PREVENTION OF WASTE OF FLOWING OIL AND GAS.

METHODS for the prevention of the tremendous waste that usually accompanies the "coming in" of wells producing large quantities of oil or gas by natural flow fall naturally into two classes, preventive and remedial. The first have to do with keeping under control whatever gas or oil may be encountered in the process of drilling; the second relate to the capping or subduing of wells that have "gone wild." Both are dealt with fully in a bulletin prepared by R. Arnold and V. R. Garfias, and recently issued by the U.S. Bureau of Mines. Of these the preventive methods are likely to be of interest in the Canadian field, and are outlined here with that in view.

A few general conditions affecting flowing gas and oil wells are as follows:—

1. The gas from gas wells and the gas that generally accompanies the oil is not injurious to health, hence workmen may labor near the well without being harmed.

2. Owing to the usual tremendous velocity of the stream of gas, the part immediately over the casing head is like a smooth column, and may be approached with safety.

3. The sand usually expelled under tremendous force with the oil or gas often wears out the casings, but this wearing action generally takes place only throughout the uppermost 30 or 40 feet and opposite or near the place where the gas enters the well, thus leaving the main part of the entire length of the strings practically sound.

4. The great volume and tremendous pressure of the gas and oil make the use of the best fittings a necessity. Some of these, being of special sizes, are made to order.

For convenience, and in accordance with common usage, the flowing oil wells and the gas wells discussed herein are designated respectively as "gushers" and "gassers."

With the present state of our knowledge regarding the situation of the "gusher" and "gasses" strata in the developed fields, there is no excuse for the general lack of precautions taken before the depth is reached at which the flow is expected. Furthermore, if the well is being drilled in a new or prospective field, adequate precautions should be taken so as not to jeopardize in advance the possible profits of such an uncertain and expensive undertaking. The additional cost of the safety devices is insignificant in comparison with the total cost of drilling such wells and with the amount that can usually be saved if their rate of production is regulated. It may be safely stated that practically all of the great waste resulting from the unrestricted flow of gassers and gushers can be prevented easily by known means which generally are within reach.

Controlling the rate of production of the well has a direct bearing on the returns to be derived from the product. There are times when, owing to the market conditions and the transportation and storage facilities, the "bringing in" of the well might be an unwelcome event, as was strikingly shown in the case of the Lake View gusher. Experience also shows that a gasser or gusher will yield a greater total production if allowed to flow only a fraction of its capacity, the famous Huasteca No. 7 well in the Mexican oil fields affording a most remarkable example. This gusher has been flowing under perfect control for about 2½ years, yielding about 23,000 barrels per day under a pressure of about 285 pounds.

One of the most successful apparatus devised with a view to controlling whatever flow of oil or gas is encountered is the blow-out preventer, which has given general satisfaction, particularly in drilling by the rotary method.

Description of Apparatus.—The blow-out preventer is a modified type of a stuffing-box casing head, which in turn is an addition to the four-way **T**. The immediate object of the preventer is to control the flow of oil or gas between two strings of casing, and naturally its use is better adapted to drilling by the rotary method in which the circulating water keeps an open space between the inner casing and the wall of the hole. An idea of its operation may be gained by imagining a four-way **T** attached to the top of the last casing set or landed and the inner casing passing through the **T**, the flow of oil or gas between the casings being deflected to the lateral openings of the **T** by closing the annular space between the inner casing and the upper part of the **T** by means of a stuffing box. In the preventer the stuffing box can be removed or put in place by turning adjuster screws which operate slips provided with hydraulic packing that fit around the inner casing as an adaptable split valve. To the lower opening are bolted interchangeable screw flanges to fit standard casings from 6 to 12½ inches in diameter, and to the opposite opening are attached suitable guide plates to prevent the wearing of the inner parts of the apparatus by the revolving inner casing. These guide plates are made to fit casings from 8 to 2¼ inches in diameter. The lateral openings are threaded to fit pipe 6 inches in diameter. The apparatus is manufactured of cast steel and lined with babbitt metal, being tested to stand a pressure of about 2,000 pounds per square inch.

Mode of Operation.—To insure the successful operation of the preventer, careful attention must be given to all the details, such as welding the bars, fitting the small pins that secure the wrench to the screws, and providing a suitable place outside the derrick for the man who is to operate the wrenches, etc., as soon as the apparatus is put in place.

The preventer, when used, is always placed on the last string of casing set or landed, thus controlling the flow between that string and the drill pipe or casing that is being lowered. The slips should be in a position to be clamped around the drill pipe, but should not be kept too near it, in order to avoid possible damage to the hydraulic packing. If the well is being drilled with a rotary rig, the back-pressure valve inside the drill pipe will effectively prevent any flow upward through this casing, and if the standard rig is used, a heavy gate valve, which can be closed after removing the drilling tools, is placed on top of the inner casing. The only outlet left is the space between the casings, and the flow through this opening can generally be controlled by clamping the split valve of the preventer around the drill pipe and closing the gate valves on the pipes connected to the two lateral openings.

It sometimes becomes necessary to exclude from the drill hole water or gas found in an overlying sand in order to control the well or to recover or test the oil below. This end can be easily accomplished in drilling with a rotary rig by forcing muddy water to the bottom of the well through one of the lateral openings of the preventer, the pressure being regulated by closing the valve connected to the other opening. A back-pressure valve in the drill pipe will prevent the flow of the mixture through this casing. By drilling a short distance and forcing as much mud as possible into the porous sands penetrated, a