COAL STORAGE.

BY WALDON FAWCETT.

Recent conditions in the fuel market of the United States as brought about by a prolonged strike have directed renewed attention to the subject of the storage of anthracite coal. It has been apparent to a growing extent of late years that with an almost constant demand on the one hand and a varying production on the other, rendered necessary by the conditions at the collieries, a uniform supply can be secured only by the use of a reservoir of large capacity which will absorb the surplus or yield it up as conditions may demand. The methods commonly employed for storing anthracite coal may be divided into two general classes: Those which do not employ machinery and those in which machinery is employed. In the first-mentioned division is the side-hill storage system, the trestle systems with or without reloading tunnels, and the pocket system, while in the second class are embraced the systems which employ machinery in part as well as those in which all of the functions of a storage plant are performed by mechanical devices.

Prior to the introduction of machinery in coal handling operations the effort of all designers of storage plants was to make gravity the sole agent in reloading. In other words, the ideal sought was to store coal in such a manner and at such an elevation that it would flow by natural means into cars. As a result there were evolved the side-hill and trestle systems, various modifications of which are yet in use.

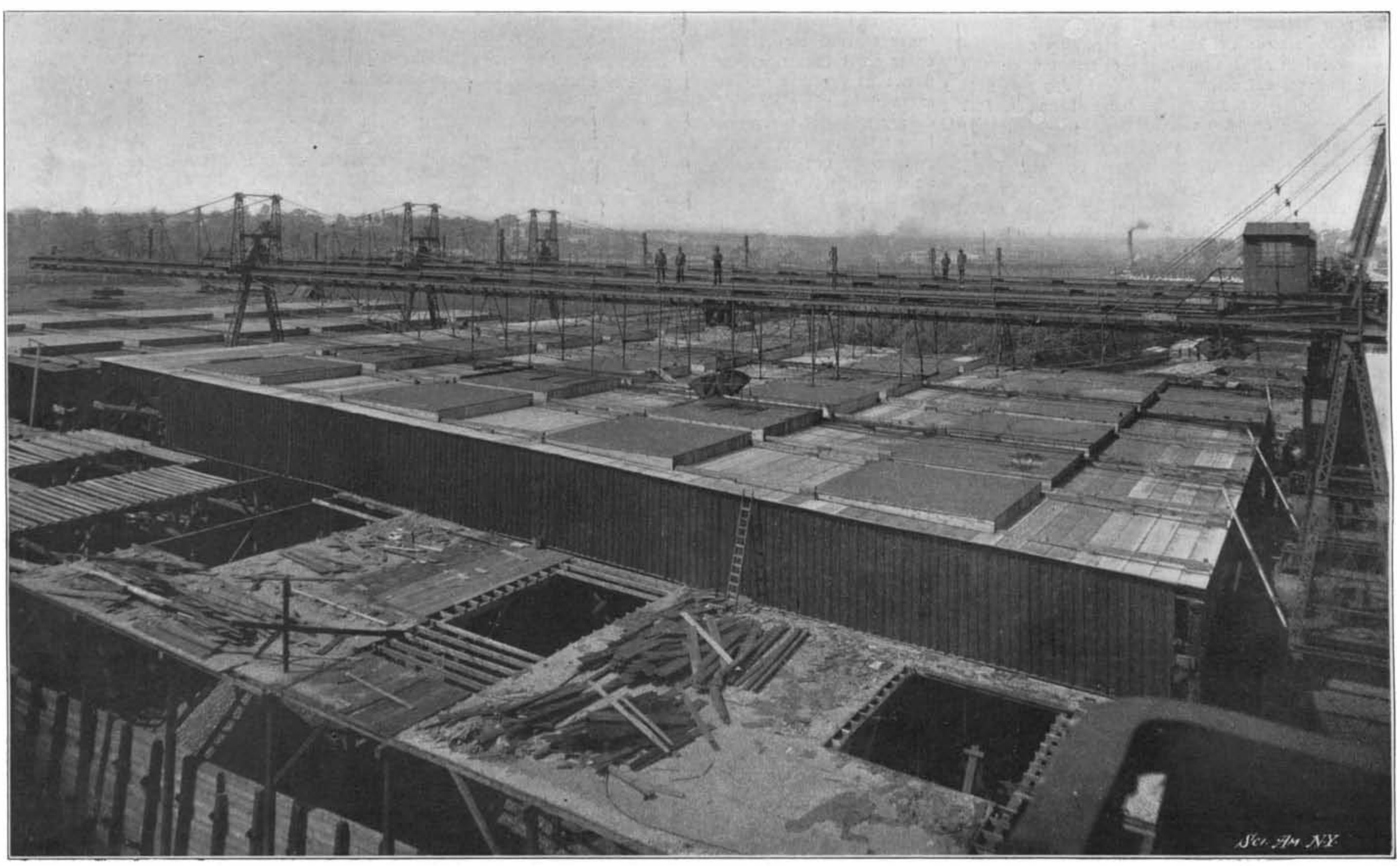
In the side-hill system the coal is stored on a hillside having a slope equal or nearly equal to the angle of flow of coal. A trestle on the hilltop carries a dumping or stocking-out track, whereas the reloading track is located in a trench near the foot of the hill. It was discovered, however, in seeking solutions of the coal storage problem that suitable hillsides were rather scarce, and as a result came the development of the trestle, which is usually built on an almost level area. In its earlier form the trestle system simply consisted of a series of dumping or stocking-out tracks carried on trestles of suitable height. No attempt was made to reload by gravity, all the coal being reloaded by hand. Later there was introduced an adjunct in the form of what is known as a central reloading tunnel. There are two different styles of reloading tunnel, one being located above ground and the other underground. The pocket system of storing coal is limited in its application almost exclusively to the handling of the fuel at shipping piers at tide-water. The coal-storage systems which employ machinery in part usually consist of installations in which the ordinary trestle system, already mentioned, is supplemented by reloading conveyors placed either in the tunnels or against the faces of the retaining walls. Obviously the most interesting coal-storage plants are those in which machinery is used exclusively. Prominent among these are the systems in which tubs and buckets are mounted upon movable bridge tramways or wire rope cableways. Machinery of this type is familiar to a majority of students of industrial progress, owing to its extensive utilization in the handling and storage of iron ore, particularly at the ports on the Great Lakes and at iron-working establishments in the so-called "Pittsburg district."

COAL-RELOADER OF THE DODGE TYPE.

Of late the efficiency of plants of this kind—all based on the inventions of the eminent engineer, Alexander Brown—has been greatly increased by various means. There may be mentioned, as contributing causes, the introduction of various types of grab or "clamshell" buckets, each capable of imprisoning from one to ten tons of coal by the closing of their iron jaws and bucket-shovels, which when drawn up the side of a pile of coal will automatically scoop up a load which equals the limit of their capacity. The latest and probably the most interesting innovation in this field, however, is found in the use of such machinery for the storage of coal under cover; the radical departure being found in the fact that the handling machinery is located in the open above the covered storage bins. Bridge tramways of excessive length span the great storage sheds, and the tubs or buckets carrying coal are lowered through hatchways in the almost flat roofs, just as they might be lowered into the hold of a ship loading or unloading at dock.

A marked advance in the coal-storage field is embodied in what is known as the "Dodge system"—a style of plant that is a radical departure from the older methods of storage. In this system the trimming or stocking out is done by conveyors arranged at angles equal to the angle of repose of the coal, and these conveyors receive the coal from cars and build it up into conical piles, beginning the delivery a trifle above the ground line and constantly advancing it to a point a little above the apex of the growing pile. The conveyor trough is constructed to permit this gradual advance of the delivery point, so that after the initial drop into the track hopper there is no further drop exceeding a few inches.

The reloading is accomplished by means of an open-side conveyor which works against the edge of the

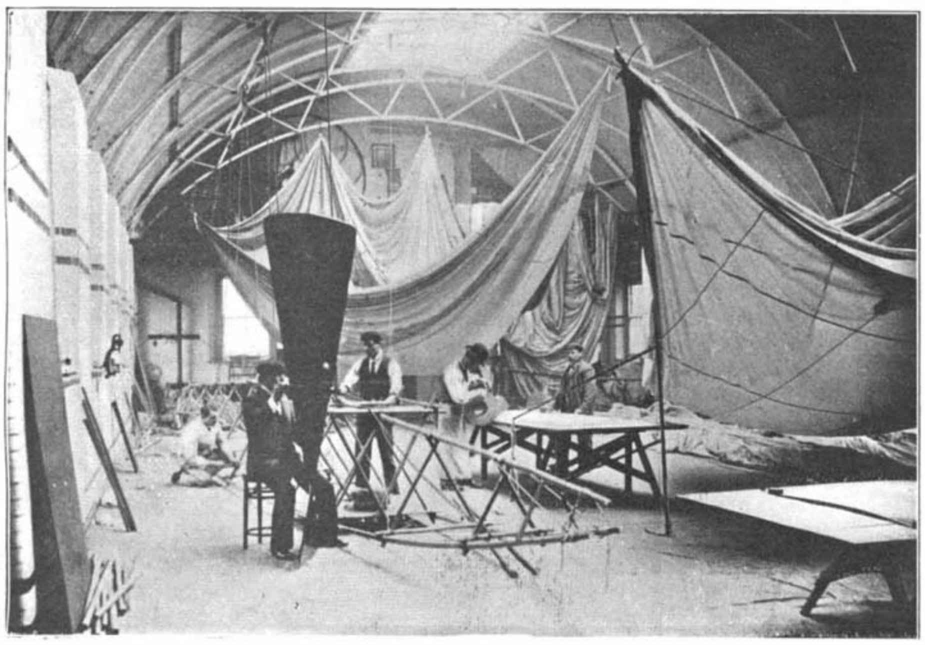


A CONVEYOR USED FOR STORING COAL UNDER COVER.

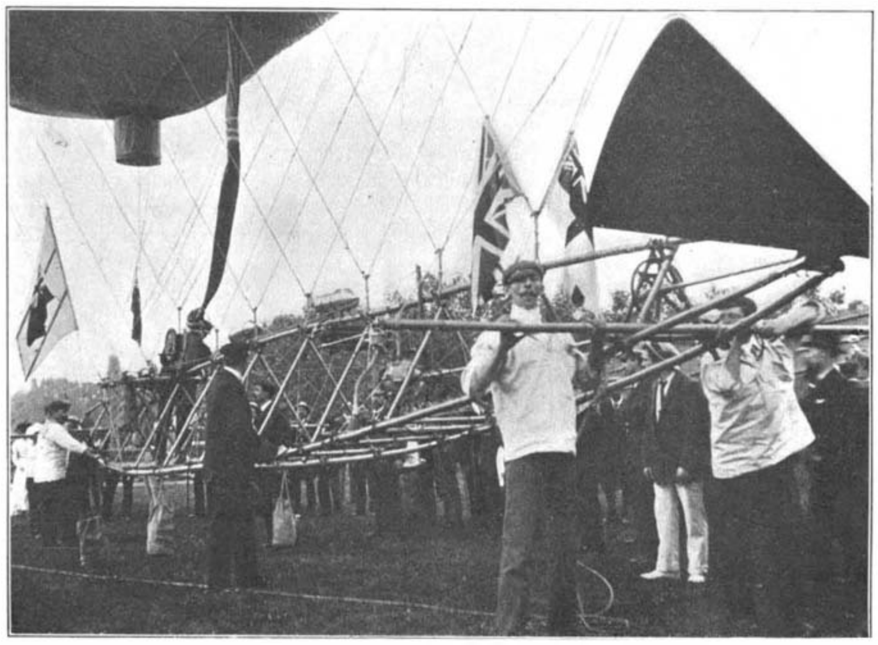
pile and follows up this edge as the coal is removed. The conveyor is mounted on a pivoted frame moved by power and so arranged as to be wholly under the control of one man. The reloading conveyor carries the coal without transfer to the reloading tower, where it can be delivered either directly into cars or else screened and then delivered into cars. A unit of this system consists of two trimming conveyors and one reloading conveyor arranged midway between them. For large capacities the dumping tracks are arranged on one side of the plant and the reloading tracks on the other. By this arrangement it is possible to carry on simultaneously the operations of trimming and reloading without any interference of cars or choking of tracks.

In the coal-storage plants of this new system each machine is of sufficient capacity to handle 1,800 tons in ten hours. In the operation of the plant of this character the coal received from cars in a hopper located beneath the receiving track is fed through a chute to the conveyor of the trimming machine, which delivers it upon the ground or at the apex of the pile as it forms. The bottom of this trimming conveyor is a steel ribbon, usually twelve inches wide, which is wound upon a drum located at the foot of the truss and arranged to be drawn out in grooves fixed in the conveyor trough, so that its end, which is the only discharge point for the coal from the trimming machine, shall always be at the constantly rising and receding apex of the pile. The reloading machine is composed of a horizontal and an inclined portion, both working together so as to render the carrying of the coal continuous from any point on the horizontal portion to the upper end of the inclined portion, where a small pocket is provided into which the coal flows and from which it is discharged over screens into cars or vessels.

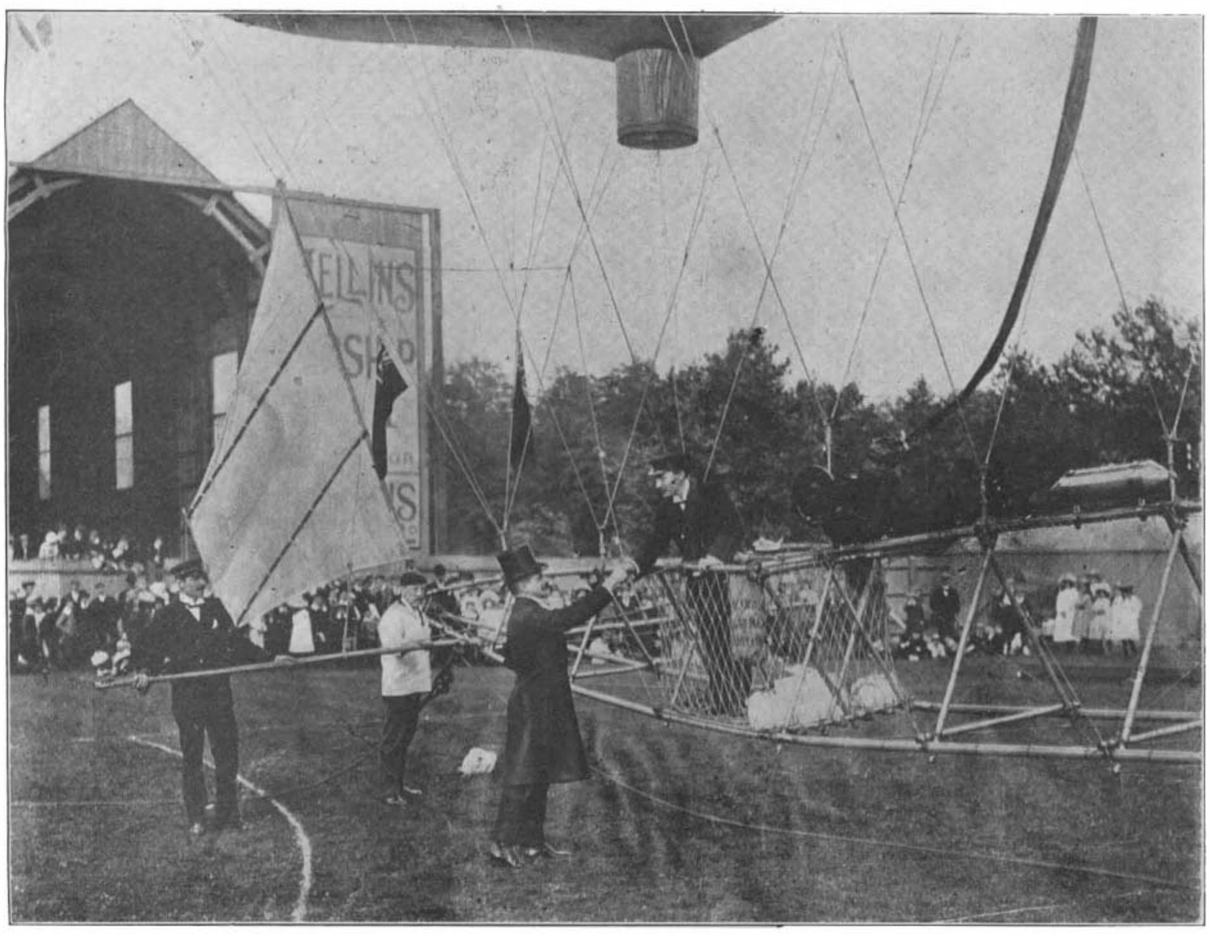
This system of coal-storage is employed in the 180,000-ton plant of the Philadelphia & Reading Railway Company at Port Richmond, Philadelphia. However, the Scranton plant erected for the Delaware, Lackawanna & Western Railroad Company has the largest trimmers and the longest reloader yet constructed under this system. Each of the two floors holds 50,000 tons in a pile 78 feet high and 310 feet in diameter, whereas the horizontal portion of the reloader is 300 feet in length. This plan of storing fuel is also adapted to use under cover in regions where heavy snowfall makes necessary the housing of all stored coal. For instance, the Lehigh Valley Coal Company has at West Superior, Wis., a plant which provides storage for 100,000 tons of anthracite coal in two circular steel buildings each 246 feet in diameter and 90 feet in height.



Building Spencer's Airship.



The Car Seen from the Front. Photographed Before the Start.



Spencer Starting on His Trip. The Aeronaut is Shaking Hands with Lachambre, Builder of the Santos-Dumont Ships.

The Ascent from the Grounds at Crystal Palace, London.

THE THIRTY MILE AIRSHIP FLIGHT OF STANLEY SPENCER.

THE SPENCER AIRSHIP AND ITS THIRTY-MILE TRIP.

BY WILLIAM EDWARD WARD.

On September 19 London was surprised to see an airship hovering over its chimneys and spires. The air was apparently quite calm, and the ship steadily headed to the northwest, traveling about eight miles an hour. Months ago Londoners heard in a vague way, that an English-built airship was in existence, but the matter excited little interest at the time, and latterly was quite forgotten.

The new airship is the work of Spencer Brothers, a firm of aeronauts now in the third generation, built in their own factory. It was sailed by Stanley Spencer, the second of the three brothers. For three months the air-ship has been awaiting trial in its shed in a South London suburb; and on several occasions it has made experimental captive flights. On September 19 the unusual stillness of the air tempted the aeronaut on what proved a successful maiden trip. At the commencement of his journey he circled in a couple of "figure eights" and repeated the maneuver when over the west of London. For the rest he covered about twenty miles in a trifle over two hours, alighting without mishap just before dark.

The balloon follows the torpedo-shaped construction made familiar by Santos-Dumont, but has more blunted ends. Consequently it has not the graceful lines of its French predecessor. The frame, which bears the aeronaut and the machinery, is constructed of bamboo held taut by piano wire. As seen in the air, it bears some resemblance, in its proportions, to a skeleton canoe. Three long strips of bamboo run the length of the frame, and are kept in position by struts bound triangularly, the base of the triangle being horizontal. The frame is slung from the bag by fine ropes. The principal feature of the construction is the position of the propeller, which is placed at the bow of the ship instead of, as is usual, at the stern. The inventor considers that the effect of this innovation will be to enable the ship to hold a more even course.

The motive power is supplied by a small petroleum motor swung in the forward end of the frame and firmly bound in position by piano wire. A small cylinder to feed the engine's water jacket is fastened just over the engine. Directly below the engine is the condenser. The fuel tank is fixed to the upper bamboo, but further aft to shield it from the motor flames. A thin rod of steel—the engine's shaft—runs forward to a gear wheel, the axis of which is the propeller shaft.

Toward the stern of the balloon is the aeronaut's stand, inclosed in netting. Behind him is the rudder, a large quadrilateral sail suspended by ropes between the ends of the balloon and the frame. The construction places all the mechanism—except the rudder—directly in front of the navigator, an obvious advantage in cases of sudden emergency.

All the working parts are under absolute control from the car. Two cords guide the rudder. The pro-