would not always avail to prevent, for there are conditions of generation and expansion of gases within boiler shells which even at this late day are not thoroughly understood.

Let us inquire into the causes of some of the recent explosions. There were twenty-five serious ones between October 15th and November 15th. In the case of the disaster in the boiler house of the Louisville (Ky.) Electric Power Co., the exploding boiler was connected with another by a large steam drum, so that when one had a certain pressure the other had the same. Each had an independent feed pipe entering at the top, and also separate gauge cocks and glass water gauges. They were connected at the bottom with a two inch equalizing pipe. It was shown conclusively that there was plenty of water in one, and none in the exploded boiler. Close inspection of the inner sides of the plates showed this. The feed valve had become closed and the equalizing pipe stopped up by scale and sediment. The indications of the back head and the flue, which showed the blue line, indicated low water, and even the engineer admitted that that was the cause. The result of this explosion was the death of one man, the wounding of several others, and a disastrous fire.

The engineer trusted to the equalizing pipe, and did not even trouble himself to keep his boilers free of scale and to watch his gauges. Even his brother engineers in Louisville condemned him in a special meeting.

A somewhat similar case occurred at the Enterprise Mills, St. Jacob, Ill. The boiler that exploded let go along the horizontal seam of the first sheet, just below the water line, one flue was collapsed its full length. There were two boilers set in battery, connected at bottom with mud drum with seven inch legs, and on top with four inch pipe only. The boiler that did not explode showed no signs of low water, while in the other they were unmistakeable. This seems to have been a clear case of driving the water from one boiler into the other. There had been a big fire under the one that exploded, and but little under the other. That and the small steam connection is thought to be sufficient to account for it.

Here is a fairly representative list of explosions for thirty days, with the causes given where known:—

Bessemer, Ala.: Electric Light Works. Cause: Low water.

Anderson, Ind.: Am. Straw Board Co. Engineer went out for his lunch. He "thought it would be all right."

Tifton, Ind.: Coleman's Mill. Cause: Not known.

Medina, N.Y.: Sanderson's Mill. Cause: Boiler scaled an inch thick.

St. Paul, Minn.: Kansas City Lime Shops, locomotive boiler. Cause: Unknown.

Manchester, N.H.: Amoskeag Mill. Fly-wheel exploded. Cause: Imperfect casting.

Chicago, Ill.: Tug-boat Parker. Foaming, caused by using Chicago River (sewage) water.

Whitcomb, Wash.: Str. Evangel. Engineer forcing boiler beyond safety limit.

Pottsville, Pa.: New locomotive, cause unknown.

Brookhaven, Miss.: Brookhaven Machine Company. Boiler hadn't been cleaned and examined in three months.

Highland Park, N.J.: Raritan Brewery. Gauges stopped up and safety valve out of order.

South Stillwater, Minn.: Stillwater Lumber Co.'s Mill. Improperly constructed boiler.

Marion, O.: Schaffner's Furniture Factory. Low water.

Philadelphia, Pa.: Conroy Boiler Co. Boiler thick and cumbered with incrustation.

Sanborn, N.D.: Thrashing machine. Low water.

Tokio, O.: Portable engine. Engineer "didn't know it made any difference how much steam he got up."

McDonald, Pa.: Drilling engine. Engineer playing cards with a friend.

Eckelson's, N.D.: Thrashing engine. The water was low, and engineer couldn't remember just how much steam he was carrying.

Kildare, Tex.: Steward's Saw Mill. Scale and lack of water.

Van Wert, O.: Steam picket saw. Engineer had to go out for his lunch.

Sundridge, Ont.: Tookey's Planing Mill. Boiler worn out.

Venedocia, O.: Saw mill. Low water.

In most of the cases where there were deaths, the coroner's inquiry brought out the fact of gross imcompetence. Indeed, the evidence in many of these cases is calculated to amaze the reader. It seems to be a fact that there are those who employ steam in their business without the smallest idea of its dangers. They hire an engineer as they hire a wagon driver, and trust to luck for the rest.

In some sections the laws bar out incompetence from the engine room, and such laws should be in force everywhere.

The Stationary Engineers of Louisville, Ky., who met recently to consider the cause of the explosion in that city, declared it as their belief that "engineers as well as boilers should be inspected." A sentiment, it may be said, which does credit to their intelligence.—*Scientific American.*

OIL AS FUEL FOR STEAMSHIPS.

A great saving in weight and cost of stoking is to be effected by using oil as fuel on steamships, instead of coal, according the "remarkable results" discovered by a New York paper, which says:

It is a great advance toward the employment of petroleum instead of coal for generating steam in the boilers of marine engines to find that the question is now nearly reduced to one of cost. When it comes absolutely to that point its use for some branches of navigation will be assured. There will be petroleum regions which can employ liquid fuel for their locomotives and ship engines, while many naval vessels will not allow the increased expense to stand in the way of increased efficiency. Provided safety in stowage and use can be assured, and provided no danger of explosion need be feared should an oil tank be hit by a shell, there will be positive advantages enough to insure its introduction. The most conspicuous of these is its superiority over coal in evaporative power. A given weight of oil will produce nearly twice as much steam as the same weight of coal, so that in order to keep up the fixed amount of steam required by a naval engine only about half as much fuel need be expended. That means, of course, nearly doubling the ship's radius of action, which is a point of high importance to war vessels. In the case of the London and Pacific company's steamship Ewo, it is said that while she had made eight and one-half knots with the use of seven tons of coal per day, she reached nine knots on less than four tons of fuel oil. It must also be noted that a ton of coal occupies about one-eighth more space than a ton of oil residuals. Hence the customary proportion of 7 to 4 in favor of the evaporative power of oil is increased to nearly double in a ship's fuel supply.

In a recently published review of the present state of the oil fuel question by Assistant Engineer Allerdice of our navy, stress is laid on the fact that petroleum refuse, or the residuum