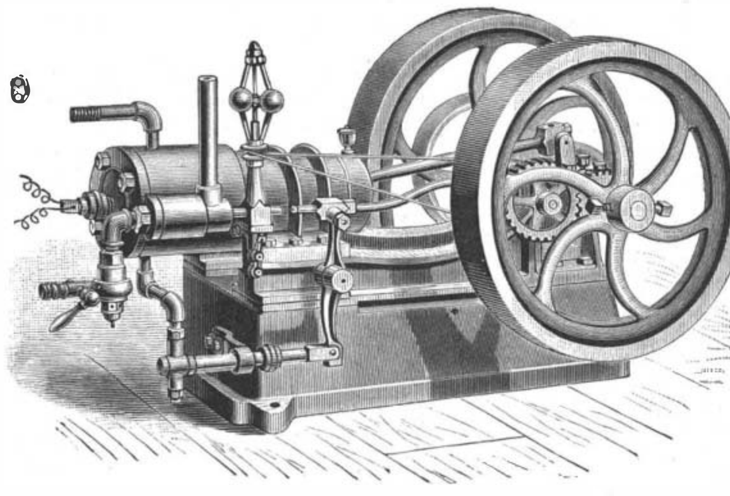
THE MANUFACTURE OF BURGLAR PROOF VAULTS.

The manufacture of burglar proof vaults has, like many other industries, emerged from the stone into the steel age. In earlier times the stone and brick walled vault was considered safe. To-day the improved appliances of the burglar can only be resisted by steel. In the present issue we illustrate some of the processes of the manufacture of burglar proof vaults, of which several very fine examples have recently been erected in this city and Boston. The walls of the vault proper are built of composite plates formed of alternate layers of soft steel or iron and of the hardest steel. In the cut, Fig. 2, the section of a plate is shown. This is a five-ply plate, with two steel layers and three iron ones. While various dimensions may be chosen, these plates are generally used of one-half inch thickness, except the outside one, which is one inch thick. The walls are built up of such plates, laid so as to break joints, and screwed together with flat-headed top bolts. Even the bolts are made of the same composite metal, twisted around. The small cut shows one of these bolts with the side cut away so as to show the steel embedded in the iron and twisted helix fashion.



A ONE-QUARTER HORSE POWER GAS ENGINE—SIZE 5 X 13 INCHES.

When the plates are received their edges are planed and they are drilled and tapped for the screw bolts. Each bolt goes through one plate, its head entering a countersunk hole and lying flush with the plate and screwing into a tapped hole in the next plate. The drilling we show as executed by the Moffet steam drill. A small rotary steam engine is mounted over the drill and steam is conveyed to it by a hose. As it turns it works the drill by gearing. In Fig. 3 is shown a workman drilling one of the plates. The outside plate has blind holes only, none going through it, and these holes are all tapped. In the building the first layer of plates is bolted to it, the next layer to them, and so on until any desired thickness is obtained.

The entire vault is built up in the factory, every plate having its own place. Next the whole is dismantled and the plates are hardened by heating to redness and immersion in water. We have already (see SCIENTIFIC AMERICAN, July 21, 1894) illustrated this process as carried out at the Cornell Iron Works. The plates are heated on the water edge and immersed in the river.

This often entails warping, and accordingly many of the plates have to be rolled cold to straighten them and some have to be polished off to a flat surface with an emery polisher, shown in Fig. 4. The workman cuts down any high portions of the plate until it is adapted to bed well against its neighbor. The edges have often to be ground off, the emery wheel buffer shown in Fig. 6 being employed.

The doors are built up in exactly the same manner. Their joints or edges are of very complicated cross section to prevent wedging, as shown in Fig. 1. Here three tongues are shown entering grooves in the jamb to afford additional protection against yielding to lateral wedging. These joints have to be constructed with great exactness, and the surfaces are all hand filed and polished. The fit alone makes them almost air tight, and list packing is also employed to insure a fit. In Fig. 5 is shown one of the great doors mounted in its vestibule; while the process of hand filing the edges is also shown.

Doors fitted as described make it impossible for the burglar to introduce gas, or a liquid, or finely divided explosive for blowing up the safe.

The inner face of the door has much of the machinery of the locks exposed. Over it is bolted a cover of heavy plate glass. In the cuts Figs. 5 and 7 the bolts for this cover are shown projecting around the edges. In the cut on this page the interior of a finished door is shown.

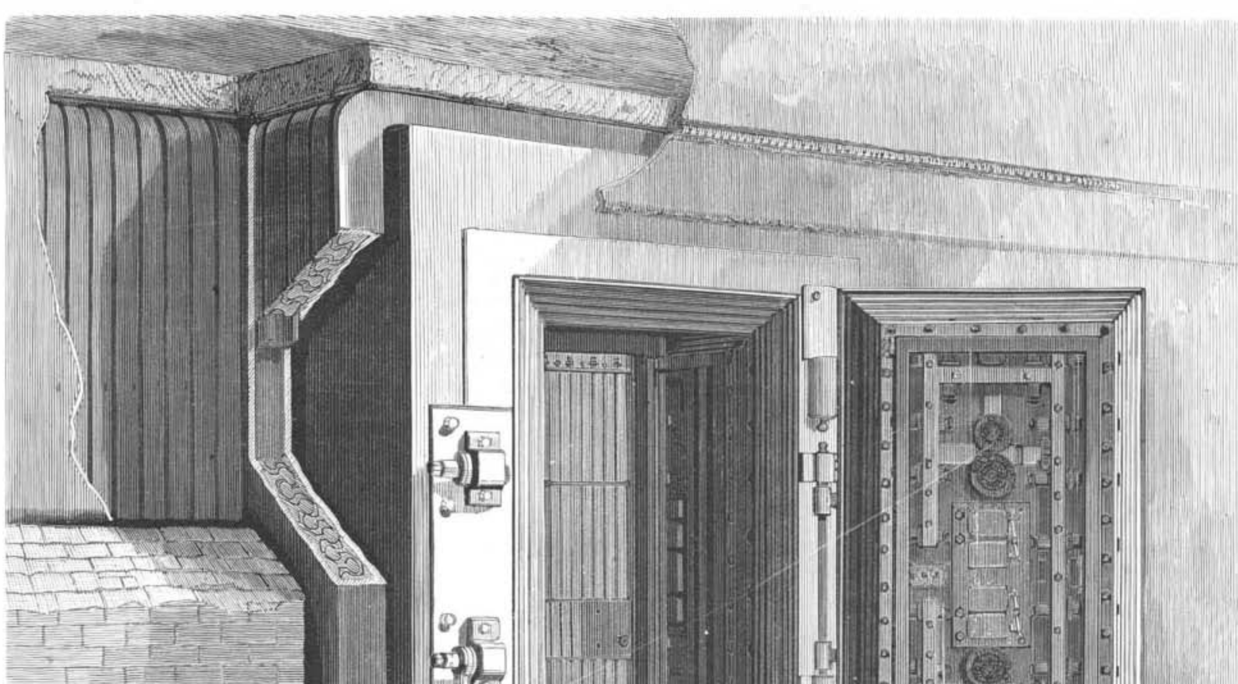
As a single door may weigh from four to six tons, ball-bearing hinges are employed to enable a man to close and open it. Time locks are used, which are set at night to run a given number of hours. Until the time assigned has expired, it is impossible to open the safe.

These vaults are often very large. In this city the National Safe Deposit Company has one in the Mutual Insurance building which has an area of fifteen feet six inches by forty-three feet ten inches, and which is nine feet high. Nearly 400 tons of steel are used in its construction. It has two entrances, the doors of which are controlled as regards opening by three clocks on each one. All the clocks are kept running, and any one is sufficient to release the time locks on its own door. Thus if five clocks out of the six were to break down, the locks on one of the doors would still be released when the appointed time came.

COMPOSITE STEEL BOLT.

A further protection is sometimes given to the vaults by a species of cage made of special section railroad iron, which is built up around the steel structure. Our cut on this page shows this element in its relation to the rest of the structure. The rails are closely nested, and when in place are bedded in or run with Portland cement.

The general arrangement of the vaults involves their exposure on all sides to the watchman's patrol. No part must be against a wall, as this would give burglars a chance to penetrate through the wall and work in concealment upon the sides of the vault. But even if a burglar were given free scope, it is doubtful if he could, within the few hours open to his operations, do much in the way of perforating the compound plates. The hard steel is almost undrillable, and if sledging or ramming were resorted to, while the hard metal might crack, it would remain so firmly bedded between the layers of soft steel that it would still resist the drill. The interior of these large vaults may be fitted up in any desired way. They may contain a quantity of smaller safes subdivided in any desired way. Electric light may be used for lighting and as an adjunct to safety. A steam pipe may be arranged over the doors outside the vault by means of which a volume of steam may be discharged in a case of a riot which would prevent any one from being able to even approach the vault. All these appliances may be seen in the National Safe Deposit Company's vault already alluded to, and which was constructed by J. B. & J. M. Cornell, of this city. In it are embodied all the features of construction described here.



SAFE DOOR AND PROTECTIVE CAGE OF RAILS.

A GAS ENGINE FOR SMALL POWER.

The usefulness and desirability of small motors is generally admitted, but the disproportionate cost of such motors has been an obstacle to their more general introduction. Many mechanics and amateurs have constructed small motors of various kinds with greater or less success, but when they have attempted to design and construct a gas engine (which is undoubtedly one of the best of small motors), they have generally failed, because it is no simple matter to design a successful gas engine. It is only after a long and expensive series of experiments that success in this line is attained.

Messrs. A. F. Weed & Company, of 106 and 108 Liberty Street, New York City, have perfected a small gas engine of about one-quarter horse power, weighing 70 pounds, and occupying a floor space of 5 by 13 inches, and offer for sale not only the engines, but the castings of all the parts and all materials and drawings necessary for building a complete working engine, so that any machinist or wideawake amateur can with little expense and a not very large amount of labor make the engine for his own use.

The engine will meet the requirements of those needing a light power. It is instantly started, and is simple and manageable.

The Weed gas engine belongs to the class of engines igniting at constant volume with previous compression.

The working cycle is divided into four parts, in which the engine makes two revolutions. During the first complete revolution of the engine, the cylinder acts as an air pump.

As the piston moves forward, gas and air of the required mixture are admitted through the automatic inlet valve. When the piston has reached the forward end of the cylinder, the inlet valve closes, and as the piston returns to the back end of the cylinder, the charge of gas and air is compressed to about one-third its original volume.

At the beginning of the second revolution, the compressed charge of gas and air is ignited by an electric spark, which causes the explosion and forces the piston forward until it reaches the front end of the cylinder, at which time the exhaust valve is opened, and during the return stroke the burned gases are discharged through the exhaust pipe.

This engine is what amateur mechanics have long looked for.

To Preserve Colors in Dried Flowers.

The discoloration of many flowers upon drying may be attributed to the presence in the atmosphere of ammonia. To counteract its injurious action Nienhaus (Schweiz. Wochen. f. Chem. u. Phar.) has hit upon the idea of pressing his plants between paper previously saturated with a 1 per cent oxalic acid solution and dried. In this manner he has obtained most beautiful specimens of dried flowers of papaverrhœas, one of the most difficult flowers to preserve unchanged. This idea may possibly be extended.

OVER seven thousand men it is said have been sheltered at one time beneath the branches of one banyan tree.