A scientific gift and what happened when industry looked in the mouth. Dry ice: its pioneering past, its warring present, its brilliant (but unproved) future.

Dry ice is among other things, a Case History. A Case History which shows, vividly and in small compass, what characteristically happens when Science hands over to Commerce a phenomenon. It illustrates one of Science's gifts to Industry—and some of the troubles resulting from looking the gift horse in the mouth.

Dry ice is, among other things, a Boom. It began in the middle '90s. It took the crash in its stride; there is no downward boost to the soaring curve of its consumption—1910: 70,000,000 pounds; 1915: 60,000,000 pounds; 1920 estimated: 120,000,000 pounds. Those are not large figures, but they're exciting.

There is something refreshing about talking to a dry-ice man. He will narrative you about price cuts and overproduction in an industry that didn't exist eighty years ago. But he hasn't lost his taste for dreams. He speaks as men spoke when the world was young and Steel sold for $4.

Rightly speaking, "Dry Ice," the name is the property of a company called the Dry Ice Corp. of America. But it's such a good name, so right and proper, that already common usage has made it generic. Dry ice is today's name for solid carbon dioxide. At ordinary pressure and temperature carbon dioxide is, of course, a gas. But, sufficiently compressed and cooled, it changes first to a liquid and then to a solid. A piece of solid carbon dioxide looks almost exactly like a smooth-cut and tightly-packed cube of snow. But it has two important differences. It is very much colder, for solid carbon dioxide has a temperature of 109 degrees below zero. Also it does not melt. It sublimes—that is, it passes directly from the solid to the gaseous state. Thus one cubic foot of dry ice turns into 450 cubic feet of carbon dioxide, leaves behind it no puddle. These characteristics of carbon dioxide were familiar physical facts in the middle 19th century and constituted nothing more exciting than a dull laboratory experiment.

Furthermore a cubic foot of dry ice, changing from solid to gas, absorbs twice as much heat as is absorbed by a cubic foot of water ice changing from ice to water. And since dry ice is a direct substitute for water ice, and the water-ice industry is an old and well-established industry which has already felt the impact of one scientific invasion and emerged bloody but unbowed, in the transportation field its railroad affiliation gave it a particularly intrenched position. So the new industry had plenty of trouble which it complicated by its own too rapid expansion, internal competition, litigation.
Yet dry ice still has both its prospects and its prospects. Its accomplishments to date have indeed encouraged the most sweeping predictions regarding its future. It is the only ice maker that can visualize in his prophetic moments—not an industry with sales of $4,000,000 per annum, but with sales of $30,000,000. This tonnage, in its expansive moments, he estimates as follows:

<table>
<thead>
<tr>
<th>Use</th>
<th>Annual consumption, tons</th>
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<tbody>
<tr>
<td>Carbonating beverages</td>
<td>44,000</td>
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<tr>
<td>Transit of fresh fruits and</td>
<td>37,500</td>
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<tr>
<td>vegetables</td>
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<td>Refrigeration of ice cream</td>
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<td>Refrigeration of frozen foods</td>
<td>1,500,000</td>
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<tr>
<td>Express and truck shipments of</td>
<td>90,000</td>
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<td>frozen meats</td>
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<tr>
<td>Refrigeration carload shipments</td>
<td>1,800,000</td>
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<td>perishable foods</td>
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Remember that these are optimistic estimates based on a very long pull and that the Dry Ice Corp., itself, largest unit in the industry, characterizes them as a most generous forecast of a most distant future. Present refrigerator cars, even if all dry ice would not carry the estimated tonnage (1,000,000 tons) and there seems to be considerable duplication in the frozen-food and carload shipment items. But do not forget that in less than seven years dry ice has replaced something in the neighborhood of 50,000 tons of water ice and that its constant (not to say violently) lowered costs are opening to it constantly widening markets.

Although dry ice today is used almost exclusively as a refrigerant, the earliest patents for the solidification of carbon dioxide were granted for a very different application. They were taken out in 1899 by one Herbert Samuel Elworthy, a doctor in the British Army Medical Corps. Dr. Elworthy, like many another Britisher, doctor, and army man, was fond of whisky and soda. But when he was stationed in Bandra, India, he found it almost impossible to maintain a supply of Vicay, and therefore made use of liquid carbon dioxide in cylinders. The liquid carbon dioxide was altogether satisfactory from the standpoint of manufacturing soda water, but Dr. Elworthy did not like to haul around 100 pounds of liquid carbon dioxide cylinders, especially since they contained only fifty pounds of carbon dioxide. He therefore decided to solidify the liquid, thus getting his carbon dioxide in lighter, more compact, and more portable form. The Elworthy patents have long since expired, and solid carbon dioxide is not primarily desired for the use to which the doctor put it, although in the spring of the present year the Dry Ice Corp. has revived the Elworthy idea and arranged to supply Coca-Cola bottlers with solid carbon dioxide. But Dr. Elworthy was not thinking of dry ice as a cooling agent, and the first U.S. sponsor of

The inventor was Thomas Benton Slate, who had spent many years in the oil and natural-gas districts of the Southwest and had brought with him some ideas concerning the widespread utility of carbon dioxide in the home. He invented a fire extinguisher which was to put out fires by spraying compressed carbon dioxide on them, a siphon that was to be used in carbonating home-drink beverages, a pump to inflate automobile tires, and a greas gun. The promoter was Walter L. Josephson, who christened carbon dioxide "prest air," and took a double page in the Saturday Evening Post to advertise the merits of the Prest Air Fire Extinguisher, the Prest Air Home Siphon, the Prest Air Army Tire Pumps, and other members of the Prest Air family.

But Prest Air Devices Co. did not much prosper. It was essentially a novelty business with its sponsors creating rather than constructing. The tire pump was subject to the handicap that carbon dioxide is one of the few gases that will leak through rubber, so "prest air" was not well calculated for inflating tires. The greas gun also had a bad habit of carbonating the grease. And there did not seem to be any lively domestic demand for squirting carbon dioxide into either tires or soda. Besides, the business suffered badly from lack of integration.

Messrs. Slate and Josephson bought their carbon dioxide, already compressed, from General Carbonic Corp. It came in cylinders containing fifty pounds of carbon dioxide, the Prest Air company then transferring it into Prest Air containers which held fourteen ounces. Unfortunately, their methods of extraction were so crude that

CAUGHT IN CHARACTER

Selling that cracked ice cream does not melt in record time was the most valuable function that dry ice has thus far performed. The ice cream maker uses more than 75 per cent of all the dry ice consumed.
they were returning the fifty-pound cylinders still containing about ten pounds of carbon dioxide, for which they wanted a credit from General Carbonic. So General Carbonic sent them a Mr. George C. Cusack, who showed a more efficient method of emptying the cylinders and was invited to join the company on the strength of this demonstration.

Mr. Cusack did not think very much of the several Press Air gadgets, so Mr. Slate exhibited to him another possibility in the Press Air future. This was a rack of solid carbon dioxide in solid form. At first the solid carbon dioxide did not impress Mr. Cusack either, he had seen carbon dioxide solidified in college chemistry classes, and although he may have known that epidemic specialists were using solid carbon dioxide in the treatment of warts, this function probably would not have appealed to him as a major industrial use. But, ah, Mr. Slate, solid carbon dioxide is also a great refrigerant. The Press Air company had added to its staff a Mr. A. R. Whalley, who had been a vice president of the New Haven Railroad and an honorary vice president of the New York Central. Mr. Whalley had interested one J. W. Norcross of the Canadian Steamship Lines, and Mr. Whalley and Mr. Norcross were going to get the railways to try out solid carbon dioxide in their refrigerator cars. So on the strength of the potential railroad business (still a great dry ice talking point, but still potential) Mr. Cusack joined the Press Air company. He arrived in January, 1914, just prior to the first big railroad experiment.

Fish from Halifax

If Mr. Whalley had located somebody in the Southern Pacific Railroad or the Santa Fe railroad system, his might have been a conclusive demonstration. But Mr. Norcross, with his Canadian affiliations, wanted the experiment to be conducted on Canadian soil. So in the deal of winter Press Air borrowed two refrigerator cars from Merchants Dispatch (the New York Central refrigerator car subsidiary), loaded them with dry ice instead of water ice, and made four shipments of fish from Halifax to Montreal. The fish arrived in perfect condition, but the weather was so cold that Mr. Slate might almost have produced the same result if he had loaded the car with the tire pumps instead of the dry ice. Thus the demonstration might not have convinced a skeptic. But the Press Air people were not skeptical and, greatly encouraged, went back to Long Island City brimming with plans for the large-scale production of solid carbon dioxide. These plans Mr. Slate soon got into tangible form, and the Press Air company was ready to go into solid carbon dioxide as its major product. But the Long Island City plant was not big enough for this purpose, so Press Air blossomed out with a fine new factory in (again because of the Canadian influence) Montreal.

Since this new plant cost money, and since not a dollar's worth of dry ice had yet been merchandised, the advance of the new plant signaled the fact that capital must have made its appearance in the carbon dioxide enterprise. And capital—persuaded by Messrs. Whalley and Norcross—had indeed appeared, personalized in no less a capitalist than August Heckscher.

So the dryer business, like so many young businesses, had risen to what might be called the backer era.

Backer Heckscher

At eighty-three, big-hearted, shrewd, and brash, Mr. Heckscher, bearded, spectacled, and Teutonic, is a great deal better known than either Press Air or dry ice, and the solid carbon-dioxide venture is only one of the many corporate bodies into which Mr. Heckscher has breathed a financial being. Having made a fortune in the New Jersey Zinc Co. and accumulated much larger wealth in Manhattan real estate, particularly in the Murray Hill and Fifty-seventh Street districts, Mr. Heckscher in his later years has been most widely thought of as a philanthropist, with child welfare and slum abolition his major interests. But he has by no means ceased to be a capitalist, and furthermore a creative capitalist whose mind is still responsive to new enterprises. Whether solid carbon dioxide will eventually result in a net addition to or a net subtraction from the Heckscher wealth is still undecided. The management of the company has been subject to sudden and sweeping changes (the last one of which brought Mr. Heckscher's personal attorney to its presidency) which is some indication that solid carbon-dioxide progress has not been altogether satisfactory. But in 1924, dry ice was still in its dawn, and all dawns are predictably rosy.

Departure of pioneers

Solid carbon dioxide, however, throughout 1914 and during the first half of 1915, showed no evidence of attaining any financial self-sustainment. Mr. Heckscher satisfied the need for financial resources, but the management factor was still erratic. Although a considerable quantity of dry ice was being manufactured, not a single pound was being sold, and in October, 1914, Mr. Slate, who apparently had lost some of his enthusiasm for dry ice, just as dry ice had also lost some of its enthusiasm for him, left the company and went out to California. Later Mr. Slate, still inventive, turned
up with a new and improved type of druggist. In the spring of 1925 Mr. Hecksher eliminated the other original dry ice, Mr. Josephson along with a sales manager who was making no sales at $500 a week and an assistant sales manager who was making no sales at $500 a week. Mr. Whaley, after the original Prest-Air company, became president. Mr. Hecksher also decided to leave the Prest-Air family to its own devices, so he sold its gadgets to a Buffalo company. Thus ended the Prest-Air period and thus began the more strictly dry ice era under the sponsorship of Dry Ice Corp.

A customer

One of the first accomplishments of the Dry Ice Corp. was a feat never before performed by Prest-Air, namely, the building of a customer. It was Mr. Cusack who did the building, with Mr. Frank G. Shattuck of Schaff's Stores in the customer's role. At this time (July, 1926) the company was experimenting with a package designed to keep ice cream hard between the time of purchase and the moment of consumption. The package was a simple corrugated paper box, which was no great shakes as an insulating agent. Mr. Cusack, who had been doing some work on the problem of designing a container for Eskimo Pie, heard of Schaff's difficulty and suggested that the ice cream container should also contain a little dry ice. Inasmuch as dry ice is unquestionably a potent refrigerant, the Dry Ice Schaff's package gave excellent experimental results and had a successful tryout at the 10th Street Schaff's. This before dry ice was to become a regular Schaff's feature, an instant customer telephoned Mr. Shattuck. The customer, it appeared, had bought some carbon-dioxide-packed ice cream at the 10th Street. His children had seized the package. They had eaten the dry ice. They had become deathly sick. But—and here the complaint took a new and unexpected tack—the gentleman who was doing the calling was the engineer who telephoned that he could provide Mr. Shattuck with a container which would be both efficient and innocuous. And he would be glad to call on Mr. Shattuck and show him how the trick could be turned. So Mr. Shattuck asked him to call, which he did. Who should be at his place but Mr. Josephson, late of the Dry Ice Corp? Whereupon Mr. Shattuck decided that he would have no further commerce with dry ice, past or present and called the whole deal off.

Dry Ice cream

The Dry Ice Corp. later quarreled with Mr. Shattuck and lost its business. For Mr. Cusack had not chewed in vain. For the dry ice manufacturer, awakened by Schaff's experiments, realized that for him dry ice was indeed the ideal refrigerant.

Dry ice and ice cream are natural affinities, especially as traveling companions. Even when dry ice was selling at $100 a ton (five cents a pound), many ice cream manufacturers preferred it to water ice at $4 a ton. Brine—a combination of water and salt, with the salt acting as an antifreeze agent—gives temperatures suitable for ice cream refrigeration. But so much more brine than solid carbon dioxide is required for the same refrigerating purpose that the product is canceled by quantity, and the unwieldiness of the water ice remains as an added handicap to its employment.

Suppose you are shipping ice cream between New York and Philadelphia, and are sending it in five-gallon wooden tubs individually packed in ice. You will need about 100 pounds of ice and salt for each tub, and the total weight of tub, brine, and contents will be nearly 150 pounds, of which only about 30 pounds will be ice cream.

But if you are refrigerating with dry ice, you can ship in five-gallon paper cartons, packing each with six to eight pounds of dry ice. Even when dry ice cost five cents a pound, you were using less than forty cents worth of dry ice compared with about twenty-five cents' worth of brine and you had a throwaway container with no empties to haul back.

On truck shipments, dry ice is even more advantageous. You can ship a ten-gallon truckload of ice cream about 60 miles a day with 1,200 pounds of salt and ice. The same trip in a properly insulated dry ice truck needs only ninety pounds of dry ice. Here the difference between hauling the waste load of brine refrigeration and the pay load of dry ice refrigeration is so great that you can use a two and one-half ton truck with dry ice in place of a three and one-half ton truck with water ice. So even at its pioneer prices, dry ice found a ready welcome from the ice cream shipper and the Dry Ice Corp. had no longer a product without a market. First large manufacturing customer was the Brown Ice Cream Co. of New York. Then came Abbott's Dairies, Inc., in Philadelphia, a group of Pittsburgh dairies, and a Boston confectionary chain. In 1925 the Dry Ice Corp. sold 265,000 pounds of solid carbon dioxide. It began
to look as though Mr. Hoeksema had picked another winner.

Troubles of expansion

But unlike the Dry Ice, that proved almost as deadly a process as giving birth.

In 1927, Dry Ice decided to stop purchasing carbon dioxide and to manufacture its own gas. So it bought a $350,000 coke-reduction plant in Elizabeth, New Jersey, the carbon dioxide of course being given off by the burning coke. The plant was one of the largest coke-carbon dioxide producing centers in the world, and there was no other at the works with it except that the carbon dioxide it produced cost more than the carbon dioxide which Dry Ice could buy from any of a number of by-product carbon dioxide producers. So Dry Ice eventually shut it down and charged the venture to永久 and loss.

Centralized production thus having turned out badly, Dry Ice went on to decentralize its operations with equal enthusiasm. It decided to put up solid carbon dioxide plants at various points throughout the country, adjacent to carbon dioxide producers. As one large carbon dioxide producer was Liquid Carbonic Corp. (which supplies carbon dioxide to soda fountains) and it is a leading manufacturer of the soda fountain itself, Dry Ice and Liquid soon concluded a working agreement. The idea of the deal was that Dry Ice would build units next door to Liquid's existing factories and would purchase Liquid's carbon dioxide for solid carbon dioxide manufacture. Liquid paid $250,000 for 20,000 shares of Dry Ice stock on the understanding that the money was to be used in putting up Dry Ice production units. In the fall of 1929 Dry Ice started a plant in Los Angeles, then completing a coast-to-coast setup with seventeen plants and 1929 production of 10,000 tons.

But before the Los Angeles plant was in operation, Dry Ice engineers changed their minds again. They decided that manufacturing in one or two centers was better after all, and recommended the abandonment of many units in the far-flung structure. This procedure naturally irked Liquid Carbonic. So, after much conference and controversy, Mr. Hoeksema took back his 20,000 shares. In exchange for these shares, Liquid took over not only the Los Angeles plant but also the Dry Ice units in Liquid's factories. Thus all lies between the two companies were broken. Liquid decided to solidify its own carbon dioxide and entered the solid carbon dioxide field as an immediate and potent competitor.

Failure of patents

After the Dry Ice Corp. sued Solid Carbonic, alleging patent infringement. Dry Ice Corp. never had succeeded in getting a patent on the manufacture of solid carbon dioxide, which was an old story long before even Great Air Devices had been thought of. It had therefore based its monopolistic position on a patent covering the process that was a manufacturing process consisting of a protective casing of insulating material having packed therein a quantity of solid carbon dioxide, and a quantity of freezable product in freezing proximity to the solid carbon dioxide. This complicated description covered an equally complicated maneuver—an attempt to remedy the lack of a patent on solid carbon dioxide by considering the carbon dioxide as a part of its package and thus patenting the two together. Since the property of attempting to sell solid carbon dioxide would be bound to sell it in a “transportation package consisting of a protective casing,” etc., the Dry Ice claim was undoubtedly sweeping.

Thus the transportation argument did not stand the scrutiny of the U.S. Supreme Court. In the spring of 1931, the Court ruled that even if the Dry Ice package were patentable, there was nothing to prevent any other solid carbon dioxide manufacturer from selling his product in the same manner. This decision was followed by a further ruling that the package itself lacked “invention and novelty.” Thus the Dry Ice Corp. lost all pretensions toward being a monopoly, and the Michigan Alkali Co. of Wyandotte, Michigan (suburb of Detroit), with the arrival of Michigan the dry ice industry definitely graduated from Dry Ice Corp.'s control.

Michigan Alkali

It is a sure thing that John B. Ford Jr. never had to eat his own carbonated soda in order to make a sale. For his father, grandfather, and great-grandfather were in Michigan Alkali before him, and Mr. Ford is now the fourth generation manager of a long-established, closely held family company. Michigan Alkali is not only about its business since no public holdings exist, neither is there any necessity for reports of income, sales, or profits. But Michigan Alkali is second only to Orlando E. Whelan's Allied Chemical & Dye in the production of soda ash and caustic soda (the leading members of the alkali family). And since, to put a complicated matter in over-simplified terms, soda ash plus silica equals glass and caustic soda plus fine equals soap, it is not hard to see that both the glass and the soap industries are Mr. Ford's large and excellent customers. With the glass industry his relations are particularly close, since Great-Great-Grandfather Ford was the first U.S. plate-glass maker and Grandfather Ford was the first Ford of Libby-Owens-Ford, window glass makers. In Libby-Owens-Ford the Ford interest remains large. In addition to supplying Libby-Owens-Ford with soda ash for windows, Mr. Ford also sells soda ash to Owens-Illinois manufacturers of all of the U.S. glass containers (Fortune, April, 1932). As one of the foremost suppliers to two of our most basic industries, and with a business which in forty years of steady expansion now occupies 1,125 acres along the Detroit River, the Ford Family was a Detroit institution long before the automotive industry2and in fact before the turnover took place. From the standpoint of a stabilized income subject to hard money more than a mere family division, Michigan Alkali must be a much more profitable enterprise than many a company in which public ownership has aroused more public interest.

It was therefore a large industrial unit that Mr. Ford was bringing into the dry ice field, and it was also a very large carbon dioxide producer. For perhaps the most basic operation in Mr. Ford's many operations is the combustion of limestone in which carbon dioxide is given off in very large quantities. Thus the problem which had so much perplexed the Dry Ice Corp.—the question of purchasing carbon dioxide versus losing its own—never was a problem to Mr. Ford. It is, of course, inaccurate to say that Mr. Ford's carbon dioxide costs him nothing, particularly since he has gone to the extreme of constructing, in one corner of his spacious domain, a fine new solid carbon dioxide plant. But it is essentially a waste product or even by-product carbon dioxide that this plant is utilizing. It is extremely low-cost carbon dioxide, since it is Mr. Ford's own limestone and his own [Continued on page 50]
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Furthermore, Mr. Ford habitually thinks in large units. Dry-ice people usually discuss their product in terms of pounds. But you do not sell crustic soda or soda ash by the pound; you sell it by the ton. And Mr. Ford's carbon-dioxide plant (completed in April of the present year) will have a capacity of 150 tons a day, which is some 59,000 tons per annum, or more than the entire carbon-dioxide sales for 1917. Along with his ideas about large volume, Mr. Ford has found about prices. When he entered the dry-ice business (May, 1931), the price, to the large user, had stabilized around three cents a pound. In the summer of 1931 (the summer months are of course the big-selling season) the price dropped as low as 1.2 cents a pound, largely through Michigan Alkali's disruptive influence. The price went back to three cents again in the fall of 1931, but in the spring of 1932 the price was reopened. The largest users such as Borden and National Dairy can now buy dry ice for as little as one and a half cents a pound, and in the present season it is likely that most of the solid carbon dioxide sold will be disposed of at below the two-cent level. Many of Mr. Ford's competitors maintain that neither Michigan nor any other dry-ice producer can make money on one-cent-and-a-half-cent dry ice, and it may well be that the two-cent figure represents a more logical point of ultimate stabilization. On the other hand, with the disappearance of old prices there has come a newly revived interest in new markets.

Possibilities of dry ice

All of which brings us back to the matter of ultimate dry ice consumption—a topic best introduced by the repetition of the term 109 degrees already set up as representing dry ice's self-prophesy:

- **Commercial use**
  - Carbonating beverages: 44,000
  - Transport of fresh fruits and vegetables: 37,500
  - Refrigeration of ice cream: 150,000
  - Refrigeration of frozen foods: 1,500,000
  - Express and truck shipments of perishable materials: 90,000
  - Refrigeration of cargoes of perishable foodstuffs: 1,800,000

This estimate evidently depends largely upon the use of dry ice in connection with frozen foods and cargoes for shipments, as these two items make up 3,500,000 tons in an estimated 3,651,000 ton total. Suppose, then, we examine the two uses by which dry ice hopes chiefly to develop.

Frozen foods

The frozen-food use of dry ice depends upon the development of the frozen-food business itself, which is an example of one industry looking optimistically toward another. Present dry-ice consumption is almost negligible. Mr. Clarence Birdseye of Frozen Foods, Inc. (General Foods subsidiary and owner of Birdseye Quick-Freezing Process) is the great exponent of frozen foods other than fish. Mr. Birdseye uses possibly 100,000 tons of solid carbon dioxide per annum. Frozen foods are not frozen with dry ice, since ammonia freezing is just as satisfactory and much cheaper. And carload shipments of frozen foods are preserved not with dry ice but with brine ice or with mechanical refrigeration. Dry ice is used in frozen-food "holding" rooms—small and portable containers which the quick freezer takes with him on his food-freezing expeditions, and in which he keeps his frozen foods provided he has large and mechanically refrigerated storage plant is available. And dry ice is also used in the tracking of frozen foods. So Mr. Birdseye is undoubtedly a dry-ice consumer and both applications of dry ice to the frozen-food business will show large increases as soon as Mr. Birdseye's rapidly growing business supplies a sufficient volume of perishable cargoes. In 1931 the Birdseye company froze 19,000,000 pounds of food. This is an infinitesimal portion of U.S. food consumption, and the frozen-food industry has theoretically an almost limitless expansion. But it will have to sell many millions of pounds at lower prices, before using as much solid carbon dioxide as the dry-ice producer estimates.

Silica gel

As for Mr. Taylor of Atlantic Coast Fisheries, here again dry ice may be used in packing and refrigeration, but currently has small prospects in railroad shipments. Although Mr. Taylor is experimenting with a more modern refrigerant than brine, dry ice is not the only refrigerating novelty. Mr. Ford's frozen fish travel in special refrigerator cars built for the use of what is called the "silica gel" refrigerating system. Silica gel is not itself a refrigerant; it is a very porous sandlike substance whose chief property is a great capacity for soaking things up. It is used in combination with any liquid refrigerant (ammonia, sulphur dioxide, methyl chloride, or even liquid carbon dioxide) and absorbs the vapors given off by the evaporating liquid. This absorption permits further evaporation and therefore further refrigeration. When the silica gel has absorbed as much vapor as it can carry, it is heated; the heat drives out the vapor and the silica gel is again dry and ready to repeat its absorption function.

The progress of silica gel is obviously a direct menace to dry ice. For here is Mr. Taylor offering an ideal dry-ice customer—one who freezes fish and is particularly perishable—preferring silica gel, largely because the evaporation of the refrigerant is more readily controlled and a uniform temperature more easily established. Also, the silica gel sponges have gone into the manufacture of silica gel trucks—trucks which compete with dry ice in the hinter's most profitable application. Here, incidentally, is another characteristic hazard of the new-way producers—their still new novelty may at any time arrive to split the market.
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109 Degrees Below Zero

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EVEN aside from its railroad applications, dry ice has ample room for expansion along lines in which its future should be more clearly realized. Whatever the railroad may think of dry ice, there is no question but that the truck has taken it very kindly indeed, and the marked increase of truck-handled merchandise has been the most significant development in recent transportation trends. In the simmertime trucking of perishable foods, particularly meats, dry ice has one of its most rapidly growing applications. Nor has dry ice by any means exhausted its ice-cream possibilities. For the ice-cream industry alone uses not more than 50,000 tons of dry ice per annum, and there would seem to be little reason why dry ice should not be rapidly utilized to advantage in the per annum use of over 100,000 tons. Meanwhile the Dry Ice Corp. has just brought out an apparatus whereby carbonated beverages may be charged with carbon dioxide directly from the solid. And the Atlantic & Pacific Stores have agreed to dispense dry-iced cream kept in special dry-iced cabinets. It is pretty difficult to visualize any glut-assumption Dry Ice year for a good many years to come. But it is equally difficult to regard the present 60,000 ton consumption as anything more than the current milestone on a road of which the greater part has yet to be covered.

Stabilization of dry ice

Meanwhile the dry ice industry itself has entered upon a comparatively stabilized period. In April, 1925, the Dry Ice Corp. took over two competitors (Solid Carbonate and Cold Carbonate) and was said to be discriminating with the Delaney Chemical Corp. The Defense Committee of Publick Alkaloids should the Delaney coal go through, the major eastern dry ice companies will present a united front against coal and western rivals. The industry will be very largely in the hands of Michigan Alkali, Liquid Carbonic, and Dry Ice Corp., although Matheson Alkali, a company very similar to Michigan, has started into solid carbon dioxide and has a large distribution in the Southeast. The Dry Ice Corp., however, sees that its days of trial and error are ended, and that its experience, however costly, has given it a considerable advantage over its newer rivals. In 1928 it sold more than twice as much dry ice as all its competitors combined, and with its recent mergers it is strengthening its position as chief supplier of solid carbon dioxide.

Even if Mr. Ford has a lower cost carbon dioxide gas, Dry Ice does not doubt that carbon dioxide will continue to be the most cost carbon dioxide. Moreover, the Dry Ice Corp. thinks that the raw material and the manufacturing end of the business is no longer its vital spot but that the problem of distribution has become the major factor. Mr. Williams S. Miller, President, estimates that in 1923 one pound of every four pounds of carbon dioxide manufactured was lost through evaporation—vanished into thin air and reappeared nothing more than the U.S. atmosphere. And it is his belief that Dry Ice Corp. is superior in its competitors in the handling and merchandising of its elusive product. On the other hand, however, Mr. Ford of Michigan is always to be reckoned with. Where other manufacturers miss their ends over two and one dry ice, thinking still a ton (two and a quarter times a pound) is the lowest price consistent with a profit, Mr. Ford is selling dry ice at less than one and a half cents, although at what profit is a long and vague question. His competitors say that even a two-cent price is unprofitable. Mr. Ford says nothing sells dry ice at one and a half cents.