

experiment cited, 30 fire pots per acre sufficed. For more extreme conditions in orchards elsewhere I find that 80 or 100 per acre are recommended. It should also be understood that vines are pruned very low, they being from 2 feet to 4 feet high, depending on whether or not they are staked or trellised, and there is thus no tree crown to entrap the heat from fires. But even with this disadvantage complete protection seems easy and sure, and many growers are awakening to the fact.

#### FROST CARTRIDGES.

By Prof. ALEXANDER G. MCADIE.

It seems advisable to publish the following as a preliminary note in connection with experiments made at San Francisco on the protection of tree fruits from injury by frost.

It has been pointed out in previous papers published in the Monthly Weather Review, that while orchard heaters of the type now in general use served a good purpose, and if used in sufficiently large numbers would afford protection in orchards, there was one serious objection to their use, namely, that the heat could not be applied at the particular level where most needed and therefore the highest efficiency was not obtained. Just as the orchard heaters marked a distinct advance over the old-style open fires, which warmed up all out of doors, so it is thought a proper use of antifrost candles, or cartridges, as they have been called from a fancied resem-

blance to a large cartridge, will be a decided improvement upon the use of heaters placed on the ground.

The cartridge consists of a cylindrical tube of heavy cardboard or other suitable slow-burning material, which is filled with a mixture of crude oil, gravel, and sawdust. Two stoppers are provided to close the ends of the tube. When filled the cartridge is suspended by a wire about 3 feet below the fruit in a horizontal direction. When used the stoppers are removed and a torch applied to small amounts of cotton waste, which have been soaked in kerosene and placed at the ends of the cartridge. A cartridge case 2 feet long and 1½ inches in diameter will burn about 2 hours. If the combustion is good there will be nothing left but the gravel and a small residue of charred cardboard.

The tubes may be filled with the mixture during the afternoon hours. Tests made at San Francisco show that the tubes will hold the oil without leakage and also without softening for several days. There will be, however, a discoloration after 24 hours. The tubes are easily handled and are comparatively cheap.

There are two objections to the use of this method, however, first, the danger of fire from the burning ends, and second, the large amount of soot given off, a portion of which is deposited upon the fruit. Experiments are in progress looking toward the atomization of the crude oil, so that the combustion will be improved.

Some form of metallic screen to be placed above the cartridge would be a great improvement, but this would materially add to the expense.