also of his brothers in trade by seeking labor elsewhere. But if A and his friends should post themselves in front of C's door, and tell B, D, and E, and every other employee of C's whom they met, that C would not accede to prices fixed by A and company, and that the shop was black-listed, and then should endeavor to make B and his comrades leave their work, not directly for B's benefit, but first to injure C, and thus coerce him into benefitihg A: such is clearly wrong, since it is an invasion of the rights of C.

A recent case decided in England exemplifies this point very clearly, and at the same time adds another to the precedents which stand to mark how far trade unions can lawfully interfere with trade. Messrs. Jackson & Graham, a large upholstering firm in London, altered their system of paying per hour to that of piece work throughout their entire establishment. The operatives at once, with a few exceptions, struck, whereupon the firm promptly supplied their places with non-society men, and continued business. The strikers then through their association, stationed pickets in the vicinity of the shops, waylaid the workmen going and coming, and for the space of three months persistently labored, though with little success, to induce the new hands to join them. No physical intimidation was employed, and nothing but verbal persuasion used to discourage the men from their labor. Finally the proprietors caused five of the ringleaders of the pickets to be arrested on the criminal charge of conspiracy. The trial involved the services of very eminent counsel, and lasted two days. Baron Cleasby, the presiding judge, in his charge laid down the law clearly and emphatically, that it was an offense to offer any molestation or obstruction to a working man, to coerce him to quit his employment, or to a master, to alter his mode of carrying on his own business. Picketing, he said, might not be unlawful under certain circumstances; but it is when carried on in such a manner, and to such a degree, that it might be expected to influence other persons to the extent of annoyance, apprehension, or loss. The case went to the jury on a mere question of fact; the defendants were found guilty, and sentenced to brief imprisonment.

THE IRON HORSE.

On page 340 of our current volume, we published a letter from Mr. Flower, President of the West End Railroad Company, of Philadelphia, Pa., in which he offers a premium of $5,000 to the inventor of a substitute for horses, to draw street cars, on condition that he gives the company the control of the invention. It appears to us that, considering the difficulties of the problem and the immense value of a successful solution thereof to those having the control of it, the compensation is rather trifling. This practical problem has been occupying many minds for several years, and many others are working at it now; but the difficulties are scarcely realized unless we consider the great advantages possessed by the living horse, in case only the power of one, two, or three horses is required. When we need the power of ten, twenty, or more horses, no doubt the locomotive is preferable; but we doubt if locomotives of one or two horse power will ever be found to give satisfaction even when well constructed, as they can never compete with a living horse, the trouble of raising which is less than the labor of building a locomotive in a shop. And the horse takes its own water and fuel when needed, and needs no stoker; it also continually repairs itself, until it is entirely worn out. Even then, at its dissolution, there is no danger of bursting a boiler. It is always ready, and needs no firing up; and finally, having a sense of self-preservation, it will not blindly go ahead, and run in the river off an open drawbridge, as locomotives have often done. If it is objected that occasionally the control of horses has been lost by the driver, and that they ran off, it must be remembered that runaway locomotives are by no means uncommon. Taking all things into consideration, we believe that the ordinary horse is a good institution, which it will be very hard to surpass by labor in a machine shop.

GRASSHOPPER INVENTIONS WANTED.

The grasshoppers have appeared in the Western States in such countless throngs that the terrible devastation worked by them among the crops of last year bids fair to be repeated. In the neighborhood of St. Joseph, Mo., it is said the gardens are literally black with the insects, and that the land extending from that city southwest, across the Territories to the Rocky Mountains, is covered for miles in breadth. The size of the locust is from that of a flea to that of a house fly; but, in spite of its lack of growth, its inroads on vegetation are none the less severe. The Colorado journals think that the crops, not merely of that State, but of five or six States to the eastward, will be entirely ruined. This is certainly a very gloomy prospect, and the wholesale destruction of the wheat will make itself felt over the entire country.

It is getting high time that the extermination of this nuisance should engage more widely the attention of inventors. A machine, for example, which can be dragged over the fields before the crops are put in, and which will destroy the eggs deposited in the ground, is needed; or a device might be produced for killing the grown insects without injury to the crops. The Greeley *Tribune*, located in the midst of the ravaged district, says: "We want the same acutenesss, the same nice observation applied to the grasshopper question, that is applied to abbreviating labor by mechanical contrivances and in constructing works of beauty and skill. Enough ingenuity is displayed in the sewing machine to catch every grasshopper in our valley and skin him into the bargain." There have been already several attempts made to invent the grasshopper out of existence. The apparatus last brought out is a fire machine, which is simply a grate on runners. The inventor says that "pitch pine is used for fuel, and our Colorado zephyrs fan it into a miniature hell." The fire is made on the grate, and a sheet iron cover directs the blaze downward. This machine is dragged by a team around in circles of large diameter, burning the hoppers which get under it and driving others before it, "corraling" them, in fact, in the scorched circumference. It keeps on its circuitous route in gradually decreasing circles until every insect within an extended radius is burned.

Ditching entirely around the fields, and filling the cut with water, is said to keep the grasshoppers out. This is probably of little use, however, after the insects are able to fly. Another plan is to keep the entire land wet (a rather difficult operation, we should imagine), it being found that the hopper prefers dry localities to damp ones. A farmer who has adopted this mode of protecting his fields combines it with the ditch system, keeping the ditches filled with running water, which is made rough by passing over a number of small dams. He cuts the ditch first around the plot, and then wets the enclosed area. The grasshoppers try to crawl off, and then tumble into the ditches where they are quickly drowned and washed away. If he finds an army marching in from a new quarter, he directs a stream of water on the threatened point and thus heads off the column. Another individual has saved a ten acre patch by putting a little kerosene oil just above the head gate which admits water to the enclosing ditch. The oil floats on the surface and is held in place by a board, the edge of which touches the water. Under this board it gradually leaks out, forming a film over the entire ditch, rendering the latter a river of death to the insects. We notice also another fire invention somewhat similar to that already described. It has wings on which fires are kindled, and a fan which blows the insects into the flame.

It seems to us that a good road engine, rigged with an extra boiler to make steam which could be directed in jets downward—something after the fashion of the numerous snow-melting inventions—might be usefully employed. It could go over the ground quickly, and one machine would serve to protect a large area. Or there is that apparatus we described a short time ago, which makes a fearful heat underneath it by a current of superheated steam entering ignited naphtha gas. This melts thick ice by merely passing over it at the rate of some four miles per hour. Judging from this effect, the machine would readily destroy grasshoppers.

The Governor of Missouri has appointed a day of prayer for relief from the scourge. If these supplications are as earnestly supplemented by products of our inventors, we have not the slightest doubt but that they will be answered. Meanwhile, we commend to the people of Missouri the old maxim: "Help yourself and God will help you;" in other words, invent first and pray afterwards.

CLIMATE OF THE ICE AGE.

The science of meteorology has, of late years, been growing more and more in popular favor. The revelations of the United States Signal Service, and the valuable practical deductions that have been made from them, have created an interest in the subject which will not soon die. And while the climatology of our own day has commanded the careful study of our best scientists, that of earlier times in the earth's history has received equal, if not more profound, consideration. The study of the plants and animals which previously existed on the globe—including the vexed questions relating to the development of organic forms—has largely to do with the climate and state of the atmosphere that prevailed in those earlier periods.

It has long been supposed, and taught by text book and teacher, that during the carboniferous age, when the sun's heat was stored up for us in the form of coal, petroleum, etc., the atmosphere was supercharged with carbonic acid gas; but recent investigations have rendered this extremely improbable, and some late experiments have demonstrated that plants are killed by a greater amount of this poison gas than is ordinarily found in the air. But doubtless the greatest intellectual capital has been invested in a consideration of the meteorological conditions of the glacial period; and the conclusions which have been reached on the subject are as widely apart as the antipodes. While all agree that the northern part of our continent, down to 40° of north latitude, was almost completely covered with a sheet of ice from one to three miles thick, during this period, some make it a season of intense cold, and others claim that it must have been a time of moderately high temperature. Many theories have been advanced to account for the climatic changes which brought the alternations of heat and cold to our earth during the past ages. One of these is the supposition that the solar system, in its translation through space, may have passed alternately through regions of extreme cold and great heat. Another is that the earth may have changed the position of its axis of rotation, because of some great mountain upheaval between the equator and the poles. Still another is the wild supposition that the earth's crust has gradually slipped on its nucleus, so as to bring the equatorial belt nearer to the pole than usual, and then away from it again. Lyell has attributed these changes to a supposed change of place between the land and the sea. He argues that, if the land were accumulated most in the tropics, the vast amount of solar heat which it would "soak up" would be carried by currents to the polar regions, and afford nearly or quite a summer climate to any islands that might be situated there. And if the land were accumulated about the poles, it would result in a great diminution of terrestrial heat, because the water, which is exposed, in this case, to the direct rays of the sun, has far less heating power than the land. Professor Shaler has advanced the idea that these changes may be explained on the supposition that our sun, like many other suns in the universe, is a variable star, and makes our earth warm or cold according as its brightness varies. Whether any one of these is the real cause of past cosmical climatic changes, we cannot say; but we can reasonably conceive that the first and the last two may each be considered a true cause.

Among those who believe the ice age to be one of extreme cold, stands prominently Mr. James Croll. His theory for explaining the cause of this cold is based upon the eccentricity of the earth's orbit, the precession of the equinoxes, and the obliquity of the ecliptic. The orbit of the earth is an ellipse, varying in eccentricity as the planets are variously situated in their orbits, being most elliptical when the planets draw it farthest from the sun. Its rate of variation is very variable. If a plane pass through the sun's center, parallel to the plane of the earth's equator, it will cut the earth's orbit in two opposite points, namely, at the vernal and autumnal equinoxes. The line between these points does not divide the earth's orbit into equal parts, on account of its eccentricity. The earth passes through the perihelion part of its orbit in seven or eight days' less time than through its aphelion part. Hence, now our winter is shorter than our summer, and *vice versâ* in the southern hemisphere. The action of sun and moon on the protuberant equatorial mass of the earth is constantly changing the plane of the earth's orbit, and hence, also, the position of the line joining its equinoctial points. These make a complete revolution in about 21,000 years. Now, when the earth had its winter in the northern hemisphere, while it was in aphelion, its winter was longer than the summer, hence extremely cold. In this case, the ice and snow of winter will not be entirely melted during the summer, because much of the sun's heat is taken up in melting ice, and therefore does not ameliorate the temperature. The result is that, during this long period, ice and snow are accumulating in the northern regions. The vapor from melting ice would obscure the sun with cloudy atmosphere in the summer, and thus make the air raw and cold. It is said by antarctic explorers that the summer there is even colder than summer in northern regions of the same latitude, though the latter are millions of miles farther from the sun.

Another consideration, Mr. Croll thinks, would make great difference with the cold at the north pole, when its winter occurred in aphelion. All permanent oceanic currents originate in the Antarctic Ocean. The chief one divides into two parts: one goes north to the East Indies; the other goes west through the Indian ocean, is deflected round the Cape of Good Hope, follows up the west coast of Africa for some distance, then crosses the Atlantic and forms two currents: the Brazilian, going south, and the Gulf Stream, going north. Now the sun causes the air at or near the equator to give place to cold currents from the poles, which rush in to produce equilibrium. During the long cold of the northern hemisphere, the north currents would be stronger than those from the south, where the climate is, at the time, warmer. He thinks this stronger current from the north might be able, by its friction on the water, to entirely stop the Gulf Stream, and leave the northern hemisphere to unmitigated cold. Croll's theory supposes that the time of the ice sheet in the northern and southern hemispheres was not synchronous, but distant by at least 10,000 years. He supposes that glacial time began some 240,000 years ago, and terminated about 160,000 years ago, that the most intense cold was about thirty or forty thousand years after the period commenced, and that there were several great changes of climate during its continuance.

Mr. Murphy claims that, if the climate at any given elevation is cold enough to form glaciers, no decrease of winter temperature will increase their magnitude, while, on the other hand, a low summer temperature is shown, by the facts of physical geography, to be eminently favorable to glaciation. He therefore concludes that the glacial age occurred when the earth's greatest distance from the sun was in summer rather than in winter.

Another theory, still more at variance with Mr. Croll's, is that held by Mr. Thomas Belt and many others. Savants of this school believe glaciation was not due to extreme cold, but to excessive precipitation. They hold that the ice was thickest over the American continent, because the great evaporating area of the Pacific lay to the southwest of it, and counter trade winds swept across it, and precipitated the moisture with which it was laden. While Mr. Croll makes the ice six miles at least in thickness at Greenland, it was probably thicker south of the poles than near the poles, because the water from warmer regions would be precipitated before reaching the poles. The glacial age probably existed on both continents at the same time, as traces of glaciation north and south of the equator nearly inosculate, and the character and appearance of the morains is the same in both. This supposition only could make correct Mr. Darwin's explanation of the fact that forty flowering plants of North America and Europe are also found at Terra del Fuego. He says that plants were driven to the equator during the ice age, and then followed the retreating ice sheet, both ways from the equator.

Agassiz considered the glacial period a cold time followed by a much warmer one. He thinks it not long and slow, else boulders would have been carried as far south as the ice sheet extended, but sudden and short, as is proven by Siberian elephants caught in the snow and frozen so that their flesh is preserved for recent dogs and wolves to eat.

To harden a wooden pulley, boil it for about eight minutes in olive oil.