority to develop an irrigation scheme to water a district which still forms a part of the public domain. If this meets the approval of the state authorities, they in turn petition the federal government to have these lands withdrawn from settlement and turned over to the state under the terms of the Carey Act. The state then lends its further aid and encouragement to the corporation by giving it certain rights of eminent domain in the construction of its dams and ditches, and sometimes by lending its credit, and also by dictating the terms on which water rights are to be sold to settlers after the enterprise is completed. Eight states have accepted the terms of the Carey Act and encouraged irrigation under it. These states are Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. F. H. Newell, in his paper before the National Conservation Commission, stated that up to that time 1,716,424 acres had been approved for construction under this plan.

Though the question of drainage has attracted less public attention and appealed less to the imagination than irrigation, it is probably of even greater importance from the standpoint of national growth and greatness. Estimates differ widely as to the quantity of land which can be irrigated, but the estimates seldom exceed 50,000,000 acres. The area of swamp land which can be drained is somewhat better known, for the simple reason that there are fewer unknown and unknowable factors in the problem. Here the problem is primarily an engineering one, and involves comparatively little guessing at unknowable climatic conditions. And it is estimated that there are 75,000,000 to 80,000,000 acres of swamp land in the United States, and that fully 60,000,000 acres are capable of reclamation through drainage. These lands lie along the South Altantic seaboard, the Gulf coast, and the northern tier of states from Maine to Minnesota.

By an act of Congress passed in 1850, practically all the swamp lands in the public domain were granted to the states on condition that the proceeds of the sale of such lands should be used for reclamation purposes. In drainage enterprises Florida leads all the other states, and Louisiana and North Carolina are second and third. These states are carrying on, under state enterprise, large drainage operations. Massachusetts, Minnesota, and Mississippi are also engaged in minor drainage enterprises.

Here, however, as in the field of irrigation, the greater part of the work of the various states is done in the way of encouraging private enterprise. Nearly all the states in the humid belt give some instruction as to drainage, though in many cases this relates merely to tile drainage and not to the reclamation of swamp lands. Iowa, Illinois, and several other states, for example, are doing a great deal of underdraining, but mainly to improve land already under cultivation. Several states in the arid belt are also encouraging drainage enterprises, not for the purpose primarily of removing surface water but merely for the purpose of preventing the concentration of alkali on the surface. No state, so far as I have been able to discover, has thought of encouraging drainage through a modification of its tax laws. As in irrigation, so in drainage it is probably true that in most of the states a man is fined for showing enterprise, by having his taxes increased as soon as he improves his land.

Other favorable legislation in the matter of drainage seems to be confined to the organization of drainage districts, somewhat similar in principle to the irrigation districts already described. That is, the state lends its authority as a territorial sovereign to compel the owners in a selected district to contribute their share to the expenses of a drainage system, and its taxing power also as a territorial sovereign to collect the funds necessary to pay the expenses. In some cases also it lends its credit to encourage the sale of drainage bonds.

Part II

Coming now to the problem of preserving the actual fertility of the soil, we have first to consider the fact that one of the greatest sources of soil destruction is the washing away of the soil on the steeper slopes in periods of excessive rainfall. There seem to be three characteristic methods of preventing erosion,—namely, forestation; planting of grasses; diking, terracing, etc. It is difficult to find out to just what extent state enterprises in the field of forestation are for the purpose of preventing erosion. In almost every case there seems to be a mixture of motives, the desire to increase the timber supply, to regulate the flow of streams, as well as to prevent soil erosion. I shall assume, however, that wherever there is a state forest reservation the desire to prevent erosion is present, among other motives. Mr. Zon, of the federal Forest Service, states in the Report of the National Conservation Commission that there are in state forest reserves 3,000,000 acres. Mr. Peters, also of the federal Forest Service, in the same Report, states that the total of state land forested is 9,460,622 acres. He names the following states as owning forest land: Arizona, Arkansas, California, Colorado, Florida, Idaho, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Oklahoma, Oregon, South Dakota, Washington, and Wyoming. More than half the states give instruction through their agricultural colleges in forestry, and thus to that extent at least lend encouragement to private enterprise in the way of forestation. A number of bulletins, particularly in the southern states, have been issued to emphasize the importance of forests on the slopes to prevent erosion.

In the field of forestation alone does it seem to have occurred to the state authorities to lend encouragement by special modifications of the tax laws. According to Fairchild, in the Report of the National Conservation Commission, the following twelve states make special provision in their tax laws for the favoring of forestation and preserving timber lands: Alabama, Connecticut, Iowa, Maine, Massachusetts, Nebraska, New Hampshire, North Dakota, Rhode Island, Vermont, Washington, and Wisconsin. In most of these cases exemptions or rebates are granted to owners of timber lands in consideration of planting, cultivating, growing, or protecting trees, usually in accordance with regulations specified by law. Iowa, for example, encourages forest and fruit tree planting by an arbitrary assessment of $1 per acre on land so planted. New Hampshire grants a rebate of part of the taxes for a period of years.

Other favorable legislation in the matter of forestation usually takes the form of special fire protection, a forestry service with fire patrols, etc. No state, however, has done enough in this direction to accomplish very much. Other forms of state aid are special appropriations for fighting pests, such as the fight against the gypsy and brown-tail moths in Masachusetts and the pine-tree beetle in South Carolina.

Very little has been done in any of the states in the way of planting grasses to prevent erosion. Massachusetts has provided something of this kind to stop the drifting of the sand dunes on Cape Cod. A number of the southern states have spread information as to the value of grasses as a means of holding the soil in place.

If we except the levees along the Mississippi River, which are not so much for the prevention of erosion as for the prevention of overflow, practically nothing has been done by the states to encourage diking and terracing. The agricultural colleges and experiment stations of the southern states have all given out information and conducted demonstrations to show how contour plowing, terracing, etc., may help to keep the soil on hillsides.

Entirely apart from the lack of a sufficient supply of plant food, there are other bad chemical conditions due to the presence of too much of certain chemicals in the soil. Soils of this kind may be grouped under the two general heads of alkali soils and acid soils. Most of the experiment stations and agricultural colleges in the arid states have been grappling with the alkali problem, and conducting experiments to discover the best way of handling it. So far as the writer can find, no state is doing anything else to solve this problem. Most of the older states, particularly on the Atlantic seaboard, are troubled more or less with acidity of the soil. It seems to be a relatively simple problem, and calls for no form of state enterprise except in the way of instruction. Most of the agricultural colleges in this section have been urging the farmers to use more lime, to correct the acidity of the soil. This seems to be about all that the situation calls for.

We now come to the question of the direct preservation and improvement of soil fertility. This is the question which appealed first to our agricultural colleges and experiment stations. Consequently we find that every state has been dealing with this problem, but the universal practice is to lend aid to private enterprise through scientific investigation and instruction. Though most of the agencies carrying on this work owe their initiation to the bounty of the federal government, they have been so long carried on under state management, and most of them have received so much additional support from state funds, that it is entirely proper to classify them under state enterprises.

With the possible exception of the problem of preventing erosion, this is by far the largest problem in the whole field of national conservation. The agricultural soil is so much the greatest natural resource of the nation that no other is even second to it. Inadequately as the soil is now utilized, its annual products exceed in value the combined value of all the mines, oil and gas wells, fisheries, and forests.

As to the inadequacy of our methods of handling the soil, a great deal of sheer nonsense has been uttered by certain apostles of conservation. This may or may not be justifiable in one whose function is to stir up public sentiment rather than to tell the truth. A certain type of windy conservationist has expatiated upon our small product per acre in contrast with the larger product per acre of European countries. The simple fact is, however, that the test of good agriculture is not a large product per acre, but a large product per *man*. And no country in the world can show so large a product per man for its agricultural population as can the United States. It is upon the product per man and not upon the product per acre that the standard of living and the civilization of our rural population depend. Therefore, let it be clearly understood, once and for all, that the only legitimate purpose of soil improvement and conservation is to increase the product per man, and that a larger product per acre is desirable only when it gives us a larger product per man, and is a thing to be shunned as the plague if it is to be secured by those forms of intensive culture which are forced upon overpopulated countries, where labor is abundant and cheap and land scarce and dear. Let us hope as we hope for nothing else in this world that we may preserve, as long as we can, those conditions where men are dear and land cheap, rather than those where land is dear and men are cheap. If we hope for those conditions, we shall stop talking about that kind of intensive culture which prevails in all old and thickly populated countries, where, because of the density of the population, land has become scarce and dear and men abundant and cheap.

It is a natural result, and very much to the credit of our agricultural enterprise, that in a country where land has been cheap and men dear our inventive genius has been exercised in the direction of contriving labor-saving rather than land-saving devices. If we are ever forced, by the opposite set of conditions, to economize land rather than labor, there is little reason to doubt that the same inventiveness and adaptability which has enabled the American farmer to economize labor will then enable him to economize land to the same degree. We shall therefore have our larger product per acre if we are forced to it.

Nor need we assume too easily that the country must be agriculturally self-supporting. In these days of world-wide commerce and cheap transportation there is no special reason, except for the possibility of war, why any particular section of the earth's surface should be self-supporting in an agricultural sense. Neither Manhattan Island, nor Boston Neck, nor Great Britain, nor Belgium is self-supporting in this sense. In fact it will be a wise economy to depend upon foreign territories for certain agricultural products, as our country becomes more densely populated. It happens, for example, that the production of wheat and beef is carried on most economically where land is abundant. These are products which do not respond so well to intensive culture as do some other products; consequently no densely populated country ought to try to produce its own wheat and beef. To do so would be to use land for these crops which might better be used for more productive or more heavy yielding crops. The alarm over the possible decline in our wheat crop is therefore misplaced. It is not a sign of declining agriculture, but a sign of increasing population, making it advantageous to use our lands for heavier yielding crops, depending upon sparsely settled areas beyond our borders for such light yielding crops as wheat and beef.

It is a distinct evidence of the wisdom and sanity of the directors of our experiment stations, and the instructors in our agricultural colleges, that this vast system of agricultural education has not resulted in misguided attempts to gauge our agricultural progress by the product per acre. If that were the test of efficiency of a system of agricultural education, we should make a poor showing indeed. Nor have they regarded it as their mission to try to make the country agriculturally self-supporting, but rather to enable the agricultural population to utilize their labor on their land so as to secure the largest income per man, or per family, and to live upon as high an economic plane as possible. Judged by this standard, our system of agricultural education makes an excellent showing as compared with that of other countries, though there is much to be done yet.

Aside from the purely educational work of the agricultural colleges and experiment stations, a number of states have encouraged the use of commerical fertilizers by laws controlling the advertisement and sale of this form of merchandise. One of the most effective hindrances to the use of fertilizers is the uncertainty of the average farmer as to what he is buying. Any kind of legislation which really prevents fraud in the manufacture and sale of fertilizers, and gives the farmer a reasonable confidence that he is not being swindled by the manufacturers, must therefore be called favorable legislation. If commercial fertilizers can really be standardized by law and sold by grade or standard, it will be the most favorable kind of legislation the state could enact, and would do a great deal toward the improvement of soil fertility.

Illinois has made a generous appropriation, amounting to $65,000 a year, for a soil survey of the state. This survey is being conducted under the efficient direction of Professor Cyril G. Hopkins. It is so significant and so valuable that it has seemed desirable to distinguish it as direct work of the state for the improvement of the soil. Missouri is also doing valuable work along a similar line.

STATES	IMPROVING PHYSICAL CONDITIONS												PRESERVING SOIL FERTILITY																			
	IRRIGATION				DRAINAGE				CLEARING STONES				PREVENTING EROSION												REMOVING or NEUTRALIZING SUPERFLUOUS CHEMICALS (6)				RESTORATION or PRESERVATION of CHEMICAL ELEMENTS of FERTILITY (7)			
													Forestation				Planting Grasses				Diking, Terracing etc.											
	Direct	Encouragement Private Enterprise: Instruction	Total or partial exemption from taxation	Other favorable legislation (1)	Direct	Encouragement Private Enterprise: Instruction	Total or partial exemption from taxation	Other favorable legislation (2)	Direct	Encouragement Private Enterprise: Instruction	Total or partial exemption from taxation	Other favorable legislation	Direct (3)	Encouragement Private Enterprise: Instruction	Total or partial exemption from taxation	Other favorable legislation (5)	Direct	Encouragement Private Enterprise: Instruction	Total or partial exemption from taxation	Other favorable legislation	Direct	Encouragement Private Enterprise: Instruction	Total or partial exemption from taxation	Other favorable legislation	Direct	Encouragement Private Enterprise: Instruction	Total or partial exemption from taxation	Other favorable legislation	Direct	Encouragement Private Enterprise: Instruction	Total or partial exemption from taxation	Other favorable legislation
Alabama		Yes				Yes									Yes	Yes		Yes				Yes								Yes		
Arizona		Yes											Yes					Yes								Yes				Yes		
Arkansas								Yes					Yes																	Yes		
California		Yes		Yes		Yes										Yes										Yes				Yes		
Colorado	Yes			Yes										Yes		Yes										Yes				Yes		
Connecticut						Yes		Yes						Yes	Yes	Yes														Yes		Yes
Delaware								Yes																						Yes		
Florida					Yes			Yes																						Yes		
Georgia																														Yes		
Idaho		Yes		Yes																										Yes		
Illinois						Yes										Yes													(8) Yes	Yes		
Indiana						Yes								Yes				Yes												Yes		
Iowa						Yes									Yes															Yes		
Kansas		Yes		Yes		Yes								Yes		Yes		Yes								Yes				Yes		
Kentucky						Yes												Yes												Yes		
Louisiana		Yes			Yes			Yes								Yes														Yes		
Maine													Yes	Yes	Yes	Yes										Yes				Yes		
Maryland								Yes						Yes		Yes														Yes		
Massachusetts		Yes			Yes	Yes		Yes					Yes	Yes	Yes	Yes	Yes													Yes		
Michigan						Yes		Yes					Yes			Yes														Yes		
Minnesota					Yes	Yes							Yes	Yes		Yes														Yes		
Mississippi					Yes	Yes		Yes						Yes								Yes								Yes		
Missouri								Yes																					Yes	Yes		Yes
Montana	Yes?			Yes									Yes																	Yes		
Nebraska		Yes													Yes															Yes		
Nevada		Yes		Yes																										Yes		
New Hampshire						Yes							Yes	Yes	Yes	Yes										Yes				Yes		
New Jersey								Yes					Yes	Yes		Yes														Yes		
New Mexico		Yes		Yes																						Yes		Yes		Yes		
New York						Yes							Yes	Yes		Yes														Yes		
North Carolina					Yes			Yes																						Yes		
North Dakota															Yes															Yes		
Ohio						Yes		Yes																						Yes		
Oklahoma		Yes		Yes	Yes																									Yes		
Oregon				Yes												Yes														Yes		
Pennsylvania																Yes														Yes		
Rhode Island						Yes		Yes							Yes															Yes		
South Carolina		Yes				Yes		Yes						Yes		Yes						Yes								Yes		
South Dakota		Yes		Yes		Yes										Yes														Yes		
Tennessee																														Yes		
Texas				Yes		Yes		Yes										Yes				Yes								Yes		Yes
Utah	Yes			Yes																										Yes		
Vermont													Yes	Yes	Yes	Yes														Yes		Yes
Virginia																														Yes		
Washington				Yes											Yes	Yes														Yes		
West Virginia																														Yes		
Wisconsin						Yes		Yes							Yes	Yes														Yes		
Wyoming		Yes		Yes												Yes														Yes		

In this chart the answer "Yes" occurs only where the author has positive information. There are doubtless other cases of state activity, but the author was not able to elicit definite and positive statements covering the points in question.

(1) By the formation of irrigation districts and the acceptance of the Carey Act.

(2) By the formation of drainage districts and the guaranteeing of the bonds of the drainage associations.

(3) State forest reserves and other state owned land on which timber is growing.

(4) In the field of forestry alone has any encouragement been given through exemption from taxation.

(5) Distribution of seeds and nursery stock at cost, fire protection, fire patrol, war against insect pests, etc.

(6) The problem of acidity in the humid belt, and of concentration of alkali in the arid belt.

(7) This is the great field for the work of the experiment stations and agricultural colleges.

(8) Illinois has made a generous appropriation for a soil survey under the competent direction of Professor Cyril G. Hopkins.

THE RESEARCH CORPORATION, AN EXPERIMENT IN PUBLIC ADMINISTRATION OF PATENT RIGHTS

By F. G. Cottrell

San Francisco, California

Some seven years ago the author while working in the University of California on a set of problems in sulphuric acid manufacture came upon certain phenomena which promised to lead to important improvements in the electrostatic collection of smoke and fumes from chemical and metallurgical plants. He was at once confronted by the old dilemma of adjustment between academic and commercial activities, as only through direct construction and study of installations on a commercial scale did it seem possible to develop into full usefulness the inventions involved.

Finally with the help both personal and financial of Prof. Edmond O'Neill of the Chemistry Department and Dr. Harry East Miller and Mr. E. S. Heller, both alumni of this Department of the University, the commercial development of the project was undertaken and patents secured, the understanding among those thus actively concerned being that when the receipts from the business should have repaid the initial investment with reasonable interest at least a considerable portion of the patent rights should be turned over to the University of California or some other public institution to be administered as the nucleus of a fund for the promotion of research, it being also hoped that this might set a precedent and stimulate similar contributions from others.

The business and technical development of the project struggled through and over many difficulties and disappointments for the first few years but with a constantly growing scale of operation and it was not until the fifth year of the work that the latter repaid what the organizers had spent upon it.

It is not the purpose here to enter upon the technical details of the inventions involved as the early history of these was published a year ago[1] and has since been extensively abstracted in other journals.[2] A further supplementary account and discussion was also given at the annual meeting of the American Institute of Mining Engineers last February[3] and two papers on the latest development of the subject are being presented before other sections of this Congress.

Merely as an index to the practical significance which the work has already attained, suffice it to say that installations made under these patents have now been in commercial operation for over five years and the largest of these have been on a scale representing a construction cost of over $100,000 each. The first were in the far West but several are now in operation or under construction in and about New York City.

By the time the work had thus reached a self-supporting basis, its significance was felt to have broadened to a degree which made its control by a local institution such as a single University inexpedient as the fullest success of such a movement is inevitably conditioned upon its being most broadly representative of the common interests of those whose co-operation and support it aspires to secure. Through Director J. A. Holmes of the U. S. Bureau of Mines, who had taken a very helpful interest in the work, it was brought to the attention of the Smithsonian Institution nearly two years ago, the informal discussion which followed resulting last October in a formal offer of the patent rights to the Institution. The only condition qualifying this offer was that these patent rights should be given an adequate business administration and the proceeds be devoted to furthering scientific research.

In December last, after careful consideration and discussion with the prospective donors and under their hearty indorsement,

[1] The Electrical Precipitation of Suspended Particles. Journal of Industrial and Engineering Chemistry, Aug. 1911, Vol. 3, p. 00.

[2] Engineering News, Oct. 26, 1911, pp. 495–498. The Engineering and Mining Journal, Oct. 14, 1911, Vol. 92, pp. 763–764. Mining and Scientific Press, Aug. 26 and Sept. 2, 1911, Vol. 103, pp. 255–258 and 286–289. Rauch und Staub, Apr. 1912, Vol. 2, pp. 187–195.

[3] At the time of going to press this paper had not appeared in the Institute's Bulletin but is expected soon.

the Board of Regents of the Smithsonian Institution adopted the following resolutions:

RESOLVED: That the Board of Regents of the Smithsonian Institution do not deem it expedient for the Institution to become the direct owner of the proposed gift of royalty-bearing patents;

RESOLVED FURTHER: That the Board of Regents of the Smithsonian Institution decide that the Institution may properly accept a declaration of trust from the owners of the patents to hold and operate the same in the interests of the Institution, and to pay over to the said Institution the net profits therefrom.

and further authorized its Executive Committee and its Secretary, Dr. Charles D. Walcott, to co-operate with those from whom the offer had come in the organization of either a subsidiary or an independent board of trustees or directors to conduct the business side of the project.

In elaborating this plan, the organizers have tried to study carefully both the economic and academic needs which it was intended to subserve. The following are among the considerations which have perhaps had most to do in determining the form and policy of the new organization as finally constituted.

During the last few years the rapid growth of engineering and technical education, coupled with a general awakening to the commercial importance of research in the industries, has brought about a persistent demand the world over for closer and more effective co-operation between the universities and technical schools on the one hand and the actual industrial plants on the other.

The value to both sides from such co-operation is today generally conceded, but as to the most expedient methods of its accomplishment opinions differ, and we are still in the experimental stage of working out the problem.

One solution which has been extensively applied consists in the universities and schools permitting and even encouraging the members of their teaching staffs to go into private consulting practice. Another form of co-operation is seen in the Industrial Fellowships recently established at several universities, through which their laboratories undertake the investigation of certain problems for individual commercial firms or organizations, the latter bearing the expenses and receiving the first fruits of the investigations, but under restrictions as regards final publication and use, intended to justify the universities or technical schools in taking their part in the work.

While these and similar methods now in use bring about the desired co-operation, it has been felt by some that they are open to the objection of introducing too direct business relations between the academic institutions or the members of their faculties and individual financial interests. As still another alternative, intended particularly to meet to some degree at least this last objection, the Research Corporation has been organized.

Briefly stated, this latter is a board of administration, whose work is to guide the development of such patents as may be turned over to it, and finally market them, the net profits from all such business being devoted to scientific research "by contributing the net earnings of the corporation.........to the Smithsonian Institution and such other scientific and educational institutions and societies as the Board of Directors may from time to time select, in order to enable such institutions and societies to conduct such investigations, research and experimentation." Under this system, it will be noticed, a part at least of the financial returns of the scientific investigations of our academic laboratories automatically goes back to them for aiding further investigations.

But this represents only one side of the good which the plan aims to accomplish. Conservation has of late become a word to conjure with, and all manner of economic wastes are very properly receiving a too-long delayed attention. The men in our universities and colleges have been among the first and most effective in promoting the general conservation movement, yet there is what we may term an intellectual by-product of immense importance, a product of their own activities still largely going to waste. This is the mass of scientific facts and principles developed in the course of investigation and instruction which, through lack of the necessary commercial guidance and supervision, never, or only after unnecessary delay, reaches the public at large in the form of useful inventions, and then often through such channels that the original discoverers are quite forgotten.

The Research Corporation was primarily intended to serve the ever growing number of men in academic positions who from time to time in connection with their regular work evolve useful and patentable inventions, and without looking personally for any financial reward would gladly see these further developed for the public good, but are disinclined either to undertake such development themselves or to place the control in the hands of any private interest.

During the process of organization, however, it became evident that the class of donors of patents to the cause would by no means be limited to men in academic positions, but rapidly extended not only to private individuals outside the colleges, but even to large business corporations who often find themselves incidentally developing patents which overrun their own field of activities. Such patents are very apt to get pigeon-holed and come to actually stand in the way of true industrial progress, even though their owners may realize that development and use by others would indirectly benefit themselves. As an official of one of the large electrical companies put it—"Any extension of the use of electricity, or even power in general, is pretty sure eventually to mean more business for us through one department or another."

A procedure adopted in academic and public positions by many men in an attempt to bring various inventions before the public and at the same time prevent private monoply has been to secure patents as matter of record and then throw them open gratis to public use. This procedure received official recognition in the U. S. Patent Act of March 3, 1883, which authorizes the remission of all Patent Office fees to Government officials on patents bearing on their face permission for everyone in the country to use the invention without the payment of any royalty.

Practice has shown, however, that this does not accomplish all that had been hoped for it. A certain minimum amount of protection is usually felt necessary by any manufacturing concern before it will invest in the machinery or other equipment, to say nothing of the advertising, necessary to put a new invention on the market. Thus a number of meritorious patents given to the public absolutely freely by their inventors have never come upon the market chiefly because, "what is everybody's business is nobody's business."

If some of these patents, on the other hand, were placed in the hands of such an organization as the Research Corporation, it could study the situation and arrange licenses under fair terms, so as to justify individual manufacturers undertaking the introduction of the inventions, and at the same time would be accumulating from the royalties funds for further investigations.

As to the details of organization, the Research Corporation was incorporated February 26, 1912, as a stock company under the laws of the state of New York, with its office at 63 Wall St., New York City, its declared purposes being:

(a) To receive by gift and to acquire by purchase or otherwise, inventions, patent rights and letters patent either of the United States or foreign countries, and to hold, manage, use, develop, manufacture, install and operate the same, and to conduct commercial operations under or in connection with the development of such inventions, patent rights and letters patent and to sell, license or otherwise dispose of the same, and to collect royalties thereon, and to experiment with and test the validity and value thereof, and to render the same more available and effective in the useful arts and manufactures and for scientific purposes and otherwise.

(b) To provide means for the advancement and extension of technical and scientific investigation, research and experimentation by contributing the net earnings of the corporation, over and above such sum or sums as may be reserved or retained and held as an endowment fund or working capital, and also such other moneys and property belonging to the corporation as the Board of Directors shall from time to time deem proper, to the Smithsonian Institution, and such other scientific and educational institutions and societies as the Board of Directors may from time to time select in order to enable such institutions and societies to conduct such investigation, Research and experimentation.

(c) To receive, hold and manage, and dispose of such other moneys and property, including the stock of this and of any other corporations, as may, from time to time, be given to or acquired by this corporation in the furtherance of its corporate purposes, and to apply the same and the proceeds or income thereof, to the objects specified in the preceding paragraph.

As practically all technical work under the Corporation's supervision will be done in co-operation with either industrial works on the one side, or school and college laboratories on the other, its expenses will be chiefly administrative, and were estimated for the first year at $10,000, the expectation being that after this it would be self-supporting. As a margin for unforeseen contingencies, the capital was placed at $20,000, divided in 200 shares, of a par value of $100 each, and issued under the condition that "no dividends shall be declared or paid thereon, and the entire net profits earned by said capital stock shall be applied to or expended for the aforesaid purposes." All stock issued is also under an option to the Corporation by which the lat er may at any time, through its Board of Directors, repurchase it at par, and the stock cannot be otherwise sold, without first notifying the Board and allowing the latter an opportunity to exercise this option.

Of the total of 200 shares, 101 have thus far been issued and their par value paid into the Corporation's treasury as working capital. This stock is held in lots of from three to ten shares by the following list of stockholders:

Edward D. Adams, of the Deutsches Bank, New York.

Cleveland H. Dodge, of National City Bank and Farmers Loan and Trust Company, New York.

James Douglass, President of Phelphs, Dodge & Co., President of El Paso & S. W. R. R., New York.

T. Coleman duPont, formerly President of the duPont Powder Co., Wilmington, Del.

Frederick A. Goetze, Dean of the Faculty of Applied Science, Columbia University, New York.

Elon Huntington Hooker, President of the Development & Funding Co., New York.

Hennen Jennings, of the Sea Board Air Line.

Charles Kirchhoff, Past President American Institute of Mining Engineers, New York.

Benjamin B. Lawrence, Consulting Mining Engineer, New York.

Arthur D. Little, President American Chemical Society, Boston.

Thomas C. Meadows, Vice-President, International Agricultural Corporation, New York.

H. C. Perkins, President, Oriental Consolidated Mining Co., New York.

Charles A. Stone, of Stone & Webster, Boston.

James J. Storrow, of Lee, Higginson & Co., Bankers, Boston.

Elihu Thomson, of the General Electric Co., Lynn, Mass.

Henry R. Towne, of Yale & Towne, President of the Merchants' Association, New York.

Charles D. Walcott, Secretary of the Smithsonian Institute, Washington, D. C.

The Directors, who need not be stockholders, are 15 in number, seven constituting a quorum, and are elected for a period of three years, one-third going out each year. They in turn elect each year an executive committee of five, of which three constitute a quorum. The present personnel of the administration is as follows:

Officers

Vice President	Charles D. Walcott
Secretary	Lloyd N. Scott
Treasurer	Benjamin B. Lawrence
Assistant Treasurer	Columbia Trust Co.

Directors

(To serve until 1913)

T. Coleman du Pont	Charles A. Stone
Arthur D. Little	Elihu Thomson

M. B. Philip

(To serve until 1914)

Frederick A. Goetze	John B. Pine
Benjamin B. Lawrence	Lloyd N. Scott

Charles D. Walcott

(To serve until 1915)

Thomas C. Meadows	Hennen Jennings
Elon H. Hooker	Charles Kirchhoff

James J. Storrow

Executive Committee

Frederick A. Goetze, Chairman

Benjamin B. Lawrence
Elon H. Hooker
Charles D. Walcott
Arthur D. Little

John B. Pine, Counsel
Linn Bradley, Engineer

It is not proposed to fill the offices of President and Manager until the work of the Corporation is well under way and the permanent demands and responsibilities on these officers can be better estimated, their duties devolving in the meantime upon the Vice President, Chairman of the Executive Committee and Engineer.

The present organization is not considered as necessarily permanent in all its details but was deemed the most simple and generally expedient for carrying out the initial stages of this experiment in economics, at least until it should have earned a safe working surplus of its own and demonstrated its ability to produce a substantial permanent revenue. It will then devolve upon the Board of Directors to decide upon a definite policy for the ultimate control of the corporation. This may be done by exercising the option to repurchase all outstanding stock at par and then proceed to redistribute the same, as for example, by turning the whole over to the Smithsonian Institution, or perhaps better still dividing it among a number of universities and similar institutions.

This, of course, does not mean that the particular institutions so selected would thereby acquire any more direct claim on the profits of the corporation than others, since the stock is non-dividend bearing, but merely that they would become trustees responsible for the election of Directors who would give the corporation a business administration, thoroughly practical but conforming to the ideals implied by its objects and associations.

The terms under which each new patent shall be acquired by the Corporation are entirely in the hands of the Board of Directors, but at least for some time to come it is probable that only such patent rights will be primarily considered as are offered freely without restrictions as to mode of administration or obligation of any financial return from the Corporation, as present indications are that the latter will find itself well occupied even by these offers alone.

The Board has authority to purchase patents where this may appear as good business policy, which may quite conceivably occur from time to time in rounding out fields in which it has already embarked. Contracts with owners of patents for administrating the same on a profit sharing basis will probably not be considered, chiefly owing to the unforeseen complications which it is easily possible, not to say certain, that such agreements would eventually lead into as the further developments of different interests began to overlap.

A much simpler, safer and more expedient procedure appears to be for the patentee to retain if he so chooses complete title and control of his patent in certain geographical territory while assigning the same in other territory entirely unencumbered to the Corporation. Any development which the latter can give it will then automatically enhance the value to both.

This procedure is well illustrated in the case of the first patents to come into the possession of the Corporation, viz., those referred to above as initially offered to the Smithsonian Institution itself. The owners of these at the time of their original offer had already spent considerable time and money in their development, but from the outright sale of their foreign rights and the rights of six western states (California, Oregon, Washington, Idaho, Nevada, and Arizona), together with a license for the one industry of Portland Cement manufacture throughout the whole United States, they felt adequately remunerated for their work and financial risks, and were willing to turn over all remaining United States patent rights as a nucleus for the experiment in economics which the Research Corporation represents. Together with this came to the Corporation a 10% interest in the net profits of the parties who purchased the rights for the Western States and for the cement industry, while incidentally growing out of the negotiations on the foreign rights, another set of valuable patents has come to the Corporation from Mr. Erwin Moeller, of Germany, which emphasizes in a most practical way the fact that academic organizations and particularly the Smithsonian Institution are international in spirit, and so recognized by scientific men the world over, presenting at once a nucleus from which may well be developed many activities leading toward world consciousness, co-operation and peace.

The present movement, as stated, had its inception on the far western edge of this continent in very unpretentious beginnings, but has already overrun national borders both in the character of its work and the personnel of its supporters. It is a question which should peculiarly interest this Congress as to how far and in what way international co-operation can best be assured in such activities which from their very nature and aims should from the outset transcend political boundaries and national pride and be treated by one and all from a standpoint as broad as humanity itself. It was with this in mind that the present paper has been presented, not so much as a record of present achievement, as to stimulate discussion and co-operative effort toward ever wider and more effective activities in this most promising field.

WHAT THE GOVERNMENT IS DOING IN FORESTRY

HENRY S. GRAVES

Forest Service, Washington, D.C.

It is a matter of history that in all countries the establishment of forestry has been brought about through the activities of the Government. Generally the first step has been to place the public forest lands under proper management. This has been true of the United States as well as of other countries. For many years far-sighted men have been calling attention to the rapidity with which our forests are being depleted, but very little progress was made in the actual protection of the forests until the United States Government initiated a National forest policy.

The foundation for this was laid by the act, passed in 1891, which authorized the President to set aside as forest reserves portions of the public lands adapted to this purpose. Under the authority of this act, Presidents Harrison and Cleveland set aside some 18 million acres as forest reserves prior to 1897. This action attracted relatively little attention. The forests were in the remote regions of the western mountains, and nothing was done to provide for their administration or protection.

The next step was taken when the Secretary of the Interior, in 1896, called upon the National Academy of Sciences to appoint a commission which should report regarding the condition of the public forests and make recommendations with reference to their management. The Act of June 4, 1897, on which is based the present system of administering the National Forests, was a direct outcome of the recommendations of this Commission. As a result of an earlier preliminary report of the Commission, President Cleveland had set aside by proclamation on February 22, 1897, some 20 million acres of forest reserves. This action was followed by a very vigorous protest from the people of the West who misinterpreted the purpose of the reserves and believed that their establishment meant the withdrawal of the land from all development and use. As soon as it was made plain that the purpose was not to close the reserves to the public but to encourage development along lines which would guarantee the continuance of the resources, the opposition began to decline.

The discussion of the whole subject of National forestry resulting from the opposition to President Cleveland's reserves had a far-reaching educational effect. It may well be said that the modern National Forest movement had its real beginnings at that time. Other reserves were added from time to time, and later they were designated National Forests rather than forest reserves. The greatest impetus to the whole movement was, however, given during the administration of President Roosevelt. In 1898 Gifford Pinchot was appointed Chief of the Division of Forestry in the Department of Agriculture. The educational work resulting from his vigorous activities began a movement for the better handling of our forest resources which soon stirred the country. President Roosevelt took deep interest in the subject and supported the movement with great energy.

The bulk of the public forests have now been included within the National Forests. There are, however, still very large areas which should be added to the Forests. These are chiefly in Oregon, Washington, Idaho, Montana, Colorado, and Wyoming. They are not included in the Forests because in 1907 the power of the President to increase the Forests was limited by a law which provided that in these six States there should be no additions except by act of Congress.

The gross area of National Forests now amounts to about 187 million acres, including about 26 million acres in Alaska. These National Forests have been placed under administration and are being handled along the lines of forestry. Their resources are open to use but under such regulations as are necessary for the protection of the public interests and for the perpetuation of the resources. Thus, mature timber is for sale. It is, however, cut in such a way that a new forest is established as the old is cut.

The National Forests have for many years suffered severely from forest fires. The organized protection given by the Forest Service has resulted in a greatly increased growth of timber. Before the Forests were put under administration the loss by fire and other causes exceeded the growth. The forests were continually going backwards although there was very little cutting done upon them. Under the present management the forests are increasing in their productiveness because the openings which were made by the fires are rapidly being filled up by young growth from natural reproduction and by artificial reforestation. It is estimated that the National Forests contain some 580 billion feet of timber of merchantable size. The actual rate of growth aggregates over 3 billion feet. Many of the large bodies of commercial timber are still at remote points, so that the Government is not yet disposing of anything like as much timber each year as would equal the actual growth of the forest. At the present time about 500 million feet are cut each year, and the sales are increasing at a rapid rate with increased demand.

The most difficult problem which the Forest Service has had to meet in handling the Government Forests has been protection from fire. The National Forests, located as they are in the high, rugged mountains, are still in a state of undeveloped wilderness. There are still in most Forests entirely inadequate means of transportation and communication, and in many cases no roads or trails whatever. The Forest Service had the task of placing this very large area under protection all at once. One of the first problems was the construction of roads, trails, telephone lines, ranger stations, and other improvements necessary for fire prevention. Although the Forests have been under management for only a few years, there have already been constructed 10,000 miles of trails and 7,000 miles of telephone lines, in addition to many other improvements. This, however, is only a beginning. There are still needed 80,000 miles of trails and 45,000 miles of telephone lines to complete the first skeleton system of control for fire prevention. This work is being pushed as vigorously as the appropriations by Congress permit. At the present rate of appropriations it will take about 15 or 16 years to finish this primary system of improvements.

The Forests are thoroughly organized, with forest officers located at convenient points for the transaction of business with forest users and for protection. Great progress has been made in the administration of the forests, although not enough money is available to give them the full protection they should have. There should be a much larger force of patrol men than can now be employed.

On account of the very destructive fires in the past the forest has, in many places, been completely destroyed. The burned areas are often so large that natural reproduction will not take place upon them for a great many years. It is therefore necessary for the Government to restore the forest in these places by artificial means. A very substantial beginning has already been made in this direction, and there is planted each year from 20 to 30 thousand acres.

The other resources of the National Forests are handled along the lines of practical conservation. There is a great deal of grass within the Forest boundaries, in the openings and among the trees. Full use of this forage is being made. It is probable that about 100 million acres produce a certain amount of grass among the trees which is available for grazing purposes. Grazing privileges are granted under regulations which insure the full protection of the forest and at the same time prevent the destruction of the productive capacity of the forest range itself. Before the Forests were placed under administration, the mountain ranges were very much overstocked. This condition has been remedied by regulated grazing. There are over nine million head of stock which are grazed on the National Forests.

The same principles of practical conservation are extended to other resources and provision is made for the utilization of land valuable for purposes other than the production of timber. The lands which are chiefly valuable for agriculture are opened for entry to settlers, and since 1906 over one million acres have been opened in individual tracts to 8,000 settlers.

During the year 1911 there were nearly 6,000 separate timber sales; over 40,000 permits issued for free use of timber by settlers; nearly 30,000 permits issued in connection with grazing privileges; and over 5,000 permits for special uses of various kinds. The special use permits comprise over 100 different uses. There are over 200 different water power permits on National Forests. This indicates that the National Forests are actually being used.

The administration of the National Forests represents a great practical demonstration of conservation. The system has now been established and rapid progress is being made in the work.

In addition to the National Forests which are under the jurisdiction of the Forest Service in the Department of Agriculture, there are public forest lands also comprised within the National Parks. These cover some 5 million acres. Most of the National Parks are in timbered regions. They are being carefully protected and administered with a view to their development as great pleasure resorts. Their administration differs from that of the National Forests in that their primary purpose is for recreation purposes and for the preservation of natural scenery, and it is not designed that their resources should be used commercially. In the National Forests the resources are available for use, although the preservation of areas of special interest is carefully considered.

The Government has further the control of the forest lands owned by the various tribes of Indians. These aggregate some 10 or 15 million acres. The Office of Indian Affairs has recently introduced a forest organization and these lands, or such of them as it is designed to keep in permanent reserves, are being handled under modern methods of forestry.

The Government does not confine its activities in forestry to the management of the public forest lands. It has the task also of developing the science of forestry in this country and promoting its establishment throughout the country. The Government is carrying on very extensive work in scientific research in forestry. It has established at Madison, Wisconsin, a laboratory for the study of problems connected with the utilization of forest products. This is one of the best equipped laboratories of its kind in the world, and the work already done has been of great benefit to the various industries engaged in the manufacture and utilization of wood products.

The application of the principles of forestry to the forests of the United States is new. A great many scientific questions still await solution, particularly those pertaining to the rate of growth of trees, methods of reforestation, and methods of handling the forest in such a way as to secure the greatest possible production of timber and other products from it. Such investigations are conducted not only in connection with the National Forests but also throughout the East. The Government is endeavoring to work out many fundamental problems which will be of assistance to private owners in introducing forestry on their lands.

At present the National Forests are located mostly in the West. In connection with their protection and administration the forest officers have interested a great number of private owners in the protection of their property. At the present time, as a direct result of the activities of the Government, many timberland owners have been introducing modern methods of fire protection, and in some cases are going further in the actual practice of forestry.

In order to reach the forests of the East which are now chiefly in the hands of private individuals, the National Government has initiated a policy of purchasing lands in the eastern mountains whose proper handling is necessary for the protection of navigable streams which rise within these areas. The Weeks Law, passed in 1911, grants authority and money for the purchase of certain lands. It is not expected that all eastern mountain lands can be purchased by the Government; it is expected, however, that there will be secured by purchase very substantial areas here and there throughout the eastern mountains which will serve as centers for the demonstration of forestry. It is believed that the same kind of co-operation can be secured with the eastern timberland owners as has been secured in the West, and in this way through the establishment of limited forests the effect may be very far reaching.

There is still considerable opposition to the National Forest policy in certain quarters. The country as a whole, however, has definitely placed itself on record in favor of the proper handling of our forests. The opposition is primarily from quarters where special interests are to some extent affected by the system. At the present time the forests of the country are being depleted at a rapid rate in spite of the fact that most of the forests owned by the public are now under proper administration. Private timberland owners have only in a few cases introduced the principles of forestry. The actual amount of timber which is used is about three times that produced throughout the country by growth. This condition can not continue. It is a problem of vital importance to the whole nation to stop the destruction of the forests by fires and to see to it that such methods of handling the forests on private as well as on public lands are introduced as will insure the production of a sufficient quantity of wood and timber to meet the requirements of the country, and the protection of the waters which flow from the wooded hills and mountains.

OUR ANTHRACITE COAL SUPPLY AND ITS CONSERVATION

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Kinds of Anthracite

An arbitrary division line between Anthracite and Bituminous coal has been adopted by scientists, based upon the relative proportions of the volatile matter and fixed carbon contained in them, which is known as the fuel ratio. Coals in which the volatile matter is one-eighth of the fixed carbon or less, are termed Anthracite in character, while those having a higher proportion of volatile matter have been classified as Bituminous. While this distinction may serve for scientific purposes, it will not answer for the practical, everyday uses of the coal trade and the consumer. A hard and fast adherence to this arbitrary separation as between these coals therefore, cannot be maintained in commerce, because both in Pennsylvania and elsewhere there are coals which fall upon the Bituminous side of the above classification, and yet, are smokeless, have the physical characteristics of Anthracite, and may be prepared in sizes, shipped and sold for domestic purposes as Anthracite coal, and are so considered and classed by the trade and the consumer.

The one great division point between Bituminous and Anthracite coal, so far as the domestic use of the coal is concerned, is the *smoking point.* Consequently, all coals which burn without perceptible smoke should be included, for economic reasons, by the conservationist, under the general term Anthracite. This smoking point in coal is not a fixed line, but varies more or less around 12% of volatile matter in the coal content, and is probably affected to a certain extent by the relative quantity of the other ingredients contained in the coal. Therefore, for the purposes of this article, Anthracite coal will be defined as any mineral coal which will not smoke in a smothered fire.

Anthracite has been derived, through a natural coking process, from Bituminous coal, and on account of the extent or degree to which the metamorphosis has been carried, we recognize different grades of Anthracite, namely: The softer, semi-anthracites, which contain considerable volatile matter; the harder or dry anthracites, which contain a medium quantity; and the very hard, or graphitic anthracites, in which the coking process has continued to the point where some of the carbon has been changed to graphite. The latter have the usual graphitic luster, are difficult to ignite, but when once ignited, burn at a high temperature and require plenty of draft. The "dry" anthracites may be recognized, usually, by their hardness and bright luster. They burn with a hot, slow fire, without flame, and, like the graphitic anthracites, have more or less tendency toward the formation of clinker in the ash, under intense heat. The semi-anthracites, that is, soft or free-burning anthracite, as it is better known to the trade, has a dull luster, and the nearer it approaches to Bituminous coal the duller the luster and the softer it becomes. It also burns with a short blue flame, without smoke. In some of the softer varieties the flame is longer and is tinged with yellow. It requires less draft, and usually burns away to a fine, feathery ash, leaving a few clinkers. As it is softer, it produces more dust in handling, and on this account it is not so much liked by the portion of the coal trade which is accustomed to the harder varieties. By others, however, it is much preferred on account of its free-burning, quick-firing qualities and its light ash.

Anthracite Coal in the United States Outside of Pennsylvania

The great reserve supply from which we annually obtain an increasing quota of the finest domestic coal in the world is the several basins of the Anthracite Coal Fields of Pennsylvania. These have been operated now for about 100 years, and for the major portion of that time it was the only economical occurrence of anthracite coal known in the United States. Therefore, the idea has gone broadcast over the country, and is still prevalent, that there is no anthracite coal in the United States except in Pennsylvania—which is not true, since we find it occurring in considerable quantities not only in Pennsylvania, but in

Rhode Island, Virginia, Arkansas, New Mexico, Colorado, Washington and Alaska. While the quantity of workable anthracite in these various localities is very limited, it is nevertheless of considerable economic value to the country. The occurrences may be briefly described as follows:

Rhode Island contains anthracite coal, but the coking process has continued to the point where the coal is graphitic in nature, and, owing to the difficulty with which it ignites, it has not been extensively used as a fuel. South of the City of Providence a bed of this coal approaching amorphous graphite has been mined for the purpose of manufacturing foundry facings. It is 30 or 40 feet in thickness, very much crushed, and although it will burn, it is of small value as a fuel. But on the Island east of Narragansett Bay, at the town of Portsmouth, the coal has been found in economical condition. It was mined about 1856, and later, through two slopes about 1800 feet in depth, from which 300,000 or more tons of coal were mined and used for fuel, exhausting about 100 acres of the coal land. The beds are several in number, and of economical thickness, though irregular. The coal is dense, hard, and exists in considerable quantity—doubtless several million tons. From the view point of market demands, accessibility and shipping facilities, its location cannot be excelled. The mines have recently been re-opened. Although the coal is difficult to ignite and when the fire is forced produces considerable clinker, nevertheless, if properly prepared for domestic purposes, it forms an acceptable, economical fuel, particularly if mixed with free-burning coal or coke.

In Virginia anthracite coal of a softer variety is found in considerable quantity. One occurrence is in the rocks of the triassic age, not far from Richmond, Virginia. It is reported, however, to be rather pockety and uncertain in disposition, and the production from this region has been very small, but the mines have recently been re-opened for an increased production.

In southwestern Virginia, however, a rather extended anthracite occurrence exists in the sub-carboniferous rocks in Montgomery and Pulaski Counties, and is at present being mined to some extent. Probably one or two thousand tons per year are produced for local consumption and railroad shipment. The outcrop extends with regularity for about 30 miles continuously along the flanks of Brush Mountain and another adjacent location known as Price Mountain, and also at intervals along the same strike, but in much inferior condition, as far northeastward as the Potomac River. There are here probably 30,000,000 tons of economic fuel contained in the seams, the coal from which is now being mined, prepared, shipped, sold and used for anthracite. There are two beds, one six feet thick and the other 2½ feet. The seams occurring in Brush Mountain are so high in volatile matter in certain localities that they are about on the smoking point. In other places certain parts of the seam will not smoke; other benches will smoke slightly. The coal of the Price Mountain locality, however, is entirely smokeless. This coal is prepared through breakers similar to our Pennsylvania anthracite, and although semi-anthracite in character—in fact, approaching closely to the line of Bituminous coal—is nevertheless a very acceptable substitute for Anthracite coal, and will be more and more used for this purpose with the passing years.

Arkansas: The semi-anthracite coals of Arkansas have long been known and have been mined in a small way for many years. Recently, however, the fields have been more rapidly developed and coal breakers constructed and mines developed on a somewhat larger scale. One area of the Arkansas anthracite occurs in a canoe-shaped basin about three miles long and one mile wide, near the town of Russellville, some 75 miles northwest of Little Rock. The bed is three to four feet thick, and is an excellent domestic fuel. There are probably 5,000,000 tons of coal in the basin and it is being operated through two or three shafts and preparation plants.

At Spadra, about 25 miles westward from Russellville, are a number of other mines now operating a softer grade of what is there termed Anthracite coal. This latter also approaches nearly to the line which separates it from Bituminous coal. It is sold throughout Arkansas, Oklahoma, Kansas City and St. Louis. This coal, together with the Pennsylvania and Rhode Island Anthracites, is found in the carboniferous rocks.

Colorado contains perhaps more anthracite coal than any other of the Western States. The greater proportion is located at points which have been out of touch with railroad transportation, except the "Ruby Mines" and the "Crested Butte" mine, the latter being about exhausted. They are located in Gunnison County, west of the central portion of the State, have been in operation for a number of years, and have produced perhaps 75,000 tons of coal per year. The coal is prepared through anthracite breakers similar to those used in Pennsylvania, and the coal is marketed in Denver.

On the Yampa River in Routt County, to the north, there are other anthracite fields covering considerable areas which are likely to be opened as soon as transportation facilities are provided.

The Anthracite coal fields of Colorado and the Rocky Mountain region generally are found in the cretaceous measures, much more recent and younger geologically than our Eastern coals. In these localities volcanic action, resulting in intrusions or dykes of igneous rock, has furnished the heat necessary to change the fuel from Bituminous to Anthracite; and in a few cases where coal beds are found one above the other, some of the beds have been changed to Anthracite by the proximity of the heated rocks, while the other beds, more remote, are still Bituminous in character.

In *New Mexico*, at Los Cerrillos in Santa Fe County, about 50 miles northeast from Albuquerque, anthracite coal has been mined for a number of years. This coal occurs in the recent rocks, similar to the Colorado coals, and has been transformed to anthracite by the heat due to the eruptive sheets near the coal beds. The coal dips from 13° to 16° and is worked by means of a slope. The seam is $3\frac{1}{2}$ to 4 feet thick, and about 500 tons have been produced per day for a number of years. It is marketed along the line of the Santa Fe Railroad and in the cities tributary to it, and in California.

In *Washington* there are two known occurrences of Anthracite coal in the Cascade Mountains, one in Lewis County, near the head of Cowlitz River, south of Mount Rainier. Here a number of seams of anthracite have been found in steep dips of about 60°. Outcrops are said to extend for a number of miles to the southward and northward from the river. The locality is remote from transportation. No attempt has ever been made to exploit the seams, and although samples and analyses of this coal bed appear to prove it of rather good quality, still nothing is known of the characteristics of the seams themselves, and they may not be economically workable.

In the northern foothills of Mount Baker, near the village of Glacier, about 45 miles from Bellingham Bay Harbor, a field of most excellent anthracite coal exists. This small coal field has been but recently discovered and is not yet exploited sufficiently to permit estimates as to quantity. There are apparently several seams of coal of workable thickness covering an area of several square miles. The coal is of excellent quality, a lustrous anthracite, very compact and firm, and altogether a most acceptable quality. It is near to transportation and adjacent to an extended market on the Pacific coast, and will doubtless soon be developed.

Alaska: So far as is now known, there are but two localities in Alaska which are positively known to carry anthracite coal. These are in the two areas of coal known as the Behring River and the Matanuska fields. In addition to the Bituminous coals contained therein there is also a small proportion of anthracite.

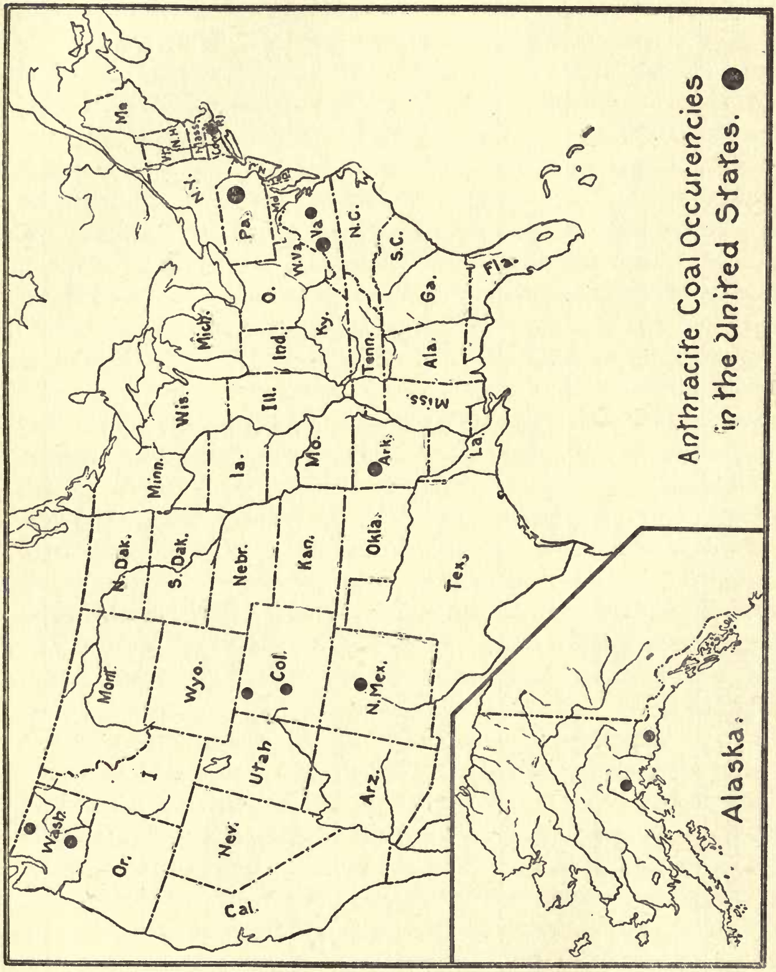
The Behring River field contains considerable high-grade anthracite coal. Like the Colorado coals and other Rocky Mountain anthracites, the proximity of the volcanic rocks has been the cause of the change to anthracite. The coal beds are at all angles of pitch and are of various thicknesses up to 20 feet, but are much crushed and folded; therefore, the quantity of merchantable coal which may be mined from a foot acre of the bed is uncertain, and predictions or estimates as to minable quantity cannot be made with any degree of accuracy.

In the Matanuska coal fields there is but one locality where anthracite coal has been so far discovered. Here a bed of beautiful anthracite about 38 feet in thickness is known, but its extent and prospective value has never been exploited, and as in the Behring River field, no approach to an accurate estimate of quantity can be made. Suffice it to say that the probability is the sum total of the anthracite coal in Alaska which is now available for economical mining is very limited.

A summary of the above Anthracite occurrences outside of Pennsylvania is more concisely set forth by the following tabulation. The areas and quantities therein are merely rough approximations, for the purpose of comparison:

TABLE SHOWING APPROXIMATE QUANTITY OF AVAILABLE ANTHRACITE COAL IN THE UNITED STATES OUTSIDE OF PENNSYLVANIA

State	Approx. Area Workable Acres	Total Produced	Approximate Minable Coal Tons	Approx. Present Annual Production Tons	Approximate Analysis Average					Remarks
					Water	Volatile	Carbon	Ash	Sulphur	
Rhode Island	Perhaps 2 000	300 000	8 000 000	15 000	About 4%	5%	79%	12%		Graphitic
Virginia	25 000	200 000	75 000 000	15 000	0.46 to 0.35	11.35 to 14.31	71.06 to 78.44	16.58 to 6.45	0.55 to 0.45	No smoke Slight smoke
Arkansas	30 000	500 000	100 000 000	120 000	2.07 to 2.11	9.81 to 11.42	78.82 to 77.83	9.30 to 8.64	1.74 to 1.99	Swells in heating
New Mexico	1 000	500 000	3 000 000	50 000	1.5	8.5	82.00	8.00		
Colorado	5 000 to 20 000	2 000 000	25 000 000 to 100 000 000	100 000	.72 to 2.60	7.62 to 4.90	87.51 to 78.20	4.15 to 14.30	Tr. to Tr.	Largely Un-developed
Washington	2 000	00	25 000 000	00	3.34	8.44	80.56	6.78	.88	Undeveloped
Alaska	2 000	00	50 000 000	00	7.88 to 5.80	6.15 to 8.87	78.23 to 76.06	7.74 to 9.27	1.36 to 1.08	Undeveloped
Total	76 000 to 87 000	3 500 000	286 000 000 to 361 000 000	300 000						


Anthracite Coal Occurencies
in the United States.
Alaska.
Me.
N.Y.
Pa.
Md.
W.Va.
Va.
N.C.
S.C.
Ga.
Fla.
O.
Mich.
Ind.
Ky.
Tenn.
Ala.
Miss.
Wis.
Ill.
Ia.
Mo.
Ark.
La.
Minn.
N. Dak.
S. Dak.
Nebr.
Kan.
Okla.
Tex.
Mont.
Wyo.
Col.
N. Mex.
I
Utah
Arz.
Wash.
Or.
Nev.
Cal.

The Pennsylvania Anthracite

The great reservoir of the Anthracite coal supply of the United States is in the several anthracite coal basins which occupy about 484 square miles in the northeastern part of the State of Pennsylvania, popularly known by the trade as the Wyoming, Lehigh, and Schuylkill regions. As shown on the accompanying map these several basins are long canoe-shaped sinclinals, which contain from five to twenty-five coal beds of varying quality and of workable thickness above the Pottsville conglomerate. The lowest productive beds in the series for the southwestern part of the field are contained in the Pottsville conglomerate and are semi-anthracite in character; but in other portions of the region these inter-conglomerate beds, known as the Lykens Valley seams, are not workable.

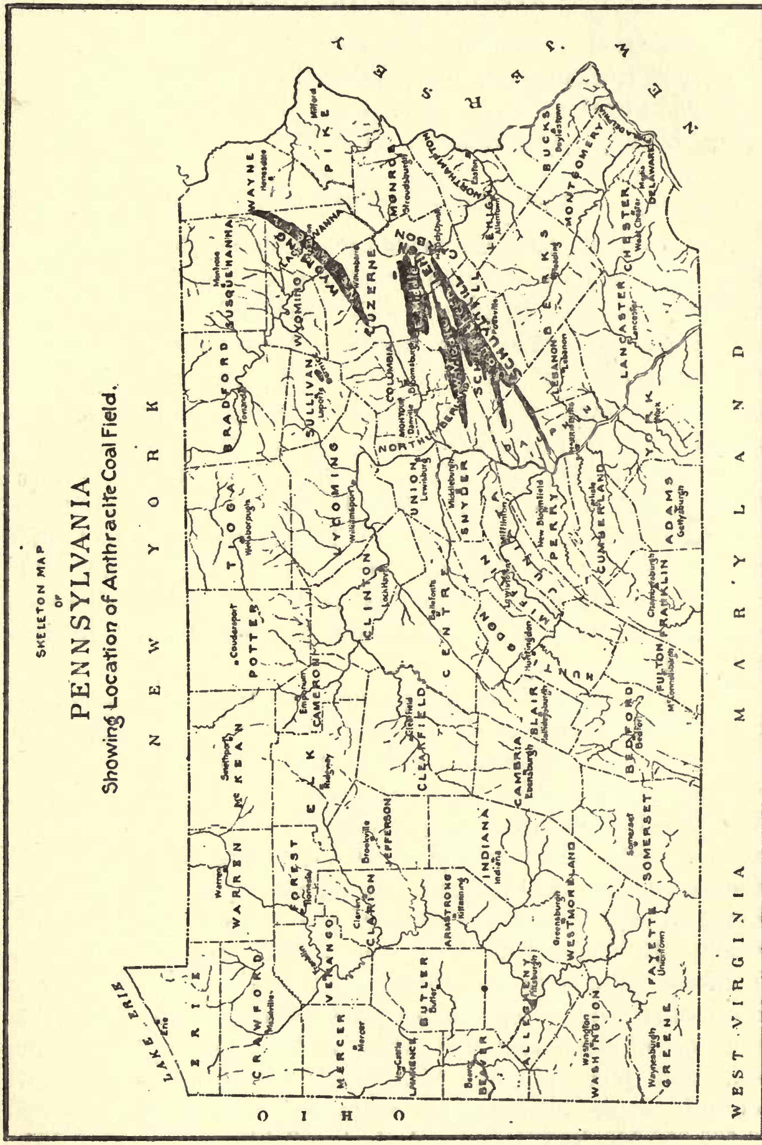
Another small area, known as the Bernice Basin, is in Sullivan County.

Of the workable beds above the conglomerate the lowest is the Buck Mountain or Red Ash bed, which occupies nearly the whole of the above large area. The other overlying beds cover continually diminishing areas from the lowest upward, and are of various thicknesses from two feet to a maximum thickness for the Mammoth bed of about 125 feet.

The coal beds have been very extensively mined and continuously worked for over 100 years. Mining first began at Plymouth, in the Wyoming coal field, in 1807–8, and the trade has continued without interruption since that time, and has increased in a marvelous manner year by year, keeping pace with the rapidly growing domestic demand, the total production of the state in 1910 being 74,717,852 gross tons. In 1911 the output was 81,165,781 gross tons; and for the ten years prior to 1911 the production increased at the rate of about 1,500,000 tons per year.

We present herewith for purpose of comparison, average Analyses of Anthracite Coal from the several regions in Pennsylvania, taken from Reports of the Pennsylvania Geological Survey:

No. of Analysis. Averaged	Name of Coal Bed.	Name of Coal Field.	Chemical Analyses					
			Water.	Volatile Matter.	Fixed Carbon.	Sul-phur.	Ash.	Total
3	Wharton	Eastern Midd'e or	3.713	3.080	86.404	.585	6.218	100
5	Mammoth	Lehigh	4.119	3.084	86.379	.496	5.922	100
2	Primrose	Western Middle or	3.541	3.716	81.590	.499	10.654	100
5	Mammoth	Mahanoy	3.163	3.717	81.143	.899	11.078	100
2	Buck Mountain	Western Middle or	3.042	3.949	82.662	.462	9.885	100
1	Seven Foot	Mahanoy	3.410	3.978	80.868	.512	11.232	100
2	Primrose (F)	Southern or	3.008	4.125	87.982	.506	4.379	100
7	Mammoth	Schuylkill	3.087	4.275	83.813	.641	8.184	100
0	Lykens Valley	Southern or Schuylkill	2.270	8.830	78.831	.676	9.393	100
3	Mammoth or Baltimore	Northern or Wyoming	3.421	4.381	83.268	.727	8.203	100
General average			3.277	4.317	83.294	.600	8.5148	100


SKELETON MAP
OF
PENNSYLVANIA
Showing Location of Anthracite Coal Field.
NEW YORK
NEW JERSEY
MARYLAND
WEST VIRGINIA
OHIO
LAKE ERIE

AVERAGE SPECIFIC GRAVITY

Lehigh Region	1.62	General Average 1.59
Mahanoy Region	1.65	
Schuylkill Region	1.6	
Wyoming and Lackawanna	1.5	

PRODUCTION, RESERVE AND WASTE

So thoroughly have the fields been exploited during the progress of the mining operations that the area and extent of the various coal beds is known with considerable exactness, and careful estimates have been made of the original contents and future resources of the field. Two very elaborate and painstaking estimates, employing widely differing methods of computation, are particularly worthy of mention, one of which was made in 1893, by Mr. A. D. W. Smith, of Wilkes-Barre, Penn'a, and the other in 1895, by Mr. William Griffith, of Scranton, Penn'a, both of whom, having been engaged upon the Geological Survey of the State in the Anthracite coal fields, possessed exhaustive information as to the geological conditions and the state of the art of mining, preparing and utilizing anthracite coal.

The estimate of Mr. Smith had reference particularly to the original content of the coal field before mining began, and from it as a foundation he computed the quantity of unmined coal remaining at that time. His estimate was published in full in the Report of the Pennsylvania Coal Waste Commission, in May, 1893, and was intended to be liberal according to the mining practice of that day. It included not only the shipments, but the coal burned at the mines, and consumed locally. It included in the Northern field, coal beds $2\frac{1}{2}$ feet in thickness; that is to say, containing 2 feet of clean coal. And in the other fields, beds two feet thick; that is to say, containing 1.44 feet of clean coal and what might be saved from culm piles and mine pillars. Mr. Smith estimated the original content of the Pennsylvania fields before mining began, at 19,500,000,000 long tons, and the available reserve at 6,898,000,000 tons.

The estimate of Mr. Griffith, made in 1905, and published in the Bond Record, New York, was upon an entirely different basis of calculation and for another purpose, being intended as a conservative estimate to ascertain the quantity of export coal which the Anthracite Coal Fields of Pennsylvania might supply for tonnage to the various railroads, and it did not include the coal burned at the mines or consumed locally. Neither did it include any coal in beds less than four feet thick; that is, three feet of clean coal in the Northern field; or three feet thick, that is, 2¼ feet of clean coal, in the other fields. It excluded all coal in culm piles and mine workings. His estimate of available reserve for export was 5,073,786,750 tons.

Re-drawing the latter estimate to conform to the more liberal lines of the former, and combining the two, to construct a new estimate having in view the recent progress toward conservation through modern improvements in the art of mining and using the coal, we have prepared the following tabulation, which we believe accords more closely with latest tendencies of mining practice.

PENNSYLVANIA

Estimate of Anthracite Production and Reserve

1912

Region	Estimator	Area Sq. Miles	Approximate Original Content Long Tons	Approximate Produced to Jan. 1, 1912	Approximate ¼ Wasted and ¾ left in old mines to Jan. 1, 1912	Approximate Reserve Coal in unmined area	Approximate Future Production based on Saving of 25% from Old Mines	Approximate Future Production based on Saving of 50% from New Mines	Approximate Future Production based on Saving of Total available	Production 1910 Long Tons	Duration of Available Supply at Present Rate of Exhaustion	Estimated Ultimate Waste of Mining
Wyoming	Smith	176	5,700,000,000		1,520,000,000							
and	Griffith	176	5,500,000,000		1,871,000,000							
Lackawanna	Av'ge	176	5,600,000,000	1,054,000,000	1,695,500,000	2,850,500,000	423,800,000	1,425,400,000	1,849,200,000	44,600,000	41 Yrs.	2,696,800,000
	Smith	45	1,600,000,000		476,000,000							
Lehigh	Griffith	45	2 100 000 000		569 000 000							
	Av'ge	45	1 850 000 000	312,000,000	523,500,000	523,500,000	130,800,000	502,400,000	633,200,000	10,000,000	63 "	904,800,000
Schuylkill	Smith	263	12,200,000,000		942,000,000							
and	Griffith	263	11,600,000,000		1,155,000,000							
Mahanoy	Av'ge	263	11,900,000,000	634,000,000	1,048,500,000	10,217,500,000	262,400,000	5,108,200,000	5,375,600,000	20,800,000	260 "	5,890,400,000
	Smith	484	19,500,000,000		2,938,000,000							
Total	Griffith	484	19,200,000,000		3 595,000,000							
	Av'ge	484	19,350,000,000	2,000,000,000	3 267,500,000	14,082,500,000	817,000,000	7,036,000,000	7,858,000,000	75,400,000	104 "	9,492,000,000

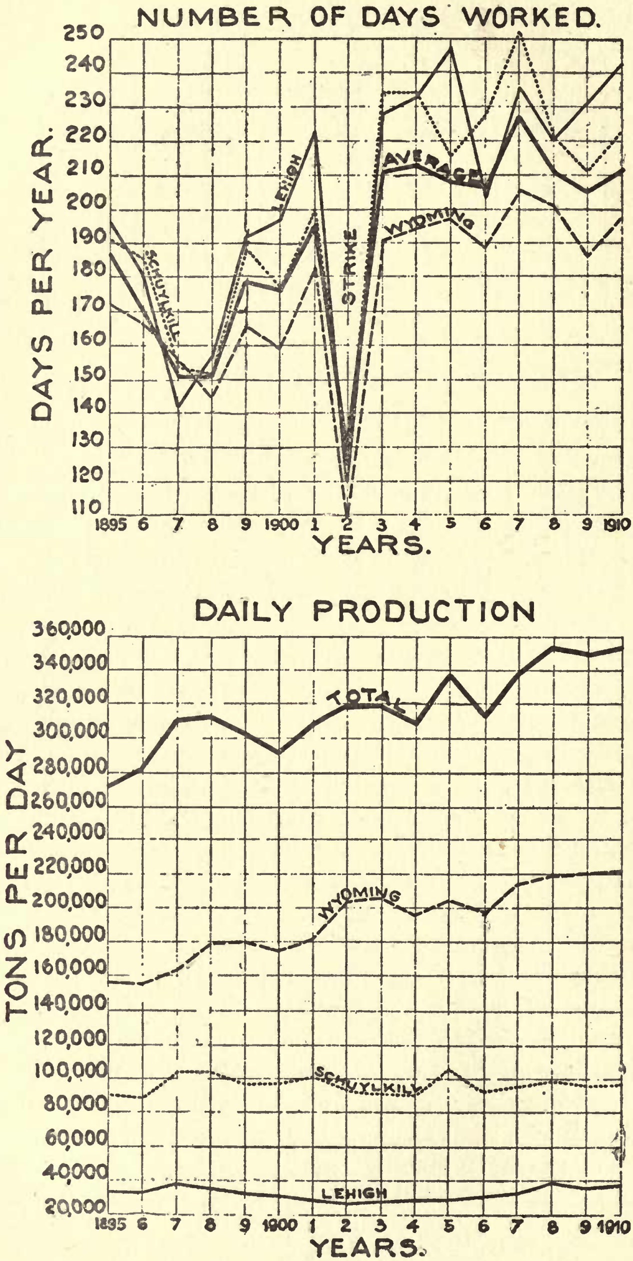
PERCENTAGES OF PRODUCTION AND RESERVE

Region	Percentage of Area	Per Cent. of Original Content	Percentage of Total Production to 1912	Per Cent. of Annual Production	Per Cent. of Available Reserve	Per Cent. of Total Reserve
Wyoming	36.3	28.4	52.2	59.0	23.5	25.0
Lehigh	9.3	9.6	15.6	13.2	8.0	8.5
Schuylkill	54.4	62.0	32.2	27.8	68.5	66.5

The Duration or Life of the Coal Supply

It is impossible to predict with any approach to accuracy, the duration or life of the supply of anthracite coal in the United States, because there are so many unknown quantities entering into the proposition. It would only be remotely approximate to divide the annual rate of exhaustion into the available supply as we have above tabulated it, because we know the production will continue to increase until it reaches a maximum, and then will gradually decrease until the supply is exhausted. At the present rate of mining, the available coal of Pennsylvania would last about 104 years. But our methods of mining are likely to be very much improved in the future, and the results of new discoveries or inventions may change our methods of utilizing it; all of which would tend to conservation and extend the duration of the supply. In fact, during the past ten years marked advance has been made along these lines, and we may expect it to continue in the future. While the Anthracite fields outside of Pennsylvania are important, their tonnage is so limited that the coal from these fields will in all probability be exhausted long before the supply of the Pennsylvania region.

If we analyze the production of anthracite in Pennsylvania by dividing it into its two factors—the number of days worked and the daily production—we will find, as illustrated in the accompanying diagrams, that the principal increase in daily production has come from the Wyoming region, which contains only 33.5 per cent. of the total available reserve. We also note that the



ANALYSES OF ANTHRACITE PRODUCTION.

average increase in the daily production of the State is nearly parallel with the average increase of the daily production in the Wyoming region, and that the Schuylkill and Lehigh regions have remained approximately constant in daily production for fifteen years. It would seem, therefore, that the maximum tonnage of Pennsylvania soon will be reached, viz., when the Wyoming region ceases to increase its daily production, because the average number of days worked per year in each of these regions has been approximately constant for seven years, and has probably already reached its maximum.

Physical Conditions Influencing the Mining Operations

As such a large percentage of the Anthracite production of the United States is mined in Pennsylvania, the methods of mining and the results attained there can be taken as a fair sample of the production of similar structural and geologic deposits elsewhere in the country; as in the main, Pennsylvania practice is generally followed in other fields.

The large percentage of waste as indicated in the preceding chapter and illustrated by diagram and tables, has always been a subject of great concern to broad-minded, far-sighted mining men, and much thought has been given to the subject of reducing the losses in mining and preparation. This subject was gone into carefully, as referred to in a preceding chapter, by the Coal Waste Commission of the State of Pennsylvania, of which the late Eckley B. Coxe was a member. Mr. Coxe was one of the foremost operators in the Anthracite region, and was a large owner of anthracite coal lands, so that he was directly interested in securing maximum yields from his own properties. The estimate of 50% actual loss of the original content, as shown by our tables, is, under existing methods of mining, about what is at present being attained, taking the Anthracite region as a whole.

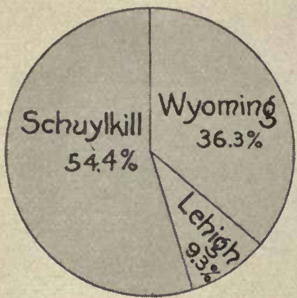
This very great loss is due to several causes. The Anthracite region is divided into several fields, due to geographical location and also to the widely varying character of the geological formation. These several regions are shown on the map accompanying the article.

The Northern Anthracite Field extending from Forest City in Susquehanna County to Shickshinny, in Luzerne County, a distance of about 55 miles, by about six miles in width at the widest point, is so laid down that the measures are comparatively flat, as is indicated by four cross-sections illustrating this article.

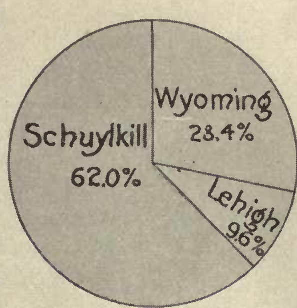
Almost without exception, the room and pillar method of mining has from the beginning, been followed in the Anthracite field. In the earlier days it was found that about one-third of the coal left in the form of pillars was sufficient for roof support, and this proportion ruled to a very great extent, and in some mines is still adhered to. It is a well-known fact that the relative proportion of pillar coal that should be left for the support of varying thicknesses of overburden, has not been definitely determined, although some interesting and valuable experiments to determine the crushing strength of coal have been conducted by engineers of eminence; still the conclusions they have reached are far from final, because each coal bed has peculiarities of its own, which offset its crushing strength, and because the character of the overlying measures varies greatly. No hard and fast rule can be laid down to determine the percentage of pillar coal which should be left in, but each property, and even each portion of any particular tract of land, must be considered entirely by itself in the determination of this point.

To illustrate the room and pillar method of mining, which generally prevails throughout the Anthracite field, there is incorporated with this paper a number of illustrations taken from the Twenty-second Annual Report of the United States Geological Survey, which speak for themselves.

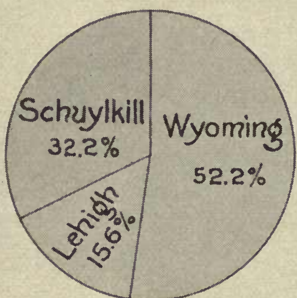
In the early mining in the Northern Anthracite field the developments were made in the middle series of coal beds, known in descending sequence as the Diamond, Rock, Big or Fourteen Foot, New County, and Clark. These beds can be identified on the cross-sections accompanying this article, from which it will be noted that the names differ East and West of Scranton. At Wilkes-Barre the "Big Bed" is known as "the Baltimore," while at Olyphant and eastward to Forest City, it is known as the "Grassy Island."



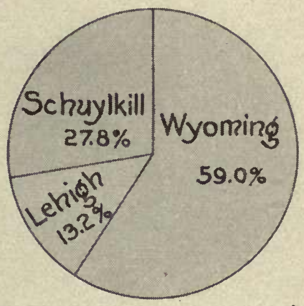
Percentage of Area.



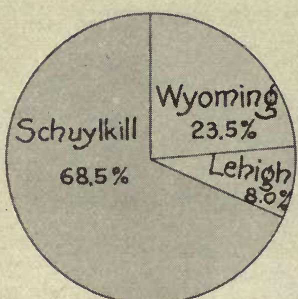
Percentage of Original Content.



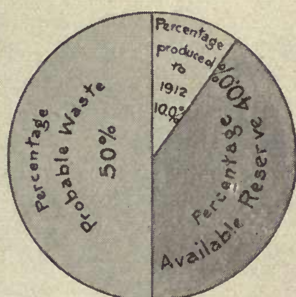
Percentage of Total Production to 1912.



Percentage of Annual Production 1910.



Percentage of Available Reserve.



Percentage of Conservation.

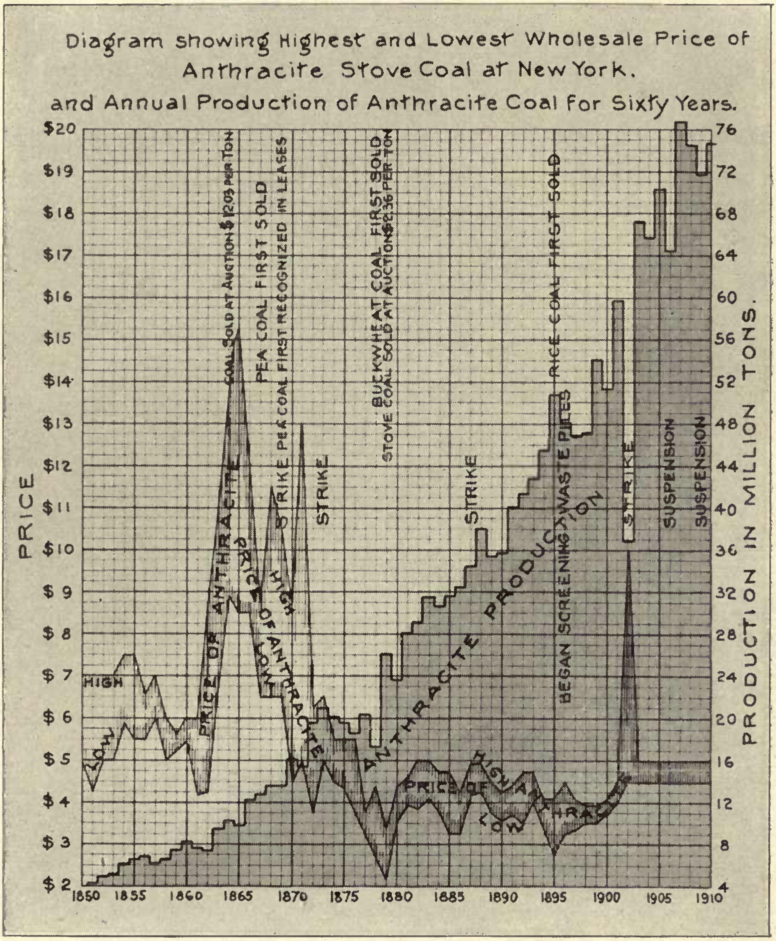
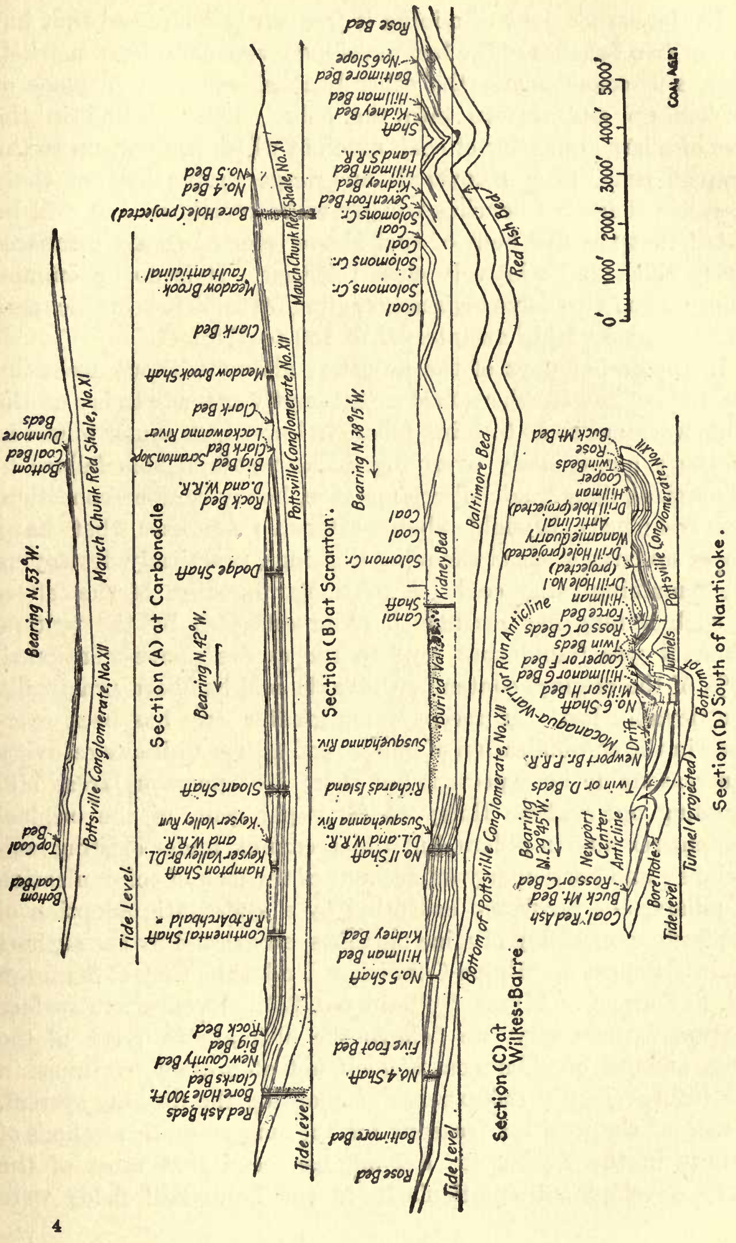


Diagram showing Highest and Lowest Wholesale Price of Anthracite Stove Coal at New York. and Annual Production of Anthracite Coal for Sixty Years.
PRICE
PRODUCTION IN MILLION TONS.
HIGH
LOW
PRICE OF ANTHRACITE
COAL SOLD AT AUCTION $12.03 PER TON
PEA COAL FIRST SOLD
STRIKE PEA COAL FIRST RECOGNIZED IN LEASES
STRIKE
BUCKWHEAT COAL FIRST SOLD
STOVE COAL SOLD AT AUCTION $2.36 PER TON
ANTHRACITE PRODUCTION
STRIKE
BEGAN SCREENING WASTE PILES
RICE COAL FIRST SOLD
STRIKE
SUSPENSION
SUSPENSION
1850 1855 1860 1865 1870 1875 1880 1885 1890 1895 1900 1905 1910

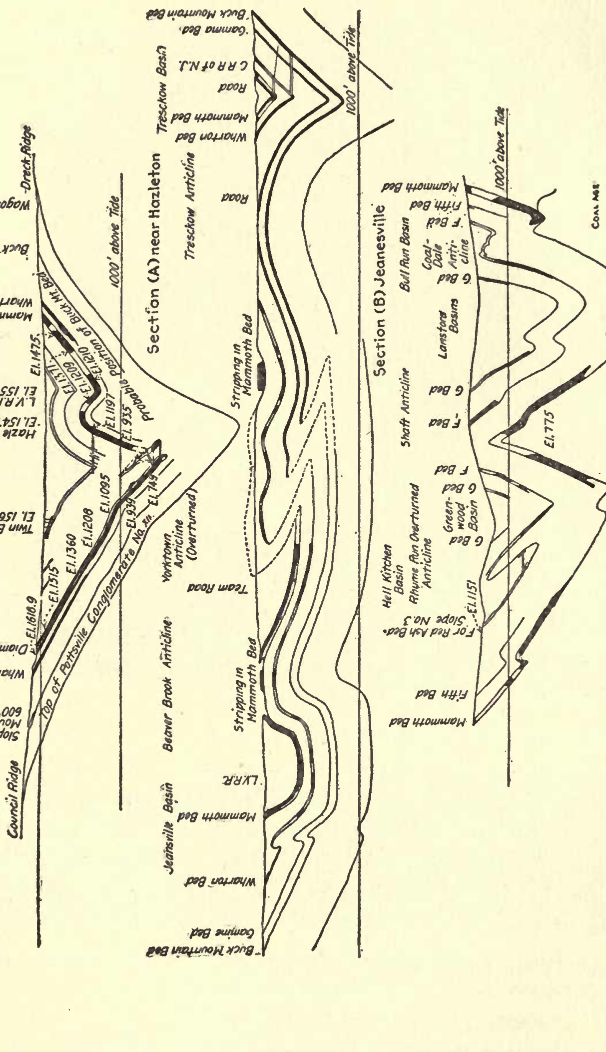


Cross-sections of Northern Anthracite Field

In the earlier days of mining it frequently happened that but one or two benches of the bed developed were considered marketable, and consequently the other benches were left in place or broken up and thrown into the gobs. This resulted in the loss of a large quantity of coal, much of which has not, up to the present time, been recovered, and large proportions of these so-called defective benches will never be reclaimed. It will be noted that the five beds of coal above referred to are comparatively thick and relatively close together. It is no uncommon thing to find these five beds aggregating 50 to 55 feet in thickness and included within an interval of 150 to 175 feet.

In the earlier days of the industry, almost without exception throughout the Northern field no attempt was made to lay off the mine workings so as to bring pillars in lower beds under pillars in the beds immediately overlying. The result of this failure to columnize pillars made a very insecure, honey-combed condition, and frequently brought about extensive squeezes that have closed up large areas of the mine workings, practically destroying the remaining pillar coal. A particular instance of the effect of such mining has recently been investigated by the writers, where it was found that, due to the causes above-mentioned, 46% of the original content of minable coal has been practically irretrievably lost. In recent years greater care has been exercised in the columnization of pillars, and a large ultimate recovery can reasonably be expected; but there are enormous areas still standing open where thirty to forty per cent. of the original content remains in pillars, but which cannot, under existing conditions—and particularly on account of the lack of columnization of pillars,—be recovered excepting by a systematic adoption of the flushing or silting of mine openings, advocated by the authors in their Report on Mining Conditions Under the City of Scranton (U. S. Bureau of Mines, Bulletin No. 25). Even where surface support is necessary, we believe the ultimate recovery of the large amount of pillar coal will—if not at present, certainly in the future—justify the expense of adopting the flushing system.

One of the principal reasons for the unsystematic methods of mining in the Anthracite Region, has been that most of the early developments particularly in the Schuylkill fields were

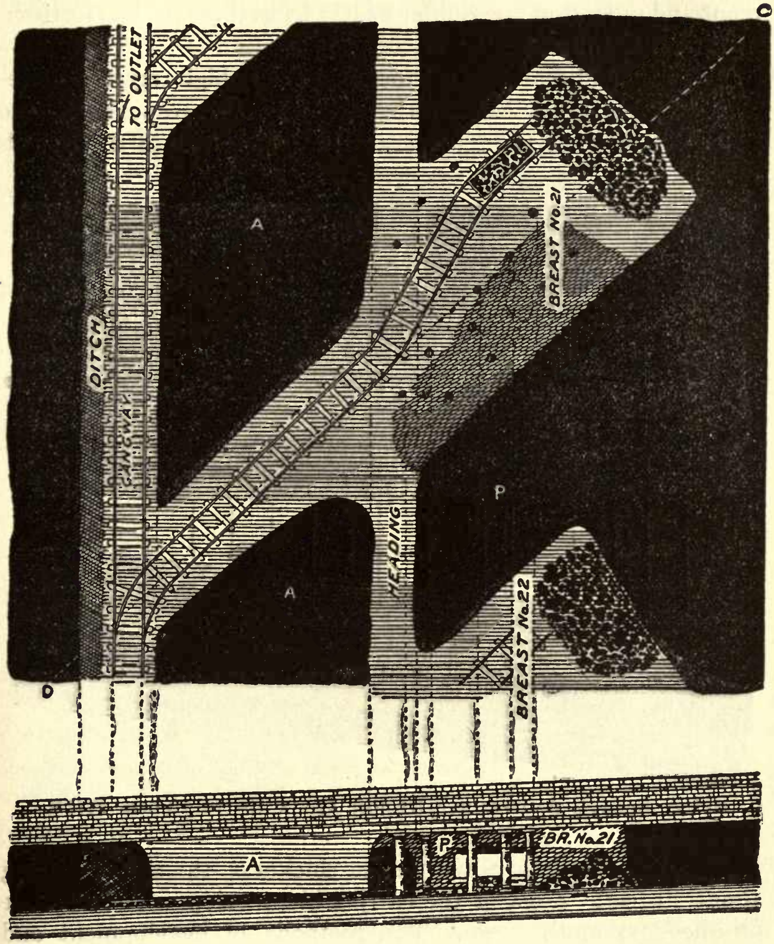


COAL BASINS IN THE EASTERN MIDDLE ANTHRACITE FIELD made by individual operators holding the properties under *comparatively short-term leases*, which carried burdensome minimum royalties, and thus compelled the operator, in order to retire his capital and make a reasonable profit during the term of his lease, to *take only the cream of the property*, oftentimes to the *great detriment of the remaining mineral.* During the past twenty years most of the individual operations throughout the Anthracite regions have come into the possession of the eight railway corporations engaged in the transportation of Anthracite coal to market. These Companies have generally adopted more scientific and systematic methods of mining, and consequently reduced the waste from the causes above-mentioned.

Another fruitful source of waste in mining anthracite in the Northern field is the shooting of the coal off the solid, which has always been the prevailing method of breaking down the coal. In recent years the great improvements in mining machines, and their extensive adoption for mining bituminous coal of all degrees of hardness has, we believe, resulted in the development of machines suitable for undercutting anthracite coal. Some experiments have been conducted with machines of several types, in the Anthracite field, and as far as the mechanical apparatus is concerned, reasonable success has been attained. If this method is more generally adopted for mining thin seams of coal on comparatively flat pitches, it will, we believe, result in saving a large quantity of first-class fuel which has heretofore been blown into the gobs and pulverized into culm.

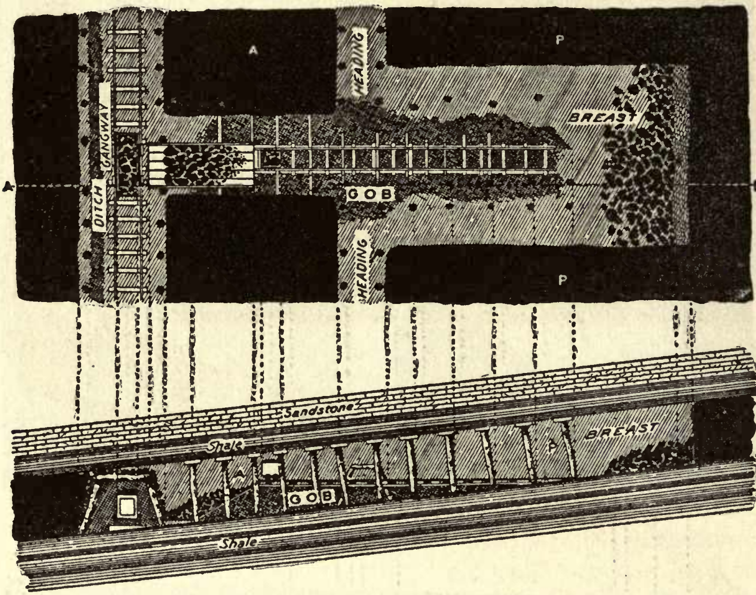
While some experiments have been tried in the Anthracite field of mining thin seams on the "long wall" method, it has never been adhered to with enough persistence to make it a success. The writers are quite satisfied that if this system—which is well known in England and on the continent of Europe—were more generally adopted in America, particularly for the mining of thin seams, decidedly beneficial results would accrue, both in the matter of cost of production and in the increased yield per foot acre of the properties worked over.

The Eastern Middle, or Lehigh Region, greatly differs from the Northern Anthracite field, due to the extreme distortion of the measures. This is well illustrated by the three cross-



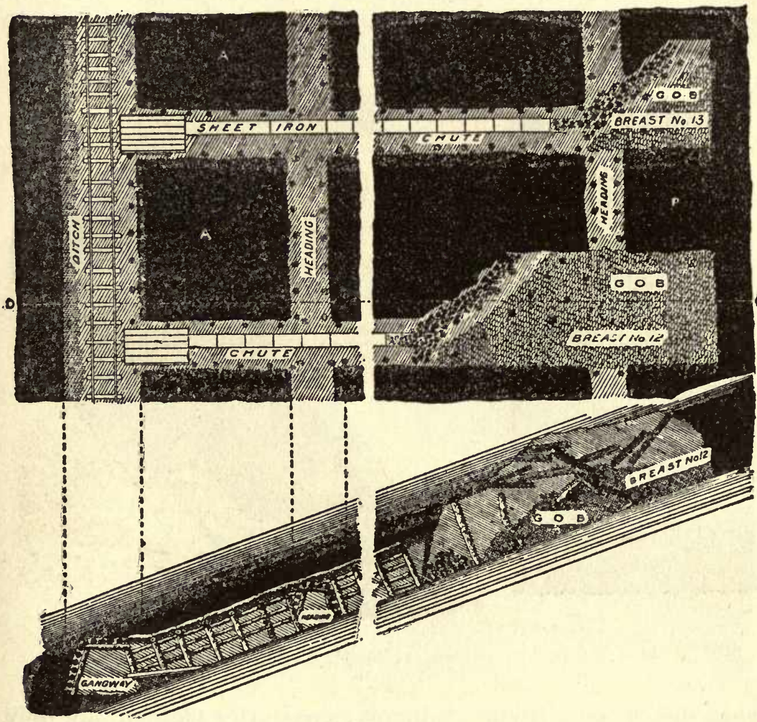
WAGON BREAST, ANTHRACITE REGION, UNDER 10 DEG. OF PITCH sections accompanying this paper. It will be noted that the main basins in the Lehigh region are deep and distorted, causing excessive pitches; consequently the methods of attack, development and operation must differ widely from those in the Northern Anthracite field.

The principal seam of coal found in the Lehigh region, as elsewhere, is the great Mammoth Bed, which corresponds to the Baltimore seam in the Northern field. This bed, in the Lehigh



BUGGY BREAST, ANTHRACITE REGION. ON A 10- TO 18-DEG. PITCH

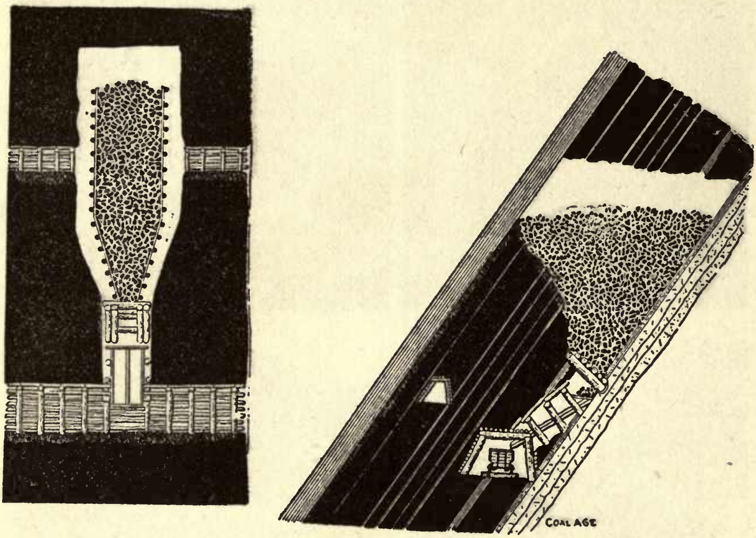
region varies from 24 to 50 feet in thickness, the average being about 30 feet. Most of the early mine development was made on the Mammoth seam. The methods of development and mining that were inaugurated many years ago, have been continued with comparatively slight changes. These methods are well illustrated by the accompanying cuts, which are also taken from the Twenty-second Annual Report of the United States Geological Survey. These cuts illustrate gangway, airway and chamber workings in thick and thin seams on steep pitches. It will be noted that where the chambers are worked "full," the entire content of the bed, whatever it may be, together with any "slab," "clod," or loose "top rock," must be drawn out of the chute, at the bottom of the chamber, into the mine car, as there is very little opportunity to separate the impurities from the



SHEET-IRON CHUTE BREAST, HAVING A PITCH OF FROM 81 TO 30 DEGREES

good coal, in the mine. This is not an unmixed evil, as it avoids the great waste referred to in the Northern Anthracite field, throwing into the gob doubtful and off-color benches of coal which if sent outside to the breaker—as is the case where coal is loaded from running chutes—can be inspected, and some part, at least, of the doubtful coal saved for the market. In other words, it is not left to the judgment of the individual miner or his laborer to determine what is or what is not marketable coal.

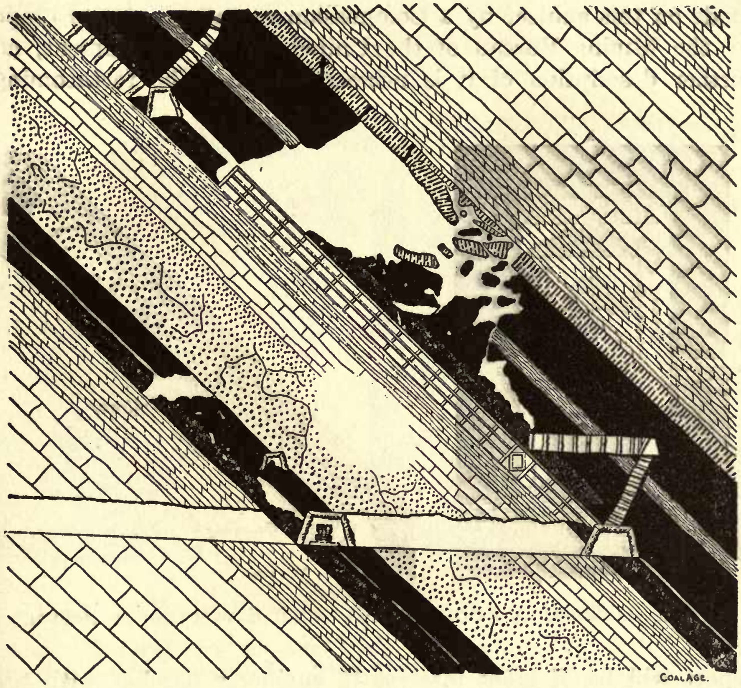
In driving the chutes and chambers, as shown by the cuts referred to, the coal is shot off the solid; but in the Mammoth and other seams it frequently happens that after the chamber has been developed so that the whole seam is cut from floor to roof, it becomes impossible to control the chamber, by reason of the coal "running." When this happens, the miner continues to draw coal out of the chute so long as it will "run." Usually,



HEAVILY PITCHING BREASTS ON MAMMOTH BED HAZELTON

when one or more chambers break loose in this manner, not only the coal directly in line with the chutes, but also the pillars between adjoining chambers run out, permitting the roof rock to come down. This may, perhaps, occur before all of the solid coal has been recovered. There is no possible way of ascertaining whether or not all of the coal that should come out of a given chute or series of chutes has been recovered, consequently it is necessary to handle the rock that comes when a fall occurs, until the foreman feels convinced that no more coal can be profitably recovered from that chute. In this way enormous quantities of rock are loaded in the mine cars, transported to daylight and dumped on the waste bank.

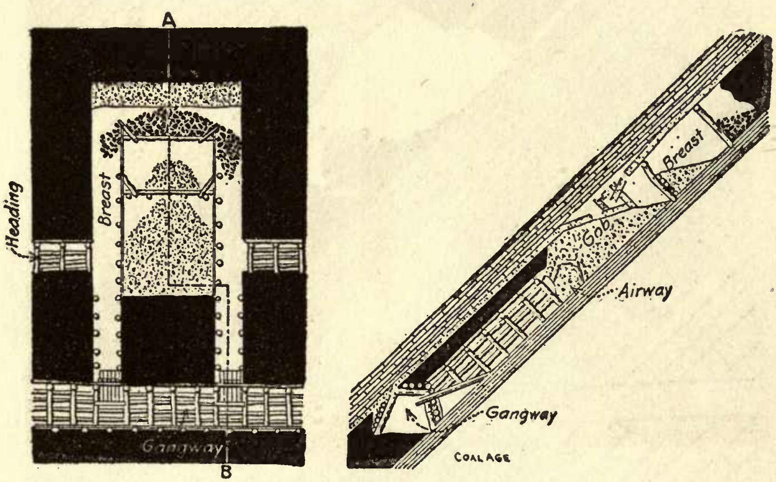
It is well known that this method of mining very thick beds of coal standing on steep pitches oftentimes results in the recovery of a lamentably small percentage of the original content. Earnest



METHOD OF WORKING CONTIGUOUS SEAM THROUGH HORIZONTAL ROCK TUNNEL

thought and effort have been put forth by able managers to devise better methods of winning these thick beds of coal, but very little change resulting in improved recovery has been made since the early days.

American engineers have been much interested in reports of the successful mining—under the quite different economic conditions which there exist—of thick beds of coal in Europe by what is known as the "slicing method," by which the coal is extracted in slices from the bottom upward, each slice being about 6 to 8 feet thick, and the space from which it is removed being filled with flushed sand or other material before the next slice is extracted. This operation is reported to result in the recovery of practically all the coal, with comparatively slight subsidence of the overlying rock. As a report is shortly to be made on this subject by a Commission recently sent to Europe by the Mining Bureau of the United States Government, no further description of it is necessary here. The forthcoming

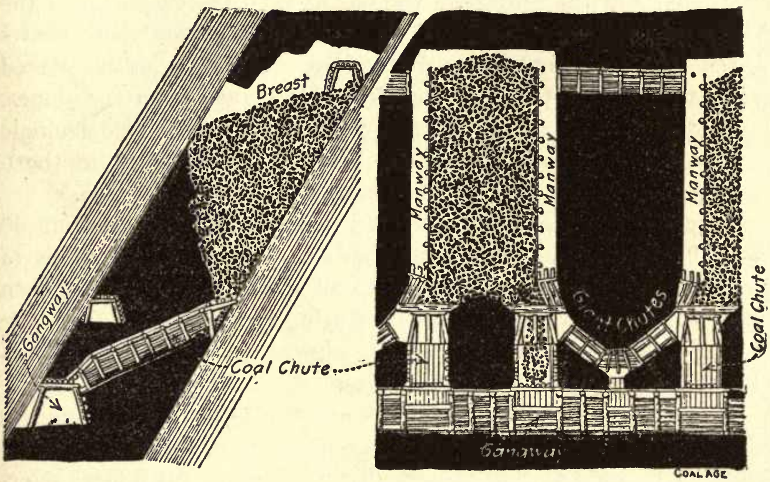


METHOD OF WORKING PITCHING COAL WITH EXTRACTION OF REFUSE

report will be of great interest to engineers familiar with the methods pursued in mining thick and steep beds in the Pennsylvania Anthracite field.

The loss of coal in the Mammoth seam is not the only damage done, as in most cases in the earlier days of the industry no attention was paid to thin and so-called inferior seams of coal overlying the Mammoth, which in many instances have been practically destroyed by the dropping of the underlying strata, due to caving of openings in the Mammoth bed. This destruction of overlying beds was of course, more pronounced years ago than in recent years, because more attention has been given to the conservation of the marketable coal in all beds, even in those as thin as thirty inches.

It will be noted by the cross-sections that there are many instances where the beds of coal come close to the surface at the "spoon" ends of basins, the marginal outcrops and on the crests of anticlinals. In such cases it has been found profitable to strip off the overlying earth and rock, exposing the seam of coal which can then be quarried in open-cut mining. It was formerly the opinion of engineers and operators that one foot of over-



DOUBLE CHUTE BREASTS, ANTHRACITE REGION

burden could be removed with profit to effect a recovery of one foot in vertical thickness of coal seam, even though the coal bed had been partially mined by underground methods. This relative proportion has been greatly changed during the past ten or fifteen years, until as much as three feet of overburden, sixty per cent. of which is rock, has been removed for the recovery of one vertical foot of coal bed.

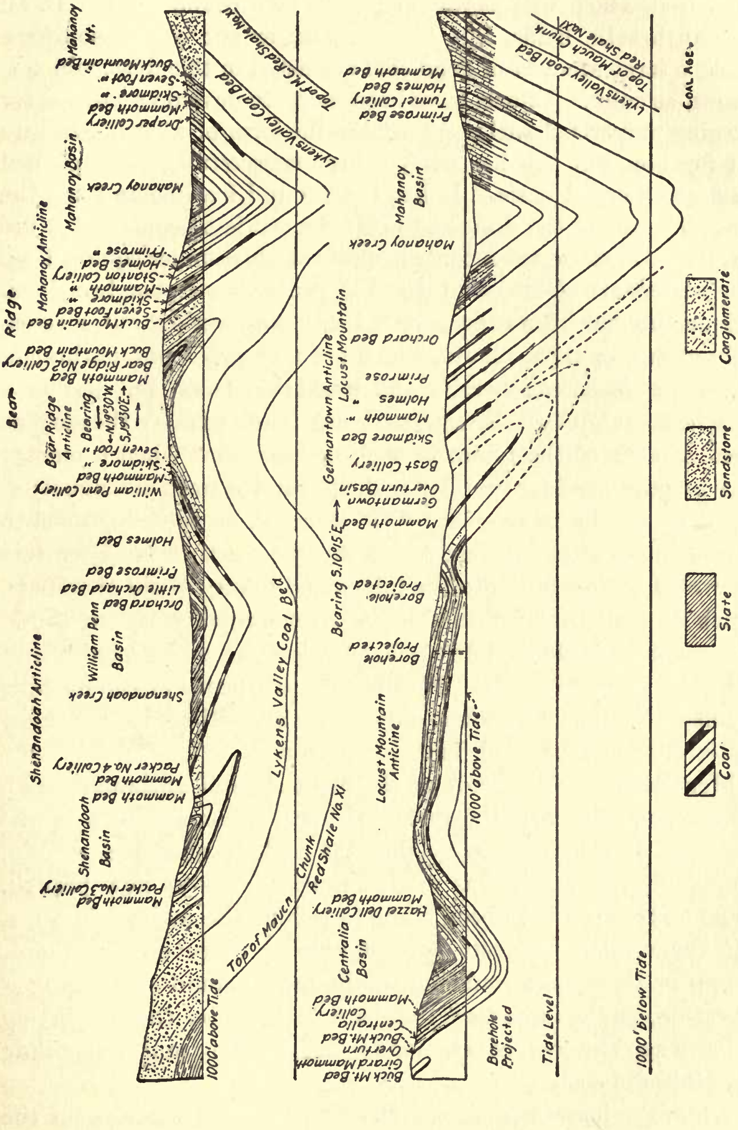
On large operations the cost of this stripping work has been done for 18¢ per cubic yard of earth, and 35 to 40¢ per cubic yard of rock. While stripping means a large outlay before much return can be secured, it permits the recovery of all the coal, with cheap methods of mining and handling.

The early developments in the Lehigh, Western Middle, and Southern fields were by sinking slopes from the outcrop, following the coal bed to the true dip. These openings were generally successful until four or five lifts, about 500 feet apart, on the pitch of the seam, had been turned. By the time the fourth or fifth lift was opened, in many cases the cost of maintenance of the slopes and several landings was and is very great. In recent years important developments have been made by sinking vertical shafts in the centers of the basins with the long axes of the shafts parellel to the axes of the cynclines. From these shafts levels are turned in rock on both sides. These levels are placed so as to intersect the old levels formerly driven from the slopes, and are generally about 400 feet vertically apart. The geologic and structural conditions in the Western Middle and Southern Anthracite fields are similar to those in the Lehigh region.

It is no uncommon thing to find the Mammoth seam from 60 to 150 feet thick. This is particularly the case in portions of what is known as the Panther Creek Basin, being the eastern extremity of the great Pottsville Basin, which extends from the Lehigh River at Mauch Chunk almost to the Susquehanna River at Dauphin—nearly 70 miles.

A cross-section showing the Southern field at Pottsville is incorporated, from which it will be noted that there are a large number of beds of coal greatly distorted—in many places overturned. This distortion has effected the hardness of the coal so that in nearly all of the operations in the Southern field very great waste occurs on account of the friability of the product going to the breakers. There are many instances where over 50% of the raw product reaching the breaker is waste, either in the form of rock, slate, bone or culm.

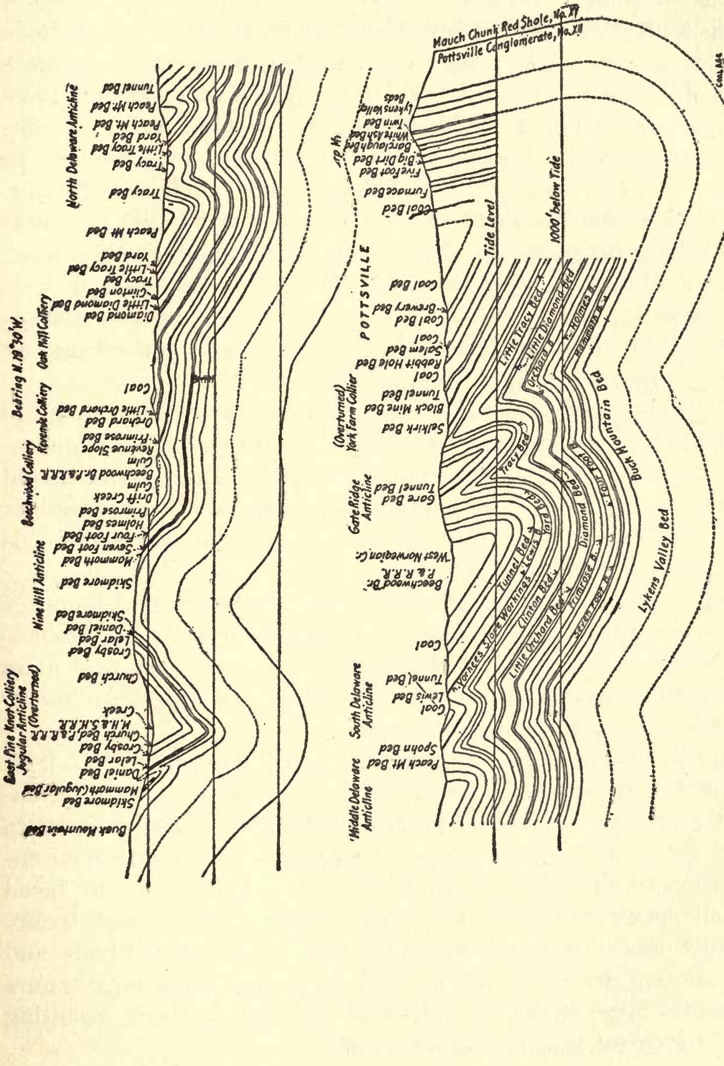
The method of preparation of Anthracite coal is by passing it over screens with meshes of varying sizes to separate the coal into eight sizes, known in the market as Broken, Egg, Stove, Chestnut, Pea, Buckwheat, and Buckwheat Nos. 2 and 3. The larger lumps of run-of-mine coal are passed through toothed rolls, which break it down to the sizes mentioned. This process



CROSS-SECTION WESTERN-MIDDLE ANTHRACITE COAL BASIN necessarily makes greater or less dust, and particles of coal smaller than that which will pass over a 3-32 inch round mesh. In all the Anthractie fields, but to a greater extent in the southern fields, a large amount of good coal is wasted in this dust, which is known as culm. Efforts have been made to develop a process for burning pulverized anthracite coal in the form of a jet blown into the fire box, but this has not yet been successfully accomplished on a commercial basis. It has been found feasible to burn the dust, but one of the difficulties experienced is to construct a fire box that will stand the intense heat of this dust under combustion. The writers are of the belief that this problem will soon be solved. Briquetting has been experimented with, and worked out successfully at two or three plants, which are now producing anthracite briquettes on a commercial and profitable basis, but not in a very large quantity. Efforts are being made to store the surplus dust at some of the mines in such manner that when a market may be developed for it either as dust or in the form of briquettes, the dust can be recovered. *This, however, is not being done* to as great an extent as it should. In many cases the mine operators are washing the culm into the mines and filling up old chambers, which is beneficial for support of overburden, but, we think, an economic mistake, inasmuch as this culm will probably not hereafter be recoverable. We are firm advocates of the flushing or silting system, but think only waste and otherwise worthless material should be used for this purpose.

Mention has been made of the eight sizes of anthracite coal. This sizing has been the result of various compromises in the past, and it is not necessary that the coal, to burn successfully, should be divided into as many separate sizes as now prevail. Recent attempts have been made to reduce the number of sizes, but the various interests were unable to agree on this point. If two or three sizes could be eliminated it would result in conservation, as the more sizes there are, the greater the proportion of breakage and loss, occasioned by the handling and re-handling of anthracite coal.

While the losses mentioned due to sizing and handling of the coal are, in the aggregate, large, they are insignificant in com-



CROSS-SECTION OF SOUTHERN ANTHRACITE COAL BASIN AT POTTSVILLE
(The lower section is a continuation of the upper)

parison with the enormous waste underground, particularly in the great Mammoth seam. Constant effort is being put forth by progressive engineers to reduce the losses due to the present methods of mining, and some of the Companies largely interested in the Mammoth seam sent engineers with the representatives of the United States Bureau of Mines, to Europe to study methods of mining there and to profit by any improvements that may have been developed. The reports of this Board of Engineers have not yet been made available to the general public, but we are informed that while European practice is in some particulars in advance of ours, it is not materially so, under similar conditions. We believe that increased yield could be secured in flat measures by flushing the openings (breasts, etc.) with sand, crushed rock, etc., as referred to in Bulletin No. 25 before mentioned, in beds of almost any thickness; but in steep pitching measures there is some doubt of the applicability of this system in beds exceeding 15 to 20 feet thick, or in free-running seams.

From the figures shown in a preceding chapter it will be quite evident that the supply of Anthracite coal is by no means "unlimited," and that the conservation of the remaining mineral should be the earnest study of everybody having anything whatever to do with the production, marketing and consumption of this invaluable natural product.

While the Mining Engineers have much to learn, and room for improvement, in the way of conservation, we believe the Mechanical Engineer is as greatly interested in conserving the heat units of the fuel delivered to him, and that there is in this department, considerable room for improvement.

In conclusion we desire to call the reader's attention to a fact,—which is prominently set forth in the foregoing and is abundantly proved by the history and experience in the Anthracite Coal fields of Pennsylvania,—an economic law of universal application to all sorts of natural resources, which must be faced by all conservationists everywhere, namely; that short tenure of title leads to small operating units, careless methods and extravagant waste of the natural resources, while long tenure promotes large operating units and scientific methods, resulting in the greatest possible conservation.

The deeper and more expensive mining of the present day leads, of course, to greater cost, and scientific methods with a resultant conservation would also add to this, and consequently increase prices to consumers; but with the increased prices greater conservation may be secured. How much of this burden the present generation should bear for the benefit of the future is entirely a commercial problem.

PROGRESS IN DEVELOPING AND CONSERVING WATER SUPPLY FOR MUNICIPAL AND DOMESTIC PURPOSES

ALLEN HAZEN

New York, N. Y.

The progress in developing public water supplies in the United States may be stated in a broad way to have consisted in developing and securing such supplies as have been required up to the present time. In general, development somewhat precedes requirement, and in some cases, sufficient water is now available to supply the needs after ten, twenty, or even thirty years of probable growth. In other cases, the supplies now available are only adequate in years that are not especially dry, and would be inadequate under conditions of continued dry weather which recur from time to time.

In many parts of the United States, water is available for all required public water supplies, without special effort being made for its collection and conservation. This is especially true of cities located on rivers of considerable size and upon the Great Lakes. In these cases it has often proved necessary to prepare the water for use by purifying it; but from the broad standpoint of securing water, no serious difficulty has been presented.

In other parts of the country, water is obtained for supply from relatively small streams by building reservoirs in which flood flows are stored and made available for use in dry periods. Many of the largest cities in the country, including New York, Boston, Baltimore, San Francisco and Denver are supplied in this manner. This general method is especially used in hilly country, and often has the advantage that the water may be supplied by gravity, thereby saving the cost of pumping. This advantage is so considerable that storage reservoirs are often used even where rivers are at hand which would furnish a sufficient quantity of water. There are also certain sanitary advantages growing out of the use of stored upland water, which have frequently been of importance in determining the selection of these sources.

Water Supply Possibilities in the United States

The water supply resources of this country are very great indeed. No one knows, or can know exactly how great they are. They differ with climate and topography. They are relatively less in the arid and sub-arid regions of the west and on the Southern Pacific coast. In this great area, the whole available water supply will be developed and used, either for water supply or for irrigation, at a date that in the history of the country is not remote. Through the middle states there are occasionally cities located near the head waters of streams where there is, or will be difficulty in securing water in large quantities without transporting it for longer distances than have been considered feasible up to the present time. With these exceptions the water resources of the country are so great in comparison with the requirements of domestic use, that they may be considered practically unlimited.

Their aggregate amount is not known because no limits can be set upon the amount of water that may be obtained ultimately from the various areas. It would take most extended and detailed studies of these areas to determine their possibilities. Such studies have been made for a few limited areas now used for water supply, as for instance, the Croton River now supplying the City of New York, and Esopus Creek, to be soon added to the supply. The great majority of streams have never been adequately studied to determine the possibilities of storage upon them, and there is no reason why the expense of such studies should be now incurred.

The results would be only moderately conclusive, even if they were made in the most thorough manner now possible. Methods of purifying waters that have been developed in the last ten years have made fundamental changes in ideas as to the availability of many sources, and have added greatly to the field. In a similar way progress in the whole art of water works construction, including pipes, conduits, tunnels, pumps, dams and reservoirs, has steadily increased the field from which water may be successfully drawn. Increase in population also increases this area, for the cost of carrying water long distances decreases relatively as the quantity to be carried is larger. A city of a million inhabitants may go a hundred miles for water with no greater relative effort than is represented by a few miles of pipe laid by a country village. On the other hand the development of the resources of the country involves the use of water and land for other purposes, so that each year many excellent sources cease to be available.

In a strip of land 400 miles long and 50 miles wide, extending from Boston to Washington, are located many of the largest cities of the United States. In this region more water has been developed for public water supplies than in any other corresponding area in the world. The amount is larger than in densely populated European areas because our per capita consumptions are several times higher; but with this done, the water resources available to this region have not been exhausted. It is true that in the immediate neighborhood of Boston and New York the most available supplies have been developed and utilized, and it is necessary to go somewhat further for additional water; but if there were demand for more water and a market to sell it at remunerative prices, physical resources are available so that an enormously greater quantity could be supplied. Without attempting a close estimate, it may be said that at least ten times the amount now supplied could be furnished, and probably a much greater quantity. This would mean the storage of at least a part of the flood waters of some of the larger rivers, such as the Connecticut, the Housatonic, the Hudson, the Delaware and the Susquehanna, thereby utilizing sources enormously greater than any now used, and which, as yet, have not been touched. To carry out such works would involve great dams, reservoirs and tunnels, and aqueducts larger but not longer than some that have been already undertaken. Railroads and towns would have to be moved, and the whole work would be carried out on a scale not justified by the present demands for water.

That which applies to this small area of greatest density of population, applies in even greater measure to most of that part of the United States east of the arid region.

Conflict of Interest between Cities

It frequently happens that a source of water supply that is selected by one city is also physically well adapted to use by another. Each city desires to secure the control of that source or sources which can be most economically and advantageously used for its own purposes, and many conflicts have grown out of this condition. Until recently the city or company or individual that was first upon the ground and acquired sufficient property to control the situation, or secured the legislative authority to take the same by the exercise of eminent domain, held it to the exclusion of all others. In recent years a number of states where cities are near each other, have established methods by which rights in new sources of supply could be acquired only after procedure intended to prevent cities, corporations or individuals from acquiring more than their fair share of water, and to protect the assumed natural right of each municipality to have for its own use the source or sources of supply most convenient and natural to it, as far as the same is not inconsistent with the like rights of its neighbors, and in case of conflict, to make as fair a division as possible.

Conflicts of this kind have given rise to much discussion and have created an erroneous impression of scarcity of water. As a matter of fact such conflicts do not necessarily or ordinarily indicate a scarcity of water. They indicate the desire of two or more parties for control of a source more cheaply developed or otherwise more advantageous than others, or supposed to be so.

Community of Interest in Water Supply

Another problem similar to the last, but differing in its manifestation, is presented, where two or more cities are so situated that they can be more economically served by natural resources by one system of works than by independent systems. Cases of this kind are numerous in the older and more densely populated parts of the country, where it is frequently necessary to transport water for much greater distances than the average distances between adjoining municipalities.

The cost of transportation is often an important part of the whole cost of the water, and this cost is reduced by using one or two large lines, as compared with several smaller ones.

To secure this and other economies of combined action, water districts have been formed comprising several, or a considerable number of municipalities. In other cases water companies have supplied groups of communities. In some cases the whole water business has been consolidated under one management. In other cases the management of the distribution systems has remained local, and water has been supplied at wholesale to the local works which have preserved their independence by acting as retailers only.

Property Available for Water Supply also Available for Other Uses

In most cases water suitable for a water supply, and land suitable for developing it, are also available for other uses. As the water resources are enormously greater than the needs of domestic supply, it naturally follows that most of the water and most of the property, from a physical standpoint, available for developing it, are not in actual use for furnishing water supply, and generally the water and the properties are taken up and used for other purposes. This is not only a natural result, but it is the best arrangement considered from the standpoint of the development of the whole country. If all the water and all the land that might possibly be sometime used for water supply were reserved from other uses, it would result in an unwarrantable tying up of the resources of the country, and would work great injustice.

Some of the uses to which such water and property may be put are not incompatible with their use for public water supply. Without attempting a complete statement, a few examples of such double use may be given. As a first example, public parks upon the gathering ground of a water supply system are not objectionable and where large parks are desired and areas are also to be reserved for water supply purposes, it is in the interests of conservation of the resources of the country to use the same areas for both purposes as far as possible.

As a second example: in mountainous districts it frequently happens that economical sites for storage are high in elevation and would furnish more pressure than is desirable, from the standpoint of economical transportation and use of the water. In such cases some of the elevation may be used for developing power. The development of a source in this way for one purpose does not interfere, but rather aids the other, and a joint use for power and water supply is advantageous.

As a third example: the presence of farms and ordinary rural communities upon the catchment areas of water supplies is not usually or necessarily injurious to the water to such an extent as to justify the elimination of such occupation. The methods of treating water and of protecting it against the possible results of pollution have so advanced in recent years, that there is even less reason than formerly for wishing the elimination of population. A great majority of the water supplies of the cities of the world are drawn from areas containing considerable populations, and this condition is to be recognized as one likely to continue. It is true that some kinds of occupation are more unfavorable than others to the quality of the water, and it is proper and desirable that authorities managing water supplies should have some voice in the management of the area from which water is drawn, and some power of discouraging those uses which tend to impair the quality of the water. But with such reasonable control as experience shows can be readily exercised, good water may be obtained; and the greatest use of the resources of the country will be obtained by permitting the land to be used and occupied for such reasonable purposes as it is best fitted for.

Occupations of Land not Compatible with Water Supply Development

If one follows up representative rivers in a hilly country, especially the smaller rivers in New England, or other densely populated portions of the east, a succession of dam and reservoir sites is frequently presented, which, from a physical standpoint, might be utilized for storing and making available the flood flows of the streams. These reservoir sites are commonly the most productive and valuable lands; and they frequently afford the best sites for towns and cities. Hundreds of New England towns are located on ground which, under other conditions, might have been the floors of reservoirs; and the sites for the high dams that might have formed such reservoirs are occupied by mill dams of only moderate height. Railroads frequently follow the streams. To utilize such possible sources involves buying all property, removing the villages, buying out the mills and moving the railroads above the flow lines of the proposed reservoirs.

When a great city is looking for a water supply to serve the added needs of the growth of a generation, it can afford to buy out villages that are not too large and to re-locate railroads, and to do the other things that may be necessary to utilize a supply in such a location. This is a matter of degree. There are limits beyond which even the largest and richest cities may not go. Some of the best reservoir sites are occupied by thriving towns and cities, and are seats of industry to such an extent that they can never be used for water supply purposes. Other natural sites are remote from development and the lines of progress, and can be secured. It is often a question of buying out and utilizing a naturally economical but now otherwise occupied site near at hand, or carrying the water from a more remote site which can be obtained, with less disturbance to existing conditions.

Water Power Developments

In the last ten years there has been a great increase in the use of streams for water power. Before that time water powers were mainly obtained by the utilization of the permanent or nearly permanent flows of the larger rivers where there were natural falls. Progress in the art of developing and utilizing water power, and of carrying it by electricity from places where it is obtainable, to places where it can be used advantageously, has resulted in construction of reservoirs upon the upper waters of many smaller streams where the stored waters can be utilized through a considerable fall to generate power at all seasons of the year.

The development of such powers has thus begun. In the next generation the number of such works will be increased many fold. This represents a conservation of natural resources which adds to the wealth of the country, and is desirable in every way.

The streams utilized in this way are, however, streams that would otherwise be physically available for domestic water supply, so far as there is, or may sometime be demand for the water.

To some extent these uses are not incompatible with each other, especially in mountainous country, when the differences in elevation are great, but broadly speaking there is a considerable conflict. If a stream is used for water supply it is not available, or not as readily available for water power, and if it is used for water power, it often ceases to be available for water supply. There are many cases where more remote and less desirable supplies have been selected because nearer and more available sources have been previously developed for power. As the number of such sources is generally much greater than the number that would be required for water supply within any period of time that may be legitimately taken into consideration, no general effort to limit the utilization of these sources for water power is to be desired.

An ideal arrangement would be for each city to look well ahead and see what it will need during a reasonably long period, and to secure the rights and such land as may be necessary for its development to control such supply. When this is done if the source can be used for power in the interval before it is required for water supply, and if the conditions are such that a water power would pay during such period, arrangements might be made by lease or otherwise for the development of the power, subject to the right of the city to take it for water supply when occasion demanded. The works for storage might appropriately be the same for water power as for water supply, and the same tunnels and some other main parts of the works might also serve, so that a substantial part of the investment for power would serve afterward for water supply.

Under such an arrangement, when it became necessary to take some water for domestic purposes, there would still be water available for power. During a long period of years the amount of water for domestic supply would gradually increase, while the amount of power would gradually decrease.

American cities do not have the powers necessary to carry out such a comprehensive plan, and the arrangement suggested is, therefore, an ideal one, which might be brought about under a more perfect form of Government than we have yet reached. It would be in the interests of true conservation of natural resources to make such an arrangement possible.

Irrigation

In the arid west the law of water is different than the law of water in the east. This is natural because in the arid west water is the most valuable element. Water is the source of life; and the development that can be reached in any locality is directly dependent upon the amount of water that can be permanently and reliably furnished. The laws of the western states are the outgrowth of experience in these climates, and have resulted from efforts to distribute the water as equitably as possible among those who have the best right to it and make the best use of it.

In the east it is common for a city to acquire, through the aid of the state, the exclusive right to all the water to be had in a certain source. This rarely, if ever, happens in the arid west. Appropriations of water are made and these appropriations are served in the order of their priority. That is to say, the man who first locates upon a stream and appropriates water for his use has the first right to use it ever after.

There is uncertainty at the start as to how much water will be available, and great uncertainty among the appropriators as to how much they will be able to use, and each is left to appropriate that which he sees fit. All the waters of the streams in the arid region have been appropriated many times over. For an appropriation to be valid, the water must be actually used and in general, appropriation is only good for so much water as is actually available and put to beneficial use.

Carried to its logical conclusion, this may mean that the city can only really hold rights to the water which it now uses, and that all rights for more water than it now uses are somewhat uncertain and liable to be replaced by junior appropriations. The laws tend to make it impossible to hold water that is not used. If a man owns water and does not use it, the man who came after him with a junior appropriation and does use it, soon acquires the right to use it, and the first appropriation ceases to have value. This may be good policy as between individuals, but it puts a growing city in a very hard position, because the use of water is constantly increasing, and it is only reasonable that water for a moderate period in the future should be controlled and held in reserve. Practically this has been done and is done in some cases by various methods suggested by the ingenuity of those having to deal with these problems.

There is also a question as to whether a city having acquired certain rights for domestic water supply may legally use them for other purposes before they are required for the use for which they were acquired.

With rapidly increasing values of water in the arid region, there is great need of having the whole matter determined by a simple adequate law, so that a city may firmly hold such rights as it needs and is able to acquire, and it is desirable, from the standpoint of the greatest use of resources, that the rights so held may be put to other uses in the interval without prejudice to the permanent right to use them for water supply. Amendments to the constitutions of some of the states may be necessary to clear up these matters.

The Right of Eminent Domain

It is commonly recognized that the use of property for water supply purposes is more important to the public than the use of water for power or irrigation, and legal methods are provided by which properties required for water supply may be taken, and compensation made to those who are injuriously affected by the new use. The exercise of such powers is common and is well understood. The courts always protect carefully the rights of those who have occupied and owned the property. The only justification for taking it for water supply purposes is that it is more valuable for those purposes, and sufficiently so, to justify the taking. The forced sale is often something of a hardship to property owners, even though full value is given.

The consideration of these two main fundamental propositions commonly leads to the payment to the property owners of sums of money in excess of the fair value of their land or rights for any other purposes but those of water supply. This must be accepted as an inevitable condition, and those who think that cities ought to be able to buy up farms for reservoirs at prices no greater than the land could be sold for for farming purposes, will be disappointed in the awards that are made by the courts. On the other hand the excessive awards for land that have sometimes been made are unfortunate, and tend to discourage carrying out projects that are in the public interest. Generally with good administration it has been possible to acquire properties at an advance over their values for other purposes that is not unreasonably great, when taken in connection with the increased value of the property for water supply purposes, which is the only justification for taking it.

Anticipating the Future

One of the most interesting and difficult questions presented is as to how far a city really ought to anticipate the future in acquiring land and rights. If it were said, our city has 100,000 inhabitants, and in a century will have a million, and we shall then require so many gallons of water per capita, and it will take such and such areas to supply this water, and we propose to buy them now, the result might easily be burdening the present generation unduly with interest charges on bonds issued to pay for remote and even speculative requirements, for it is quite possible that the increase in population may not be as great as assumed, and it is equally possible and probable that the habits of the people who live in another century will be different from ours. It may be that more will be required or it may be that less will suffice. It is only necessary to mention the shower bath and the swimming pool to suggest the great uncertainty of the remote future.

Then there is the certainty that there will be great developments in the whole business of water supply, and the possibility that sources will be opened up not now considered available. If there were a magnificent source of supply near at hand which could be obtained at small expense, prudence would dictate the advisability of securing it. This condition may still exist in a few cases. Far more commonly to secure a liberal supply for a century would involve the expenditure of great sums of money to procure land and rights which would not be justified by the reasonable prospects of the case, and which ought not to be lightly undertaken. What then will happen? The properties controlling the sources will fall into other hands, and be put to such uses as they are fit. Water power is developed, the land is cultivated, railroads are built and the property becomes valuable. Many sources of supply otherwise excellent are used for other purposes to the point which forever effectively prevents their use for water supply. Towns and even cities are located in valleys which would otherwise form ideal reservoir sites. They cannot be moved with increasing demand for water. Instead other and more remote sources of water supply must be found and developed and the saving in land and rights may more than compensate for the added length of conduit.

If the water resources of our country were more limited, so that, for instance, all the water that could be produced was likely to be required for domestic and municipal purposes within a limited length of time, then it would seem desirable and necessary to study the water resources more thoroughly and to make outline projects for future requirements, and to make a greater effort to reserve the properties for water supply purposes. With conditions as they are, it may be questioned if this is feasible except in a few exceptional cases.

State Lines in Water Supply

The business of procuring, storing, distributing and selling water is under state control. That is to say, it is done by municipal and other corporations having state charters, and subject to state laws. The business is not regulated or controlled by the general Government. There are cases, including one very notable one, where the most economical and advantageous supply for a city is in another state; but one state does not have authority to build water works in another state, nor to authorize its municipalities to do so. There are instances of private corporations that have secured water in one state and sold it in another, but in many important cases the state line has been regarded as an insurmountable barrier. For this reason a supply partly on either side of a state line is usually considered not to be available for municipal use at the present time.

This is a matter where the Constitution of the United States at present seems to be somewhat inadequate to meet the present requirements. There is no logical reason why any city in this country should not have the privilege and all the rights that are necessary to develop a water supply wherever in its neighborhood it can be most economically and advantageously done. If existing laws do not permit this, as they apparently do not, the sooner this matter can be corrected the better it will be.

The Constitution of the United States prohibits the States from imposing duties on exports. It does not seem to prevent a state from prohibiting the export of a commodity. One state has done this with water, and has amended its constitution to this end. Probably the idea of this change in the law was that ultimately all the water resources of the state would be required by its own citizens, and that it was wise to prevent the diversion of any of the water into another state.

But from another standpoint, the action seems both shortsighted and unwise. If Pennsylvania were to say that all her coal would sometime be required by her own citizens, and that none of it were to be sent out of the state, it would be unfortunate for all her neighbors, but there would be some reason for it, because for each ton of coal sent out of the state there is one less ton left in the mines.

But with water, the case is different. The supply is renewed each year by the rains falling upon the whole surface of the ground and all unused water runs to the sea. If water supplies are developed and used, and all the water drawn from them that can be drawn during this century, there will be just as much water available in the centuries that follow as if not a drop had been utilized in this. If, instead of prohibiting the sale of water outside the state, provision were made for controlling it, or so that the rights would revert after a long period, water could be sold and profits realized on its sale through a period of years, which might be very long, and still there would be absolutely no reduction in the amount of water ultimately available to the citizens of the state.

On the other hand, developing supplies for use outside the state would tend to insure retaining the properties on which they rest for water supply purposes, while if they are not so used, some of them are certain to be used for other purposes, and will cease to be available for water supply before the time when they might be required for use in the state in which they are situated, and so far as this is the case, the prohibition of present use means permanent loss of these sources of water supply.

Compensation in Kind

The American laws and courts require compensation for water that is taken by eminent domain in money. The compensation is calculated upon the theory that when the right to divert water is obtained, the diversion of the water begins at once and is complete. In order to secure a valid right for the diversion of water from a particular source, it is customary and apparently necessary in most cases to secure the full right to the whole source. This practically results in the recovery by the riparian owners of damages for the diversion of all the water, and as only a fraction of the water is needed at first, the balance flows down the stream as before, and the owners continue to enjoy a large part of that which they have been paid for. Of course, conditions vary greatly. There are cases where diversion is comparatively complete from the start, but they are exceptions.

It frequently happens that the area from which water is to be taken is large and that flood flows from it are very great, and flow to the sea without advantage to anyone. In fact these flood flows are frequently destructive and do positive harm instead of good on their way. Taking a source for water supply frequently means building a large impounding reservoir and holding back these flood flows to fill the reservoir. It is sometimes possible to so manage the business that only flood flows will be taken for water supply, and that the moderate flows of the stream will remain undiminished. In England this procedure has been established by law and is called compensation in kind. That is to say, the law provides that when a stream is taken for water supply, the storage provided shall be sufficient to not only furnish the water taken for domestic supply, but also to maintain flows of the stream which are regulated by procedure so that riparian rights below will be no less valuable than they were before.

In a number of cases arrangements of this kind have been carried out in America voluntarily. Such arrangement may be mutually advantageous because it relieves the water undertaking of heavy water damages and at the same time, if properly carried out, insures the power owners against loss of power, and in fact practically may even give them more power than they had before. Legal recognition is needed to enable this most useful procedure to be carried out fully, and with the best results.

CONSERVATION AND USE OF WATERS IN THE RECLAMATION OF ARID LANDS THROUGH GOVERNMENTAL AGENCIES

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Under the terms of the so-called Newlands Act of June 17, 1902, the United States has invested upwards of $70,000,000 in the building of reservoirs for the storage of flood waters and in canals and related structures for taking these and other available waters to lands which in their natural condition have such a small supply of moisture that valuable crops cannot be obtained each year.

The moneys for this purpose are obtained from the disposal of portions of the public domain, and as the lands are disposed of the moneys received are put into a fund in the Treasury. These moneys are then expendable under the direction of the Secretary of the Interior in his construction of the works above mentioned. When these works are completed to a point where water can be brought to the lands, these latter, if in public ownership, are opened under the terms of the Homestead Act in tracts of not more than 160 acres in extent, the size being limited by the area which in the opinion of the Secretary of the Interior will be sufficient for the support of a family. This averages about 40 acres. In some cases it is as small as 10 acres.

The public lands thus reclaimed are given away on condition that they are cultivated and actual residence established and maintained during five years. The estimated cost of bringing the water to the land, including the construction of the reservoirs and all administrative and relative charges, must be repaid by the homesteaders or by those purchasing private lands to which the water may be brought. The payment is made in annual instalments not exceeding ten; for example, if the cost of storing and bringing the water to the land has averaged $30 per acre, the homestead entryman or purchaser of the land is required to pay $3 per acre per annum for ten years. The amount thus received goes immediately into the Reclamation Fund and can be expended at once without further act of appropriation. Thus the Reclamation Fund is what has been termed a revolving one, being continually returned. At the same time it is being increased in amount by the additions from the disposal of other lands not taken up under the terms of the Homestead Act.

The works are widely distributed and have been built in each of the western states, from the Rocky Mountain region to the Pacific Coast. These states in alphabetic order, are: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota Utah, Washington, and Wyoming. The irrigated land will extend into the state of Texas from works built into New Mexico and experimental construction has been undertaken in Oklahoma.

The works already completed or nearing completion furnish water for a little over one million acres and when finished the projects now in hand will supply nearly three times this area. The number of farms irrigated is, in round numbers, 14,000. There are now being operated nearly 5,000 miles of canal and the value of crops obtained from lands thus being served with water was over $13,000,000 in 1911. It is estimated that a population of very nearly 70,000 persons, exclusive of those in the cities and towns, is now dependent upon these works.

The act of Congress as originally passed was very broad in its provisions, and simply indicated the results to be attained. In the ten years which have elapsed since the passage of this act, a vast amount of executive detail has been developed, additional legislation upon minor matters added, and an organization built up competent to handle the widely scattered work. The wisdom of the act has been demonstrated by the success attained and the optimistic predictions of the framers of the act have been amply verified.

The work in many respects has been pioneer in character. The country in which the projects are constructed is sparsely settled, the structures themselves frequently remote from railways or other lines of communication, and it has been necessary for the employees of the Government to enter into many details which appear at first sight to be quite foreign to the object of the law. Thus it results that the operations being distant from the railways in some cases, it has been necessary to build these and as it was impossible to deny to the scanty population the conveniences of these railroads, it has been necessary to operate them upon a commercial basis.

One of the principal items for construction is Portland cement. In the case of the Roosevelt dam in Arizona, this was so far away from railroads, and conditions were such that it was found desirable for the Government to build and operate its own cement plant. Incidental to much of its work it has been necessary to operate commissaries, boarding houses, mercantile stores, hospitals, and enter into an infinite variety of matters which would not be necessary in an older country. It has been necessary to bring together hundreds of workmen and subsist them and their families in remote places, and thus has resulted the development of many enterprises carried on by the Government, which would not be necessary excepting under pioneer conditions.

From the standpoint of the chemical engineer, the most interesting of these operations are possibly those which relate to the development of water power in connection with the conservation of waters for use on the dry land and the employment of this power coincident with its use in irrigation. The storage of flood waters in the mountain valleys makes it practicable to control the flow of certain streams through a great part of the year, and the water in passing from the point of storage to that of use descends in many localities at such rapid rate as to furnish facilities for water power development.

In earlier decades water powers were used to a considerable extent at factories distributed throughout the mountain country. Later the inconvenience of going to the water power resulted in steam largely displacing it as the most important agency in manufactory. Then came the development of electrical transmission by which the water power could be brought to centers of population, and again water power came into prominence in industrial affairs. But one of the conditions of success with hydro-electric power is that of continuity of service day by day without intermission throughout the year. In the case of water stored for use in irrigation, the maximum demand comes during the hot period of summer or during winter. In the season when crops are not growing the water is not needed and should be stored. Thus we have an excess of water for power during the summer or crop season and little or no water available for power during the remaining months.

Under these conditions of summer supply only the water power obtained from works built for irrigation has relatively little value, especially in the ordinary uses of lighting, transportation, etc. But there have been found to be certain chemical industries where the time element is not very important. Thus it results that much of the water power which would otherwise be unavailable can be utilized for chemical manufacturing in connection with, but secondary to, the demands for irrigation.

One of the industries which it is hoped may be developed is that of the making of fertilizers by fixing the nitrogen of the air by means of the electric current developed from the waters stored for irrigation and released during the crop season. In all irrigated countries there is a great need for fertilizers. There is a popular fallacy that irrigation water brings all that is needed for the growing plant, but this is not true. Under intensive cultivation such as is possible by irrigation, there is great need for fertilizers. Very few, if any, of the natural waters, even though carrying considerable sediment, supply the nitrogenous matter needed by the crops.

In a less direct manner the operations of the Reclamation Act have interest to the manufacturing chemists of the country, in that through the conservation and use of the waste waters employed in the cultivation of the waste ground, there is developed a market or necessity for all of the articles which enter into the operations of daily life. The putting into the waste places of the country of a dense population of prosperous farmers results in a demand for manufactured products (including those from various applications of chemistry) to a degree unequaled by any other form of development. The soil when properly cultivated in the arid regions, where the sunshine occurs daily throughout the year, has a degree of productivity unknown elsewhere. Where intelligently handled the small farms yield a return which enables the owners to enjoy more than the average share of profit, and hence these farmers are not only producers of raw material, but the best and most reliable consumers of manufactured articles of any class of people.

When it is comprehended that the owners of these small farms would probably have been unable to secure homes in any other way and that the individuals are taken largely from the non-productive class and converted into producers of wealth from the soil, it will be appreciated that the action of the national Government in utilizing its resources in this manner is not only wise in adding to the prosperity, but to a certain degree is one of the best insurances of the continuity of national life. The owner of the small intensively cultivated farm is one of the most progressive of citizens and at the same time conservative so far as those things which affect the stability of the Government and of its institutions.

The operations under the terms of the Reclamation or Newlands Act are committed to the Secretary of the Interior. He has authorized the creation of an organization or bureau known as the Reclamation Service, at the head of which is a Director, reporting to the Secretary and responsible to him for the planning, initiation and conduct of details as authorized by the Secretary, The principal executive officer under the Director is a Chief Engineer, who in turn has 6 supervising engineers located at convenient points in the west, each supervising engineer being the local representative of the organization. The Director and Chief Engineer alternate in the Washington office and in the field, dividing or sharing the duties of the field and office work, the Director giving principal attention to the larger administrative matters and the Chief Engineer to the more purely technical details.

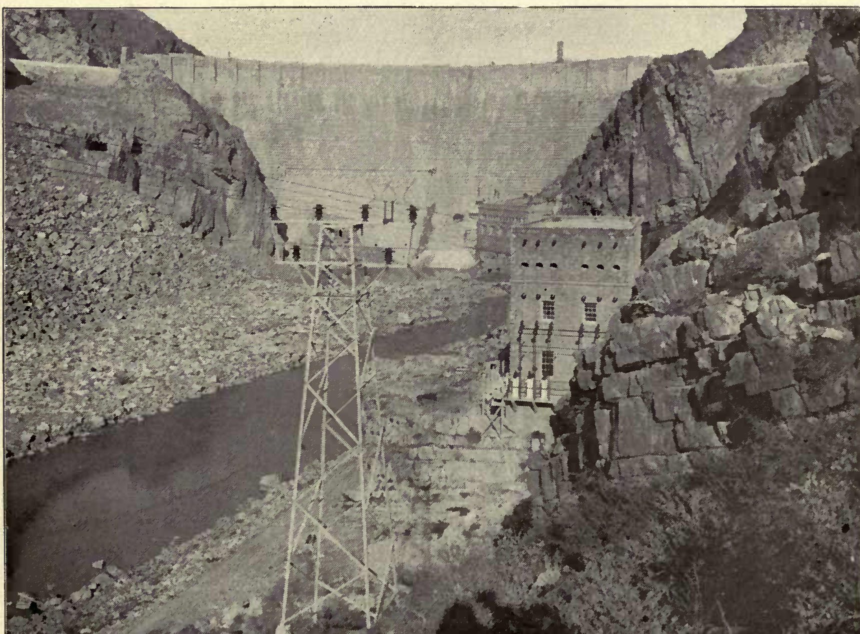
Each supervising engineer has charge of a number of projects located usually in different states. These projects cover considerable areas, being sometimes from 50 to 100 miles in length, and the project engineer or manager must spend his time largely in moving about over the project. Each separate feature is under the direction of a resident engineer or superintendent, who reports to the project manager. For example, during construction the project engineer has general charge, and if a large storage dam is being built perhaps 50 or 100 miles away, there is a resident engineer on the ground in immediate charge and another engaged in the building of the diversion dam, distributing canals, etc.

Each of these resident or constructing engineers and superintendents of construction has one or more engineering and technical assistants and each project is provided with a chief clerk, who supervises the bookkeeping, costkeeping and all the details of records and correspondence.

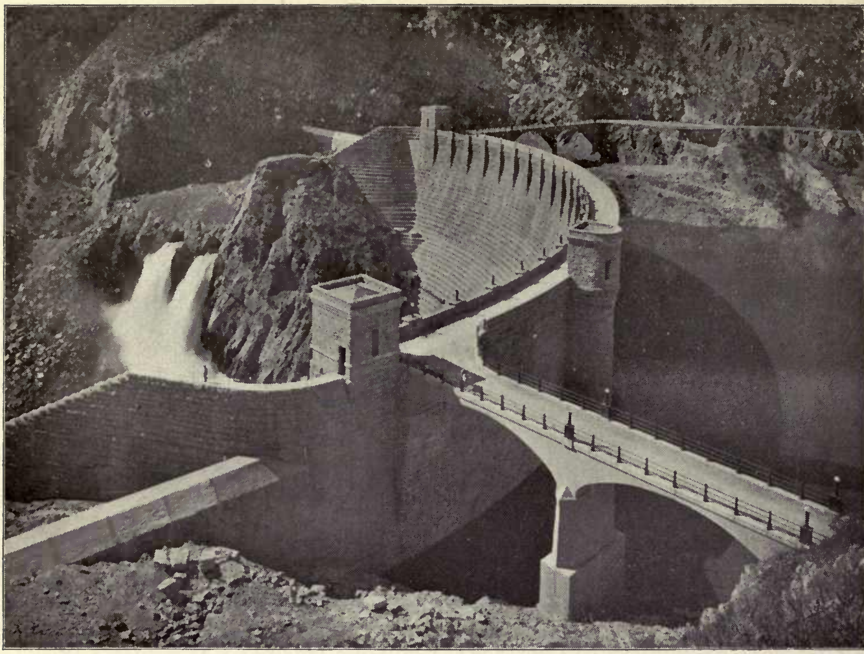
The Reclamation Service as a whole embraces about 1,500 persons appointed after competitive Civil Service examination, and employs from 5,000 to 7,000 laborers, the number varying from day to day according to the work in hand. Much of the work is done by contract, especially by a series of small contracts in which the work is divided up into items of such size and character as to be readily described and bid upon by experienced men. That is to say, instead of attempting to let a large amount of work in a single contract and to throw upon a single contractor the responsibility of many ramifying details, it has been found far more economical to subdivide the work, the Reclamation Service occupying the position itself of the principal contractor and apportioning the operations to what would otherwise be subcontractors. For example, in building distributing systems involving many miles of canal, these are subdivided into portions of a mile or two and over in length, so that the farmers may bid upon as much or little as desired and may thus earn the money needed to establish themselves on the land and pay to the Government the cost of water delivered to their farms.

In the construction of tunnels for conveying water and in the building of dams where the foundations are far beneath the surface, it has been found more economical and effective to do the work by Government forces than to endeavor to let it by contract. The risks involved are so great that the contractor must either bid in such a way as to afford him a large margin to cover contingencies, or if he bids too close and his bid is accepted,

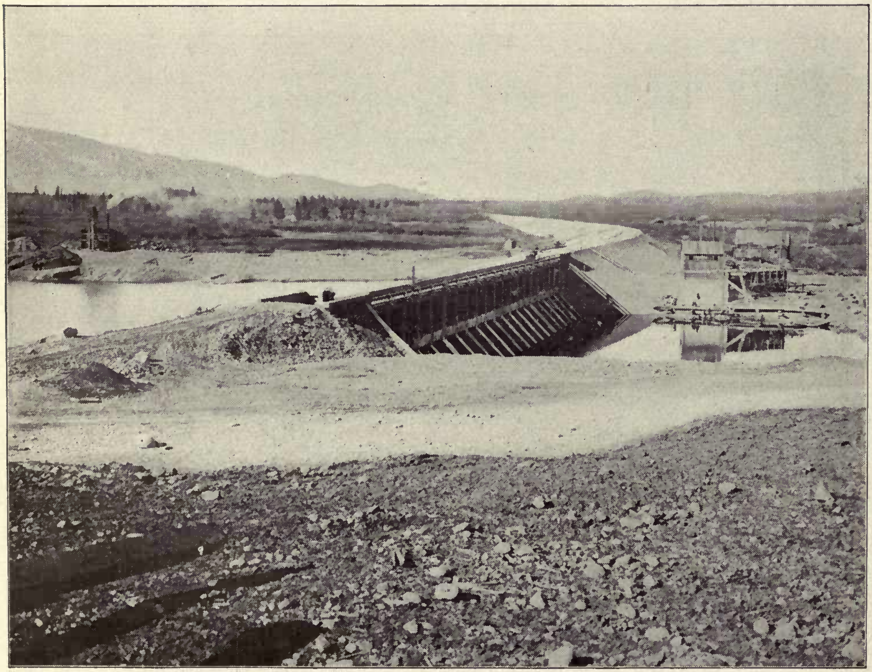
Pl. IA. Cement mill in foreground, contractor's camp in rear near Roosevelt dam site, Arizona.



Pl. IB. Power plant utilizing stored water for generation of power at times when it is turned out of the reservoir for irrigation purposes.

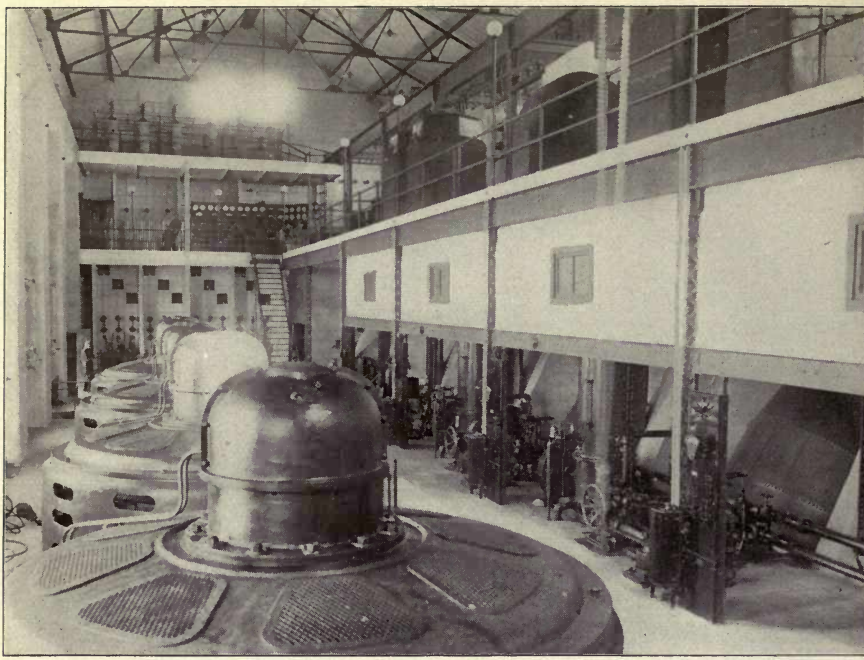


Pl. IIA. Roosevelt dam, Arizona, view from above showing stored flood waters.

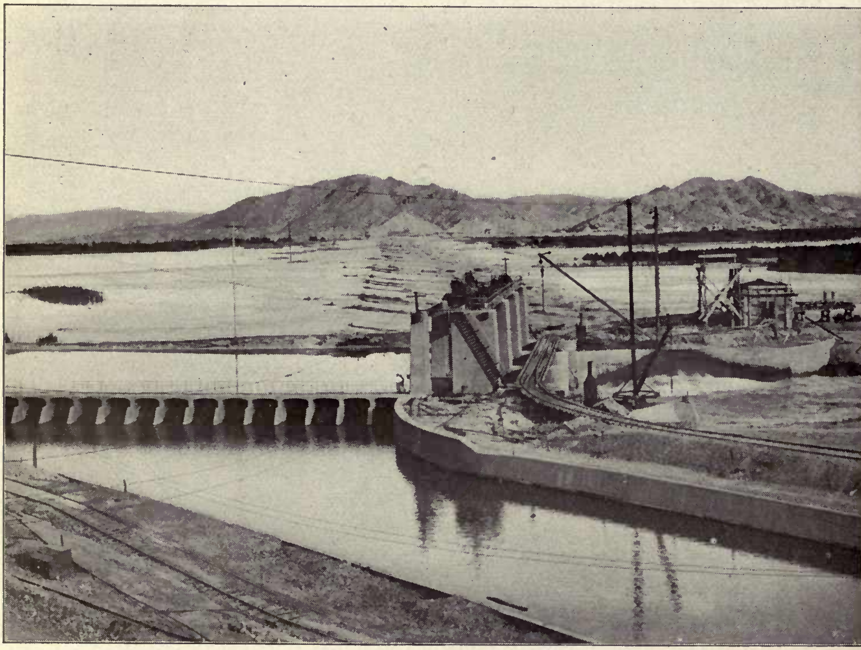


Pl. IIB. Jackson Lake dam at head of Snake River in Wyoming holding waste waters for use on desert lands in Southern Idaho.

Pl. VIII. Shoshone dam, (highest in the world, 327 feet high) on Shoshone River east of Yellowstone Park, Wyo., for holding flood waters.

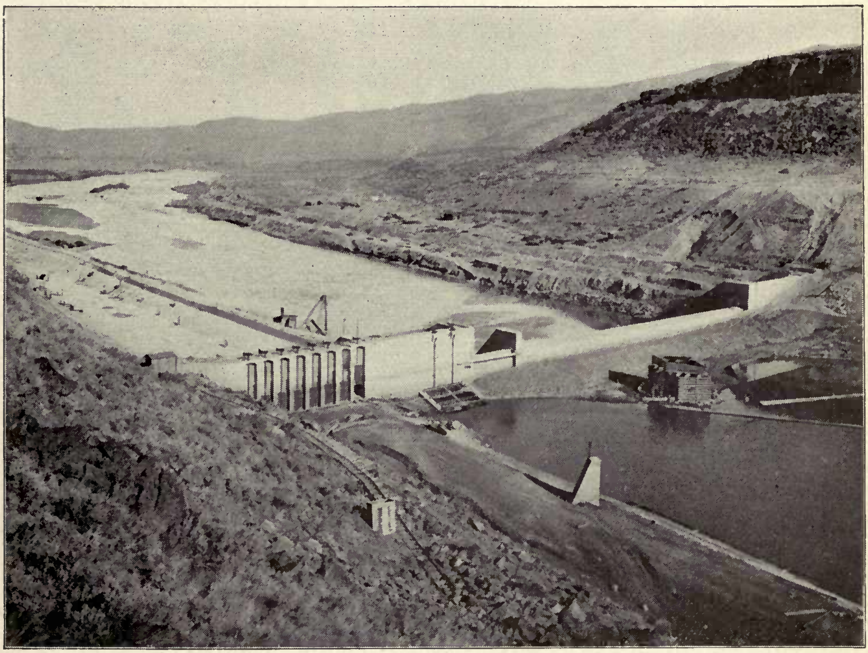


Pl. IIIA. Interior of power plant at Minidoka, Idaho, operated by waters controlled by irrigation works built for Minidoka project.

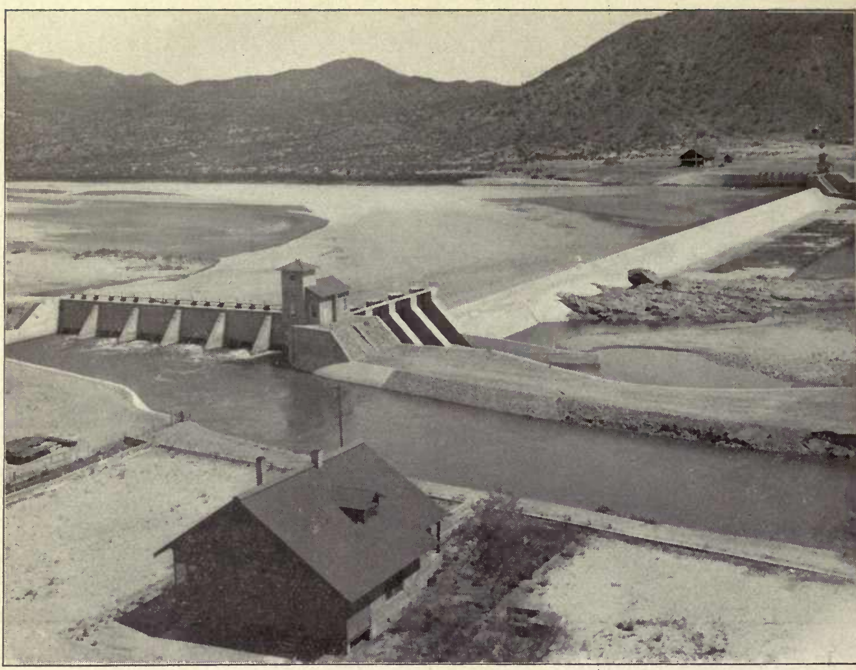


Pl. IIIB. Laguna dam on Colorado River looking from the California side easterly to the Arizona shore, dam is 4,000 feet long. In foreground is skimming device for taking out the less muddy waters.

Pl. IVA. Drops on South Canal, Uncompahgre project, Colo., taking otherwise useless Gunnison River waters to Uncompahgre Valley; method of dropping these waters to the Valley.



Pl. IVB. Dam on Boise River to divert flood waters into the storage reservoir. View at time when large canal is being lined with concrete and low water flow of the river



Pl. VA. Diverting dam on Salt River, Ariz., showing in foreground the head of the northside canal and on opposite bank the corresponding heading of south canal.

Pl. VB. Methods of distributing irrigation water to the desert lands.

Pl. VIA. Distributing canal and structures on North Platte project, Nebraska.

Pl. VIB. Stack of alfalfa grown upon land otherwise worthless, excepting for the use of waters conserved and distributed by the Government system.

the losses usually force him into bankruptcy with corresponding delay to the work and increase of ultimate cost to the Government. The confusion and litigation which has resulted from the failing contractors on pioneer work of this kind more than overbalances any possible saving by letting such work by contract.

In the ten years which have elapsed since the passage of the Reclamation Act, the organization of the Reclamation Service has been developed, many notable structures built and large experience gained in operations of this character. The work has been conducted with a high degree of economy and continual efforts have been and are being made to improve in every possible detail. As a result of the character of construction initiated by the Reclamation Service all companies or associations entering upon reclamation by private capital have been induced or forced by public opinion to adopt similar methods of construction and to substitute instead of temporary works of wood the more permanent structures of concrete and iron. The development of the country has been greatly stimulated and altho the Reclamation Service has not reclaimed and will not irrigate more than a portion of the irrigable area, yet the results attained by it have greatly encouraged and stimulated private and corporate efforts and served as a standard for them.

It may be said that the larger problems of organization and construction have been solved, altho continual improvements are being made. The most difficult period of the work, however, is now being entered upon, namely that of operation and maintenance of the completed works and especially of the dealings with the thousands of farmers and collection from them of the cost of the work.

While construction is under way and money is being spent by the Government, there is little criticism but when the time arrives that these expenditures must be recovered in small payments from the farmers, then arises a critical attitude and an attempt to ascertain whether it is not possible to avoid repaying to "rich Uncle Sam" the investments made on behalf of the hard-working farmers! This is perfectly natural because the public has been educated by gifts of seeds and beautifully illustrated publications to the belief that the generosity of Uncle

Sam is unbounded and that there is no limit to the expenditures that he may make.

In the case of the reclamation fund, however, there is a very definite limit. Any concession granted to one man or set of men in the nature of delay in repaying the expenditure means the depriving of another man or set of men of a corresponding benefit. It is this condition which is depended upon to bring about a true appreciation of the opportunities afforded by the Reclamation Act and a safeguard of the Reclamation fund, namely the needs of the man who has not yet obtained adequate water supply may be depended upon to force the man who has already obtained water to make payment for the benefits received.

The cost of water provided by the works built by the Government may be said to range in general from $30 to $40 per acre. In some cases it has been as low as $22 per acre, and in others as high as $93 per acre. Without the water the land is practically valueless. With an assured supply the land when properly cultivated will pay a good return on an investment of from one hundred to several hundred dollars per acre. The addition of the water allows the owner of the land practically to capitalize the sunshine, and altho the soil may not be of the best, yet with sunshine and water at the right time extraordinary crops may be produced, especially in the warmer parts of the arid region. Even in the northerly latitudes the crop production of forage is large enough to repay an investment of upwards of $50 per acre in obtaining water.

From the figures above given it might be assumed, and has been, that operations of this kind would afford wonderful opportunities for investment of private capital. There are, however, certain conditions which are not generally understood and have resulted in the past in depriving investors of the return of the money used in building irrigation works. The economic conditions have usually not been carefully studied in advance; generally the estimated cost of the completed system has been too small. While the engineers may have figured with considerable accuracy on certain structures, it has been found that the building of these necessary structures is only the beginning of the expenditure. The cost of promotion and of administration has frequently equaled that of engineering and construction proper; on top of this has usually been a lack of knowledge of water supply and of other conditions which have rendered many private enterprises unprofitable. The most difficult condition, however, has been that arising from the unforeseen delays and the impossibility of collecting promptly from the farmers the cost of the water. It has usually required years for them to subdue the soil and put it into highly productive condition. As a rule they have neglected to properly level and prepare it and the average crop production per acre has been ridiculously small at first as compared with the possibilities of the case.

On every irrigated area there are usually to be found a number of persons who with skill and care have produced very large returns per acre, illustrating what might be done by their neighbors if all would exercise the same energy and follow the same methods. But the majority of the new comers do not do this at once and it requires many years of trial and the gradual elimination of the incompetent before the farmers, coming from all parts of the world, have acquired through individual experience the knowledge which enables them to produce highly profitable crops. Meantime the investors in these private works have been compelled to continue to operate and maintain them at large cost and have as a rule been unable to pay interest on their bonds, and have finally gone into bankruptcy during the time in which the farmers have learned how to irrigate successfully.

In the case of the work of the Government these delays, while injurious, are not as destructive as to private investors because the Government is not immediately dependent upon getting its money back or making large payments on interest on bonds. For this reason it is able to undertake and to carry through to successful completion enterprises which from their magnitude or intricacy would not be profitable to private capital.

The most serious of the complications which beset all enterprises of this kind are those which arise from the imperfections of the laws relating to the control of the waters in the streams. The distribution of these is under State authority and very few of the arid or semi-arid States have laws which are adequate to the conditions, most of the laws were patterned originally upon the common law practice of the humid states; the so-called "riparian rights," still lingering in portions of the arid West, practically forbid irrigation development. Even where the states have adopted the doctrine or theory of appropriation the practice has been so imperfect that the waters of most streams have been over appropriated to an extent many times that of the flood flow. The result is that in some of the states development is not only retarded but it has been ascertained that in some localities the amount spent in litigation exceeds that utilized in irrigation.

In the works built by the Government these matters of water rights are determined in advance of construction and on the basis of carefully conducted observations of river flow. Thus while it has been impracticable for private capital to delay to ascertain what are the conditions, it has usually been possible for the Government to select those localities where it is known that water is available and has not already been appropriated by others. For this reason the water rights obtained from the Government can be depended upon to actually yield water, while those purchased from private corporations have often been open to doubt.

Summing up the conditions, it may be said that the work of the Government in the conservation of waters and the use of these has not only stimulated private enterprise but has forced it to a high degree of attainment and has furnished a standard for construction and for adequacy of supply such as to materially improve the general conditions. It has used its resources in undertaking projects which otherwise could not have been handled, and in so doing has added materially to the wealth and prosperity of the nation and particularly of the sparsely settled states, not enriching any one small group of men, but enabling men of relatively small means to acquire homes and affording them an opportunity to become land owning citizens.

MAP NO. 13106 UNITED STATES RECLAMATION SERVICE JULY 1911

PRINCIPAL IRRIGATION PROJECTS
IN THE WESTERN UNITED STATES

THE RELATION OF THE CHEMICAL INDUSTRY TO THE ANNUAL FIRE LOSS OF THE UNITED STATES

J. Albert Robinson

Boston, Massachusetts

The people of the United States as a whole, born and bred as they have been in a country of apparently boundless natural resources, have failed to grasp the economic significance of the annual fire waste which is now giving deep concern to the few who are making careful studies and investigations of what is now recognized to be an unnecessary National affliction. Those who are born to great wealth and who accept such an environment without original thought do not usually realize the sources from which such wealth is drawn until a curtailment of the supply precipitates an investigation. The thought to which the American mind has long been a victim, namely, that our natural resources were unlimited, has resulted in the disregard of our created resources as well.

The destruction of our utilized resources by fire is increasing at such a rapid rate that the subject of its reduction must be deeply considered by every thinking man in the country. After a resume of the magnitude of this annual ash heap, should not every technical and manufacturing chemist here assembled, ask himself to what extent he has been a contributor to this profligate burning every year? And he should review the work that he has done to prevent this crime that means the inevitable impoverishment of the nation with a consequent demoralization perhaps in the particular industry with which he is identified. Perhaps the perspective of time and experience will make it clear that he has not done all that he might or all that he should.

The enormity of the following facts should sink deeply into the minds of every thinking person in the country. Losses recorded for the thirty-five years previous to 1907, not including forest, mine or marine fires, total the enormous sum of $4,906,619,240. Unrecorded losses, if obtainable, would materially increase these figures. These annual fire losses run from $64,000,000 in 1876 to $518,000,000 in 1906. In 1907, a normal year, our recorded losses were $215,084,709, and our estimated fire defense cost $241,401,191, or a total amount equalizing about fifty percent of the value of the new buildings erected that year in the entire country. In 1908, also a normal year, our ash heap cost $217,-885,850 and the relations of defense cost and fire loss to new buildings remained about the same. Our contributions to fire that year were over 1¼ million dollars each day of the year, a sum equal to the operating expenses of our government including those of our army and navy, for the same year; and in 1909 we gave to fire over $25,000,000 more than was spent in that year for the same governmental functions.

According to the statistics of the Interior Department of the U. S. Government for the year 1910, the fire loss in the United States was more than $234,000,000. And in addition to the loss of this property these same statistics show that 1449 lives were sacrificed by fire and 5654 people were injured through this same agency. This tremendous drain upon the financial resources of this country, as indicated by these statistics, does not include any of the cost borne by the cities and villages, manufacturers and corporations throughout the country for the maintenance of the equipment to fight fire.

The loss for 1911 was also over $234,000,000. While there is no authentic record of all the outbreaks of fire in this country, it is generally known that the figures, if they could be presented, would serve as a monument to the carelessness of the nation. A carefully compiled record of the fires credited with causing a property loss of $10,000 or over in each instance shows that there were no less than 3410 such fires during 1911. This compares with 3225 fires in 1910.

An analysis and comparison of the reports of the Committee on Statistics of the National Board of Fire Underwriters for the years 1910 and 1911 show that the per capita loss for all the cities of 20,000 population and over in the United States was $2.39

in 1910 and $2.62 in 1911. A comparison with the per capita losses of foreign countries is most striking. Without going into the details of the number of cities and their population, which entered into this study, the average per capita losses for certain foreign countries were as follows:—England, 53 cents, Ireland 58 cents, Scotland 56 cents, France 81 cents, Germany 21 cents, Italy 31 cents, Russia $1.17. The statistics on which this data was based was doubtless sufficiently broad to be a fair indication of the rates of burning in the countries as a whole, and the average per capita loss for all of these foreign countries, as enumerated was sixty cents.

Many people, and even manufacturers and corporation managers, fail to give heed to the full significance of the facts and figures that have been quoted at length, owing to the prevalence of the foolish notion that the insurance companies pay this collossal tax. But how could they, and remain solvent? They are mere collectors and distributors of that portion of this tax which is represented by their policies. And although a factory and its contents may be fully covered by insurance, its owner cannot protect himself in event of fire against failure to complete orders of contracts; loss in the efficiency of his organization, (since skilled operators will accept positions with rival concerns during a shut-down of the burned-out plant); and loss of trade because no new business can be contracted until rebuilding is started.

Having considered broadly the fire loss of this country as a whole, it now becomes of especial interest to consider in more detail the relation of the chemical industry to the annual fire loss of the United States.

An analysis has been made of the losses from fire which occurred in thirty classes of techincal chemical and allied industries, during a period of ten years beginning January 1st, 1893 and ending December 31st, 1902. The figures used in this study were obtained from the carefully compiled annual records of The Chronicle Company which ceased publication of the Chronicle Fire Tables with the annual volume covering the statistics for the year 1902, and represent the most comprehensive and accurate figures of this kind that can be obtained.

List of the Thirty Branches of the Technical Chemical Industry Considered in the Statistical Study which Follows

1. Asphalt Works.
2. Bone, Ivory and Lampblack Factories.
3. Breweries.
4. Brick and Tile Works.
5. Cement, Lime and Whiting Works.
6. Charcoal and Coke Works.
7. Distilleries.
8. Drug and Chemical Works.
9. Fertilizer and Phosphate Works.
10. Gas Works.
11. Glass Works.
12. Glue Factories.
13. Hop Houses.
14. Lard, Tallow and Grease Melting Works and Refineries.
15. Malt Houses.
16. Oil Mills, Cotton Seed.
17. Oil—Miscellaneous Stills and Refineries.
18. Oil Tanks.
19. Paper and Pulp Mills.
20. Patent Medicine Factories.
21. Pottery Works.
22. Powder Mills.
23. Rubber Works. (Vulcanized Goods, etc.)
24. Soap and Candle Factories.
25. Starch Factories.
26. Sugar Refineries.
27. Sugar and Syrup Works.
28. Tanneries.
29. Tar, Pitch, Resin and Turpentine Factories.
30. White lead, Paint and Varnish Factories.

The following table shows the actual number of fires each year during this ten-year period, the total losses each year and the average loss per fire for each year in the thirty industries grouped together.

NO. OF FIRES AND LOSSES PER YEAR

Year	No. of Fires	Total Loss	Average Loss Per Fire
1893	497	$7,034,003	$16,165
1894	455	5,320,478	11,693
1895	527	6,176,064	11,719
1896	604	5,165,501	8,552
1897	580	5,801,530	10,003
1898	745	8,108,435	10,884
1899	781	5,342,620	6,841
1900	862	8,923,105	10,352
1901	820	8,749,865	10,671
1902	860	8,841,715	10,281

The following tables show in detail the number of fires, the losses, and the average loss per fire for each year of the decade, experienced by each of the thirty branches of the technical chemical industry which have been enumerated. They also show the total number of fires and total losses for the ten-year period and the average loss per fire determined from these totals.

While it is perfectly obvious that it is utterly impossible to gather together figures such as are contained herein with any absolute degree of accuracy, it does not necessarily follow that such a study will not have much of interest and even of considerable actual value. The general economic trend of the great fire waste in the chemical industry as a whole, and the broad relations between its branches, as regards the relative losses, number of fires, average losses, etc., cannot fail to show the chemical manufacturer that he had better look to his own fences if he wishes to keep in the vanguard of the march of progress.

The total loss figures, as given, are undoubtedly under estimates rather than over estimates, and the total losses today are unquestionably greater than in the decade during which the losses have been reported. This assumption is based on the fact that the aggregate average fire loss of the country is increasing steadily year by year, irrespective of the occasional great conflagration which may swell the loss figures for some individual year. Also the increase in the number and size of the various industries would suggest a normal relative increase in fire losses.

The total number of fires, as reported for each year and under each branch of the industry, is undoubtedly low, and the corresponding average losses per fire are probably high, but the general relations, as determined from the figures, are thought to express the actual facts fairly well.

There were probably many fires which occurred in plants equipped with automatic sprinklers where a small loss resulted that were never reported, but many of the industries, especially at the period represented by these figures, had no automatic protection and perhaps very little fire protection of any kind. Since this period, however, the automatic sprinkler has come into more general use in a number of the industries enumerated. While the aggregate losses, due to reasons previously mentioned, are undoubtedly greater today than ever, the average losses per fire are probably smaller than those given in the following tables.

There were 6771 fires included in this period which occurred in these thirty industries with an aggregate total loss of $70,584,-111. The general average loss per fire for these industries was $10,424. The general average yearly rate of fires was 667 with a general average yearly loss of $7,058,411.

ASPHALT WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	17	$72,055	$4,328
1901	25	156,170	6,247
1900	13	22,245	942
1899	20	50,030	2,501
1898	10	7,900	790
1897	5	3,455	691
1896	3	25,700	8,567
1895	8	31,225	3,903
1894	9	28,880	3,209
1893	9	5,283	587
Totals	119	$402,943	$3,386

BONE, IVORY AND LAMPBLACK FACTORIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	2	$125	$63
1901	5	12,020	2,404
1900	4	7,100	1,775
1899	3	1,625	541
1898	1	250	250
1897	2	3,300	1,650
1896	4	4,250	1,063
1895	3	6,100	2,034
1894	3	24,600	8,200
1893	4	7,210	1,803
Totals	31	$66,580	$2,148

BREWERIES

Year	No. of Fires	Loss	Average L9ss Per Fire
1902	57	$817,590	$14,344
1901	48	413,435	8,613
1900	51	326,625	6,404
1899	58	323,260	5,573
1898	55	555,555	10,101
1897	46	573,070	12,458
1896	57	479,555	8,413
1895	52	534,514	10,279
1894	45	435,401	9,675
1893	44	517,334	11,758
Totals	513	$4,976,339	$9,700

BRICK AND TILE WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	92	$719,895	$7,825
1901	80	493,070	6,163
1900	66	471,960	6,651
1899	71	279,430	3,936
1898	78	278,635	3,572
1897	46	246,845	5,366
1896	51	304,885	5,978
1895	53	703,565	13,275
1894	56	343,145	6,128
1893	66	837,121	12,684
Totals	659	$4,678,551	$7,100

CEMENT, LIME AND WHITING WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	28	$155,775	$5,564
1901	25	305,180	12,207
1900	39	637,450	16,345
1899	26	379,050	14,579
1898	37	324,255	8,764
1897	24	300,505	12,521
1896	19	89,865	4,730
1895	12	58,621	4,885
1894	12	97,050	8,088
1893	15	282,040	18,803
Totals	237	$2,629,791	$11,096

CHARCOAL AND COKE WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	5	$30,820	$6,164
1901	8	13,960	1,745
1900	2	40	20
1899	2	425	213
1898	5	47,500	9,500
1897	5	2,275	455
1896	1	15,000	15,000
1895	3	4,020	1,340
1894	3	5,650	1,883
1893	2	11,000	5,500
Totals	36	$130,690	$3,630

DISTILLERIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	28	$119,095	4,253
1901	22	60,415	2,746
1900	18	74,420	4,134
1899	26	125,905	4,843
1898	28	334,475	11,945
1897	17	64,775	3,810
1896	19	186,675	9,825
1895	14	252,607	18,043
1894	12	90,500	7,542
1893	24	657,164	28,215
Totals	208	$1,966,031	9,452

DRUG AND CHEMICAL WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	60	$650,455	10,841
1901	65	705,885	10,860
1900	75	582,260	7,764
1899	72	353,355	4,908
1898	53	434,065	8,190
1897	36	118,605	3,295
1896	51	280,235	5,495
1895	34	259,280	7,626
1894	24	217,979	9,082
1893	22	328,103	14,914
Totals	492	$3,930,222	7,968

FERTILIZER AND PHOSPHATE WORKS

Year	No. of Fires	Loss	Average Loss per Fire
1902	23	$590.950	25,693
1901	26	320,585	12,330
1900	25	360,335	14,413
1899	29	284,620	9,814
1898	13	603,410	46,416
1897	21	579,340	27,588
1896	22	369,055	16,775
1895	10	278,125	27,813
1894	16	429,172	26,823
1893	20	433,024	21,651
Totals	205	$4,248,616	20,725

GAS WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	47	$76,565	1,629
1901	32	53,435	1,670
1900	54	65,365	1,210
1899	55	36,880	670
1898	42	124,890	2,974
1897	32	60,075	1,877
1896	24	134,475	5,603
1895	17	79,725	4,690
1894	19	42,227	2,222
1893	28	77,906	2,782
Totals	350	$751,543	2,147

GLASS WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	50	$439,840	8,797
1901	43	500,750	11,645
1900	61	359,805	5,900
1899	34	356,285	10,479
1898	33	894,315	27,100
1897	21	291,075	13,861
1896	15	364,560	24,304
1895	22	553,800	25,173
1894	15	408,250	27,216
1893	25	604,275	24,171
Totals	319	$4,772,955	14,962

GLUE FACTORIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	11	$136,005	12,364
1901	7	86,360	12,337
1900	3	975	325
1899	5	75,295	15,059
1898	5	142,325	28,465
1897	1	20	20
1896	4	202,025	50,506
1895	1	36,100	36,100
1894	1	24,000	24,000
1893	1	2,000	2,000
Totals	39	$705,105	18,079

HOP HOUSES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	8	$18,405	2,300
1901	8	19,075	238
1900	24	38,100	1,588
1899	29	50,200	1,731
1898	19	39,575	2,083
1897	19	34,100	1,795
1896	23	32,450	1,411
1895	29	43,750	1,509
1894	24	56,650	2,360
1893	14	29,000	2,071
Totals	197	$361,300	1,834

LARD, TALLOW AND GREASE MELTING WORKS AND REFINERIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	8	$277,595	34,699
1901	14	74,230	5,302
1900	15	267,920	17,861
1899	12	13,150	1,096
1898	8	35,575	4,872
1897	6	1,675	279
1896	11	10,625	966
1895	2	11,000	5,500
1894	3	11,000	3,667
1893	8	49,913	6,239
Totals	87	$752,683	8,652

MALT HOUSES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	17	$499,450	29,379
1901	7	43,085	6,155
1900	9	102,240	11,360
1899	6	119,240	19,873
1898	7	324,555	46,365
1897	19	219,175	11,536
1896	8	178,991	22,374
1895	9	354,123	39,347
1894	20	222,227	11,111
1893	8	254,099	31,762
Totals	110	$2,317,185	21,065

OIL MILLS, COTTON SEED

Year	No. of Fires	Loss	Average Loss Per Fire
1902	10	$243,600	24,360
1901	22	374,855	17,069
1900	12	670,165	55,847
1899	8	133,795	16,724
1898	11	189,800	17,255
1897	7	110,375	15,768
1896	6	245,850	40,975
1895	3	204,000	68,000
1894	3	315,050	105,017
1893	1	500	500
Totals	83	$2,487,990	29,976

OIL—MISCELLANEOUS STILLS AND REFINERIES

(Not including Cotton Seed, Linseed and Lubricating Oils)

Year	No. of Fires	Loss	Average Loss Per Fire
1902	70	$421,415	6,020
1901	43	771,270	17,937
1900	24	138,345	5,723
1899	31	147,035	4,743
1898	28	198,065	7,074
1897	38	190,260	5,007
1896	33	300,400	9,043
1895	21	253,355	12,065
1894	17	96,388	5,670
1893	26	467,694	17,988
Totals	331	$2,984,227	9,016

OIL TANKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	48	$186,955	3,895
1901	50	240,135	4,803
1900	102	2,108,630	20,673
1899	48	139,255	2,901
1898	66	351,160	5,321
1897	41	168,155	4,101
1896	55	112,500	2,045
1895	33	103,250	3,129
1894	15	149,025	9,935
1893	14	76,100	5,436
Totals	472	$3,635,165	7,702

PAPER AND PULP MILLS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	73	$639,225	8,620
1901	70	1,752,275	25,033
1900	62	1,128,670	18,204
1899	44	403,015	9,159
1898	42	708,700	16,874
1897	35	895,150	25,576
1896	32	178,410	5,575
1895	37	649,136	17,544
1894	38	612,340	16,114
1893	45	878,529	19,523
Totals	478	$7,845,450	16,413

PATENT MEDICINE FACTORIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	6	$9,150	1,525
1901	14	34,930	2,495
1900	10	155,475	15,548
1899	14	58,620	4,187
1898	7	22,580	3.226
1897	13	53,850	4,142
1896	11	46,480	4,225
1895	7	26,605	3,801
1894	9	22,201	2,467
1893	8	31,074	3,884
Totals	99	$460,965	4,656

POTTERY WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	29	$578,350	19,943
1901	22	401,905	18,268
1900	19	236,500	12,447
1899	16	74,630	4,664
1898	20	82,030	41,015
1897	16	202,165	12,635
1896	7	307,500	43,929
1895	18	263,165	14,620
1894	12	178,800	14,900
1893	15	227,375	15,158
Totals	174	$2,652,420	15,244

POWDER MILLS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	21	$120,700	5,748
1901	10	44,700	4,470
1900	7	23,800	3,400
1899	7	15,400	2,200
1898	20	77,250	3,863
1897	8	264,100	33,013
1896	14	53,950	3,854
1895	4	8,500	2,125
1894	2	4,000	2,000
1893	4	51,000	12,750
Totals	97	$663,400	6,839

RUBBER WORKS (VULCANIZED GOODS, ETC.)

Year	No. of Fires	Loss	Average Loss Per Fire
1902	10	$36,930	3,693
1901	17	32,125	1,890
1900	14	50,785	3,628
1899	10	42,485	4,249
1898	14	634,485	45,320
1897	14	84,645	6,046
1896	7	45,800	6,543
1895	12	63,175	5,281
1894	8	4,200	525
1893	4	6,085	1,521
Totals	110	$1,000,715	9,097

SOAP AND CANDLE FACTORIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	13	$39,585	3,045
1901	14	30,780	2,199
1900	20	166,310	8,316
1899	26	104,845	4,033
1898	18	376,010	20,889
1897	14	19,040	1,360
1896	19	231,590	12,189
1895	25	209,455	8,378
1894	13	42,475	3,267
1893	20	110,498	5,525
Totals	182	$1,330,588	7,311

STARCH FACTORIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	6	$4,435	739
1901	9	683,560	75,951
1900	3	2,575	858
1899	5	9,700	1,940
1898	7	506,800	72,400
1897	2	36,500	18,250
1896	3	8,700	2,900
1895	6	206,200	34,367
1894	1	700	700
1893	0		
Totals	42	$1,459,170	34,742

SUGAR REFINERIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	2	$50,090	25,045
1901	8	70,350	8,794
1900	1	25	25
1899	3	61,865	20,622
1898	1	55,000	55,000
1897	3	62,500	20,833
1896	2	70,400	35,200
1895	2	63,650	31,825
1894	0		
1893	2	233,166	116,583
Totals	24	$667,046	27,794

SUGAR AND SYRUP WORKS

Year	No. of Fires	Loss	Average Loss Per Fire
1902	36	$206,890	5,747
1901	28	199,905	7,139
1900	18	301,865	16,770
1899	22	156,285	7,104
1898	26	267,025	10,270
1897	11	285,215	25,929
1896	13	244,930	18,841
1895	10	246,900	24,690
1894	10	807,574	80,757
1893	3	51,967	17,322
Totals	177	$2,768,556	15,642

TANNERIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	36	$1,043,700	28,992
1901	43	396,880	9,207
1900	40	1,028,435	25,711
1899	38	1,077,340	28,351
1898	28	369,420	13,193
1897	35	676,015	19,315
1896	41	237,750	5,799
1895	33	454,465	13,772
1894	23	327,750	14,250
1893	32	333,080	10,409
Totals	349	$5,964,835	17,091

TAR, PITCH, RESIN AND TURPENTINE FACTORIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	9	$19,865	2,207
1901	8	5,900	738
1900	19	31,750	1,671
1899	9	24,800	2,755
1898	24	31,500	1,313
1897	11	41,090	3,735
1896	17	16,030	943
1895	17	29,155	1,715
1894	16	16,150	1,009
1893	24	47,850	1,994
Totals	154	$264,090	1,715

WHITE LEAD, PAINT AND VARNISH FACTORIES

Year	No. of Fires	Loss	Average Loss Per Fire
1902	38	$636,205	16,742
1901	47	452,640	9,631
1900	52	562,935	10,826
1899	52	444,800	8,554
1898	39	91,330	2,342
1897	32	214,180	6,693
1896	32	387,665	12,115
1895	30	188,498	6,283
1894	26	307,094	11,811
1893	49	423,613	8,645
Totals	397	$3,708,960	9,342

The following table shows the number of fires experienced during the ten-year period in each of the thirty branches of the technical chemical industry enumerated, in the order of their frequency.

FREQUENCY OF FIRES BY CLASSES

Class	No. of Fires
1. Brick and Tile Works	659
2. Breweries	513
3. Drugs and Chemical Works	492
4. Paper and Pulp Mills	478
5. Oil tanks	472
6. White Lead, Paint and Varnish Factories	397
7. Gas Works	350
8. Tanneries	349
9. Oil Stills and Refineries (Miscellaneous)	331
10. Glass Works	319
11. Cement, Lime and Whiting Works	237
12. Distilleries	208
13. Fertilizer and Phosphate Works	205
14. Hop Houses	197
15. Soap and Candle Factories	182
16. Sugar and Syrup Works	177
17. Pottery Works	174
18. Tar, Pitch, Resin and Turpentine Factories	154
19. Asphalt Works	119
20. Malt Houses	110
21. Rubber Works	110
22. Patent Medicine Factories	99
23. Powder Mills	97
24. Lard, Tallow and Grease Melting Works	87
25. Cotton Seed Oil Mills	83
26. Starch Factories	42
27. Glue Factories	39
28. Charcoal and Coke Works	36
29. Bone, Ivory and Lampblack Factories	31
30. Sugar Refineries	24

The following table shows the total losses during the ten-year period in each of the thirty branches of the technical chemical industry enumerated, in the order of their magnitude.

LOSSES BY CLASSES

Class	Loss
1. Paper and Pulp Mills	$7,845,450
2. Tanneries	5,964,835
3. Breweries	4,976,339
4. Glass Factories	4,772,955
5. Brick and Tile Works	4,678,551
6. Fertilizer and Phosphate Works	4,248,616
7. Drug and Chemical Works	3,930,222
8. White Lead, Paint and Varnish Factories	3,708,960
9. Oil Tanks	3,635,165
10. Oil. Miscellaneous Stills and Refineries	2,984,227
11. Sugar and Syrup Works	2,768,556
12. Pottery Works	2,652,420
13. Cement, Lime and Whiting Works	2,629,791
14. Cotton Seed Oil Mills	2,487,990
15. Malt Houses	2,317,185
16. Distilleries	1,966,031
17. Starch Factories	1,459,170
18. Soap and Candle Factories	1,330,588
19. Rubber Works	1,000,715
20. Lard, Tallow and Grease Melting Works & Refineries	752,683
21. Gas Works	751,543
22. Glue Factories	705,105
23. Sugar Refineries	667,046
24. Powder Mills	663,400
25. Patent Medicine Factories	460,965
26. Asphalt Works	402,943
27. Hop Houses	361,300
28. Tar, Pitch, Resin and Turpentine Factories	264,090
29. Charcoal and Coke Works	130,690
30. Bone, Ivory and Lampblack Factories	66,580

The following table shows the average loss per fire, during the ten-year period, in each of the thirty branches of the technical chemical industry enumerated, in the order of their magnitude.

AVERAGE LOSS PER FIRE BY CLASSES

Class	Average Loss Per Fire
1. Starch Factories	$34,742
2. Cotton Seed Oil Mills	29,976
3. Sugar Refineries	27,794
4. Malt Houses	21,065
5. Fertilizer and Phosphate Works	20,725
6. Glue Factories	18,079
7. Tanneries	17,091
8. Paper and Pulp Mills	16,413
9. Sugar and Syrup Works	15,642
10. Pottery Works	15,244
11. Glass Works	14,962
12. Cement, Lime and Whiting Works	11,096
13. Breweries	9,700
14. Distilleries	9,452
15. White Lead, Paint and Varnish Factories	9,342
16. Rubber Works	9,097
17. Oil. Miscellaneous Stills and Refineries	9,016
18. Lard, Tallow and Grease Melting Works & Refineries	8,652
19. Drug and Chemical Works	7,968
20. Oil Tanks	7,702
21. Soap and Candle Factories	7,311
22. Brick and Tile Works	7,100
23. Powder Mills	6,839
24. Patent Medicine Factories	4,656
25. Charcoal and Coke Works	3,630
26. Asphalt Works	3,386
27. Bone, Ivory and Lampblack Factories	2,148
28. Gas Works	2,147
29. Hop Houses	1,834
30. Tar, Pitch, Resin and Turpentine Factories	1,715

While the foregoing tables have shown the actual losses, number of fires, and average loss per fire in each of the thirty branches of the technical chemical industry, and vividly illustrated the great toll that the chemical industry is paying to the fire fiend, they have not brought out facts in regard to the actual rate of burning in the various industries. They show clearly those classes which are prone to suffer a greater or less degree of loss in the fires which occur, but they do not show which industry would appear to be the most hazardous or suffer the greatest drain on the resources of that particular industry. To get these facts we should make comparisons with the actual number of plants employed in any given branch of the industry and the total values of these plants in these branches. Such comparisons have been made in following tables.

The following table is based upon information gathered during the 12th census of the United States in the reports on manufactures. The values include building, machinery, tools and implements.

NO. OF PLANTS AND VALUATION IN VARIOUS INDUSTRIES

Class	No. of Factories	Total Value	Average Value
Bone, Ivory and Lampblack Factories	15	$542,793	$36,186
Breweries	1509	195,631,283	129,643
Brick and Tile Works	5422	38,345,021	7,072
Drug and Chemical Works	459	39,621,776	86,322
Fertilizer and Phosphate Works	422	16,022,778	37,969
Gas Works	877	435,276,807	496,325
Glass Works	355	31,201,576	87,908
Glue Factories	61	1,580,002	25,900
Malt Houses	146	17,788,931	121,842
Cotton Seed Oil Mills	369	21,200,788	57,455
Paper and Pulp Mills	763	95,791,250	125,545
Rubber Works	262	11,093,119	42,340
Soap and Candle Factories	558	13,169,030	23,600
Starch Factories	124	6,406,813	51,667
Tanneries	1306	35,807,651	27,418
Tar, Pitch, Resin and Turpentine Works	425	1,274,626	3,000

The following table expresses the relation between the average number of fires per year, during the last five years of the ten-year period, in the sixteen branches of the technical chemical industry enumerated, and the number of plants reported in each industry according to the previous table, given in the order of the rate of burning.

RATE OF BURNING

(An average of one fire occurred for the number of factories indicated)

Class	Average No. Fires per Year During Five-Year Period	Total No. of Plants	No. of Plants per Fire
1. Bone, Ivory and Lampblack Factories	3	15	5
2. Drug and Chemical Works	65	459	7
3. Glass Works	44.2	355	8
4. Glue Factories	6.2	61	10
5. Paper and Pulp Mills	58.2	763	13
6. Malt Houses	9.2	146	16
7. Fertilizer and Phosphate Works	23.2	422	18
8. Gas Works	46	877	19
9. Rubber Works	13	262	20
10. Starch Factories	6	124	21
11. Breweries	53.8	1509	28
12. Cotton Seed Oil Mills	12.6	369	29
13. Soap and Candle Factories	18.2	558	30
14. Tar, Pitch, Resin and Turpentine Works	13.8	425	31
15. Tanneries	37	1306	35
16. Brick and Tile Works	77.4	5422	70

The following table expresses the relation between average loss per fire during the last five years of the ten-year period, in the sixteen branches of the technical chemical industry enumerated, and the average value of the plants in each industry, given in the order of the average percentage loss on each per fire.

PERCENTAGE LOSS PER FIRE

Class	Average Loss per Fire During the Five-Year Period	Average Value of Plants	Percentage Loss per Fire
1. Brick and Tile Works	5,796	7,072	82
2. Starch Factories	40,235	51,667	78
3. Tanneries	21,166	27,418	77
4. Tar, Pitch, Resin and Turpentine Works	1,649	3,000	55
5. Glue Factories	14,225	25,900	61
6. Fertilizer and Phosphate Works	18,620	37,969	49
7. Cotton Seed Oil Mills	25,591	57,455	45
8. Soap and Candle Factories	7,885	23,600	33
9. Rubber Works	12,259	42,340	29
10. Glass Works	11,543	87,908	13
11. Paper and Pulp Mills	15,917	125,545	13
12. Malt Houses	23,665	121,842	11
13. Drug and Chemical Works	8,388	86,322	9
14. Breweries	9,057	129,643	7
15. Bone, Ivory and Lampblack Factories	1,408	36,186	4
16. Gas Works	1,553	87,908	Less than 1

Prevention is the keynote of the situation. The tendency of all humanitarian endeavor today is toward prevention of evil. In sociology we no longer rely upon efforts to reform the hardened criminal; we have turned our attention to the child to save him from the ways of crime. In medicine we no longer only drug and physic the sick; we teach the well how to keep from getting sick. The basic idea of modern sanitation also is prevention rather than cure. Although there has been a popular idea that the insurance companies profit by and welcome great fires, as a matter of fact the most marked feature in the insurance field in the last decade has been the growth of the preventive idea, the deliberate attempt of the companies to combat the dangers against which they have insured. It may be that in so doing their motives have not been entirely altruistic—that they realize that profits are made not from high-priced risks but from the so-called "improved risks," risks where losses are extremely unlikely to occur.

But whatever their motives the fact remains that the companies in every branch of the insurance field are doing everything in their power to prevent the casualties insured against. The burglar insurance companies do not seek to shield the thief, nor fidelity companies the defaulter. We find the fidelity companies fighting the race tracks and other sources of temptation, the burglary companies fighting crime, the liability companies fighting accidents, the life companies fighting disease. The fire insurance companies have developed engineering bureaus maintained by specialists in the art of proper construction and protection, and experts capable of solving the problem of safeguarding the common and special fire hazards encountered in all lines of manufacture and business. Help and advice are given freely at all times to those who seek it. A great laboratory is maintained for the purpose of examining and passing upon the integrity of fire prevention apparatus and the regulation and approval of apparatus involving the use of hazardous materials.

It is, therefore, a pertinent question for us to ask,—"What are the manufacturing chemists of the country doing in the way of prevention?" The New York Capitol cost $28,000,000 but it did not contain a water pail, a foot of fire hose, or a fire alarm box. Such short-sightedness is incomprehensible now, although it required a costly fire to reveal the absence of the most rudimentary fire-fighting appliances. How many, many other public buildings, upon which millions have been lavished, are in the same condition? And are any manufacturers taking such a chance?

Innumerable means have been devised from time to time to minimize this chance, involving the use of both automatic and hand-operated devices. It is needless to say that the former are, at the inception of a fire, much the more valuable by reason of the fact that when properly operative they act as soon as the fire has made its presence distinctly manifest. The record of sprinklered risk fires, as shown by the carefully compiled fire records of the National Fire Protection Association, show that in 12180 fires occurring in properties equipped with automatic sprinklers during the past sixteen years, 63.63 percent were practically or entirely extinguished by the operation of the sprinklers.

There were five percent in which the automatic equipment proved unsatisfactory, and in 31.37 percent of the fires the sprinklers held the fire in check. More than three-fourths of the failures were due to the water being shut off, a generally defective equipment and unsprinklered portions, defective water supplies and exposure fires.

Remarkable as is this record of success in controlling fire through the action of automatic sprinklers, it must not be assumed that there is no limitation to their power of accomplishment in fire extinguishment, as a reference to the figures given above will show that something over thirty-one percent of the fires were simply held in check by the sprinklers until other means of fighting the fire could be utilized, and this fact emphasizes the necessity for always being prepared for any untoward condition of automatic equipment, by providing auxiliary means to control the flame when from any cause the sprinklers fail to completely extinguish it, for even with a perfectly satisfactory installation we are often confronted with conditions due to accident or carelessness which, for a time at least, may entirely or partially disable the equipment after it has gone into operation.

From figures compiled by a manufacturer of automatic equipment it was shown that before the more general introduction of automatic sprinklers in factories, the average cost per fire was $7,361, while under automatic sprinkler protection the average cost per fire in 13,476 cases covered by their records, amounted to but $277.26 each.

The fact must not be overlooked, however, that in several kinds of chemical industries the use of automatic sprinklers does not prove practical owing to the nature of construction, corrosive action of fumes and vapors, and damageability of the materials used and their liability to explode. To such plants, earnest thought should be given as to the best methods of protection against fire, and advice should be sought from well qualified fire protection engineers which is freely given by the Underwriters having jurisdiction.

We, however, must strike deeper than fire protection to attain real prevention. Medicine, after the disease has become malignant, can only be palliative. To cure the disease the fundamental causes must be removed. Our great fire losses are due to two fundamental defects—improper construction and neglect of common and special hazards. To these must be added our national trait of endemic carelessness and a tendency to neglect proper housekeeping.

The common errors of construction, such as unprotected floor openings, undivided areas of great magnitude and lack of protection against exposure, are too well recognized today to need further elucidation in this paper, and the factories of the future will more and more be built of fire-resistive construction.

The actual causes of fire, however, are often overlooked and do not receive the attention that they should. As we learn mostly from experience a study of the causes of fires which occur in a given industry offers the best source of information as to preventive measures against their reoccurrence. The various branches of the chemical industry suffer their share from the common causes of fire which are prevalent in all classes of property irrespective of the particular occupancy or industry that may be carried on therein. These common causes of fire are due to heating and lighting systems, transmission of power, boilers and fuel, smoking and matches, locomotive sparks, lightning, oily waste and similar materials liable to spontaneous ignition, sweepings and rubbish, general uncleanliness and poor housekeeping, incendiarism and exposure fires. They are largely due to inexcusable ignorance or criminal carelessness.

The so-called special hazard fires, or fires due directly to the occupation or processes carried on within the premises, should receive the most careful consideration. It is such fires that differentiate one class of industry from another in the eyes of the underwriter so that certain classes are found in his experience to be much more hazardous than others. It is from such fires, therefore, that the manufacturing chemist can well give more thought. Revolutionary changes and improvements in the processes of manufacture have frequently been brought about in the past through an endeavor to improve the fire hazards of that process.

In order to demonstrate the instructive points that may be found in such a study, the following abstracts of fire causes are taken at random from fire reports in the files of the National Fire Protection Association covering fires of a special hazard or process origin in establishments manufacturing pharmaceutical general and heavy chemicals.

1. There were four dry boxes about two feet square and six feet high for drying various pharmaceutical preparations in wooden trays set six inches apart, none of which extended the length of the four boxes. A block supporting the radiator was found tipped over and the pipes came in contact with woodwork. There was a tray at bottom reserved for catching compounds spilled from trays. Fire undoubtedly caused by contact of steam pipes with woodwork.

2. Dry room contained twenty-four frame dry closets, twelve on each side of the room, each separated by a frame partition and heated by steam pipes on iron to a temperature of approximately 200 degrees Fahrenheit. The dry closets were arranged with slats on the sides to hold light wooden trays with canvas or muslin fastened to these to hold the paste mixtures for drying. Closets where fire occurred contained a mixture of charcoal and water and a mixture of oxgall and pancreatin. Fire thought to have been caused by the trays or cloth coming in contact with the steam pipes.

3. Closet of light wood construction with a large number of trays with wooden sides and canvas bottoms. Drier contained quinine tablets and no combinations liable to spontaneous ignition. Steam pipes probably responsible.

4. Steam pipes in contact with woodwork of small frame bismuth dry room.

5. Frame enclosed metal lined rack drying closet, drying medical paste.

6. Steam pipes in metal clad drier box in a medicine factory was cause of fire.

7. Fire occurred in bark grinding mill, caused by a nail in the material.

8. Fire occured in drug grinding mill, caused by some foreign substance. Spark ignited the powdered stock.

9. Alcohol was spilled by the night watchman in the fluid room of a pill factory, and the vapor was ignited by his lantern.

10. Watchman went to drug vault for some kerosene and his lantern ignited benzine vapors.

11. While filling a bottle from a tank of turpentine in a dark room, the operator lighted a match and accidentally ignited turpentine on the wooden support for the tank.

12. Half a gallon of ether in a bottle was being heated on a steam bath. Bottle burst and vapors were ignited by a gas jet nearby.

13. Oily waste accidentally ignited in quinine extracting room.

14. Explosion occurred in alcohol refining still.

15. Fire occurred in a plant manufacturing hospital supplies, in the acid room, due to explosion of nitric acid fumes probably in connection with fumes of ammonia.

16. Fire occurred in stock room due to spontaneous ignition of a bag of cascara bark.

17. Fire caused by the explosion of a retort used for distilling.

18. Compound consisting mainly of creosote, which was being heated in a cast-iron kettle heated by wood fire, boiled over and ignited.

19. Fire occurred in a tablet room having a dust collector box with metal pipe exhaust to roof, due to friction of pulley on blower fan.

20. An employee pouring ether from small cylinder into a can or other receptacle spilled some of the ether. The liquid ran along a table and struck the hot electric soldering iron and this iron was hot enough to ignite the vapor of the ether. An explosion occurred, followed by fire.

21. Fire occurred in a wood alcohol manufacturing plant due to the jamming of one of the wheeled iron cages containing charcoal fresh from the furnaces, against the top or side of the iron cooler into which the charcoal was being run. It was supposed that one of the rails had sprung which would account for the jamming. Although every effort was made by the employees to force the car far enough into the cooler to enable them to close the air tight door, they were unable to do so owing largely to the intense heat thrown off by the burning charcoal.

22. Workmen were engaged in removing a carload of chlorate of soda and depositing it in a frame warehouse by means of a

wheel-barrow with iron rimmed wheel. Some of the chlorate sifted through the kegs and men noticed a fire creeping along the floor where a barrow had passed.

23. A case contained bottles of hydrochloric, nitric and sulphuric acid. One of these became broken and the excelsior packing was ignited.

24. A small smount of aniline oil was being distilled in an ordinary can over a bunsen flame under a hood in the laboratory of a chemical works. The solder in bottom of can melted and allowed the boiling liquid to escape. This was ignited and caused a fire.

25. A carboy of sulphuric acid was broken and hay packing became ignited.

26. Wood alcohol plant totally destroyed through negligence in taking proper care of the charcoal after removal from the retorts. There was about 300 bushels of charcoal stored in bins inside of building, and this ignited.

27. Fire thought to have been caused by a leak in the fuel oil pipe which fed burners under caustic soda furnaces. The oil flowed into the furnace and was ignited.

28. An iron pan set over a brick furnace fired with hard coal was used to boil nitrite of soda. The contents boiled over and a vigorous fire ensued. Hot coals were scattered about the room and a large wooden rotary drier some distance away was ignited.

29. Fire occurred from unknown cause in a warehouse containing chlorates of potash and soda and saltpetre. The account given by the investigator is of interest.

"Across the street there were a number of old dwellings and the occupants were awakened by a hissing sound attending a fierce fire. The windows and openings of the warehouse were soon blown out. Repeated explosions followed with varied force and noise, which could be heard several blocks away. Fortunately, the roof was broken by one of the first explosions and this afforded a vent, directing the effect of the explosions upward.

30. Explosions during combustion among chlorates or nitrates wherever present are to be expected even from combination with the wood of the kegs alone; the result being the evolution of

immense volumes of oxygen from the salts, producing rapid combustion; and where bodies of smoke arise intermittingly, an explosive mixture is formed by the heated oxygen with the gases and unburned carbon in the smoke. The violence of the detonations depends on the proportions of oxygen and other gases. The firemen stated that the water at times seemed to add to the explosions. This latter effect results from water in the form of spray being thrown on such a fire; the heat being so intense as to cause decomposition of the water with sharp explosive effect."

31. Fire occurred in still room of an acetone plant, due to an explosion from unknown cause.

32. Fire caused by the boiling over of a kettle of rosin through lack of attention on the part of the night watchman.

33. Fire occurred from unknown cause in a bismuth drying building.

34. Employee was cleaning out a metal tank which had contained a hydro-carbon oil. He had an electric lamp with extension cord in tack. A short circuit occurred owing to a defect in the cord and a slight explosion followed.

35. A kettle of rosin boiled over causing a fire.

36. Fire evidently started from friction around the driving gear of a steam heated sodium nitrite drier, and heat became sufficient to explode contents of rotary with considerable violence.

37. In the sulphur burning room of a plant manufacturing hyposulphite of soda, fire was caused by melted sulphur which ran through cracks in the floor and ignited loose sulphur scattered about underneath.

38. An employee was placing granulated chlorate of potash on trays previous to placing them in steam heated driers, when a blaze occurred on one of the trays and spread so rapidly that employee was burned while making his escape.

39. Fire occurred in an electrolytic cell in the manufacturing of bleaching powder. A new cell had been put in operation about an hour before the fire and in some unknown way it became overheated. The paraffin oil contained therein boiled out, ignited, and set the frame cell-house on fire.

40. An explosion occurred in grinding mill of a sulphur plant caused by foreign substance in the mill.

41. An explosion occurred in the elevator leg of a sulphur plant caused by the friction of the elevator against the inclined leg. Fire ensued and frame mill adjoining the flour chamber was destroyed.

42. Retort house of a sulphur plant destroyed by fire presumably due to a defective flue.

43. Fire occurred in the roll stick department of a sulphur plant due to a defective still which ignited the low roof trusses of building.

44. Fire occurred in the retort and still house of a sulphur plant while still was in operation, probably due to escaping gas through connections from retorts.

45. Fire caused at a chemical works by the process of lead burning with an oxy-hydrogen flame. A new crystallizing tank was being lined with lead. A wooden post at corner where lining was being jointed became ignited.

46. Fire occurred in the finishing room of thorium nitrate plant. The finishing process consisted in boiling the nitrate of thorium down in open vessels over a gas fire. Over these vessels was constructed a wood ventilating hood for carrying off fumes. The attendant discovered that the hood was in flames, and the supposition was that the wooden hood had become kiln dried and ignited from the heat.

47. Fire in a saltpetre works started in room where saltpetre was dried in shallow iron vats with steam coils underneath. A workman was installing a new vat and spark from hammer flew a few feet into adjoining vat, igniting the saltpetre. Fire spread very rapidly to other vats.

48. A camphor still was located in a separate room and discharged through a pipe into a room called the camphor chamber. Several days before the fire, a damaged lot of camphor was returned from a celluloid factory to be refined. This was put through the still and was probable that nitric acid fumes were carried into chamber with the camphor vapor, settled on walls of chamber, and finally oxidized and ignited the camphor deposited there.

49. Fuel oil used to supply burners for borax roasters escaped and became ignited by flame at burners.

50. Fire resulted from the explosion of a grease still used in the manufacture of stearic acid and glycerine. Carry-off pipe was found to be clogged with the deposit, and live steam was injected. It is supposed that an excess pressure accumulated in the still which ruptured the still. Room was filled with tar and vapor and was ignited from the fire under steam boiler nearby.

51. Fire caused by cold cream boiling over in a laboratory manufacturing perfumes and toilet articles.

52. The boiling kettles used in the manufacture of aniline blue were heated by coal. One of these kettles boiled over and aniline oil took fire at once, causing a hot fire. There were two occurrences of this sort at one plant which caused a loss of $1,500.00.

> "Find out the cause of this effect:
> Or, rather say, the cause of this defect,
> For this effect defective comes by cause."
> Hamlet 11:2

One cannot study these miscellaneous effects, chosen at random from a large source of similar fires in the varied classes of chemical industries involved, without being greatly impressed with the fact that most of these defects were readily preventable and that many of them were due to gross carelessness.

The few fires of unknown chemical origin that have been quoted, and a larger number of fires which are constantly occurring in bleach and dye works and other manufactories using products of the chemical industry, that have apparently been due to the presence of the dyes or chemicals, suggest the possibility of valuable study and research on the part of chemists to eliminate these conditions.

Having stated the national scope and economic significance of the annual tremendous loss of created and natural resources by fire, and analyzed in detail the magnitude of this loss in the chemical industries, it is hoped that each member of the Eighth International Congress of Applied Chemistry will become sufficiently interested in this most vital subject, to become an ardent disciple of fire prevention and fire protection and to give greater thought and study to ways and means of applying such remedies as may seem desirable to his own needs.

Franklin H. Wentworth, Secretary of the National Fire Protection Association, which is an organization and technical body of national scope and broad membership, making the standards under guidance of which the fire waste may be checked, and educating the people in the observance of those standards and pointing out the grievous economic penalties for ignoring them, stated a great truth in a recent notable address:—

"Our civilization grows daily more complex. Every man's life is becoming more inextricably linked with the lives of others. An injury to one is increasingly an injury to all. Out of a proper realization of these facts is coming a larger sense of civic responsibility. As citizens of a common country, and brothers of a great national family, we may some day evolve a civilization in which there shall be no waste and in which the thought of the common good shall be the profoundest impulse in the hearts of our people."

THE CONSERVATION MOVEMENT IN WISCONSIN

By Charles R. Van Hise; Forests by E. M. Griffith
Madison, Wisconsin

The Conference of the Governors at the White House in May, 1908, upon the conservation of natural resources in the United States will by future generations be regarded as one of the great historical events of the nation. For many years the voice of the scientific man had here and there been raised for conservation, but his voice was a voice in the wilderness. President Roosevelt made the voice of conservation the voice of the nation.

Following the White House Conference, the President appointed a national conservation commission and many of the governors of the states appointed state conservation commissions. Governor James O. Davidson in Wisconsin, by executive act without authority of the legislature appointed a State Conservation Commission. This commission was made effective through a letter by the governor to the heads of the various departments of the state, requesting them to co-operate with the commission.

The Wisconsin commission has made two reports which by the governor were presented to the legislature, the first in 1909, and the second in 1911. The legislature of the latter year placed the conservation commission on a legal basis and made a small appropriation for its work.

The Wisconsin conservation commission early adopted the policy of confining its reports to specific matters regarding which the commission thought the time was ripe for legislative enactment or for a public movement. Upon such subjects brief papers by specialists were prepared describing the situation and pointing out the remedies. The commission, using these papers as a foundation, made definite recommendations to the governor. A surprisingly large proportion of these recommendations have been enacted into law.

THE WATER POWERS

Since the admission of the state of Wisconsin to the Union until 1909, it had been the practice of the legislature to grant franchises for the construction of dams, nominally to improve navigation but really for the development of water powers, upon the request of any individual or company, without condition, except the protection of such recognized public rights as navigation, maintenance of runways for fish, etc. Many of these franchises included the right of condemnation in order to give the necessary flowage areas.

The conservation commission in its first report recommended that thereafter franchises for water powers be granted under a general statute; that the issuing of such franchise be placed with the railway commission, or similar board, under conditions provided by the general statute; that such franchise be in the nature of a lease for a long period of years, with privilege of renewal on reasonable terms; and that an equitable rental charge, low at first, be imposed.

The legislature of 1909, at least partly in consequence of the report of the conservation commission, refused to grant any special franchises for the construction of dams, and appointed a special recess committee to investigate the subject of water powers and report a bill to the succeeding legislature.

In the report of the conservation commission for 1911 there was proposed as an alternative method of leasing water power, indeterminate franchises carefully safeguarding the public interests, and under the principles of the general public utilities act. In case either of rental for a definite period or an indeterminate lease, the rate of rental was to be low at first and to be readjusted at reasonable periods.

The legislature of 1911 refused to grant any special franchises for water powers, but enacted a general law [1] relating to the construction and maintenance of dams across navigable waters and granting franchises for the improvement of navigation and the development of hydraulic power. The act provided for granting franchises for the term of twenty years, with the right of con-

[1] Chapter 652, Wisconsin Session Laws of 1911.

tinuance of such franchises for two further terms of ten years each, subject to readjustment of the charge per horse power. The franchise fee was to be five per cent of the franchise value of the water power utilized, with the provision that such charge be not less than ten cents nor more than two dollars per horse power per annum. The administration of the water power law was placed upon the railway commission.

The law declared that "all energy developed or undeveloped on the navigable waters of this state is subject to the control of the state for the public good and also the beneficial use and natural energy of the natural waters of this state for all public purposes are held by the state in trust for all the people." These provisions of the law are in accordance with constitutions of a number of the western states; for instance, Colorado, California, North Dakota, Washington, Wyoming, and Idaho.[1]

In these newer states the constitutional provisions and laws embodying the same principles in other states have been upheld by the courts. Unfortunately in Wisconsin, before the value of the energy of falling water was appreciated, the courts had made various decisions which limited the right of the state in the waters of navigable streams to that of navigation, fishing, etc.; but general legislative enactment has never been made in which the right to develop the energy of the falling water has been declared to appertain to the riparian; and no general decision of the court had been made upon this matter at the time the above law was passed. The legislature in granting franchises for the development of water power, had, with the exception of a few of the earliest ones, included the provision that they are subject to amendment or repeal; and also that state constitution contains the provision that all general or special acts regarding corporations may be altered or repealed by the legislature at any time after their passage. However, for many years the energy of falling water had been utilized by many riparian owners under the special acts of the legislature authorizing the building of dams for the improvement of navigation.

[1] Conservation of Natural Resources in the United States, C. R. Van Hise, pp. 153–154.

The supreme court of the state in January, 1912, declared the act, making a franchise charge upon the use of water power, unconstitutional. The opinion of Justice Timlin, accompanying this decision, contained the dictum that "the right of the riparian owner to use the water of the river on his own land within his boundary determined by ordinary high water mark, for the purpose of creating power or, as the act in question puts it, 'developing energy,' returning the water again to the stream, is unquestionably a private right appurtenant to the riparian land."

This dictum appears to affect not only water powers, franchises for which have already been granted and development made, but it affects the half a million or more of undeveloped water power in the state.

Why the decision should be extended to the undeveloped water power nowhere appears in the opinion rendered. The right of the riparian to the developed water powers is recognized upon the basis that the legislature granted the charter "in consideration that the grantee would make the improvement in aid of navigation; the latter accepted the offer and invested thousands of dollars in making the improvement" . . . "By contract with the state, therefore, the riparian owner bought and paid for this valuable property right so far as the state had power to grant it. He had also acquired by purchase the riparian right hereinafter referred to."

Admitting the full force of these statements, the argument does not apply to undeveloped water powers.

If the dictum of the court be accepted as law, the owners of the riparian rights upon meandered streams have come into possession of a property of enormous value, without cost and thru judicial decision. To illustrate: If in the future there are developed 500,000 additional horse power and the value of such horse power for creating energy should prove to be $5 per annum, this on the basis of five per cent would represent a capitalization of $50,000,000. The situation appears to be that thru the decision of the courts more than one half of the water power of the state has been granted to the riparian without compensation.

If the opinion of Judge Timlin stands, apparently the best that can be done in Wisconsin regarding the water powers is to amend the constitution so that the state may acquire and operate them and pass laws giving to the state municipalities the right to acquire water powers thru condemnation and to operate them as public utilities. A bill to this end was introduced in the special session of the legislature in 1912, but it failed of passage; therefore the entire subject of the general regulation of water powers has gone over to the legislature of 1913.

The recommendation of the conservation commission that hereafter franchises for water powers be granted under a general act and that the administration of this act be placed under some commission seems to be the accepted policy of the state. This is however small solace for the loss of the energy of the falling waters of the streams of the state which should belong to the people. It appears to me personally that the conservation commission should make another effort to have a bill passed which at least will save the energy of the falling water of those powers in which franchises have not been granted. If this can be accomplished it will still save for the people about one half of the water power resources of the state.

Forests

Creation of Forest Reserve. Twenty-five years ago Wisconsin was one of the greatest and wealthiest forest regions in the United States, and the twenty-seven counties which comprised the northern portion were practically an unbroken forest extending from Michigan to Minnesota. Even as late as 1900, Wisconsin ranked first among the states in the production of lumber, but by 1910 it had dropped to eighth place.

The axe, followed by terrific forest fires, has depleted the great forest wealth of the state; and when it is almost too late the state is waking up to appreciate something of the value of this wonderful, natural resource, which has been dissipated so recklessly.

As early as 1867 a law was passed providing for the appointment of three commissioners to investigate and report upon the injurious effects of clearing the land of forests and the duty of the state in regard to the matter. An exhaustive and very valuable report was published by the three commissioners, but no results were accomplished. In 1897 another law was passed providing for the appointment of a forestry commission of three members by the governor, who were to draw up a plan for the protection and utilization of the forest resources of the state, for the organization of a forestry department, and for the creation of a forest reserve. The commissioners' report, including a draft of a bill which they recommended for passage, was published in 1898, but no legislation resulted until 1903 when a forest reserve of about 40,000 acres was created. But the first effective forestry legislation was not accomplished until 1905. Under the law of 1905 a non-political state board of forestry was created, and it was provided in the act that the state forester, to be appointed by the board, must be a technically trained forester and certified as such by the secretary of the United States Department of Agriculture. The most important provision of this law was that all state lands in the northern, or timbered, portion of the state were set aside for forestry purposes, and that the agricultural and scattered lands could be sold by the board, the proceeds to constitute a "forest reserve fund" to be used in purchasing lands suitable for enlarging the forest reserve area. The law of 1905 included in the state forest all state lands in the northern portion of the state. This immediately increased the area of the reserve from 40,000 acres to over 300,000 acres. State appropriations for the extension of the forests were made in 1911. Through the purchases of privately owned lands over 100,000 acres, at an average cost of $3.00 per acre, have been acquired, so that the reserve today totals some 425,000 acres, and contracts for purchases when executed will increase the total to about 475,000 acres.

It thus appears that the conservation movement in the state of Wisconsin, so far as the forests are concerned, began before the White House Conference and the appointment of the state conservation commission. A number of recommendations of the commission regarding forestry were however enacted into law, and therefore the work of the commission may be said to have accelerated the movement for state forests. Among the recommendations adopted were a direct state appropriation for additions to the forest reserve, an increase in the appropriation for the administration of the reserve, and making the land in the Menominee Reservation a part of the reserve. Recommendations were also made that the state constitution be amended so as to prevent the taxation of timber land, by a method which would tend to preserve the forests instead of destroy them. A system of compulsory patrol and the burning of slashings by the state in private forests in the forest belt were recommended. Realizing that no general regulations are applicable to the burning of slashings or to patrol, it was advocated that the formulation of the regulations upon these matters and their execution be under the state board of forestry.

Character of Forest Reserve. It is difficult to draw a clear picture of the Wisconsin forest reserve since some portions have very heavy stands of virgin timber, others promising young growth, while large areas are either restocking naturally or have been so badly burned that they must be replanted. The finest bodies of timber which the state owns within the forest reserve area are on the 16,378 acres within the Menominee Indian Reservation, and on the 35,427 acres which the state owns in Forest county. The timber upon the Menominee Reservation is white pine, which grows in mixture with magnificent hardwoods, principally basswood, birch and maple. On the Forest county lands the timber on the ridges is white and Norway pine in mixture, with hemlock, basswood, birch, maple and elm. On the lower ground hemlock predominates and in the swamps there is good cedar and spruce.

Within the Lac du Flambeau Indian Reservation, which is in the heart of the forest reserve, the state owns 20,666 acres, and in the northern portion of the reservation there are some splendid stands of virgin white pine, while on the poorer sandy soils the timber is largely Norway pine.

The balance of the state forest reserve lands are located in a number of counties. The lands which are suitable for agriculture, or so widely scattered that they cannot be used for forest reserve purposes, will be sold and the proceeds used to purchase other lands to block up the permanent forest reserves.

It is felt that satisfactory progress has been made in increasing the forest reserve from 40,000 acres to 425,000 acres in seven years, but Wisconsin has only made a good start for the state should have a reserve of about 1,500,000 acres in order to meet the future needs.

The forest reserve lands in Price and Iron counties, which comprise some 57,000 acres, are typical hemlock and hardwood ridges, with some cedar, spruce, and balsam in the swamps. Some fifteen to twenty years ago the large white pine was cut on these lands, but a young growth of pine timber is coming up which only needs protection from fire to become a fine forest.

The state owns some 123,000 acres in Vilas county and 57,000 acres in Oneida county. The lands in Vilas and those in the Northern part of Oneida county, will constitute the backbone of the permanent forest reserves, as they lie at the headwaters of the Wisconsin and Chippewa Rivers, and also in the heart of the beautiful lake region. The lands in northern Oneida county are largely covered with hemlock and hardwood on the ridges, and on the level, sandy plains, from which the virgin pine was cut many years ago, the young pine growth is in most sections most promising and very little planting will be necessary. On the forest reserve lands in the eastern and northern portions of Vilas county, there is upon the whole a fairly heavy stand of hemlock and hardwoods, with scattering white and Norway pine. In the central portion of the county the virgin stand of pine was so dense that the cutting was very heavy, and the forest fires which followed the slashings of the lumberman were so severe that all the remaining timber was destroyed. However, there was a large amount of pine seed buried in the thick humus and where the fires have not burned too deeply the young white and Norway pine seedlings are beginning to appear.

Just how much of the burned over land must be replanted, it is impossible to tell, but it is probable that a very considerable percentage will be restocked naturally.

State Forest Policy. What specific objects has Wisconsin in view in creating her forest reserve? The state is building up her reserve in some of the most northerly counties, viz.: Forest, Vilas, Oneida, Iron and Price, and within this area there is not only a wonderful lake region of over 1,200 lakes, but also the headwaters of four of the greatest rivers in the state, viz.: the Wisconsin, Chippewa, Menominee, and Wolf.

The state lands set aside for the reserve, as also the lands purchased, are not suitable for agriculture, being either too sandy, rocky, or swampy, but these lands have grown some of the finest pine timber in the state, and all the young timber needs is protection from fire. The state forest policy then is looking to the accomplishment of the following points, viz.:

(1) Extensive forests should be maintained upon the headwaters of the important rivers. This together with the use of many lakes as storage reservoirs will tend to make the flow of these rivers regular, thus preserving and even improving many waterpowers which will become increasingly valuable, especially since Wisconsin has no deposits of coal.

Wisconsin has adopted the policy of allowing river development companies, under careful state supervision, to use many of the lakes at the headwaters of the Wisconsin and Chippewa rivers as reservoirs, so as to hold and store up the excess or flood waters, which may be drawn upon at times of low water. No new storage dam can be built without the consent of the state board of forestry and the board also controls the level to which the water may be raised or lowered, so that the beauty and attractiveness of the lakes for summer camps and cottages will always be carefully protected. With a large forest reserve surrounding these lakes, thus preventing the deep snows from melting too rapidly, and the lakes as storage reservoirs holding back the spring freshets, the stream flow of the Wisconsin and Chippewa rivers can be systematically regulated, and thus the waterpowers will gain enormously from a constant and even flow. Wisconsin has gone much farther than the other states in developing a definite policy looking to the full development of storage reservoirs and the forest reserve will always protect the reservoirs from silting up.

(2) In 1910 a study of the wood-using industries of Wisconsin was made in coöperation with the United States Forest Service and it was found that more than 930 million board feet of lumber valued at $20,000,000 is annually utilized in the wood-using

industries, and that already almost fifty percent of this lumber is purchased outside of the state. This means that in time the state will lose its wood-using industries unless the rapid destruction of the forests is checked. A state forest reserve of 1,500,000 acres can aid very materially in supplying this raw material.

If Wisconsin had been as wise as Canada and retained its timbered lands instead of selling them, the forester would have a going concern and the timber would be his stock, which he would sell as it became mature and thus be able to show a revenue at once. But Wisconsin chose in the past to sell its timber lands to anyone and everyone at a fraction of what their present value would be. Therefore the state must buy back the timberlands that it sold, and it will be many years before there will be much merchantable timber to sell from the forest reserve. The bright side, however, is that much of the timber that was left is now, with increasing demands, becoming valuable.

Taking into consideration the acreage of land within the forest reserve that contains virgin timber and that which is fairly well timbered, also the areas that contain only young growth and those that must be planted, it is not probable that in twenty-five years the state will receive a net revenue of over $1.00 per acre, but at the end of fifty years this should increase to at least $2.00 per acre. The probable revenue from the firewood and all other forest products is included in this estimate; also the revenue from leasing camp and cottage sites, which will be very considerable. If then the state acquires a forest reserve of 1,500,000 acres, it should be able to count on a net annual revenue of $1,500,000 after twenty-five years, and of $3,000,000 after fifty years.

(3) Preserving the forests in the beautiful lake region of northern Wisconsin will greatly enhance its present attractiveness as a resort region, not only for the citizens of the state, but of the entire Mississippi valley as well. The value of such a resort region is not generally understood, even from the dollar view point; but the report of the bureau of labor of New Hampshire for 1905 shows that the resort business yielded in that year over $10,000,000, and the report of the forest, fish and game commission of New York for the same year states that it was over $7,000,000.

The state board of forestry has adopted the policy of leasing camp and cottage sites upon the shores of the beautiful lakes within the forest reserve. Owning several thousand acres of land upon the shores of some of the most attractive lakes in Oneida and Vilas counties, the state is easily able to meet upon reasonable terms all present demands for sites of various kinds.

As Ex-President Roosevelt has so well pointed out, the National forests as well as the forest reserves maintained by the various states are intended for the fullest and best use consistent with their protection, and one of the most natural uses to which a portion of the reserves should be put is as fish and game preserves; and this will greatly enhance their value for resort purposes.

Forest Planting. In 1911 nearly 200,000 seedlings were planted on lands within the forest reserve which were not restocking naturally, and the state now has over 1,400,000 seedlings, in one large nursery, which will be utilized in planting denuded lands. It has been discovered, however, that a large percentage of the cut-over lands in northern Wisconsin will restock naturally, provided that forest fires have not burned over the land so frequently as to destroy all the seeds in the soil. Therefore it is not expected that many large tracts will have to be planted.

It is the intention of the state board of forestry to sell plants at cost to individuals and corporations who may wish to reforest their denuded non-agricultural land.

Fire Prevention on the Forest Reserve. The state board of forestry has a force of rangers and patrolmen whose chief duty it is to see that any forest fires which start upon the forest reserve are promptly extinguished. When active patrol work is not necessary, these men take charge of the crews who are engaged in cutting roads, trails, and fire lines, and in constructing telephone lines or destroying dangerous slashings.

The object of the roads, trails, and fire lines is to divide the forest reserve into a large number of blocks or compartments so that if a forest fire starts it can be held to the block of land in which it originates. By means of the lookout towers and telephones the rangers can readily locate forest fires and then summon the necessary help without any loss of time. In order to patrol their districts as rapidly as possible most of the rangers either have saddle horses or railway velocipedes.

Forestry by Private Owners

To the present time in Wisconsin very little real forestry management has been practiced by lumber companies, large timberland owners, or private individuals. This has been largely due to the danger of timberlands being destroyed by forest fires, and also the annual taxing of growing timber which has encouraged forest destruction instead of forest conservation.

Many of the large wood-using industries of the state, especially the paper and pulp mills, should own large tracts of timber and operate under a systematic plan of forest management; but many are held back from doing this on account of the fear of fires and taxes. The first can and will be overcome through education of the people to the fearful and needless losses from forest fires, together with well organized forest fire patrols; and the second obstacle will be removed when the state appreciates that the present system of annually taxing growing timber is archaic and that it directly encourages and even forces forest destruction.

Parks

Closely connected with forests are parks. The importance of parks and playgrounds for the health and happiness of the people has not been generally appreciated in this country. In consequence of this, many large cities have an entirely inadequate park system and the majority of states have scarcely begun to realize the importance of a number of parks conveniently situated to be the common property of the people.

In Wisconsin in 1907 a park board was created and appropriations were then and later made for acquiring state parks. Two of the most picturesque areas in the state have been secured. One of these is in Door county on the peninsula extending east into Lake Michigan, containing eight miles of shore line. The second park is in the uniquely beautiful Devil's Lake area. Prior to 1907, by coöperation with the state of Minnesota, the Dalles of the St. Croix River had been acquired as an inter-state park. In addition for provisions for state parks, laws had been enacted giving to cities very large authority in acquiring parks. Already Milwaukee and Madison have taken advantage of these laws and the same is true to a less extent of other cities. In the future this movement, which will result in numerous parks of moderate size, both state and municipal, will be recognized as one of far sighted wisdom.

Soils

The land is the basal resource of the nation, is indeed more important than all other resources. From the land come our food and clothing. Food and clothing we must have; all of our other needs are subordinate to these. While the preservation of the fertility of the soil is the most fundamental of the problems of conservation, so also it is the most difficult. Many of the owners of the soil have very imperfect knowledge and little sense of responsibility regarding its preservation. In the rather sparsely settled United States, where until recently rich, virgin land has been free, there has been wastefulness in the exploitation of the land such as perhaps has existed nowhere else in the world.

Realizing this situation, from the first the Wisconsin conservation commission has directed its attention to the conservation of the soil. In the state of Wisconsin there are more than 175,000 farms. The problem is to get a vast number of farmers so to handle their soil as to enrich instead of diminish its fertility. While Wisconsin is one of the relatively new states and the larger portion of its lands has not been cultivated on an average for as much as fifty years, already there is serious depletion in the fertility of large areas. The efforts to secure the conservation of the soil of Wisconsin have proceeded along three lines: (1) education, (2) investigation, and (3) legislation.

(1) The most comprehensive and satisfactory way to secure the conservation of the soil is to educate the farmers regarding scientific methods in order that they may so handle their lands that they increase in fertility rather than decrease. This problem of education, while very large, is hopeful because of the fact that the practices advocated will in the long run work to the

advantage of the farmers as well as to the advantage of the state and nation. In a brief paper it will be impossible more than to mention some of the lines of effort which have been directed to the education of the farmers of Wisconsin.

At the University of Wisconsin, in addition to a four year college course in agriculture, there are a two year course of a more practical character, and still shorter general courses, dairy courses, courses for farmers, etc. Further, the college has undertaken agricultural extension upon an elaborate scale, with the idea of carrying out to the farmers through demonstration and illustration improved agricultural practices. In a considerable number of counties there are county schools of agriculture which are designed especially to give training for the farmer. By the action of the legislature of 1911, high schools which contain agricultural courses are granted special state aid. This was recommended both by the conservation commission and the commission on industrial education. Provision is made for agricultural instruction in the county training schools, twenty-six in number, the duty of which is to prepare teachers for the rural schools. Thus the entire system of education from the University to the rural schools is designed to tend to conservation of the soil.

(2) Investigations relating to the conservation of the soil are being pursued along many lines.

The first report of the commission recommended a soil survey. An appropriation was made for this purpose by the legislature of 1909. This work in coöperation with the United States survey is being actively pushed. To the present time a detailed survey has been finished for more than 5,500 square miles. A reconnaissance survey of the northern part of the state has been made for an area of 4,500 square miles. One of the purposes of this reconnaissance survey is to determine lands which are better adapted for agriculture than for forestry.

Some of the questions under investigation by the college of agriculture, are soil erosion, the preservation of the essential elements of the soil, the eradication of weeds, and agricultural economics.

For parts of the state the depletion of the soil is due largely to erosion, in other parts mainly to depletion of essential elements; altho thruout the state almost everywhere both are important factors. In regard to the loss of soil thru erosion the state is being studied in relation to its topography and the character of the soil, in order to formulate methods of cultivation adapted to the situation. However, for much of the state the question of depletion of essential elements is no less important than erosion, and no where else has this problem been more seriously attacked. In this brief paper it is quite impossible to take up in detail the methods which are being worked out for the prevention of erosion and the reduction of loss of essential elements. The general principles of these matters are well known, but in each state these principles must be adapted to the particular conditions.

A very important factor in the depletion of the soil is noxious weeds. For many counties in the eastern part of the state large areas are badly infested by such weeds, among which Canada thistle and quack grass are the worst. Not only is there a considerable portion of the state thus weed infested, but the area is extending. These weeds make heavy drafts upon the fertility of the soil, and where present greatly decrease the amount of the crop. Already investigation has shown that quack grass and Canada thistle can be eradicated by at least two methods. Having found successful economic methods for eradicating these weeds, a campaign of education is being carried on among the farmers to produce their destruction.

The economics of agriculture have scarcely been considered by farmers in this county, altho cost accounting has been introduced into business for many years. In most cases, when a farmer sells his crop he does not take into account the question of whether his soil has been enriched or depleted as a result of the operation. Professor H. C. Taylor says:

"Types of farming have been studied from the standpoint of their influence upon the future usefulness of the soil. Two leading types of farms in Wisconsin are grain and dairy farms. Commercial fertilizers are rarely used on grain farms in this state; hence grain farming means exploitation, while dairy farming stands for soil maintenance. In the early history of Wisconsin, wheat farming dominated. In a few decades, soil exhaustion and other causes led to the abandonment of the selling of grain in favor of the selling of butter and cheese. The readjustment has been in progress for thirty years, but is not yet complete. The greater profits of dairying have led the more intelligent farmers to make the change, but many are so bound by habits of thought and action that only the stern hand of economic necessity will drive them to make a change in their methods."

(3) The third stage, that of specific legislation for the preservation of the soil, has no more than begun. Laws have been placed upon the statute books prohibiting the importation into the state of impure seeds, and especially those infested with deleterious weeds. The Director of the Agricultural Experiment Station has been given authority to inspect nursery stocks, with reference to the prevention of the importation of infective plants. Laws have been passed which make it the duty of local officials to extirpate noxious weeds; but as yet these laws are largely a dead letter and will be until the legislation is so modified as to place the execution of the law in the charge of state officials who have as their special duty the execution of these laws. This the conservation commission has recommended, and an act to this end will be vigorously pushed at the next session of the legislature.

While great improvements have been made in the agricultural practices of the state looking toward the lessening of erosion and depletion of the valuable elements, a balance sheet shows that to the present time Wisconsin has not nearly reached a condition in which upon the average the land of the state is richer at the end of a given year rather than poorer; and this notwithstanding the fact that the state is one of the greatest in its dairy interests. Thus for phosphoric oxide, the most crucial element of the soil, it is estimated that the annual loss to the state is 15,000,000 pounds. The largest loss is due to the waste of manure by washing the same into the streams. Another large loss is through sewage and another part is due to leaching of exhaustive crops, such as tobacco.

It is clear that the campaign of education and investigation in Wisconsin with supplementary legislation must go on until the balance sheet shows increased fertility upon the average rather than decreased fertility; for only thus will it be possible one hundred years hence for the state to produce food for its large population.

The situation above described illustrates how great is the problem of education, investigation, and legislation, which confronts the states of the Union, in the vast majority of which, if not in all, the situation is less advantageous than in Wisconsin.

Minerals

Progress has been made in the conservation of mineral resources of the State of Wisconsin only to the extent of surveys and investigation. The first step in these matters is to find out the facts. In the southwestern part of the state the losses in the mining and extraction of lead and zinc are very great. It is estimated that only a little more than one half of the zinc in the ground becomes spelter; thus the loss is nearly fifty percent. Some thirteen and one half per cent of this loss is in mining; the remainder is mainly in milling and smelting. The large loss in mining is due to the very high royalty; ten per cent of the concentrated product, which is paid to the fee holder. If this rate were decreased for lower grade ores, they could be profitably extracted in connection with the richer ores, whereas they are now left in the ground. The conservation of the metallic ores is also related to the system of taxation.

The question of remedying the great losses in zinc beginning in the southwestern part of the state and a system of taxation for zinc and for iron ore are subjects which are under investigation by the state conservation commission, with the hope of being able to make recommendations to the legislature at their next session.

General Statements

In the second report of the state conservation commission the desirability of a general law regarding conservation was pointed out and it was shown that if such a law were possible it would be supported by the highest courts, state and national. A bill to this end was therefore prepared and was by the legislature of 1911 enacted into law.

The essential parts of the law are as follows:—

"1. It is hereby made unlawful for any person, firm or corporation, unreasonably to waste or maliciously to injure, destroy, or impair any natural resource within this state.

"2. It is the purpose of this act to promote and secure the conservation of the natural resources within the state in the interests of the public welfare."

This is probably the only comprehensive law yet enacted by any state which includes the fundamental principles which should obtain in regard to conservation. At the outset this law may not produce much effect, but it is believed that it will have an increasing potentiality as the years go by. It can be invoked at once to prevent the wasting of artesian water either carelessly or maliciously. As soon as it can be shown to be practicable and economical to save the branches and tree tops in the cutting of forests, the law may be invoked to compel such utilization. If a farmer wantonly allows gullies to form in his farm, and thus permit unnecessarily rapid erosion either to the injury of his own land or to that of his neighbors, this law may be invoked to compel the delinquent farmer to take the necessary steps to stop the destruction of the soil, the most important resource of the state.

It has been found necessary to have special officers to enforce the pure food laws. In order that this general conservation law shall produce its full effect, it will be necessary to have special administrative officials whose duty it will be to see to its enforcement. As soon as public sentiment has sufficiently developed so that such offices are created this law will have a controlling influence in the conservation of the resources of the state.

Under the broad charter of this law it is the plan of the state conservation commission to move forward carefully, but as rapidly as public sentiment will support the commission. The commission plans to present at the next session of the legislature recommendations adopted to the new situation in the water powers, and recommendations regarding the extension of forests, the drainage of swamp lands, the reduction of the losses of lead and zinc, the taxation of ores and mineral rights, the conservation of the soil, and the destruction of noxious weeds.

The conservation commission fully appreciates that with reference to the future of the people of the state the conservation of its natural resources is of greater importance than any and all other questions before the people. The recommendations of the commissioners have thus far received a response from the legislature quite beyond their expectation. Therefore they look forward confidently to a continuation of the progress of the conservation movement in Wisconsin until the time comes when it can be said that the natural resources of the state are transmitted to the succeeding generation unimpaired. This should be the aim and the ideal of each state conservation commission. When it is accomplished the foundation of the future prosperity of the nation will be assured.

GENERAL INDEX
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