however, endeavor to mitigate the danger of their buildings' collapsing by constructing them upon the frame principle, with massive timber beams securely bolted together. By this means if a subsidence occurs the house does not necessarily collapse, but heels over in toto. In this instance the house is raised to its normal position once more by means of jacks, the cavity filled in, and the building once more rests upon a firm foundation. Should another subsidence occur, the process of lifting is repeated. In the case of the subject of our illustration, however, the original house was so damaged that it had to be demolished and the ground prepared for the building depicted in our illustration. But it had not been built twelve months before another subsidence occurred, throwing the building into the position shown in the photograph.

Yawning chasms are constantly appearing in the streets, and in some instances the cavities are so extensive as to necessitate the closing of the thoroughfare.

The area in which these subsidences occur covers about two square miles. A few years ago the matter was brought before the attention of the British Parliament, and the result of their investigations showed that damage had been inflicted upon 892 buildings, of which total 636 comprised houses and cottages. Some idea of the extent of the excavations in this area may be gathered from the fact that as a ton of salt represents one cubic yard, and 1,200,000 tons of salt are produced every year, therefore 1,200,000 cubic yards of solid material underlying the town is removed annually.

The water from the river also gravitates toward these subsidences, causing huge inland lakes, which aggravate the danger. One of these lakes, locally called "flashes," covers no less than 100 acres and varies from 40 to 50 feet in depth.

Notwithstanding the frequency of these subsidences and that they are often unexpected, strange to say not a single life has been lost. Havoc has been wrought among cattle, however, several animals having been completely engulfed. The tall shafts of the pumping stations are also another source of danger, since they are gradually thrown out of plumb, the list continuing until the stack heels over, burying and destroying everything in its path.

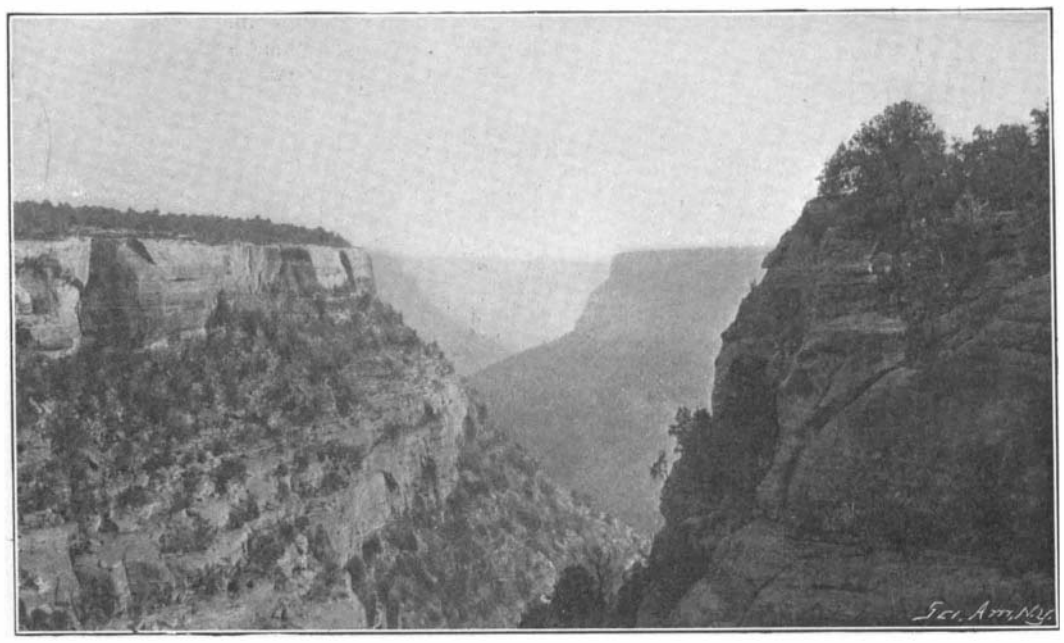
A few years ago a compensation board was founded. This corporation levies a tax of six cents upon every ton of brine that is pumped to the surface, the revenue derived from this source being devoted to compensating those unfortunates whose property has been damaged by subsidence.

In an article by M. G. L. Bourgerel, in the Moniteur Scientifique, the author states that by using an acetylene blowpipe, and a suitable supply of oxygen, temperatures approaching those of the electric arc can be readily obtained. It seems, however, that undiluted oxygen must not be used, or there will be a deposit of carbon and other troubles. By experiment the proportion of oxygen and air can readily be found, under these conditions the acetylene burns with a [illegible] luminous, but intensely hot, flame, which, by varying the relative proportions of oxygen and air, can be made either oxidizing or quite neutral.

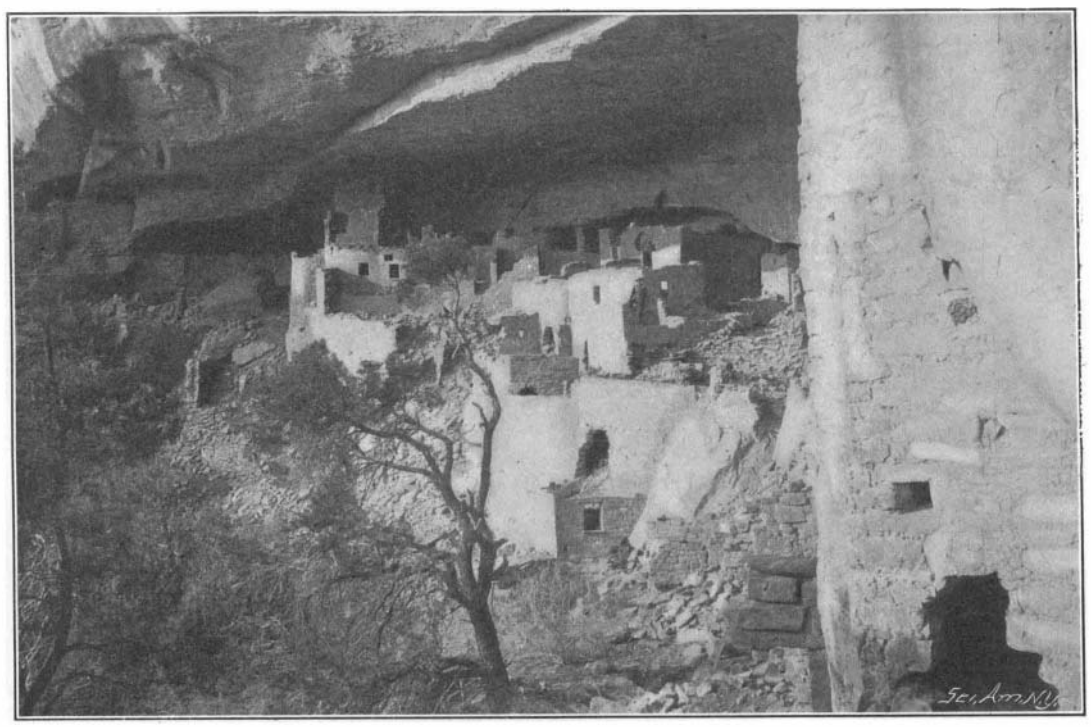
A CLIFF-DWELLING PARK IN COLORADO.

BY COSMOS MINDELEFF.

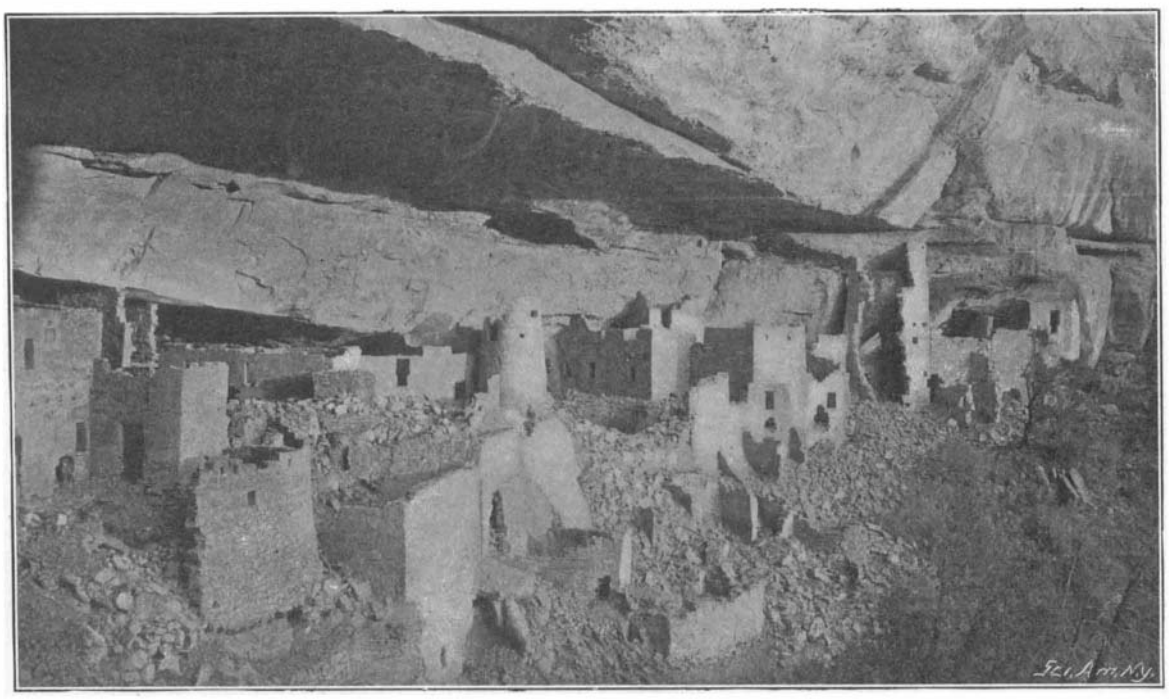
Action by Congress in the closing days of the session which ended March 4 last renders certain the preservation of the most interesting cliff ruins in this country, and their protection from further spoliation. The region known as the Mesa Verde, in Colorado, in which there are hundreds of ruins, is to be set aside as a public park, and steps are to be taken to put a stop to the commercial exploitation of the works of the ancient cliff dwellers.



VIEW DOWN CLIFF CAÑON.



RUIN IN CLIFF CAÑON FROM SOUTH END.



RUIN IN CLIFF CAÑON FROM NORTH END.

Discovered some twenty-five years ago, the ruins on the Mesa Verde and in the Mancos Cañon, which cuts through the heart of the elevated tableland, rested for a long time undisturbed and even unvisited, owing to the inaccessibility of the place. Within the past ten years, however, ranchmen living in the vicinity found that specimens from the ruins had a commercial value, and active work began on the stripping of the remains of everything which could be carried off. Under the Act of Congress this destruction will soon cease. The Mesa Verde is an elevated tableland of the type which characterizes southwestern Colorado and northern New Mexico and Arizona. It is irregular in form, comprising about seven hundred square miles, approximately flat on top, but cut into innumerable cañons and gorges by the Mancos River and its tributaries. The great development of the art of building among the ancient cliff dwellers was due in a large measure to the peculiar geological features of the country, nowhere better illustrated than in the Mesa Verde.

The Mancos Cañon is about thirty miles long and from 1,000 to 2,000 feet in depth, the narrow, irregular river bottom being bounded by long, steep slopes of débris, which merge into a succession of steeps and slopes, culminating above in a series of lofty cliffs. Traces of the old cliff dwellers are to be found throughout the region, along the bottoms, in the cliffs, and on the high tablelands. Taken altogether, there is no region which surpasses the Mesa Verde country in its archæological interest, or which is better worth preservation, although it should be noted that the Indians have a tradition of another and better region to the south.

Practically all the more important types of ancient dwellings are represented in the remains found in the Mesa Verde region, and, in addition, there are others which reach a development there not attained elsewhere. Even the large valley settlements, comprising several hundred rooms, and located without reference to defense, the highest type of the ancient builders' architecture, are found here and there in favorable sites on the canyon bottom.

These valley settlements merge almost insensibly into the cliff dwellings proper through another type which might be termed cliff villages, a type which appears to have reached its highest development in the Mesa Verde region. One of the most imposing of these cliff villages, discovered in comparatively recent times, is a ruin which has been called the "Cliff Palace," found in the upper part of Cliff Cañon, one of the principal gorges which join the Mancos Cañon from the north. The ruin is 425 feet long and occupies a cove in the cliff about 80 feet high and about the same in depth. Some of the rooms were circular, some oval in shape, but most of them were rectangular, and in places the structure was at least three stories high. Access to the settlement could be had only from above, by the aid of a series of steps cut into the face of the cliff. Eight miles above the mouth of the Mancos there are the ruins of another large cliff village. In this case the houses occupied two narrow ledges in the cliffs, one about thirty feet above the other, and at least 800 feet above the cañon bottom.

The cliff villages always contained one or more circular rooms, the use of which was doubtless religious, for similar structures are found in the valley ruins

and in some of the inhabited pueblos, where they are known as estufas. In them are performed many of the most sacred ceremonies of the tribe. Besides the cliff villages, however, there are hundreds of cliff dwellings in the Mancos Cañon and its branches, ranging in size from single rooms up to groups of considerable importance, in which no circular rooms are found. Many of them are on sites so inaccessible that it seems incredible that human beings should select such places for homes.

A type closely related to the cliff dwelling proper is the cave dwelling, fine examples of which are found in the Mancos Cañon and in other parts of the region. These curious habitations are hollowed out of the cliffs by digging away the soft shaly rock and then walling up the fronts. In one place in the Mancos Cañon a picturesque outstanding promontory is literally honeycombed with these dwellings, which give one the impression that they were constructed by a race of pygmies, for neither the outer apertures nor the openings between the rooms are large enough to permit a person of ordinary stature to pass through.

On the brink of the cliff above these cave dwellings is the ruin of a circular tower. These towers are found throughout the Mesa Verde country; in fact, there is hardly a half mile without the remains of one or more of them. Nowhere else do they attain the same development. In size they range from ten feet in diameter up to forty or more, with walls one to two feet in thickness still standing, in some cases to a height of over fifteen feet. They are invariably connected with other structures, usually groups of rectangular rooms, and in the finest examples the circular walls are double and even triple, the spaces between them being divided into apartments by partition walls of lighter construction. The masonry is of the highest type, the stones being dressed on the outside of the curve by pecking with a stone implement, and laid neatly in mud mortar.

It has been suggested that the circular towers were in some way connected with the peculiar rites of serpent worship, and perhaps were the repositories for the snakes used in the sacred ceremonies. In the Moki villages, to the south, where the snake dance is a biennial rite, all that part of the ceremony which precedes the public exhibition takes place in the estufas, and if the same rites prevailed in the Verde country, as seems likely, it is probable that they were performed in the circular towers.

Throughout the whole of the Verde region, in favorable localities, there are dozens of pictographs, both pecked into the rock and painted upon it. That many of these were executed by the people who built and lived in the houses now in ruins there can be no doubt. The figures are engraved or cut into the face of the rock, which has been chipped out to a depth of a quarter of an inch or more. One of the most striking groups is about six feet long, and consists of a procession of men, birds, and beasts, a general movement to the right being shown. The figures appear to be tied together in a continuous line, with smaller figures, perhaps representing dogs, above and below, while a number of men are stationed on either side as if to keep the procession in order. Doubtless the artist of long ago, who must have devoted months to his work, sought to represent some event of the highest importance to his tribe, perhaps a migration or a victory over some other people.

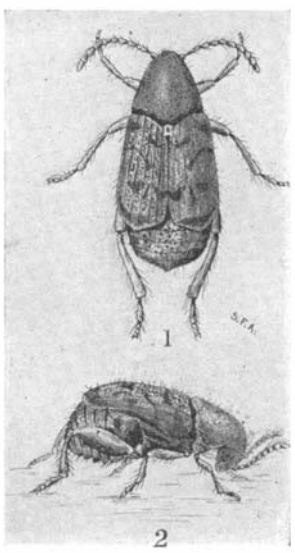
The illustrations are from photographs by Mr. F. H. Chapin, of the Hartford Archæological Society.

THE BEAN WEEVILS.

BY S. FRANK AARON.

There are few insects that when infesting materials useful to man cannot be easily detected at all times. Only the wood borers, and certain weevils in grain, etc., are hidden during the larval stage, and the pea and bean weevils are particularly unobservable. The pea weevil attacks its chosen food only in the green, rarely, if ever, breeding in dried peas. The bean weevils breed for generation after generation in dried beans, so riddling them in time that they become a mass of holes, perhaps, indeed, more holes than beans. A recent and considerable infestation of dried beans may be detected by the somewhat dirty appearance, caused by the beetles and young larvæ cutting into the beans. When attacking green beans, there is not, except under almost microscopic examination, any evidence of the work. There are only small cuts in the pod where the eggs are deposited and minute holes where the just-hatched larvæ have bored through into the beans. So it often happens that the little weevils within are cooked or canned along with the beans and eaten all unsuspectedly. But need we really care, if such is the case? The little larva or pupa, full of nothing but bean food, is so much bean itself that it is certainly doubtful if the epicure could distinguish between a mess of bean weevil larvæ and a mess of uninfested beans similarly cooked.

The bean weevils, common and very destructive in the United States, are of two species, belonging to the family Bruchidæ. They are allied to the snout beetles, or true weevils, the Curculios. *Bruchus quadrimaculatus* is reddish or mahogany brown with four large black spots on the wing covers and other black markings. *Bruchus obtectus*, called also *B. fabæ*, is slaty brown with somewhat obscure darker markings. The beetles of both species average about one-eighth of an inch in length. The habits of both are similar. The female cuts a slit in a green pod or dry bean and lays an egg therein, depositing many eggs thus in suitable places, but rarely more than one or two to



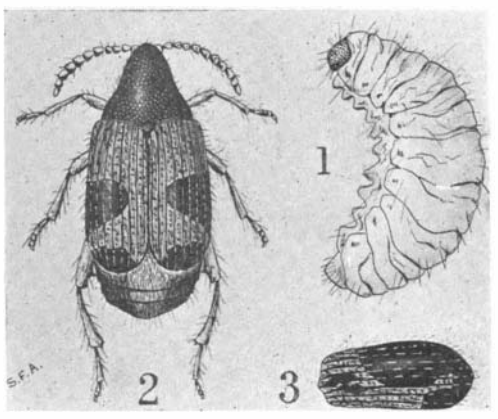
BRUCHUS OBTECTUS.
1. Dorsal View. 2. Lateral View.

each seed. The larva hatches soon after, and at once bores its way into the bean, filling the hole behind it rather loosely with its cuttings. Thence its tunnel grows larger and larger to accommodate its increasing bulk and appetite. When full grown, and the better to permit the subsequent beetle to force its way out, the larva bores to the inner surface of the thin skin of the bean, leaving that intact for the protection of its transformations. Then it changes into the pupa stage and later into the fully developed beetle, which on emerging cuts open the thin, semi-transparent skin at the end of the burrow and escapes, leaving the boring exposed. Beans with holes are a sure indica-

THE WORK OF WEEVILS IN BEANS.

tion of having been infested by this insect. Sometimes in the very large varieties of beans several holes, the work of one generation, may be observed.

Little has been ascertained as to the means of checking the ravages of this insect. There is no sure way by which they can be prevented from attacking growing beans. Insecticides are here valueless. But when the insects are found in dry beans they can be killed and general infestation prevented by fumigation with carbon bisulphide in tight bins or barrels, or by subjecting the beans to a dry heat of about 150 deg. F. for several hours. Infested beans cannot be successfully used for planting as they produce sickly plants,



BRUCHUS QUADRIMACULATUS.
1. Larva. 2. Beetle, Dorsal View. 3. Wing Cover.

and when a general infestation has taken place the beans had better be burned or effectually destroyed, thus rendering subsequent crops less in danger of attack.

Opening of the Pan-American Exposition.

The Pan-American Exposition opened quietly on May 1, without the usual ceremonies, which are reserved for the formal dedication on May 20. In a short time the Exposition will be entirely completed, and even at the present time the showing is an interesting one. In connection with the Exposition, we have opened a new office in Buffalo, Room 577, Ellicott Square Building, which is in charge of Mr. F. J. Wagner, our advertising representative for the Central States. All manufacturers and advertisers are requested to call upon Mr. Wagner at some time during their sojourn in Buffalo.

Our Special Pan-American Edition.

There is no doubt that the Pan-American Exposition at Buffalo this summer will attract thousands of travelers and buyers from Spanish-America and even from such distant lands as Japan, China and India.

Recognizing that these travelers could be benefited by a species of guide, which would give the various routes of travel to and from their homes and Buffalo, we have decided to issue a special number of our Export Edition in the early part of June, devoted to the interests of this Exposition along the lines already indicated.

As soon as our intention became known, we found that such a special edition would be most acceptable throughout the countries reached by our Export Edition. So hearty have the responses been to our tentative efforts that we can confidently assure our advertisers that the circulation of this special number will be at least double the present and already large circulation of our Export Edition. We believe that advertising in this issue will bring most excellent results, inasmuch as each copy reaching the hands of influential importers and buyers abroad will be kept as a ready reference guide to the Buffalo Exposition, and will therefore become a directory of American manufacturers advertised in its columns.

Our advertising pages have already felt the effects of our first essays at securing advertising on the strength of this special edition, and we urge our patrons and intending advertisers to secure the space in this edition as soon as possible, as, owing to the large number of copies to be issued, as well as the large amount of advertising matter to be handled, we expect to be obliged to close our forms at an earlier date than usual. For this one issue, we will allow advertisers to sign contracts for one insertion at special rates, to be furnished on application, either from our agencies or directly from this office.

We hope that many manufacturers who do not make a practice of advertising in regular publications will make a trial of one insertion in this special edition as we feel confident that the large circulation which will be given to their advertisement will be conducive to their using the advertising columns of our publication regularly thereafter.

We should be pleased to enter into correspondence on this subject with all manufacturers interested, and ask their co-operation, with any suggestions which they may think advisable for such a special edition.

The Current Supplement.

Among the articles in the current SUPPLEMENT, No. 1323, which should be of interest are a biography of America's Nestor of engineers, Charles H. Haswell; an article on the "Prospects of Automobiling," by M. C. Krarup, and an account of Suter's airship, in which the inventor nearly lost his life. "A Petroleum Turbine" is the title of an illustrated article which should be of no small value to those interested in the development of the explosion-engine. In his description of the "Great Salt Lake," Prof. Ralph S. Tarr tells much that is not generally known. Some curious animals provided with queer teeth are described by Mr. R. Lydekker in an article on "Living Millstones." Inspector Rice P. Steddom has much valuable information to convey pertaining to the cattle of Porto Rico. "Destructive Insects and Insects as Etiological Factors in Disease" is the title of a lecture delivered by Prof. Henry Skinner, M. D. Illustrations and an account of a process of long-distance radiography are also presented in the SUPPLEMENT. Prof. Charles F. Holder tells, in an interesting way, something of the way in which Californians move large palms. The usual consular notes, formulas, etc., will be found in their customary places.

Contents.

(Illustrated articles are marked with an asterisk.)