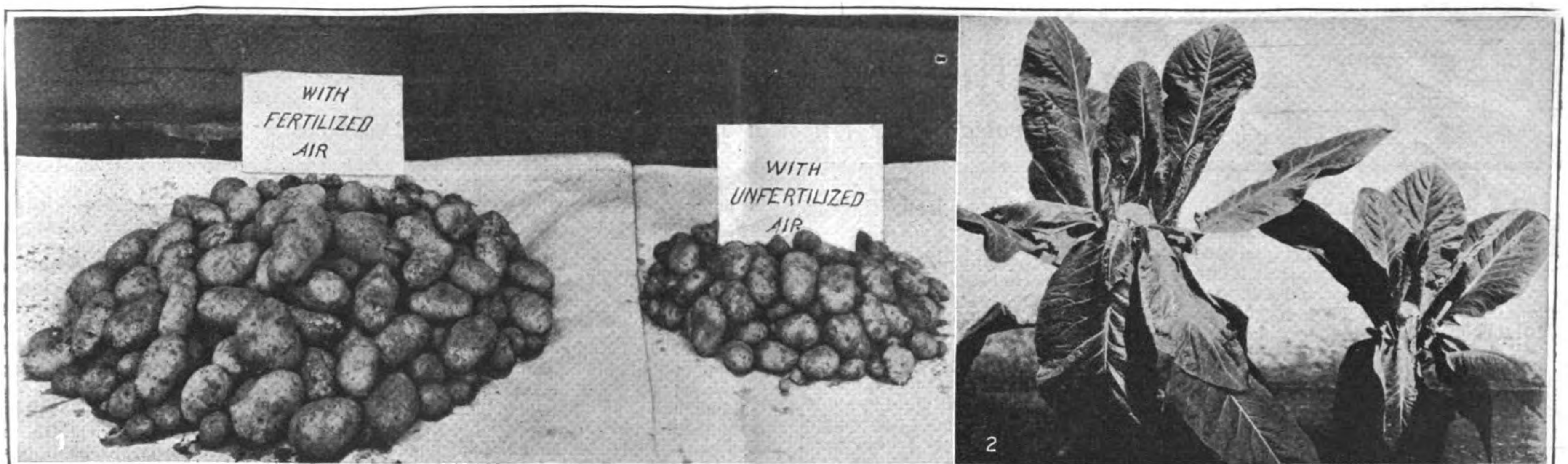
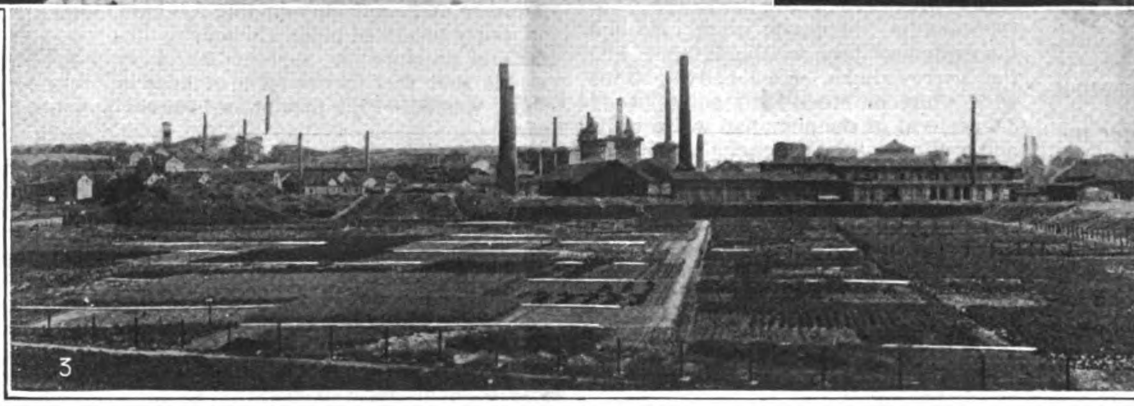




1. Yield of potatoes in fields over which the air was fertilized with carbonic acid gas and left unfertilized. 2. A similar comparison for cauliflower plants. 3. An open-air carbonic-acid fertilizing plant

Fertilizing the air with carbon dioxide to promote plant growth

Carbonic Acid Gas to Fertilize the Air

By Dr. Alfred Gradenwitz

ONE of the principal constituents making up the body of a plant is carbon, representing about one-half of its organic substance. The opinion that this carbon is derived from the soil has long been abandoned, modern investigation having shown atmospheric carbonic acid to be absorbed by means of the chlorophyl or green matter of the leaves and decomposed into its elements, the carbon, in conjunction with the root sap and atmospheric moisture, being worked into organic compounds.

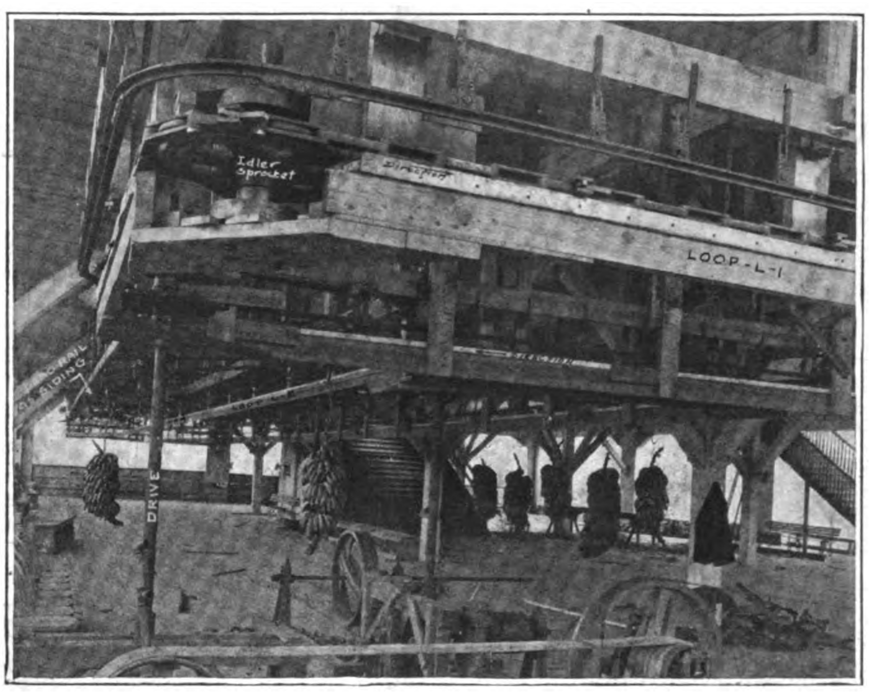
Whereas atmospheric air at present is relatively poor in carbonic acid, of which it contains only about .03 per cent, at an early period in the development of our planet, when this was covered with the luxuriant forests our coal deposits are derived from, it comprised incomparably greater quantities of this gas. This fact suggested the idea of heightening the fertility of the soil by increasing its carbonic acid content and thus producing conditions resembling those of antediluvian ages. In order to enable such a process to be carried out on anything like a commercial line, a cheap source of carbonic acid had, of course, to be provided.

This was found by Dr. Fr. Riedel of Essen-on-Ruhr in the combustion gases escaping from all factories, but most abundantly from blast-furnaces, and which so far had been allowed to flow out into the atmosphere without serving any useful purpose. He accordingly set to work designing a process for which patents were obtained and which was put to practical tests on a large scale. Three greenhouses were at first erected, one of which served as testing room, while the two others were used for checking purposes. The testing room was supplied with purified and burnt blast-furnace exhaust gases through a line of punctured piping traversing the whole greenhouse in a forward and backward direction. The gas supply was started on June 12th, that is to say, at a time when plant growth was at its height.

On account of the careful cleansing and complete elimination of constituents such as sulfur, the gas was found to exert no harmful effects. On the contrary, even a few days after starting the test, there could be observed in the testing room a more luxuriant vegetation than in the checking houses. The leaves of the castor-oil plant in the greenhouse supplied with gas were found to reach more than one meter in span, whereas the largest leaf in the checking houses was only about 58 centimeters in width. Plants submitted to the influence of carbonic acid gas also showed a marked advance with regard to their height. With the tomatoes planted in another part of the greenhouse a crop of 29.5 kilograms was obtained for a given number of fruits, the weight of the same number of fruits in the testing room being 81.3 kilograms, that is, 175 per cent more. With the cucumbers planted at the same time a somewhat slighter difference was noted, the yield in the checking houses being 138 kilograms, in the testing house, however, 235 kilograms, corresponding to an increase in yield of 70 per cent. An interesting phenomenon noted in this connection was that, while the cucumbers in the checking houses would exhibit bright spots, those in the testing house, on account of the more plentiful formation of chlorophyl were of a dark green color throughout.

Experiments in the open air were made simultaneously with these greenhouse tests, a square plot of ground being encircled by punctured cement pipes from which a continuous supply of exhaust gases was escaping. The wind, mostly striking the ground at an angle, would drive the carbonic acid in a variable direction

(*Continued on page 557*)



The bananas, hung to trolleys on a monorail, are pushed forward in the desired direction, by fingers attached to the chain shown near the top of this illustration, near L-1. The system is so devised that the over-ripe bananas are given separate and speedier handling There are monorail sidings, like ordinary railroad sidings, on which the fruit is stored until it can be put aboard a car

A corner of the banana conveyor mechanism installed at New Orleans

Mechanical Stevedore That Handles Bananas

By Thomas Ewing Dabney

A NEW application of an old principle—which is all that invention is—has met the high cost and scarcity of labor on the wharves of New Orleans, and enabled that port to expand its trade in its most important article of import—namely, bananas. This is a handling device which transfers the fruit from shipside to the cars at an estimated saving of 2½ cents a bunch. As New Orleans imports 20,000,000 bunches of bananas a year, this means a gross saving of $500,000. Add to this the saving in time and the fact that there is less damage to the fruit by the mechanical than there is by the physical method of handling, and the annual saving will not greatly miss the million mark.

About 600 shiploads of bananas are brought to New Orleans a year. The average ship carries 35,000 bunches, which are under present conditions unloaded in about seven hours. Three machines of the type shown in the SCIENTIFIC AMERICAN of Oct. 20, 1917, lift the bananas out of the ship and deposit them on the wharf. These machines consist of 50-foot structural towers, with a base 14 by 28 feet, set upon eight wheels resting upon two transverse rails at 14-foot gage. This tower is fitted with a main boom and a plumb marine leg which reaches into the hold of a ship; the bananas are lifted out in a continuous belt of pockets held between two parallel link chains which traverse the marine leg, main boom, auxiliary boom and tower, at the rate of 125 feet a minute. The bananas are finally deposited at the foot of the tower and then lifted upon the back of laborers, who carry them to the car a couple of hundred feet away. But the bus is too fast for the stevedores. Even with 1,000 men working, the greatest number that can be economically employed on the wharves, it is not possible for the machines to work more than 40 minutes in each hour.

To avoid this 33 per cent loss in time—and because of the rapidity with which bananas ripen, especially in the summer, every minute is worth money—William Steckler, an engineer of the Board of Port Commissioners of Louisiana, set his inventive brains in motion. He studied the trolley systems by which meat, auto tires, machinery, etc., are handled in manufacturing plants, and worked out a mechanical means of conveying the bananas from shipside, after they have been delivered on the wharf by the elevator, to the cars.

He has tried it out and it has proven a success. Every banana wharf in New Orleans is to be equipped with the device as soon as it can be manufactured.

The essential features of the device are an overhead monorail of medium design,

(*Continued on page 557*)

The Dawn of American Commercial Aviation

(*Continued from page 555*)

to escape seasickness will probably be one of the causes, while the enchantment the aerial traveler experiences aloft will offer a further inducement to go *via* the air route. And European experience shows that the keenness of this latter class of travelers for air transport increases with each trip.

In the Modern Saw-Mill

(*Continued from page 548*)

automatic unstackers facilitate handling.

Handling the refuse of a large lumber mill presents a considerable problem. It consists largely of dust, edgings, and trimmings and a large proportion of it is used for fuel. Shavings and dust are lifted by suction and blown directly to the fuel bins. Slabs from the slasher and stub ends from the trimmer are suitable for making broom handles, lath, and the like and after all usable material has been picked out, the waste goes to the "hog" which cuts the refuse up in small pieces for fuel.

Shingle machines are operated in connection with the mill. The lumber is cut into bolts for them and their action is entirely automatic. The din from a battery of these machines is deafening.

Not only does the waste from a lumber mill furnish sufficient fuel to operate all the machinery, but there are instances where the lumber company sells electric power to the local light and power concern, which in turn sells it to other consumers.

The transfer of lumber in and around the mill was for many years mainly done by means of hand trucks. Two electrical devices have replaced this antiquated system—the storage battery truck and the telpher or monorail. The latter consists of an overhead rail from which is suspended a car or cars, equipped with electric hoists, the operator riding in the car. The telpher is, of course, restricted in its movements and electric trucks are used for the miscellaneous hauling that has to be done.

Even in a plant where the fuel costs nothing it is important to have an economical steam installation, because the greater the steam demand the greater the investment in the boiler room and its maintenance. For this reason steam turbines have replaced reciprocating engines in many mills. In others, where the power requirements have outgrown the capacity of the plant, steam turbines have been installed which receive their steam supply from the exhaust of the old reciprocating engine. Such installations have been made to deliver one horsepower for every horse-power delivered by the original plant. In other words the capacity of the plant is doubled with no additional operating expense.

In some cases where the use of steam in a few operations is insisted on a mixed pressure turbine has been installed. This turbine consists of two elements, one of which operates on high pressure steam and the other on the low pressure exhaust steam from the auxiliary engines.

Certainly our big lumber mills cannot be accused of wasteful methods. They are manufacturing plants of the most efficient type, in which both material and human effort are conserved to a fine degree.

Carbonic Acid Gas to Fertilize the Air

(*Continued from page 549*)

toward the plants, thus allowing extensive areas to be supplied with the fertilizing gas. On the opposite side of the greenhouse plant there was provided for checking purposes a plot of the same size submitted to no carbonic acid gas, the soil in the two plots being of the same quality. Samples were derived from the best portions of the checking field, but from the center of the field submitted to the action of carbonic acid gas, the increase in yield in the case of spinach being found to be 150 per cent, with potatoes 180 per cent, with lupines (a legume) 174 per cent, and with barley 100 per cent. The potatoes in the field submitted to the action of carbonic acid gas were found to ripen much more quickly than in the checking plot.

The testing plant in view of these surprisingly favorable results was eventually extended, three greenhouses of the same size as those existing being added, while the small open-ground plant was increased considerably and more extensive grounds—30,000 square meters—were provided with an underground central pipe and branch pipes encircling lengthy plots. Especially favorable results were obtained on this field with potatoes, a 300 per cent increase being recorded in connection with tests on a large scale.

All experiments so far made go to show that fertilizing the air by means of carbonic acid gas is a much more efficient process than even an increased fertilization of the ground with stable manure and cow dung. If, on the other hand, a plot fertilized from the air at the same time be submitted to soil fertilization, the latter, on account of the increased need for other elements (nitrogen, phosphorus, potassium, etc.) entailed by the increased absorption of carbonic acid, can be driven much farther than otherwise.

According to Dr. Riedel's calculations an iron works dealing in its blast-furnaces with about 4,000 tons of coke per day will daily produce as much as 35 million cubic meters of combustion gases, containing 20 per cent carbonic acid gas. This is such an enormous amount that even in the case of a partial utilization most extensive plots of ground can be supplied with the precious air fertilizer. Dr. Riedel therefore believes that carbonic acid works for supplying agriculture will before long be quite as common a feature as electricity and gas works, the large industrial centers at the same time becoming centers of increasing agricultural production.

Careful analysis has shown the increase in the percentage of carbonic acid in the air to remain far below the limit where the gas becomes liable to endanger the health of man.

Mechanical Stevedore That Handles Bananas

(*Continued from page 549*)

suspended rigidly from above at intervals; monorail trolleys of 250 pounds capacity, having roller bearings to carry the bunch of bananas suspended from a special hook to which the bunch is hung by a loop device invented by Mr. Steckler for the purpose; and a power-driven chain provided with fingers at three-foot centers, in constant motion at the rate of 125 feet a minute, the path of motion being parallel to the monorail at such location that the fingers engage the suspended bunch of bananas, and thus push the trolley along on the monorail.

The accompanying photograph illustrates the device. One track (Loop L-1) is parallel with the ship. It connects with several switches, each swiftly operated by compressed air. Down one switch the bananas that are turning ripe are first shunted to the waiting cars or wagons. The green ones are diverted down another switch, following the entire line of box cars on the siding. From this main line switch, a dead-rail line branches out in front of each car. The dead rail is down grade to the car door, and the bunches of bananas are delivered there without human handling. There are bumpers to prevent the bruising of the fruit. After the trolley is unloaded, it is sent back to its point of origin by a separate return system, and is there reloaded for further use.

It will thus be seen that there are only a few trolley switchmen between shipside and the cars, where formerly at least 400 men were working. These switchmen