

nounce, in a paper printed in the *Transactions of the Royal Society* for that year, the foundation of this new method of research, which, transcending the wildest dreams of an earlier time, enables the astronomer to measure off directly in terrestrial units the invisible motions in the line of sight of the heavenly bodies.

To pure astronomers the method came before its time, since they were then unfamiliar with Spectrum Analysis, which lay completely outside the routine work of an observatory. It would be easy to mention the names of men well known, to whom I was "as a very lovely song of one that hath a pleasant voice." They heard my words, but for a time were very slow to avail themselves of this new power of research. My observations were, however, shortly afterwards confirmed by Vogel in Germany; and by others the principle was soon applied to solar phenomena. By making use of improved methods of photography, Vogel has recently determined the motions of approach and of recession of some fifty stars, with an accuracy of about an English mile a second. In the hands of Young, Duner, Keeler, and others, the method has been successfully applied to a determination of the rotation of the sun, of Saturn and his rings, and of Jupiter.

It has become fruitful in another direction, for it puts into our hands the

power of separating double stars which are beyond the resolving power of any telescopes that can ever be constructed. Pickering and Vogel have independently discovered by this method an entirely new class of double stars.

Double stars too close to be separately visible unite in giving a compound spectrum. Now, if the stars are in motion about a common centre of gravity, the lines of one star will shift periodically relatively to similar lines of the other star, in the spectrum common to both; and such lines will consequently, at those times, appear double. Even if one of the stars is too dark to give a spectrum which can be seen upon that of the other star, as is actually the case with Algol and Spica, the whirling of the stars about each other may be discovered from the periodical shifting of the lines of the brighter star relatively to terrestrial lines of the same substance. It is clear that as the stars revolve about their common centre of gravity, the bright star would be sometimes advancing, and at others receding, relatively to an observer on the earth, except it should so happen that the stars' orbit were perpendicular to the line of sight.

It would be scarcely possible, without the appearance of great exaggeration, to attempt to sketch out even in broad outline the many glorious achievements which doubtless lie before this method of research in the future.

*Science News Letter, April 15, 1933*

## ENGINEERING

## New Style Mattress On Mississippi River Bed

**A** BRAND NEW mattress with dust in it. A huge black flexible mattress 300 feet long, made and slid neatly into New Orleans harbor. This is the latest experiment of U. S. Army engineers, in their effort to find a really satisfactory mat to keep the Mississippi River's bed in order.

Since 1878, mats of one sort or another have been contrived and laid down in the river at the New Orleans wharves. The problem was, and is, to keep the river from eroding the banks and levees until they cave in.

For a year, Col. J. N. Hodges, district engineer of the U. S. Army Engineer Corps, has been directing work on this new type of mattress which would solve New Orleans' old problem. Walter C. Carey, a civilian engineer, took charge of the task.

After trying many ingredients, the engineers pronounced themselves satisfied with a mixture of about 12 per cent. paving asphalt, 66 per cent. river sand, and 22 per cent. loess—earth so fine that it is light dust. The mixture was poured over a great sheet of chicken wire, completely covering the wire, and producing a mattress that is flexible, does not crack, stands up under heavy water pressure, has no corroding metal exposed. Previous river mats have worn badly for lack of one or more of these qualities.

The new mattress was completed and lowered safely into place during the late-winter rise of the Mississippi, when the strain on the fabric would be greatest. The big black mat withstood the initial hard test and is apparently going to be as satisfactory in real wear as it promised in the laboratory tests.

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## METEOROLOGY-ARCHAEOLOGY

## Incas Anticipated Moderns In Frost-Fighting Method

**T**HE modern method of protecting orange and lemon groves from frost damage by orchard firing on cold nights is not so new after all, archaeologists point out.

California groves are protected by thousands of pots burning a heavy crude oil. Long ago, in Cuzco, Peru, where

the U. S. Pharmacopoeia requires that they should be kept below freezing. With the old-style, ordinary icebox it was sometimes difficult for druggists to keep the vaccine cold enough to prevent its deterioration.

Public health officials believe that the refrigerated vaccination "takes" more often, and consequently more people are protected.

Other officials state that while refrigerated vaccine may play a part, it may be that the reduction in cases is due to chance or to unknown causes. They point to unexplained fluctuations in influenza and infantile paralysis.

*Science News Letter, April 15, 1933*

## PUBLIC HEALTH

# Electric Refrigerators Credited With Reducing Smallpox

**T**HE LOWEST number of smallpox cases ever reported to the U. S. Public Health Service for the country as a whole has been recorded for the year 1932. The current year is on the way to breaking this record.

During 1932, 11,168 cases were reported. As recently as 1930, there were 48,907 cases.

Electric refrigerators may have been a factor in lowering the number of smallpox cases during recent years, public health officials suggested. Smallpox vaccine for preventive vaccinations keeps best at low temperatures. All vaccine packages are labelled with a warning to keep the vaccine on ice, and