can thus be very much lessened, and the profits of well owners, brokers, and all concerned, correspondingly increased. Pumps are wanted, boring tools and engines are required, besides a host of minor auxiliaries not necessary to specify. Let oil men make their wants known in this particular and they can be supplied with any machine required. Ingenious men connected with operations of the character in question should keep their eyes open. Fortunes have been pumped up out of the ground in a week, out there are a good many above ground still, and those who shall seek shall find.

CONCERNING VALVES.

When a feed pump becomes deranged the first thing the engineer thinks of examining is the valve seats. They are so universally a cause of trouble that the ingenuity of inventors has been exhausted to facilitate the inspection of these parts. Bolts are made ready to cast off at a moment's notice, and bonnets are so contrived that they may be quickly disengaged. The trouble with valve seats frequently arises from imperfect construction. Valves are of so many different kinds, however, that some discussion of the several varieties may not be out of place. The ordinary circular brass valve with a brass seat, sometimes called a clack valve, is one generally used in small pumps for feeding boilers, and other uses. They are sometimes made with flat seats, but are oftener conical in form, and when thus made are frequently defective from bad proportion. The taper is made too slight, so that in rising and falling the valve becomes jammed in its seat, and refuses to work. Valves with spindles often leak from the spindle being bent; a very slight bend, not visible except by putting the valve in the lathe, is enough to disable the pump. Muddy water is also a source of trouble in this respect. These valves work very well in pumps where not over four or five inches in diameter, but beyond that size a better substitute is found in a vulcanized india-rubber disk. The disk in use varies from half an inch in thickness to two and a half inches, according to the area of the passage; and the seat is simply a grating, with the sharp edges rounded so that the valve will not be cut by them. In spite of this precaution, however, the valves wear rapidly when large, by reason of the heavy pressure from above. This objection has been measurably overcome by employing a number of small valves instead of a single large one. This plan, again, has the disadvantage of necessitating small bolts and narrow openings in large pumps and heavy buckets, so that the small fixtures are often knocked off and broken by the violence of the water in meeting, or passing through them. These small valves and openings also churn the water into foam, so that the pump is much less effective than when lifting a solid column.

Of old the ponderous metallic butterfly valves were used in marine steam engines for foot valves, outboard delivery valves, and the valves at the nozzle of the air pump, where it delivers its contents to the hot well. These valves weighed upward of 200 pounds each, on heavy engines, and the thumping and pounding when they were at work may be imagined. It was a great improvement when they were deposed by rubber valves, as they now are universally. Force pumps on screw engines and locomotives have usually much larger valves and openings than common pumps, and in marine engines they are invariably of vulcanized rubber. Ball valves were formerly much used, but are not now in modern steam engines. The objection to valves of this form is that they fill the water ways above, unless a side passage be made for the water in the valve chamber. When made of rubber it answers well in small pumps. Metallic balls are used, but they are costly to make, and are not always tight; they are also heavy, and batter the seats.

Much ingenuity has been expended in making valves in complicated forms, but such methods are, in our opinion, wrong. Simplicity of construction in a steam engine is the first requisite, for from it generally arises other good qualities. The puppet valves of marine engines were first made of cast-iron, and were single disks. Intelligent engineers, however, prefer to use double beat, or balanced valves instead, not only on account of the reduced labor in handling the engine, but also from the decreased wear and tear of the parts which operate them. Mere force can as well be applied to a single disk valve as to raise an anchor, but it requires no judgment to apply it, and is a simple question of areas. Instead of being iron they are now brass and iron, in such proportions that the greater expansion of the softer metal is compensated for by its reduced quantity. When this proportion is observed the valves are perfectly tight, and will remain so with proper care.

GREASE BALLS.

Mr. Gilbert Valentine, engineer at Messrs. Harper & Bros., in this city, recently called at this office with some balls of grease which had collected in the exhaust pipe of his engine to such a degree that the opening was practically closed. These balls were sixteen in number, and we are informed that there were six more. They are about an inch and three-quarters in diameter, in appearance black, and of the nature of black-lead in consistency and fracture. They cut easily and leave a shining mark under the knife. Mr. Gilbert informs us that he uses nothing but tallow in his cylinder. The formation of such balls is not unusual in steam engines, and we have seen them taken from locomotive cylinders and other engines in localities where hard water was used. They are principally composed of tallow, which combines with the impurities in the water carried over by the steam, together with such foreign matter as may accidentally be introduced to the cylinder. The wear of the surfaces in contact, such as the packing and the cylinder, is also carried off by the grease, so that a portion of iron is contained in them. These balls often accumulate in the bottom of the cylinder ports, and, where the clearance is great behind the piston, or before it, have been known to knock out the head by being blown out of the port into the cylinder. Balls formed in engines operating in limestone regions, or where the water is unusually calcareous, are frequently as hard as stone. Those which Mr. Valentine brought us are the largest we have ever seen.

Some engineers use black-lead in cylinders that have been badly scratched, and the presence of this mineral is exceedingly favorable to the formation of grease balls. The existence of them shows the necessity of frequent examination of all parts of steam engines, especially the pistons and ports, or those points where such accumulations are likely to occur. The passage of the exhaust pipe alluded to was almost stopped by the presence of eighteen solid balls nearly two inches across.

EXPANSION OF LIQUIDS.

In a former article we treated of the degrees of expansion of certain metals and other solids. Gases and liquids expand also, but in different ratios. The same liquid, water for instance, expands unequally at different temperatures; but the law for its changes as well as for those of other liquids cannot be laid down with certainty. As a general rule, however, the fluids which expand the most are those which boil at a low temperature, as alcohol and some of the more volatile essences. The amount of force generated in the expansion of liquids is enormous, and this is taken advantage of by practical men in testing steam boilers with little or no labor, and with great certainty and safety. The plan is to fill the boiler as full of water as it will hold, close all apertures, and load the safety valve to the greatest amount the boiler will ordinarily bear. A fire is then kindled in the furnaces, as usual, and the heat causes the liquid to expand, long before it reaches its boiling point, with great force. Water expands very irregularly, with equal increments of temperature, between the freezing and boiling points; the whole amount of its expansion between the two degrees just mentioned is comparatively small, its coefficient of expansion being less than that of any other liquid, except mercury. The most noticeable irregularities in the expansion of water occur between 32° and 40°, and, what is most singular, while all other fluids have the greatest density at their freezing points, that of water is shown at 39°.2 Fah., and either above or below this point it expands. This fact is fully proved by experiments made with apparatus devised for the purpose, and it explains why but a comparatively thin coating of ice, compared to the body of water, is formed on the surface of rivers and lakes, even in winters of great severity; for although water freezes at 32°, before that temperature can be reached the water on the surface expands, and although colder is specifically lighter than the warmer and larger bulk below on which it floats. Ice is then formed on the surface; and, being a bad conductor, prevents the water below from freezing to a great thickness by checking radiation.

FINED FOR NOT WORKING.

It seems that the race of Gradgrinds, that Charles Dickens speaks of in "Hard Times," is not yet extinct in England. An apprentice to an iron-founder in England, who lately plead guilty of having absented himself for one day from his work, was sentenced to one month's imprisonment, at hard labor.

That must have been a cheerful service which the youth rendered after this punishment. Employers are often foolish. Compulsion is no part of a youth's instruction in a trade; if he do not take to it cheerfully and naturally he is useless, and might better be out of the shop than in it. Apprentices are no longer bound in this country, and this reform has instituted itself. The character of our apprentices is too high to admit of even seeming vassalage, and when master and apprentice cannot agree it is time, for the self-respect of both, that they should part.

There is something to be said for both sides. Boys will be boys, and to expect a youth to come into a shop and lay aside forever all his youthfulness and become the sober journeyman is unnatural. A boy without spirit is no boy at all, and he must have recreation at proper times and seasons.

Eye service is useless. A boy that works while his foreman is present, and goes into ground and lofty tumbling when he is absent, is better out of the shop, for he wastes his own time and sets a bad example to others. Out of the shop the employer has nothing to do with him, and his time is his own; his morality and his accountability for misdeeds are also his own; he alone must answer for them.

If a youth wishes to learn a trade he will apply himself; it is his interest to do so; and if his master is wise he will encourage, but never enforce, attention. Keep boys apart. Recruits in the army are put with veterans, and soon make good soldiers. Fun is contagious, and one joker will infect a dozen steady fellows. Boys have their places in the shop as well as in the world, and they make journeymen as well as members of society. It is no part of the law of good sense or kindness to misuse them or be hard upon them.

BEWARE OF RAW PORK.

A few days since we observed a butcher tasting some raw sausage meat in his shop, and the act was immediately associated in our mind with a singular-looking bottle which Dr. Hallett, of Brooklyn, has standing on the table in his office. When we first saw this bottle we supposed that it contained strips of some white bark very nicely prepared. But Dr. Hallett informed us that it was a tape worm, which he had recently taken from the bowels of a man who contracted it by eating raw pork in California.

The old readers of the Scientific American will remember that the origin of tape worms in raw pork was pointed out in the pamphlet of Dr. Weinland, which was noticed on page 100, Vol. V., new series. As we have several thousand new readers we repeat the caution. Fortunately the tape worm is very rare, but when it does occur it is caused by eating raw pork.

BLOWING UP OF THE "ALBEMARLE."

The rebel ram *Albemarle* was destroyed on the 28th ult., by a torpedo, which was placed in position by a method that has been frequently recommended in the Scientific American. This method is to attach the torpedo to a boom extending forward from the bow of a swift vessel. It was demonstrated by Fulton that any vessel could be destroyed by the explosion of 100 lbs. of gunpowder in contact with her bottom. The difficulty has been to get the torpedo against the vessel's bottom and explode it there. Plans for floating torpedos down by the tide very rarely if ever succeed, and even when they are placed on the bottom vessels usually pass over them with impunity. But when a brave officer has a torpedo