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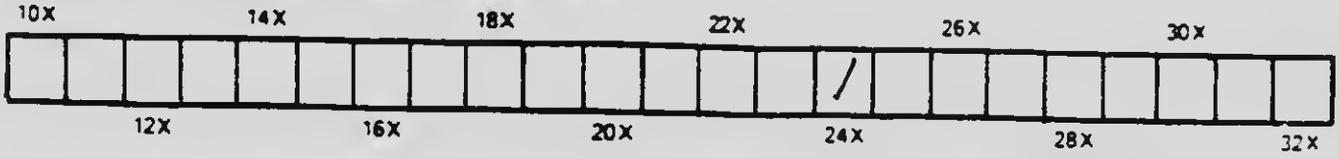

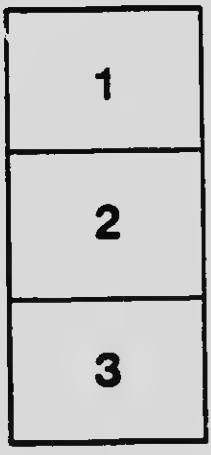

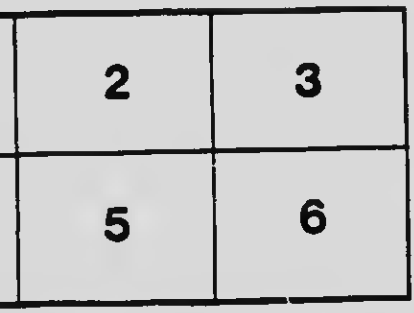

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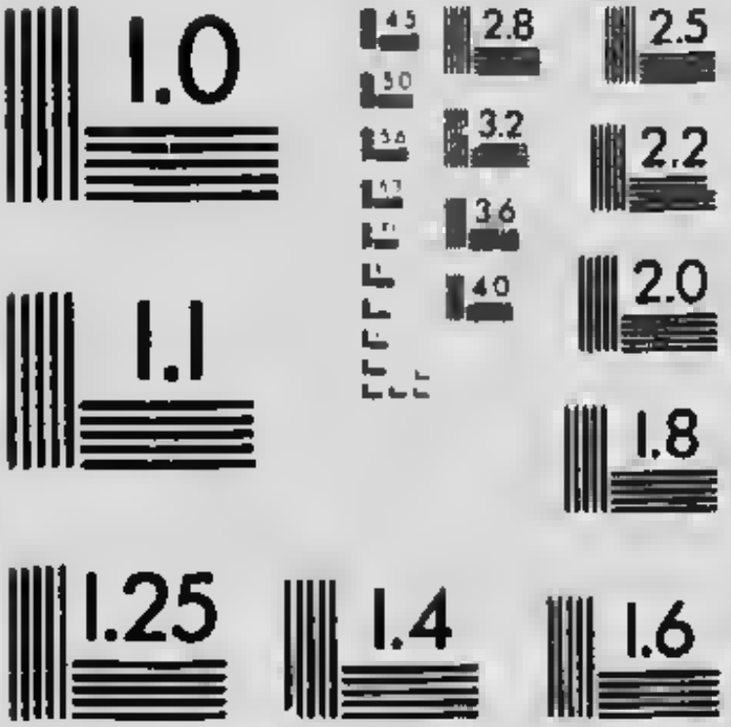

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POTENTIAL WEALTH OF CANADA'S NATURAL RESOURCES

BY
C. E. W. DODWELL, M. Inst. C.E.
M.E.I.C.

LINO PRINT, LTD., HALIFAX

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¶ THESE articles appeared in the Halifax Morning Chronicle during the months of March and April, 1919. ∴ ∴

Potential Wealth of Canada's Natural Resources

THE Morning Chronicle is moving today the first of a series of special articles which Mr. C. E. W. Dodwell, C. E., is writing on the exploitation and development of our natural resources and potential wealth. Canada is fortunate in possessing almost illimitable natural resources, and the problem of today is not only to conserve but to convert this potential wealth into actual assets. Mr Dodwell recommends in his introductory article the creation of a new Federal Department of national development. Other phases of the problem will be treated in future articles in The Morning Chronicle.

NOW that this appalling four years of world c[illegible]t has been brought to a glorious conclusion, so far, at least, as actual fighting is concerned, the energies and attention of the country will be immediately and earnestly directed, not merely to our Military Demobilization, but to the remobilization of our dislocated peace activities, and the readjustment to normal conditions of the many phases of our industrial and commercial life.

In an effort—praiseworthy, if nothing else—to arouse the country to the supreme importance, and the unique opportunities afforded by the gigantic struggle and its triumphant and successful issue, of not only capturing from our Teutonic enemies much actual and potential wealth in Trade, Commerce and Manufactures, but of expanding old and establishing new industries throughout Canada, it occurs to me that you may deem worthy of a place in your columns an article—on the instalment plan,—on,

"The Exploitation and Development of our Natural Resources and Their Conversion to Actual and Potential Wealth, with Minimum Waste in the Process and the Maximum Public Benefit."

A full and comprehensive treatment of the subject would require a volume, indeed several volumes, so I shall only attempt to deal in a concise, and necessarily more or less superficial manner, with a few of its branches that appear to me to have in this country, and at this juncture, outstanding interest and importance.

The present article is merely introductory; a sort of bird's-eye view of the general situation.

The Problem of Today

THIS, the beginning of the second half century of the life of our great Dominion, is the most momentous epoch in its history. The mature of the present generation and those young men of Canada now at school and college will be called upon to face and to solve problems that have no parallel in the history of any country; problems involving the stability of the very foundations of our prosperity, resources and development, nay, of our national existence; problems which will tax the energies and the intelligence of the country's manhood as they have never been taxed before. In this place reference is permissible to but one phase of these problems, but to the Engineer especially, it is a phase of absorbing interest.

The only and proper way in which Canada can hope to pay the interest, to say nothing of the principal, of the enormous loans that have been raised to justify and maintain our proud position

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in the Empire, and to meet the cost of our share in its defence, without letting these enormous financial obligations become an undeserved and intolerable burden on posterity, will be to exploit and develop, on sound business principles and as soon and as thoroughly as possible, the almost unlimited natural resources within our borders, to convert them from potential wealth to actual and realizable assets, and withal so carefully, so judiciously, so skillfully, and on such sound and far-seeing economical principles and methods, that they will be conserved, protected, nursed, husbanded and, as **invested capital, made to pay interest or dividends,** instead of suffering continuous depletion and impairment. Thus shall we fulfil our duties as guardians and trustees of our goodly heritage, passing it on to our posterity in at least as good a condition as we received it.

Major E. T. P. Shewen, Consulting Engineer to the Department of Public Works of Canada, at St. John, N.B., in a brief but valuable paper on Coal Tar Derivatives (to which subject I shall refer in a future article) forming Appendix IV. of the 8th Report of the Conservation Commission, 1917, stated a remarkable but self-evident truism,

In Exporting Raw Material a Country Derives from its Natural Resources the Least Advantage.

The enunciation of this aphorism is a flash of genius, entitling Major Shewen—until and unless he disclaims originality—to at least the Nobel prize for the year, or the Cordon Bleu of the Academy. The words are so pregnant with truth, and with truth of such tremendous and far-reaching import, that they should forthwith be adopted as the motto of the Government. They should form the text

of sermons to be preached, of speeches and addresses, the subject of articles and essays in the journals of light and leading throughout the country.

The Case of Pig Iron.

TAKE the crudest but most forceful case. A ton of pig-iron today is worth about $50.00. Convert it into watch-springs and it is worth nearly $40,000. In the process of conversion it has increased seven hundred fold in value. The enormous sum of nearly $40,000 has been added to its value; this sum representing the difference between its actual and its potential value. Whence came this enormous increment? It is **created wealth** accruing to the country in which are carried on the thousand and one processes, operations and manipulations incidental to the development from the crude pig-iron to the delicate watch springs.

This is admittedly and purposely an extreme case, but the principle underlies the whole subject.

A ton of coal and its many hundredfold increment in value by distillation, I shall deal with in a future article.

A cord of pulp-wood is worth six or seven dollars. Ground into pulp it is worth about $20.00; converted into paper, even the cheaper form of wrapping paper, it is worth about $200.00. In the fiscal year 1914-15 we exported to the United States over a million cords of pulp wood, valued at nearly $7,000,000. Had we first converted it into paper, or merely ground it into pulp, we should have been the gainers by many millions of dollars.

A ton of gypsum is worth a couple of dollars. Calcined and ground, and thus converted into wall plaster, it is worth about $16.00, an eightfold increase. In the fiscal year 1914-15 we exported to the

United States over 300,000 tons of gypsum, worth nearly $900,000. If we had first ground it and calcined it we should have been the gainers to the extent of four or five million dollars.

These and other similar instances, to be found in our table of imports and exports, seem to indicate a deplorable disregard of the rudimentary principles of national prosperity. Admitting the absolute necessity of a revenue—and for a number of years a revenue of unprecedented magnitude—we see that our tariff, so far at least as it has to do with our national resources, will need very careful revision, that it will be expedient to adopt and exploit by all legitimate means the principle of **export duties** on all exports of raw material, and encourage their conversion and development here in Canada into refined and valuable manufactured goods of every description.

A New Department.

IN order to grapple in a vigorous and intelligent fashion with these different problems, to insure proper organization and co-operation of effort, it seems desirable that a new Department of the Federal Government should be created. For instance:

The Department of National Development,

or the Department of Conservation and Development,

or the Department of Development and Industry,

or the Department of Conservation and Industries.

In it would be grouped and intimately co-ordinated the **Commission of Conservation,** the **Honorary Advisory Council for Scientific Research,** the **Fuel Testing Laboratories,** the **Forest Products Laboratories,** and all other Governmental branches or sub-Departments, or officers, whose work and activities are, or have been, in the direction of, or connected with, any feature of development and research. The new Department would be manned by a considerable staff of scientific men, generously equipped with necessary and ample laboratories, instruments, appliances, tools, etc., for carrying on extensive research work in many branches or fields of scientific industry, and provided with liberal funds. Practical co-operation should be established with, and all necessary and proper assistance given to, those schools and colleges and scientific institutions throughout the country, which teach or investigate industrial and practical science in its many aspects and branches.

The functions and organization of the new Department would, of course, be developed and established after the most serious study by, and advice of, the most capable men to be found in the Dominion, and it cannot reasonably be doubted that its inauguration would, in a very short time, justify its existence, and redound to the great advantage of the whole country.

To come from the general to the particular, my next article will deal with the subject of Alcohol as a source of light, heat and power.

C. E. W. DODWELL,
M. Inst. C.E., M.E.I.C.

Halifax, 1919.

ALCOHOL AS A SOURCE OF LIGHT, HEAT AND POWER.

I.

IN our papers at the end of November last year appeared the following despatch:

> OTTAWA, November 29—Government control of alcohol required for use in industry in Canada has been recommended by a Committee of the Advisory Council for Scientific and Industrial Research. The Committee—Queen's University; T. H. Wardleworth, of the staff of the Imperial Munitions Board; Dr. Ruttan, of McGill; and Dr. Macallum, chairman of the Council—has made an investigation of the use of the spirit in manufacturing in the Dominion. It proposes that the existing excise duty on alcohol for use in industry be removed.

It is at the reader's option to consider this despatch as my text or my justification for the following article.

Many people use small quantities of alcohol in their domestic economy for the purpose of heating a chafing dish, for making coffee, or some such purpose. We send to the druggist and pay 25 cents for less than a pint of so-called methylated spirits, which, when burning, is often so evil smelling as to be almost unusable.

In the United States, and I believe in all other civilized countries, except Canada, denatured alcohol, or Pyro, as it is called in the United States, can be bought for about 50 cents per (U.S.) gallon, and it is coming into very general use for domestic, cooking and heating purposes, as well as for the production of power. There is a concern in New York, called the Alcohol Utilities Company, that makes all kind of utensils for

the use of alcohol in cooking and heating, and also lamps for lighting purposes. The lamps are, of course, of the incandescent mantle type, and they are made of all powers, from about 10 to about 500 c.p., the higher power lamps being, as they claim, very much cheaper in operation than electric lamps. I went through the place two or three years ago and was amazed at the variety, simplicity and usefulness of the many utensils that I saw. Denatured Alcohol in the United States is in fact a tremendous boon to the people, and I was told that some four or five immense distilleries in the United States, which a few years ago were turning out whiskey, are now confining their operations exclusively to the production of denatured alcohol, showing that, besides being a tremendous boon to the people, it is a profitable industry and no doubt one capable of very considerable expansion. Such an industry would, I think, be fully as suitable to Canada as it is to the United States, and there is no question whatever but that it would be as great a boon here as it is proving to be in the great Republic.

Removal of The Duty.

I HAVE discussed this matter with one or two members of Parliament, who are all very favorably impressed with it, and they agreed with me that it was a matter that might very properly and profitably be taken up by the Government. My first suggestion would be that in any tariff revision that may come before the Government in the near future, the duty should be removed, in whole or part, from denatured alcohol, for domestic, industrial or power purposes, and that encouragement in some way be given to the home production of this valuable article.

The law removing the prohibitory tax of $2.08 per U.S. gallon ($2.50 per Imp. gallon) from denatured alcohol was enacted by the United States Congress,

June 7th, 1906. It took effect on the first day of January, 1907. At the end of March, 1907, a supplementary law was passed, taking effect on the first day of September, 1907. This second law liberalized the terms of the first law, and made possible a system of distribution, under which denatured alcohol may be obtained at reasonable prices all over the United States.

As an illuminant the relative economy and efficiency of pyro has been demonstrated by the Electric Testing Laboratories of New York, which give the following summary report:

Alcohol Burner—One U.S. gallon will last 38 hours 30 minutes; average candle power, 45.2; candle power hours, 1740.

Kerosene Lamp—One U.S. gallon will last 32 hours 42 minutes; average candle power, 14.8; candle power hours, 484.

Therefore, with pyro at 50 cents per U.S. gallon, it would be as cheap as kerosene (refined petroleum) at 15 cents per gallon, and a 45 c.p. pyro lamp would cost less than one and a third cents per hour.

Source of Light and Fuel.

ELECTRICITY as a source of light is cheaper than alcohol, acetelene gas, or oil, a 45 c.p. electric lamp costing less than 1 cent per hour; but in villages and country districts, where electricity is not available, the alcohol lamp is facile princeps, on account of cheapness, health and convenience.

As a fuel for cooking purposes, and burnt in a specially devised stove, in which it is first vapourized, pyro is cheaper, cleaner and far more convenient than coal, wood or oil. There are in general use in the United States many forms of stoves, for kitchen and table use,

boilers, bakers, broilers, toasters, etc. Experiments at the Housekeeping Experimental Station at Darien, Conn., U.S., go to show that one gallon of alcohol is sufficient to do all the cooking for a family of four persons for seven days.

For heating purposes, on a small scale, there are portable steam radiators of about 20 square feet heating surface that will heat a small room to a comfortable temperature, without the offensive odor and the vitiation of air, inseparable from the usual portable oil heater.

Its Use for Power.

AS a source of power it seems not improbable that alcohol will, in the not very remote future, supersede gasoline or petrol, at least partially, in accordance with the immutable laws of supply and demand. Gasoline, being a distillate from petroleum, has a certain fixed and definite limit to quantity, and though its exhaustion may be remote in time, the fact has a continued and marked tendency to increase its price ultimately to its limit of commercial use as a source of power. The relationship between its supply and demand therefore is not a constant. In the last dozen years its price has risen from about 18 cents to over 40 cents per gallon, and any material reduction of the latter figure is probably remote.

Early in 1914 the Imperial Motor Transport Council, of London, set up a committee, called the Alcohol Motor Fuel Committee, for the purpose of considering the high price of petrol (gasoline). The serious nature of the enquiry may be judged from the personnel of the committee, which was constituted as follows:—Hon Arthur Stanley, M.P., Chairman of the Royal Automobile Club (Chairman); Mr. J. C Critchley, President of the Inst. of Automobile Engineers; Mr. S. F. Page, President of the

Society of Motor Manufacturers and Traders; Dr. H. S. Hele Shaw, representing the Automobile Association and Motor Union; Prof. V. B. Lewes, Professor of Chemistry at the Royal Naval College at Greenwich; and Sir Boverton Redwood, Adviser on Petroleum to the Government.

The case presented to this committee was in its simplest form as follows:

With the increasing use of motor vehicles the demand for fuel goes up, but the supply diminishes. Another fuel must be found, and alcohol, which can be produced at about half the present price of petrol, is held to be the most promising substitute. When mixed with a small proportion of benzol (a product of coal-tar) it is as effective as petrol, **given the right engine**.

It was the purpose of the committee to ask the Government to modify their conditions as to alcohol, so far at least as it is used for power purposes. The question of an efficient alcohol engine would form the subject of experiments to be carried out under the control and at the expense of the committee.

No Limit of Potential Supply.

WITH alcohol there is no limit of potential supply, for practically every vegetable substance in nature that is capable of fermentation is capable of yielding alcohol, and therefore, as to this article the relationship between supply and demand is a constant.

Among the more direct, convenient and plentiful sources of alcohol may be mentioned grain, molasses, potatoes, beets, sawdust, wood-pulp and peat. As to the three last of these substances, their economic possibilities will no doubt be investigated by the Forest Products Laboratories. A year or so ago an article

n a newspaper said that a large English company had commenced the commercially successful production of acetone and wood oil from saw-dust, by a simple process of fermentation. These are valuable substances, and if alcohol can also be produced, the thousands of tons of saw dust now lying waste all over the country will have considerable and hitherto un-suspected value.

Molasses as a source of alcohol is hardly in the running, in Canada at any rate. Most of the alcohol used in the United States and Canada is distilled from grain, and that it can be done economically and on a commercial basis is evidenced by the fact that within the last few years several large American distilleries that formerly turned out whiskey have taken up the production of pyro. That in doing so they were actuated rather by business principles than by temperance motives is a reasonable inference.

I close this first instalment of "alcohol" with the quotation of an interesting article that appeared in the Halifax "Herald" for October 3rd, 1918, copied from an American paper:

"Although this country (U.S.) produces about two-thirds of the petroleum of the world and turned out more gasoline this year than ever before, investigations are being carried on with a view to exploiting the use of mixtures of alcohol and gasoline in motor vehicles. It is now definitely established that alcohol can be blended with gasoline to produce a suitable fuel that will avoid the difficulties of starting a cold motor on alcohol alone, and without any change in the carburetor. The production of industrial alcohol on a large scale would accordingly help materially to increase the supply of motor fuel.

"Nearly all the automobiles in Norway and Sweden are operated on alcohol made from waste sulphite liquor from pulp mills. Alcohol is also used in automobiles in Spain, where the sale of gasoline

for use in passenger cars has been prohibited.

"The Scientific American says that alcohol can be produced at the pulp mills in this country at a cost of 15 to 20 cents a gallon at the present time, and if all the paper mills suitable for the purpose were equipped with the necessary plants they would have a combined capacity of 15,000,000 gallons a year.

"Waste from sugar mills and waste vegetable products provide other sources for the production of alcohol. Distilleries and breweries whose business is being curtailed by passage of dry laws in different States and by regulations of the food administration against use of grain for manufacture of intoxicants, have the apparatus and skilled labor requisite for the production of industrial alcohol from these wastes. They should welcome an opportunity to continue operation utilizing such products."

C. E. W. DODWELL,
M. Inst., C.E., M.E.I.C.

ALCOHOL.

II.

I AM not aware that any considerable quantity of alcohol has been produced in Canada from potatoes, though the industry has had at least a trial, but in Europe, notably in Germany, it is an extensive, and presumably a profitable, industry. Incidentally I may mention the fact, not generally known perhaps, that a large proportion of the Scotch whiskey absorbed throughout the drinking world is nothing more or less than potato spirit distilled in Germany, and shipped from Hamburg in thousands of gallons to Scotland, where it is refined, diluted, flavored, colored, bottled, labelled, capsuled, advertised, exported, sold and

drunk as the best brands of "genuine Scotch whiskey," "seven years in wood," etc., etc.

If the production of alcohol from potatoes, and their growth for the purpose are remunerative industries in Germany, it is difficult to see why they could not be profitably introduced into Canada, where the conditions of soil and climate are eminently suitable. The high prices of both potatoes and labor at the present time, however, and probably for several years to come, are undoubtedly obstacles, but whether permanent and insuperable obstacles or not, time must tell.

In every Province of Canada there are many factories for the production of jams, tinned, bottled, preserved and desiccated fruits and vegetable. In most of them their refuse, comprising many tons of pulp, skins, peelings, cores, seeds, etc., etc., would be more profitably used as sources of alcohol than as fuel, manure or swine-feed. A couple of years ago the papers reported that in the West many thousands of bushels of wheat were spoiling (by incipient fermentation) in store-houses and elevators for lack of, or delay in, transportation facilities. Little of the value of this grain need have been lost if it could have been hurried to a near-by distillery for the production of pyro. In December, 1913, it was stated, by a member of Parliament, that about a million barrels of potatoes, valued at $1,250,000, were going to waste in New Brunswick on account of the United States markets being barred to Canadian potatoes. If they could have been made immediately available as a source of alcohol there need have been no waste.

I deem it unnecessary to further elaborate this subject, or to go into the details of the alcohol values of the several substances mentioned, even were such figures accessible. The chief object of this note is to point out the importance and great desirability of making such changes in existing tariff and excise as will permit the

public to obtain cheap alcohol for industrial and domestic use, as in the United States and other countries.

Let me here call special attention to some bulletins issued by the Government of the United States, to which the following are brief references:

(1) **Denatured Alcohol at Home and Abroad,** issued by the Commissioner of Inland Review in 1909. This is an interesting and important report on the manufacture and use of denatured alcohol, or pryo, in Europe, and especially in Germany, where this valuable substance has reached its highest development and use. The report briefly describes a remarkable Institute in Berlin called the "Institut fur Garungsgewerbe und Starkefabrikation."

> "This Institute is an extensive establishment maintained by the distilling trade for the combined purpose of experiment, instruction, and scientific supervision of the industries concerned. A corps of instructors is provided, giving short courses in the technique of the industries, and carrying on research work on the problems presented from time to time; experts are furnished for solving practical difficulties that arise in manufacturing operations. . . . . Experiments are carried on in the testing of appliances utilizing alcohol, such as lamps, stoves, engines, etc., not only for the purpose of determining the merit or demerit of new appliances, but also to see that no device is put forth for sale that has any dangerous features. . . . This institute forms one of a group of similar establishments carried on by lines of industry which require for successful operation a high degree of scientific knowledge and skill. . . . . These Institutions have undoubtedly played a most prominent part in the high development obtained in Germany within recent years by the industries supporting them."

Speaking of Government encouragement of the manufacture of denatured alcohol, the Bulletin goes on to say:

> "The best way of aiding it in this unequal struggle—the most simple, decent, and straightforward method under our system of taxation—is by a direct bounty paid upon every gallon used for industrial purposes. Ample precedent exists for this in the bounty paid upon home-grown sugar from 1890-1894. Like sugar, it is an agricultural product which not only takes nothing from the soil, but greatly contributes to its fertility. Unlike the sugar industry, the alcohol industry is already a subject of governmental supervision, and must, in the nature of things, always remain so; the machinery for the payment of a bounty on alcohol already exists, and it would not require the inauguration of an extensive new control, as was the case with the sugar bounty. Moreover, the producer of industrial alcohol has a very real and actual claim for subvention to the extent of the cost of supervision to which he is obliged to submit, because he is unfortunate enough to produce an article subject to tax when used for other purposes. This is the sole basis of the English surtax, or allowance, of 3d per proof gallon now paid upon all alcohol used industrially, and which is not considered as a bounty, but as the equalizing allowance."

(2) **Regulations and Instructions Relating to the Manufacture, Sale and Use of Denatured Alcohol,** issued by the Commissioner of Internal Revenue in 1911, with supplement issued in 1914. These regulations are adaptable to the proper control of the manufacture, sale and use of denatured alcohol in Canada, and they should have the earnest consideration of our Department of Inland Revenue.

(3) **Foreign Trade in Denatured Alcohol** (with special Consular Report No. 51), issued by the Department of Commerce and Labor in 1912. These Bulletins give statistics and particulars of the manufacture and use of the spirit in nearly every civilized country of the world. Canada, conspicuous by its absence from the list, is the only country lacking the advantage enjoyed by the others, a fact of which we have no reason to be proud.

From the Bulletin I quote, and commend to careful study, a significant sentence:

> "It is possible that the monopoly that Germany enjoys in the coal-tar by-product industry is due to the early recognition in that country of the value of tax-free alcohol in the manufacture of coal-tar colors, etc."

In France the Claassen process, for the production of ethyl alcohol from sawdust, is in successful commercial operation.

(4) **Production and Use of Denatured Alcohol in Principal Countries** (Special Agents Series, No. 77), issued by the Department of Commerce in 1914. In this Bulletin, as in number (1) above, special stress is laid on the German status.

> "It is a well-known fact that the country that makes the most extensive use of the privilege of tax-free alcohol for industrial purposes is Germany. In small part this is probably due to the remarkable industrial expansion in recent years in that country and to the strong national impulse to utilize every possible economy in every line of manufacture. In much greater measure, however, the prestige is due to the system of Government taxation of spirit production, which favors industrial alcohol as against potable alcohol."

On page 20 is given a brief description of the **Spiritus Zentrale**, from which I quote:

"This organization, which includes and represents nearly 4,000 agricultural distilleries and also most of the spirit-refining distilleries of Germany, is well worthy of study as an object lesson in trade economy, as it entirely eliminates middlemen's profits and brings the consumer into direct connection with the producer, while at the same time it serves the purpose of equalizing profits and losses, preventing unfair and destructive competition, and simplifying the methods of marketing the product.

"There can be no question that the systematized method of sale and distribution employed by this organization has played a very important part in the development of the large industrial-alcohol consumption in Germany. It is a private agency, but it works in harmony with the Government and affords a very efficient implement by means of which governmental policies and plans can be carried out. It constitutes a practical monopoly, as it controls over 90 per cent of the entire spirit production of the German Empire, but it is intended to be a beneficial monopoly, as it is supposed to conserve the interests of both producer and consumer, and its operation is necessarily under very close supervision by the Government, as it deals with a highly taxed commodity."

The quantity of tax-free alcohol used in Germany in 1912 amounted to nearly 42,000,000 U. S. gallons of **pure** alcohol which is equivalent to nearly 84,000,000 of **proof spirit**.

The Bulletin also quotes in extenso a paper published in Motor Traction for July, 1913, by Sir Boverton Redwood and Prof. Vivian B. Lewis, which attracted general attention, owing to the reputation

of the former as one of the most distinguished authorities on petroleum products.

Let me make a couple more brief quotations from this valuable Bulletin, because I think they are worth recording:

"It may be asserted without hesitation that the primary impetus that has brought about the present high degree of development of the German alcohol system was the fostering policy of the German Government, which had for its aim, first, the improvement of the thin sandy soils of northeastern Germany by the cultivation of the potato; and second, the development of a source of liquid fuel supply that would make the country independent of foreign sources of petroleum. . . . . Substantial benefits have resulted, however, from the inauguration of tax-free alcohol legislation in the United States. There are few lines of manufacture that have not had some measure of advantage from the reduction in price of alcohol to one-fifth of its previous value, and in some manufactured products, such as varnishes, ethers, and fulminates, the effect has been revolutionary.

"Its use for heating, lighting and cleaning purposes, which was practically prohibited by high prices when all alcohol was taxed, has expanded rapidly since the tax was removed, and has resulted in great advantage to the public at large. Its use as a motor fuel, naturally of the greatest benefit when it comes, awaits only the inevitable exhaustion of the mineral liquid fuel supplies that are adapted or adaptable to this purpose."

The above Bulletins, with others of similar purport, should be—perhaps are—in the working Library of the Commission of Conservation.

Some idea of the magnitude of the Industrial Alcohol business in the United States may be gathered from the fact that the United States Industrial Alcohol Co. early in 1916 had closed a contract with the French Government for the delivery of $25,000,000 worth of the spirit, in which transaction the trade profits were estimated at $6,000,000. While it is true that this immense quantity was for the purpose of making explosives, there is no doubt that now the war is over the whole output of the United States Industrial Alcohol Co. will be absorbed by home industries of many kinds.

C. E. W. DODWELL,
M. Inst., C.E., M.E.I.C.

ALCOHOL

III.

AT the "National Exposition of Chemical Industries" in New York, in September, 1916, the increased industrial value of alcohol and the possibility of its substitution for gasoline was discussed. Dr. Arthur D. Little of Boston, who presided at the Conference, said, "The only fuel in sight which promises to take the place, or hold down the price, of gasoline is alcohol . . . . ."

"Alcohol is the best fuel for internal "combustion engines, as benzol, which "had been suggested as a substitute for "gasoline, is not sufficiently plentiful to "keep the 3,000,000 automobiles in this "country going for two days. . . ." He quoted figures to show that from 1912 to 1915 the production of completely denatured and specially denatured alcohol rose from 8,400,000 gallons to 14,000,000 gallons a year. He asserted the Government restriction was one reason why there had not been a greater production.

I call attention to an article in the "Engineering Supplement" of the London "Times," for the 25th of December, 1914, on "Fuel for Motor Car Engines", in which is described (in a paper by Prof. W. Watson and others, read before the Institution of Automobile Engineers) a series of experiments carried out at the Royal College of Science. Also to an even more important article in the same journal for the 26th of February, 1915, on "The Cracking of Oils" **for the production of motor spirit**. This latter article reviews a paper read before the Institution of Petroleum Technologists by Mr. William A. Hall, in which the origin of the term "cracking" is traced to the old Pennsylvania refineries of half a century ago. The importance of the process is forcibly stated and the significant fact mentioned that "The Standard Oil Com-"pany, the greatest Company producing "oil and motor spirit, have taken up "'Cracking' extensively. It was only "about three years ago that they started "it, on a really extensive scale, with a few "small stills at Whiting, Indiana; now "they are stated to be working the so-"called Burton process, with several hun-"dred 200-gallon stills, the output from "which has had a material effect on both "the volume and the price of petrol. . . . "Though 'cracking' is undoubtedly in its "infancy, it must play a most important "part in the future and in many coun-"tries."

The Imperial Oil Company is now carrying on the process on a large scale at its works on Eastern Passage, Halifax Harbor.

Sawdust As a Source of Alcohol.

A WORD now in regard to the possibility of **sawdust** as a source of alcohol, because the subject is of considerable importance. At the "National Exposition of Chemical Industries" in New York, in September, 1916, referred to just now, Dr. Little quoted Arthur H. Coney,

Chemist at the Pont Powder Laboratories, as having stated that the production of alcohol from sawdust was a great commercial success and that it would grow accordingly. Dr. Tuttle also said:

> "In the Yellowstone district alone enough material is wasted to make 600,000 gallons of alcohol a day, and that there are 10,000,000 tons of materials available every year in the United States from which alcohol could be made."

It is a dozen years since the conversion of the cellulose of sawdust into glucose, and the resulting production of ethyl alcohol, has been accomplished on a large scale by methods largely devised by Claassen.

> "In ordinary soft woods we have a mixture of true cellulose and oxycellulose, the latter of which may be rather easily hydrolyzed and converted into sugar. By the Claassen process this is accomplished by heating sawdust with sulphurous acid under pressure in large lead-lined drums. . . . The Claassen process was first worked in America by the Liguin Inversion Company in an experimental plant at Chicago. In this plant it was found that a ton of dry pine sawdust would yield about 20 per cent. of sugar, or about 400 pounds, three-fourths of which was readily fermentible with yeast. Twenty-five gallons of 188 degree alcohol (94 per cent. by volume) was found to be a good working yield.

Following the demonstration in this experimental plant the Claassen Liguin Company was organized to work the process on a commercial scale. A plant was built at Hattiesburg, Mississippi, in an important lumber region, and, after much delay on account of defective machinery, was brought finally to the condition of working efficiency.

A considerable quantity of high-grade ethyl alcohol has been produced and put on the market. The operating Company seems to be convinced that the process could be worked at a profit. From latest reports it appears that the plant is being enlarged and that a new one is to be built on the Pacific Coast.

> The alcohol secured in this process is of high grade and practically free from by-products occurring when certain other materials are worked up. The sawdust which is not converted into sugar is left in a condition for easy compression into briquettes, for direct use or conversion into charcoal."

(The above quotations are from R. F. Herrick's admirable work **"Denatured or Industrial Alcohol,"** New York, John Wiley & Sons, 1907.)

Cost of Production.

THE Wisconsin Forests Products Laboratory has demonstrated that the manufacture of alcohol from sawdust and other wood waste is,

> "Not only chemically possible, but commercially profitable. After nearly five years of experimentation, a method has been evolved whereby, under reasonably favorable conditions, ethyl alcohol may be produced for 24 cents per (Imp.) gallon. Under more ideal conditions, as outlined by E. W. Kressman, chemist in charge of the experiments, the cost of production may be reduced to between 16.4 and 23.4 cents. The cost of making grain alcohol from corn is about 48 cents per (Imp.) gallon. . . . . Two large plants are already engaged in making alcohol from wood-waste, one, located in Louisiana, recently changed its methods to conform the newest improvements in process, as pointed out

by the experiments here. A number of other plants are reported to be arranging to adopt the Wisconsin process."

(The above quotation is from a newspaper article in 1916).

In the light of the above facts, the importance of sawdust, shavings and other forms of wood waste as sources of alcohol, appears sufficient to justify the Government in initiating the industry by the establishment, in the first place, of an experimental plant, on an adequate scale, and subsequently in substantial financial aid in the form of bounties or subsidies.

The present price of fuel of all kinds, but especially of coal, points to the desirability also of Governmental encouragement or exploitation of the manufacture of compressed blocks of sawdust, with a binder of pitch, bitumen, or crude or refuse petroleum. **Such fuel could certainly be made for half its market value.**

The American Lumberman said four years ago that machinery had recently been perfected by which sawdust may be pressed into blocks without the use of any binder or cohesive.

From the destructive or dry distillation of sawdust and other wood waste many useful and valuable substances are derived, illuminating gas, wood vinegar or pyroligneous acid, methyl alcohol, wood tar, creosote, benzol and many other chemical substances, and finally pure charcoal.

Production From Peat.

BEFORE leaving the subject of alcohol production, I should like to point out that experiments have demonstrated that one ton of peat has been made to yield from 25 to 30 gallons of ethyl alcohol, and that excellent peat fuel could be put on the market for $2.00 to $2.50 per ton. This is probably too low a figure, but even

at double this price the production of peat fuel should be assisted and even encouraged by the Government by means of either subsidy or bounty, and the potential value of the scale of millions of tons of peat, scattered all over the country, converted into actual wealth as **alcohol, fuel, or power-gas**.

In that valuable and interesting Bulletin, No. 11, of the Mines Branch, Department of Mines, "**Investigation of the Peat Bogs and Peat Industry of Canada, 1913-1914**," though the process of the manufacture of peat fuel, at the Alfred Bog, Ontario, is described and illustrated, all information as to the very important question of **cost** is conspicuous by its absence, and this is the essence of the whole question of the possibility of peat as a commercial and general fuel. If it can be put on the market for less than the cost of coal—and of this there seems to be no doubt—an industry of enormous value and importance is waiting development. If the information is available, or in the possession of the Mines Branch, it should be made publicly known. If it is not known it should be ascertained as soon as possible.

In the **Report on the Utilization of Peat Fuel for the Production of Power**, by B. F. Haanel, issued by the Department of Mines, Mines Branch, in 1912, the only reference to the cost of Peat is a sentence on page 86:

> "In estimating fuel costs, the assumption is made that peat with a moisture content of 25 per cent. can be delivered to the producer for $2.00 per ton."

This is not very satisfactory, for nothing is said of the grounds for the assumption, as to whether it is based on actual experiments and when, where, and under what conditions experiments were made. Presuming, however, that the assumption is not wholly gratuitous, and that peat fuel can be delivered to the gas

producer for $2.00 per ton, it can surely be put on the market and made accessible to the general public for less than twice that figure, at which it would be an enormous boon.

In connection with the combined subject of alcohol-fuel-peat-sawdust, I make one or two strong and specific recommendations.

In my opinion it is very desirable that the Government, by the Conservation Commission, the **Advisory Council for Scientific and Industrial Research, the Mines Branch**, or some other executive organ, should (1) Send somebody, preferably a practical or industrial chemist, to visit and investigate thoroughly and at once the plants now being commercially operated in the United States, for the production of ethyl alcohol from sawdust and other wood waste, and from peat. (2) Set up a small distillery—on something more than an experimental scale—for the treatment of these substances. The plant should be established in a suitable locality, convenient to large deposits of either or both sawdust and peat, and accessible by and to transportation facilities. It should be modeled on the very latest and best development of practice and be so devised as to be as portable as possible consistently with efficiency.

This article concludes the subject of Alcohol.

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PEAT

IN Canada there is said to be 30,000,000 acres of Peat Bog (in the United States 20,000,000), constituting immense potential wealth, which, up to the present, has to a very insignificant extent been realized or developed. Spasmodic efforts have been made at several

places in the Dominion to establish factories for the preparation of commercial peat fuel, but for various reasons inadequate capital, high cost of labor, low cost of coal and others the industry cannot be said to have passed tentative stages or to have gained a footing on a commercial basis.

A dozen years ago a company was formed and a plant was set up at Tusket, near Yarmouth, N.S. Something over $20,000 was spent on the installation, and a few tons of excellent partly carbonized compressed peat fuel were turned out, but for reasons that, although a shareholder to a small extent, I never discovered, the enterprise languished and finally died. I had a few bags of the output sent to me at Halifax for trial, and I got Admiral Sir V. L. Douglas to try it in his steam barge. He told me afterwards that it was admirable steam fuel, but that his engineer did not like it because it needed such a lot of shoveling into the fire box. I tried it in a grate at my house, and there it was simply an ideal fuel, giving a cheerful, hot, smokeless fire with almost no ash. The manager of the concern at Tusket claimed that the finished product could be turned out for about, or less than, $2.50 per ton, and if this figure were correct, it makes the failure the more unaccountable.

The Department of Mines, at its Fuel Testing Station at Ottawa, has, in the past few years, done much valuable experimental work and issued numerous interesting bulletins descriptive of exhaustive trials of peat as a fuel, but in spite of the very favorable character of the results and reports of these trials, the manufacture of peat fuel seems to hang fire as a commercial industry in Canada. Much more has been done in this line in the United States.

BULLETIN No. 154 of the Department of Mines "**Report on the Utilization of Peat Fuel for the Production of Power,**" by Mr. B. F. Haanel, B.Sc., Chief of Fuel Testing Division, is an elaborate compilation, with voluminous tables and diagrams, embodying the results of experiments conducted at the Fuel Testing Station in 1910-11. In the "General Deductions and Conclusions," at the end of the Report, the comparative power values of peat and coal are not specially emphasized, but figures are given from which it would appear that, pound for pound, coal is slightly superior as a source of **producer-gas power,** though a little more expensive.

Calorific value of coal, 12500 B.T.U. per pound.

Calorific value of dry peat, 8650 B.T.U. per pound.

Fuel economy of producer-gas power plant, 1.25-1.50 pounds of coal per B.H.P.

Fuel economy of producer-gas power plant, 1.78-2.04 pounds of peat per B.H.P.

Fuel cost of peat in producer-gas power plant, with peat at $2.00 per ton, $8.70 per B.H.P.

Hence, the superiority of peat over coal as a source of power in a producer-gas plant would depend upon its lower cost, which is the point at issue, and not the relative advantages of the ordinary steam-plant and the producer-gas plant as developers of power, the latter, as is well known, being a good deal superior to the former.

The salient fact to which I wish to call attention is, that excellent peat fuel could be put on the market for $3.00 to $3.50 per ton, and that good business could be done by a company with sufficient courage and capital to take up the industry on an adequate scale.

The chief obstacles in the way of the establishment of the industry appear to be (a) the difficulty of adequately drying the peat before carbonization and compression. It has been almost conclusively shown that artificial drying is impractical, or at any rate too expensive, and natural or air drying for a plant of any considerable size, requires an immense area of drying space and longer periods of warm dry weather than are experienced in most parts of Canada. (b) Even with a factory on a large scale, the machinery would have to be more or less portable because the peat bogs throughout the country are widely scattered and none of them are inexhaustible, or even approaching our working coal fields in available quantity.

But peat has other features of potential value. Experiments have shown that it will yield from 25 to 30 gallons of alcohol and from 20 to 40 pounds of ammonia-sulphate per ton (pre-war value of the latter $78 per ton). Indeed, 40 gallons and 66 pounds respectively have been claimed as actual results. I have no information regarding the cost per gallon of distillation, on which the possible utility of the substance naturally depends, and this is a matter in regard to which the Forest Products Laboratories might profitably do some very interesting and valuable experimenting.

In Michigan, in 1900, a factory was opened for the manufacture of paper from peat. Whether it was a success or a failure I do not know, but in view of the rapid depletion of our forests, now going on, immense public benefit will result from a demonstration that peat is capable of replacing pulp-wood as a source of paper.

Coal Tar Derivatives.

IT is a well known fact that the ultimate derivatives from the destructive distillation of a ton of bituminous coal are worth many times the original ton of

coal, but that it costs money and skill of a highly scientific character to produce them. In recent years Germany has led the world in industrial chemistry, not because she has had a monopoly, either in capital or scientific knowledge, but simply that she seized opportunities that were neglected by other countries, notably England. Today she enjoys practically a monopoly in synthetic dyes and many other chemical substances derived from coal.

The partial paralysis of Germany's industrial activities as the direct result of the recent devastating war, places within the grasp of England, and the Empire at large, a unique opportunity—I might say the national duty—of capturing from our enemy much actual and potential wealth in trade, commerce and manufactures, and in this national duty campaign Canada should actively participate.

Mr. W. J. Dick also said, in his report to the Conservation Commission on **"Conservation of Coal in Canada, 1914"**:

> "Canada and the United States are far behind Germany and other foreign countries in adopting the economies resulting from the coking of coal in **by-product ovens**. In Germany, at the present time, little or no coke is made except in retort (by-product) ovens. When the economies which may be effected by the use of such ovens have been so clearly demonstrated, not only by plants which have been constructed in Europe, but also by plants in the United States, and at Sydney and Sault Ste. Marie in Canada, it seems difficult to understand why they are not more generally adopted in Western Canada. There are several reasons why they have not been introduced, first, the greater cost incurred in installing them, and second, the lack of markets for the resulting by-products."

one of our collieries are equipped with coke ovens which produce coke for iron and steel making, but of these coking plants only some two or three are by-product ovens. At the others, where the ovens are of a bee-hive type, the products are almost wholly wasted. A by-product oven costs about $10,000, a bee-hive oven about $1,000, but it has been shown that the advantage of the by-product oven over the bee-hive is so marked that the saving in coal and by-products by its use amounts to about $1,500 per annum, or for by-products alone about $3,700 on the normal output of 6.3 tons per oven per day.

In Cape Breton the collieries of the Dominion Coal Company have a total output of about 5,000,000 tons per annum. In connection therewith, the Dominion Iron and Steel Co. have at Sydney, a coking plant turning out nearly half a million tons of coke per annum, nearly all of which they use in iron and steel making. The resulting tar they sell at two or three cents per gallon to the Dominion Tar and Chemical Co., at whose neighboring works it is distilled for its primary products of light oils, heavy or creosote oils, carbolic acid and pitch, the creosote being used at their works for treating timber.

So far as I am aware, no attempt is made by this last named company, or by any other company in Canada, to extract any of the more complex and valuable derivatives from tar distillation, and herein lie the roots of a potential industry of considerable value and importance. As against the practicability of its establishment in Canada, it cannot be urged, as it undoubtedly can be urged in the case of several other industries suggested in these notes, that it is hampered by the high cost of labor, for comparatively little manual labor would be employed. The necessary highly skilled labor of practical chemists would cost little or no more here than in other countries.

IN no part of the field of ind
chemistry to which at this ju
we should lay siege, is the prom
reward greater than in the directi
coal tar distillation. Following the
ary derivatives therefrom, the ben
naphthalene, anthracene and phen
rene series, are a host of deriva
(Lunge "**Coal Tar and Ammonia**" giv
list of 190 substances) some of ther
course mere chemical curiosities, rare
unimportant, but many of great and
creasing scientific and pharmaceut
value.

Mr. E. T. P. Shewen, Consulti
Engineer for the Public Works Depa
ment at St. John, N.B., contributed
brief but valuable paper on the subjec
published as Appendix IX of the 8t
Report of the Commission of Conserva
tion, 1917. Mr. Shewen states tha
while a ton of coal at the pit's mouth is
worth only about $2.50, its primary de-
rivatives—coke, gas, creosote and pitch
are worth $8.50, an increment of nearly
300 per cent. Even this statement is
over-conservative, for a ton of **slack** at
the pit's mouth is not worth as much as
$2.50, and its primary derivatives are
today worth much more than $8.50.

The most important first product of
tar distillation is creosote oil, in which
engineers all over Canada are particularly
interested, because it is the best known
preservative of timber from decay and
destruction by fungoid and parasitic
germs, and by the limnoria, teredo and
other sea-pests. In the construction of
wharves and breakwaters in salt water
the Public Works Department has hither-
to been compelled to buy creosoted timber
from the United States, though we have
in our own resources abundance of both
oil and timber.

But if the first by-products of coal are
worth three times as much as the coal,
the secondary products are still more
valuable. These are mainly benzenes,

phenols, pyridines, napthalene, anthracene and heavy and light oils. Tertiary and ultimate derivatives from these again are aniines, toluene, xylene, and a host of other precious chemical substances, estimated at many dollars per ounce. (See Bulletin No. 323 **Products and By-Products of Coal**, issued by the Mines Branch in 1915.)

As a first and practical step towards the general development and inauguration of coal distillation, and particularly with a view to establishing our own urgently needed creosoting plant for the treatment of timber, the Government should offer a substantial bounty on every gallon of creosote oil produced **bona fide** in Canada from Canadian coal. With this initial stimulus and encouragement, followed by further timely and judicious aid, the industry of coal distillation will, in a comparatively near future, be established on both scientific and commercial principles, to the great advantage of the country.

HIGHWAYS

IF Agriculture is the backbone of a country, transportation routes, whether wet or dry, may aptly be called its veins, arteries, or other vital circulatory organs. It should not, though it seems to, require a high order of intelligence to understand that good roads are of immense importance to all the inhabitants of a country, but especially to the farmer. It should not require a mathematician to appreciate the fact that the value of a barrel of apples or a bushel of potatoes varies inversely as the cost of carrying it to market. Needless to say the coming of the automobile adds enormous importance to the whole matter of public roads.

It is encouraging to note that the whole subject of highways is now being vigorously discussed all over the country, and that efforts are being made to educate the

public to a proper realization of the i
mense importance of good highways
lectures, by articles and letters in new
papers and magazines, and by the form
tion of Good Roads Associations throug
out the whole of Canada. It is a worth
campaign, and it is devoutly to be hope
that it will result in substantial develop
ment and the prosperity of the who
Dominion.

ON the occasion of the recent annua
convention of the Engineering Insti
tute of Canada on the 11th, 12th and
13th of February, 1919, at a luncheon in
the Chateau Laurier, at Ottawa, at which
nearly 100 engineers with their lady
friends and guests were present, the Hon.
F. B. Carvell, Minister of Public Works,
in an able and vigorous half hour's ad-
dress, made special reference to the sub-
ject of good roads. He said, what we all
know to be true, that in the past thirty or
forty years, many millions of dollars had
been improperly expended or wasted in
the faulty construction and maintenance
of highways without proper engineering
advice and supervision. He also said—
and it was good to hear it—that it was the
policy and the intention of the Govern-
ment to give prompt and vigorous atten-
tion to the matter, and to spend consider-
able sums of money with the dual object
of building new, and improving old roads,
and of thus affording some measure of
solution to the problem of unemployment
that faces us.

I have but little knowledge of the con-
dition of public highways in other parts
of the Dominion, but (I speak whereof I
know, when I say) in Nova Scotia in the
past half century there has been money
enough wasted on the public roads to
build macadamized highways nearly all
over the Province and that at this date,
with few exceptions, they are little short
of a disgrace to a supposedly civilized
country. The money grants have been
expended under such circumstances, and

under supervision of such a character, that the only perceptible result is a bad road made worse. The favorite method of repairing or remaking a road seems to have been to plough the side ditches and then throw the resulting sods and mud into a bank, or windrow, along the middle of the road. It has long been my firm conviction that greater and more direct advantage would accrue to the people at large from the expenditure of $1,000,000 on the public roads, under honest management and expert engineering supervision, than from the expenditure of $2,000,000 in railways. There are few subjects of more direct importance, from the point of view of the development of the natural resources of the country, than that of good roads, and it is in furtherance of which the public press might very appropriately do a little missionary work, in enlightening the community on its great importance, and inducing the Governments, Federal and Provincial, to take up the matter with vigor and intelligence. As a practical policy of far-sighted wisdom, few courses of action would appeal with greater force to the more intelligent section of the electorate.

AT the last session of the Provincial Legislature of Nova Scotia an Act was passed constituting a new Executive Department of the Government, viz, a Minister of Highways, and five Commissioners, whose sole and special duties will be the construction and maintenance of public roads. It is a step in the right direction as indicative of the Government's realization of the importance of the question, and of their earnest desire to meet the growing demand of the people for better roads, but I have heard the opinion very freely expressed that the existing Departments of the Government, with a few additional salaried officers—which will be necessary anyhow—are adequate to the needs of the efficient management and control of road operations, that the new machinery is unnecessary—especially as not one of the

four newly appointed gentlemen is an engineer or a practical road builder—and that their aggregate emoluments—some nine thousand dollars a year—could, to better advantage, have been expended directly upon the highways.

In this connection let me make a few practical suggestions:

(1) The ancient system of issuing commissions to expend money on the roads should be abolished, if it has not already been superseded.

(2) The system of statute labor might be retained, but the essence of the new regime should be that **every dollar and every hour's labor expended on the roads should be expended under responsible and intelligent supervision.**

(3) In each County there should be a salaried inspector to have direct and responsible charge of all the public roads in his County. He should be an honest, energetic, intelligent and decently educated man, if possible with some knowledge and experience of road making, and every dollar expended on the roads in his County should be laid out under his own personal supervision, or that of a capable and responsible foreman under him.

(4) The Provincial Engineer's Office should prepare a set of Standard Plans and Specifications for road repair and construction, adapted to the various and differing soil conditions to be found throughout the Province. It should also prepare or adopt a standard little book or manual on road construction, and a copy of this book, together with a set of the Standard Plans and Specifications, should be put into the hands of each Inspector, who should also receive special and general instructions in regard to the essential and elementary principles of road constuction.

(5) Each County should have at least one road roller and one rock crusher (the latter operated by a 10 h.p. gasoline or oil engine.)

(b) Every dollar collected by the Government, whether Provincial or Municipal, in the form of taxes or licenses on automobiles, should be expended on the public roads. The licenses might well be doubled.

THE great majority of farms throughout the Province are situated from 2 to 10 miles from a railway. If their owners could be educated to realize the fact that the value of their farms was largely dependent on the condition of the road to the nearest station, they would soon make their voices heard in the insistent demand for reformation. There are many orchards in the Province, notably in the Annapolis Valley, 6 or 7 miles from a railway station, and in these it is often better economy to let the apples rot on the trees than haul them over the roads, bad at any time, but at their worst and sometimes almost impassable in the fall, when the apples are picked and marketed. This obvious fact applies to every form of farm produce. Farmers, remote from railway transport facilities, and lacking good highways, cannot economically raise anything which they and their families cannot themselves consume.

The coming of the automobile should have revolutionized the whole question of public roads, but that it has not yet done so, in this Province at least, is distressingly obvious.

To the twelve or more millions of people of the Atlantic States, from Portland to Philadelphia, and even further south, Nova Scotia would be in summer, a little Paradise, **if we had decent roads**. To come quite near home, if the Government of the Province of Nova Scotia, or of the City or County of Halifax, were to expend, under proper supervision, several hundred thousands of dollars on the roads leading out of the City of Halifax in every direction the outlay would be both directly and indirectly **a very profitable**

investment. We should attract, during our brief summer months, a class, and a number of American tourists that we have not seen yet, nor will see, until we can afford them good roads for their "joy riding." (Better hotels and better transportation facilities are also essential to the proper development of the tourist business, but these are not in my present story). The first thing wanted by tourists on arriving at Halifax is a drive. They hire a motor, or a carriage, and they tell the driver to take them some miles out in the country. Whichever way they go, whether towards Chester, Windsor or Musquodoboit, they are nearly shaken to pieces, and they slang the driver for taking them over the worst road he could find. He protests that it is the best road we have. What is the result? These tourists pay their hotel bill, and take their departure on the following morning, to carry the report of our execrable roads to other would-be visitors to our city. This is no romance. I have come across lots of exactly similar cases.

IN the "Canadian Engineer" for February 13th, 1919 (p.233) is a most interesting and encouraging article on "Federal Aid for Highways," being a slightly condensed report of a notable speech by the Hon. J. D. Reid, Minister of Railways and Canals, at the annual meeting at Ottawa, early in February, 1919, of the "Eastern Ontario Good Roads Association." Dr. Reid said that the Federal Government would furnish its share of money to help the Province in road construction; that the Government had decided to take up the matter seriously during the present Session, and that his Department had organized the "Dominion Highways Department," with Mr. A. W. Campbell as its executive head. A complete system of highways was an indispensable adjunct to the railways and waterways of the country in the development of the whole Dominion. He gave

a few figures as indicative of the vast importance of the subject. In the Dominion there are 250,000 miles of roads, of which only 10,000 are "first class" or connecting large centres.

"There are 262,000 licenses for autos "and motor trucks in the Dominion, cost- "ing two hundred million dollars. The "extra depreciation on these, due to bad "roads, would build many thousand miles "of good roads each year."

After a few words as to what the United States is doing in the matter of good roads, Dr. Reid says:

"Wait till we get started in Canada and you will see how we will go. I promise to continue on the work and do my best to see that all parts of the Dominion have assistance to the greatest extent that we should go to get good roads. You have not a better friend for good roads than I am."

C. E. W. DODWELL,

Mem. Inst. C.E., Mem. E.I.C.

WASTEFULNESS

He also that is slothful in his business is brother to him that is a great waster.—Prov. XVIII. 9.

SECOND only to the importance of the proper economic utilization of our natural resources is their conservation, or the prevention of their waste.

I say second in importance because, firstly, the judicious use and exploitation of our resources is a **direct** source of national wealth and prosperity and the prevention of their waste is a more or less indirect or secondary source. Secondly, because here in Canada we are in a somewhat different position as to the fundamentals of national

house-keeping from other and older countries, the outstanding points of difference being those relating to population. Here we have 8,000,000 people, scattered over an area of 3,000,000 square miles—the population of the City of London spread over the whole of Europe—or less than three people to the square mile. If we contrast this sparsity with the 33 to the square mile in the United States, 266 in China, 311 in Germany, 374 in Great Britain and 688 in Belgium, it is plain that in Canada the prevention of waste is not of so great importance as it is in those countries, owing to the simple fact that we have vastly more of every kind of material wealth in natural resources **per head of population** than they have. Mathematically speaking our natural resources are in inverse ratio to our population.

Must Mend Our Ways.

WHILE, however, these facts explain our wasteful and careless use of nature's bounteous gift they do not excuse our short-sighted improvidence, and the time is fast approaching—indeed may be said to have arrived—when we must mend our ways.

A hundred years ago the matter of thrift versus waste had three conspicuous features:

(1) We had then less than half our present population, small as it is today.

(2) Our natural resources were greater than they are today by what we have used and wasted in a century.

(3) Transportation was so difficult and expensive that a certain amount of waste was not only unavoidable, but almost excusable.

At this stage of our national history and development, and of the world's needs and conditions, the question has a different aspect.

It is not my desire, however, to usurp the functions of a preacher, and to indite a pulpit homily on the sin and folly of wastefulness, but rather to direct attention to some of the chief industries in which there is much avoidable waste, and possibly to suggest ways and means for its arrest.

There are remediable wasteful methods and practices in every one of our present activities in the conversion of our natural resources from potential to actual wealth; in the fisheries and the gathering of all fresh and salt water food products; in all agricultural and horticultural operations, in the marketing and consumption of the products of the farm, the garden and the orchard; in the conversion of the trees of the forest into structural timber and lumber; and in most of our numerous mining operations, but chiefly in coal mining.

Our Coastal Fisheries.

IN Nova Scotia perhaps the most important of these is in connection with our coastal fisheries.

The marketed value of our fisheries for the whole of Canada in the calendar year 1917 amounted to the very considerable sum of $52,312,044, divided among the Provinces as in the following table:

British Columbia	$21,518,595
Nova Scotia	14,468,310
New Brunswick	6,143,088
Quebec	3,414,378
Ontario	2,866,419
P. E. Island	1,786,310
Manitoba	1,543,288
Saskatchewan	320,283
Alberta	184,009
Yukon	67,400
Total	$52,312,044

The following varieties making up the Nova Scotia total of fourteen and a half millions are:

Cod, fresh and dried	$4,553,534
Lobsters, canned and shipped in shell	3,071,171
Haddock, fresh, smoked and dried	2,866,220
Mackerel, salted and fresh	973,324
Herring, pickled, bait, smoked and fresh	841,404
Hake and cusk, dried, smoked and fresh	658,768
Halibut, fresh	336,820
Pollock, dried, salted, smoked and fresh	239,279
Salmon, fresh, smoked and canned	198,947
Smelts	106,146

The small balance of our total value is made up of fish oil, albacore, sword-fish, clams, scallops and a few other items of minor importance.

It is not too much to say that the total value of the fisheries of Canada of over fifty millions of dollars, could and should be increased by 20 per cent. to 40 per cent. of the total catch, if the proper steps were taken to prevent waste, and to make use of every part of every fish taken from its native element.

Professor Prince's Report.

PROFESSOR E. E. Prince, Commissioner of Fisheries in the Department of Marine and Fisheries in a special report on "Unutilized Fishery Products in Canada," 1907, says:

"The utilization of waste products is one of the most remarkable features of the manufacturing world today. The fisheries have been an exception, almost the sole exception, among the great industries of the world, and little has been done to turn to account the waste materials and by-product yielded by the fish business. The flesh or muscular tissues of fish, and in a few instances the liver, are almost the only portions that are, speaking in general

forms, made of commercial value. The head, fins, tail, skin, bones, or skeleton, entrail and various internal parts are usually thrown away and wasted. The amount of offal or 'gurry' and other waste materials produced at great centres of the fishing industries is astounding. But apart from these by-products, which are unutilized, there are also vast quantities of materials of value going to waste and unutilized because no one recognizes their value, and few realize that they exist."

Perhaps the most conspicuous instance of waste is in the lobster canning of our Atlantic Coast. Of the 32,000,000 pounds of lobsters taken from the sea for the purpose of canning, only 6,500,000 pounds is canned, the remaining 25,500,000 pounds being thrown away and wasted, a loss of nearly 80 per cent. This, however, is an extreme case, for the shells, forming a considerable percentable of the weight, are useless, except as a crude fertilizer, for which they are often used.

On our Pacific Coast the salmon canning of British Columbia, which in 1917 represented a value of a little over $14,000,000, is deplorably wasteful, for it takes 88 pounds of fish to make up a case of 48 pounds canned, a loss, or waste of nearly 50 per cent.

Enormous Annual Waste.

ON all marketable fish there is a waste of 30 per cent. to 50 per cent., and on both our Atlantic and Pacific Coasts the annual waste amounts to the appalling total of about 250,000 tons. To make use of some of this huge waste is one of the most important matters in our fish history.

"The enormous benefit to the fishing industry in a profitable utilization of this fish waste cannot be over-estimated. The fishermen in every branch of the industry will receive more for their fish. At the present time they are getting paid for just

that portion which is marketable—the balance represents waste for which they get nothing. Everything that comes on the hooks or in the nets is of value and worth something if it could be utilized, and it can be utilized.

"The soap, drug, leather, oil, paint, glue trades and agriculture are heavy purchasers of products manufactured from fish waste, and in every instance, so far as Canada is concerned, they have to purchase these materials from foreign manufacturers—who, more astute than we are, have realized the value of fishery waste.

"We strongly urge that every man engaged in the fishing industry of Canada give some thought to this problem, and demand that Governmental machinery be set in motion to make use of the enormous waste incidental to the fisheries." ("Canadian Fisherman" of March, 1917.)

"The importance of present day economic problems demands that an investigation be made into the possibility of utilizing this fish waste and the investigation should be started now. The Canadian Fisheries Association has looked into the problem, and already memorialized the Marine and Fisheries Department to have investigations and experiments conducted with a view to making the best use of fish waste, as soon as it is possible to get the necessary appropriations and secure the services of the biologists to undertake the work. With proper plant and machinery, and not expensive, either, it is possible to manufacture fish offal into fertilizer worth $30 per ton. Every ton of fish waste can produce 12 to 15 gallons of fish oil, which is worth from 35c. to 80c. per gallon, according to its grade of refinement. Fish-meal, manufactured from strictly fresh offal, is worth from $50 to $60 per ton as food for live stock. Fish glue is worth 75c. to $2.50 per gallon, according to grade. There are many other things which can be made

from fish offal, but which need some experimental work to determine the most economical way of producing them." (Canadian Fisherman.)

Something has been done by the Federal Government, but so far as I am aware, little or no effort has been made by any Provincial Government to redeem our fisheries from the charge of wastefulness.

"The Canadian Government have the dog fish reduction works for manufacturing fertilizer at Canso, but owing either to the lack of proper machinery, skilled knowledge or good management, the scheme has been a failure, though the product found ready sale." (Canadian Fisherman.)

Private enterprise has also accomplished something, but in this country, where there are so many other and more promising investments for capital, it is gratifying to know that even this little has been done.

"On Lake Erie, the Producers' Fish Company at Port Stanley has erected a small plant to manufacture fertilizer and fish oil out of waste which comes to them. They have made a profit on their venture and could make more were their machinery more suitable for the particular work of processing fish material.

"The Robinson Glue Co., of Canso, N. S., manufactures an excellent fish glue from the fish offal of the Canso Fish Docks, and operates profitably." (Canadian Fisherman.)

What Britain Is Doing.

IN Great Britain are a number of factories for the conversion of fish waste and offal into fish meal and guano. One of the best and most modern of these has been established at Fleetwood, Lancashire, on the coast of the Irish Sea, by the Fleetwood Fish Meal Company. The works, which were designed and equipped throughout by Messrs. William Douglas

and Sons, Ltd., of Putney, London, are described in detail by L. M. Douglas, Lecturer at the College of Agriculture of Edinburgh, in an article, or lecture, copied into a recent issue of the "Pacific Fishermen," an American West Coast journal. The guano produced by this concern has a value of about $30 per long ton and an analysis of:

Phosphate of lime	17.28 p.c.
Nitrogen equal to ammonia	10.50 p.c.
Water	18.98 p.c.

The article above referred to says:

"The business is indeed a very considerable one when well managed, and there are many ports in the United Kingdom where fish guano factories can be put down with every prospect of converting fish residues, which are at present simple waste, into a highly remunerative product."

From our Atlantic Coast there are shipped to the coast of Maine nearly $1,000,000 worth of small herring, to be packed as "sardines" in factories on the coast of Maine. If these fish were treated and packed in this country their value would be nearly ten times as great. The United States "sardine" industry is worth from $5,000,000 to $7,000,000 per annum.

Government Initiative.

IT would redound to the great advantage of our fisheries, one of the most prolific sources of material wealth, if the Federal Government were to take a vigorous initiative in efforts to put a stop to the prevailing wastefulness, the encouragement of thrift and the businesslike and economical management and reorganization of the whole industry by several available methods.

The most practicable way would be by establishing factories and reduction works at numerous and judiciously selected

points, and putting them under the management of highly trained and scientific experts of wide experience. Even were these plants operated at a small direct financial loss they would at least offer employment to a number of people, and so, even in a small way, contribute something to the solution of the unemployment problem which is no doubt going to be a very serious one in the process of the remobilization to normal peace conditions of our National Industries. An indirect, but probably efficacious course would be to offer bounties on the various products—fish glue, fish meal, fertilizer, etc.—to be obtained from fish waste.

Our Provincial Government, in collaboration with the Federal, might do something by inaugurating a campaign of education—by means of lectures, widely distributed pamphlets, etc.—not only of the fishermen themselves, but of fish dealers, merchants, shippers and exporters.

By virtue of an Act of the United States Congress of 1916, the Bureau of Fisheries has carried out a series of experiments and observations with the object of making some use of the dogfish, deemed by our fishermen a pest and a nuisance. The first active step was to change its name to **gray fish**, by which it now appears in many a menu in restaurants and hotels in the United States.

"Already a limited market for the fish has been found in New York, and during the fall and winter this will not only be increased in that city, but extended to other large communities."

"The liver oil will take care of itself, and the Bureau has been assured that there will be a demand for the eggs for leather dressing as soon as the regular supply can be obtained. There is now a small market for the skins for the manufacture of novelties, and there is reason to believe that they can be converted into leather which will find more extensive use. The production of gelatine from the fins and of fertilizer from the refuse

is possible, and it is believed that it will become a fact when the fishery shall have become established." (Fisheries Service Bulletin No 15, of August 1st.)

Utilization of By-products.

PROF. Prince in his special report, referred to above, says:

> The suggestion has been made that the eggs of dogfish and skates, which are obtained in great numbers when these fish are being captured and utilized, might be made of some use. When the dogfish are being handled at the Government Fish Reduction Works, these eggs, (like the large eggs of birds removed from their shells) may cover the wharves to a depth of several inches. They are most excellent and nutritious food. In my former report on the dogfish, I mentioned their use in Scandinavia in the making up of puddings, and recently an eminent English chemist, Dr. T. E. Thorpe, in an official report to the Cornwall County Council, emphatically states that:
>
> "'The eggs of the dogfish, when boiled, are very similar to an ordinary hard boiled hen's egg, and a wholesome and highly nutritious food.'"

In the Victoria (B.C.) "Daily Times" of the 23rd of July, 1917, Prof. Prince is quoted as having said that in the salmon industry of British Columbia:

> "There is an enormous and unexcusable waste of valuable by-products. There are some 60 varieties of edible fish abounding in British Columbia waters, yet only 8 of these are at present of any account commercially in local or foreign markets. Japan and Norway have long given the world examples of the wealth contained in the by-products of fish. In Great Britain in recent years this

question has been given serious consideration, with the result that enterprising men have developed a market that is demanding the complete utilization of fish value.

"Canada today imports $40,000 worth of fish glue annually, yet she has on this coast every requisite for its manufacture. A profitable industry involving the manufacture of this glue from the skins of British Columbia fish is at present untouched by the commercial men of the country. What has been done in other lands with what were at first considered to be useless products can be accomplished with the fish industry of this Province."

In another issue of the paper from which the above quotation is taken it goes on to say:

"The waste of fish roes in British Columbia is another appalling reality. This product should be saved, cleaned and salted. Siberia has developed a flourishing industry with this material, and is annually exporting thousands of tons in the form of caviar, which is now worth $2 a pound.

Another product that may be made from much fish that is now wasted is a very nutritious cattle food. This can be manufactured entirely from fish waste. The preparation is in the form of a white powder very rich in protein. In South America it has been found to be of great value, and scientific investigations and experiments have shown that for hogs there is nothing superior. When used with other foods in certain proportions it does not flavor the pork.

The opportunities for the manufacture of fish oils is an industry that the commissioner notes has not been

developed locally. The raw material is available, but the enterprise has not been undertaken. Markets for such products are always to be found, and it rests with men of foresight to undertake the establishing of industries that promise to have the making of British Columbia commercially."

FIRE WASTE

THE loss and waste of material wealth by fire has two main features; first, the destruction of towns and cities, with their contents, whether valuable goods in stores, warehouses, etc., or household furniture and effects in dwellings; second, the destruction of potential timber and lumber in the trees of the forest.

The first of these two categories, though having but a secondary connection with the general subject of the conservation of our national resources, calls for at least a few sentences, and the presentation of a few salient facts and considerations.

It is with deplorable frequency that we see in our papers the account of a conflagration in one of our leading cities, involving a loss running into hundreds of thousands of dollars. Our chief and immediate interest in such a catastrophe is centered in the insurance, and we are prone to regard the difference between the gross value of the property destroyed and the amount of the recoverable policies as the whole of the actual and irrevocable loss. Needless to say, this popular fallacy is a totally wrong view of the circumstances. The whole of the property consumed by fire, of whatsoever nature, represents so many dollars, so much material wealth, utterly annihilated and wiped from the face of the earth. It not infrequently happens that the destruction of a squalid and ramshackle block of buildings, or section of a city, is

popularly and rightly regarded as a blessing in disguise, as affording a most desirable, and perhaps long-hoped-for, opportunity of erecting more sanitary, useful, ornamental, and permanent structures on the devastated area, but the basic fact remains that the money value of the destroyed property, whether great or small, has irretrievably gone out of existence.

Losses of Insurance Companies.

THE losses of the Insurance Companies, while perhaps less acutely felt than those of an uninsured or under-insured property owner, are none the less real, whether spread over a few or many stockholders; they are direct or indirect losses to the community as a whole. As an excuse for these obvious generalities, I offer the incontrovertible statement that a very large proportion of this class of fire loss is **preventable,** as is abundantly shown by comparison of the losses in Europe with those in America.

From Appendix III of the 7th Report of the Conservation Commission (1916), I gather a few facts and figures that throw a lurid light on the subject:

> "During the five-year period ending December 31st, 1914, 31,400 fires, exclusive of forest conflagrations, destroyed Canadian property valued at $115,000,000."

An average of $23,000,000 per annum! If we add to this (a) the annual amount of fire premiums in excess of losses paid, (b), cost of water works chargeable to Fire Service, (c) cost of operating Fire Departments, and (d) cost of private fire protection, we have the appalling total of $49,700,000 as the direct and indirect annual loss to the country by fires in cities and towns!

A statistical comparison for the year 1912 of the figures in nineteen Canadian cities, with an equal number of European

cities (but including Tokio) shows that in the Canadian cities there was an average of 5! alarms per 10,000 of population, and an average direct loss of $4.35 per capita. In the European cities there was an average of 9 alarms and a direct loss of 13 1-2c per capita, or about one sixth the number of alarms, and exactly one tenth of the per capita loss.

These figures are all that are necessary to explain the facts that during the three years prior to 1914 the average insurance rate in Canada was $1.22 per $100 insured, while in Sweden it was only 40c; in Austria 30c; in England 23c; in Germany 22c; in France 21c; in Spain 19c; and in Italy 19c.

The Losses in Halifax.

IN Halifax in the fourteen years ending April 30th, 1917, the total fire losses, according to the annual reports of our fire chief, appear to have been $2,265,208, an average of $161,802 per annum, or a per capita loss of about $3.44. This last figure is little more than half the amount given in the table quoted above from the Conservation Commission report, so one of the two reports is probably in error. The fire loss in Halifax in the first three months of the present year has reached the enormous total of $400,000, a figure that suggests the need of a searching investigation

In the United States the per capita alarms, fires and losses are almost identical with those of Canada. The total fire loss (exclusive of forest fires) of the two countries amounts to the stupendous sum of approximately $218,000,000 per annum!

An inquiry into the causes for the striking difference in the fire facts and figures as between Europe and America would lead us too far afield.

Fundamental Reason Psychological

DR. F. H. Wentworth, Secretary of the National Fire Protection Association, Boston, Mass., thinks the fundamental reason is psychological and due mainly to the temperament of our people and our confidence in the supposed inexhaustibility of our resources; but there are obvious causes of a more practical nature. Large areas of our cities and towns are built of wood, and for the most part of more or less flimsy construction; our building and inspection laws are defective and their administration is lax; our winters are, as a rule, more severe than in Europe, and hence we need more fires; we are in too many cases almost criminally careless, and incendiarism and frauds, or attempted frauds, on insurance companies are deplorably rife. "A $100,000 fire in Europe shocks Europe. It at once precipitates inquiries as to who was responsible and whether the thing could possibly be duplicated, but if we take up a morning paper and do not find two or three such fires we think it has been a dull evening!" Mr. Wentworth suggests that there should be an engineer in the employ of the Commission of Conservation "whose special duty should be to consider the fire waste problem and how to solve it." He points out that there is no person or official in Canada from whom authoritative information can be obtained regarding fire protection and fire waste, except the insurance companies. Another excellent and entirely practical suggestion is that in every city there should be a commission or committee of leading citizens—most of the Boards of Trade in the United States have them—whose functions would be to exercise a general supervision, authoritative or consultative, over the building and inspection regulations, to set afoot or conduct investigations, to initiate legislation, if and when found practicable; and in the line of prevention, to co-operate in the line of cure. Such a committee

would be guided by the maxim "Prevention is better than Cure," and an intelligent conviction that the former is the cheaper of the two.

A couple of years ago the Conservation Commission instituted an inquiry into the general subject of town fires, and commenting on this, in a paper on "Fire Prevention" in the Conservation Commission's Report for 1916, Mr. J. Grove Smith, Dominion Fire Commissioner, Department of Insurance, says:

> "The evidence submitted from all parts of the country demonstrates that building construction and improvements, fire protection and effective legislation are neglected to a shameful degree, while existing laws are in the main, loose, unrelated, lacking in uniformity and without centralized authority for their proper enforcement. The inquiry also indicates that at least 75 per cent. of the total number of fires in Canada is due to the gross carelessness and negligence of our people. Twenty per cent. is, in all probability, started by those who wish to benefit at the expense of the insurance companies, and a bare five per cent. originates through unavoidable accident."

Waste of Forest Wealth.

SO prevent the loss and waste of our forest wealth and its destruction by fire, is a different and more difficult problem, and in this branch of the subject the consideration of a few leading facts should compel our earnest attention and endeavors.

There appear to be no trustworthy statistics or sources of information as to the gross value of the forest resources of the whole Dominion; and anyhow they are not essential to our present inquiry. Suffice it to say that our forests have been a mine of wealth, indeed in manner of exploitation they resemble a mine, for

until very recent years they have been worked without regard for the future. If you take a ton of ore from the earth you leave a hole that will never be refilled with ore. If you cut down a tree the place where it stood may some day be occupied by another tree. The forest, therefore, should be regarded as a crop, not a mine. Two important but unpleasant facts must be recognized: (1) Our forest wealth has been grossly exaggerated, and without extreme care in fire prevention, added to systematic and scientific reforestation, stands to be exhausted within a generation. (2) Fire has destroyed many times the quantity of timber that has ever been cut and used in Canada. The Forestry Department of the Federal Government estimates that two-thirds of our total original forests have been destroyed. A really bad forest fire, such as is unhappily too frequent, not only consumes the timber, but in many places actually destroys and burns up the soil consisting of a few feet in depth of humus and decayed vegetable matter, leaving bare the forever sterile hardpan or rock underlying it. The destruction of the forest, and the soil on which it grew, results in alternate floods and droughts in the brooks and streams, owing to the denudation of the soil which acted as a sponge-like reservoir and regulated their flow. The destruction of two-thirds of the whole of our forests referred to above means a loss to the public treasury in stumpage dues alone of over $1,100,000,000, while the loss to the country at large is many times greater.

Need of Preventive Measures.

FEW people realize the magnitude and significance of these facts and figures, but those who appreciate them will be forcibly impressed with the imperative need of putting forth national and vigorous effort to prevent forest fires,

so far as it is possible by practical means, and at a reasonable expenditure of public money.

> "All our work for the conservation of our timber resources is wasted if we cannot conquer the fires. . . . . Fire protection is not forestry, any more than it is logging or milling, but it is the foundation, the absolute essential, of all these. Without it they cannot exist. If we are not prepared to protect our forests, then as practical men, let us cut them down and use them up before they are burnt. Fire protection is not a matter of cost; it must be done as cheaply as possible, but it must be done at any cost."—(Elwood Wilson, Forester, Laurentide Co., in Conservation Commission's Report, (1916.)

Timber Lands Vast and Varied.

THE timber lands of the Dominion are vast and varied, and no thorough and adequate survey has yet been undertaken to ascertain their extent and value with any definiteness. The Dominion Forestry Branch of the Department of the Interior gives the following rough estimate:

	Acres.
British Columbia	50,000,000
Alberta, Saskatchewan, Manitoba	11,000,000
Ontario	70,000,000
Quebec	100,000,000
New Brunswick	9,000,000
Nova Scotia	5,000,000

In British Columbia, the Province in which there is at this date probably the largest reserves of standing timber, more than 95,000 square miles of forest area have been burnt over, involving the destruction of the enormous quantity of 650,000,000,000 ft. B.M. (at $20 per M., $13,000,000,000) or nearly double the whole of the timber now standing in the

Province. The value of the timber resources of the Province is illustrated by the fact that the revenue from the Crown Land reserves alone amount to nearly $3,000,000. The value of manufactured timber is from $35,000,000 to $40,000,000 annually.

I have seen no trustworthy figures as to the total forest area, nor of the extent of destruction by fire in either Ontario or Quebec, but it is known that in both Provinces the burnt areas are of vast extent. In Ontario the Provincial revenue from timber is between two and three million dollars.

In Quebec, of the 70,000 square miles of timber limits under license, about 10,000 square miles are burnt, representing a loss in revenue of about $15,000,000 from scumpage dues alone.

In New Brunswick the lumber industry, second only to agrienlture, and the chief source of the Provincial revenue, has an annual value of over $15,000,000. In this Province, too, the desolate appearance of immense areas, once covered by noble forests, testifies to the terrible ravages of the fire fiend.

In Nova Scotia, where there is comparatively little Crown Land left, the Provincial revenue from timber is now only about $20,000. Here, too, the flames have claimed many times the quantity of timber that ever went to the market or the mill.

The known causes of forest fires are mainly three, viz., in the order of their frequency: by locomotives, by careless burning of slash (the tops and branches left in the woods) by settlers and the lumbermen themselves; and by campers, travellers and sportsmen. Needless to say over 90 per cent. of all causes may be classed under the head of criminal carelessness, which can only be conquered slowly and gradually by legislation and education.

Use of The Aeroplane.

IT IS gratifying to record that in the past few years much valuable work has been done towards forest fire prevention in most Provinces. In British Columbia, which perhaps takes the lead in this excellent work—with Quebec a good second—observation stations on eminences have been established. Portable telephones are in use over large areas by forest rangers and inspectors, who are also equipped with small portable gasoline-operated pumps, weighing only 140 pounds, and having 1500 feet of 1 1-2 inch hose. The latest device for forest observation is the hydroplane which was adopted last year by the Department of Lands, B. C. Unfortunately on a trial flight the machine took a nose dive from a height of 1200 feet, crashing down on to the top of a house in Vancouver. The pilot, Lieut. Bishop, R.A.F., had a miraculous escape from death or serious injury. The Government will, however, try again and great things are expected of it. It has recently been tried for a year in Wisconsin with marked success. A still more valuable device that will, no doubt, be available in the near future is the aeroplane in communication with earth by wireless telephone.

C. E. W. DODWELL,
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