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Blasting. Part 1. Explosives and the farmer

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PART I

ABOUT 3,000 tons of commercial blasting explosives of various types are used every year in Western Australia of which approximately two thirds is utilised by mining industries and the remainder goes mainly to quarrying and public works. The farmer and orchardist actually use only very small amounts but nevertheless explosives are a very useful working tool for the primary producer.

This article will give some general information on the sale of explosives, licensing requirements, types of explosives as well as on deterioration and how to avoid it. In a further article the use of explosives on the farm and orchard will be discussed.

The Explosives Act is administered through the Mines Department and provides a system of licensing, regulation and inspection which applies to the importation, packing, storage and transport of all explosives. It also provides for testing and inspection of all explosives before they are released for distribution and sale. Regulations for the use of explosives are provided under the Mines Regulation Act (1946) and apply mainly to mines and quarries which are supervised by Inspectors of Mines. The man on the land may have had mining experience but otherwise he will not always know the rules for safe-keeping and use of the explosives which can help to develop his property.

DEVELOPMENT OF MODERN EXPLOSIVES

Until about 100 years ago gunpowder was the only explosive available for mining and engineering work and blasting was a very hazardous business until the safety fuse was first invented by Bickford in 1831. Nitroglycerine was introduced for blasting by Nobel about 1860. In the pure liquid form, it caused a number of serious accidents owing to its dangerous sensitivity. Nobel persevered in his efforts to make it safe and in 1866 he produced the first dynamite by absorbing the liquid nitroglycerine on Kieselguhr. At the same time Nobel also invented detonators or blasting caps which could be fired by safety fuse and provide the means of detonation for the less sensitive dynamite. It was in 1875 that Nobel made his greatest discovery by dissolving nitrocotton in nitroglycerine. This resulted in a gelatinous mass much more powerful and more water resistant than dynamite. The mixture was called Blasting Gelatine and it is still the most powerful commercial explosive available.

At the present time blasting explosives are made in a number of grades for different purposes, but all consist of varying proportions of sodium and ammonium nitrates incorporated with nitroglycerine, nitrocotton and some organic matter such as starch or wood-flour. Ammonium nitrate not only provides oxygen but does itself decompose with explosive violence and over the last 30 years it has become...
widely used in all blasting explosives. It has one disadvantage since it readily absorbs moisture from the air causing the explosive to become soft and wet. For this reason all explosives of this type are packed with waterproof liners inside the case and the plugs themselves are wrapped in waxed paper. Adequate precautions can be taken to prevent deterioration and the use of ammonium nitrate is justified by the added power it gives to the explosive, its safety in handling and transport and greater economy in manufacture.

### DISTRIBUTION IN AUSTRALIA

Australia has only one factory producing commercial blasting explosives and all our supplies come from Deer Park near Melbourne. This factory is associated with the original factory established by Alfred Nobel at Ardeer, Scotland about 1880 and its products are distributed through Imperial Chemical Industries of Australia and New Zealand Ltd. who act as agents in all States. The Deer Park factory produces fuse, detonators and a wide variety of blasting explosives as well as other accessories for mining, oil prospecting and special purposes. Supplies come to Western Australia either by rail to Kalgoorlie or by small motor vessels to the Explosives Reserve at Woodman’s Point near Fremantle. On arrival, all explosives are inspected and sampled by the Explosives Branch before being released for distribution. Any variation from the agreed requirements for wrapping, packing or general condition of the explosives is noted and reported to the factory for correction. Any explosive or fuse damaged in transit is thoroughly inspected and if necessary destroyed. It is then the further responsibility of the Branch to see that explosives reach the consumer in sound condition and to ensure that they are stored and kept in a safe and secure manner.

### EXPLOSIVE TYPES

Many different grades are used for quarrying, gold-mining coal-mining and oil prospecting but the farmer is concerned only with blasting powder, gelignite, safety fuse and detonators. Indeed the country store, where small amounts are purchased, will probably not stock any other explosive since there is no local demand for it.

**Blasting Powder** is the modern form of gunpowder. It is not a powder but consists of hard pellets about the size of bean seeds. The pellets are polished with graphite on the surface and sold in plastic bags each holding 1 lb. or in bulk bags of 50 lb. Blasting powder is a low or heaving explosive; it reacts by very rapid burning rather than by sudden detonation and is now used mainly for splitting timber since there is less tendency to shatter and splinter. It is also used for splitting monumental stone. It is easily ignited by spark or flame and...
does not require a detonator; when ignited in the open it produces a sudden flash and a cloud of smoke but no loud report. (This sometimes leads to complaints that the powder is ineffective since no useful work is done unless blasting powder is well tamped into a confined space). Firing is done by the safety fuse with no detonator and because of the sensitivity to flame or spark great care must be taken in its handling and storage. Any spillage onto a hard floor should be thoroughly cleared up and smoking or the use of matches with blasting powder creates a dangerous hazard. It is readily desensitised by water which provides a simple and effective means of decontamination or destruction.

**Gelignite** is the commonest grade used for all general purposes. It has all the power required for most work without the intense shattering detonation of higher grades such as Gelatine Dynamite or Blasting Gelatine; it is the grade stocked by all licensed stores and purchased by the farmer. Gelignite plugs bear the printed marking “AN Gelignite 60” which may or may not be prefixed by the word “Polar.” “AN” refers to the mixture being based on ammonium nitrate and “60” means that it has 60 per cent. of the power of blasting gelatine. The word “Polar” refers to a special grade of nitroglycerine which has a lower freezing point and is suited to cold climates. In Western Australia this is not necessary but for convenience in making up consignments the factory may despatch both types to this State. The plugs are generally 1 in. in diameter but \( \frac{3}{8} \) in., \( \frac{1}{8} \) in., and 2 in. are supplied to mines and quarries when required. One inch gelignite is available in both bulk and carton packs. The former is suitable for mines and quarries or for any job where a case is used up in short time while the 5 lb. cartons are recommended for stocking by stores and for the small user. Carton packs are enclosed in waxed paper and each plug is fully coated with wax to protect it from moisture.

To prevent deterioration of gelignite it is most important that it be kept in a cool dry place and protected from moist air. We have already learned that ammonium nitrate is hygroscopic which means it has an affinity for moisture; this is why such explosives become wet and soggy when exposed to the air. Generally the effect is first seen at the ends of the plugs which become soft and wet, finally the whole plug will deteriorate and free moisture will drip from the explosive. The red colour which exudes is derived from the dyestuff in the mixture. Explosive which has deteriorated in this way is quite unfit for use; even when affected only at the ends there is a marked loss in sensitivity which may prevent communication from one plug to another. It should also be remembered that the exuding moisture carries ammonium nitrate in solution; it is highly corrosive to most metals and can create a potential fire hazard by impregnation of wood, bagging or other organic matter. Such a mess should be thoroughly cleaned up and washed out with water. Of course if the explosive is properly kept and used in reasonable time this will not occur. The farmer keeping a few cartons of gelignite must provide a secure receptacle with a well fitted lid. There are some army disposal stocks which are very suitable for this purpose. Cartons should not be damaged or broken until required for use. Loose plugs keep very well in an air tight tin or a plastic bag. The receptacle should be painted conspicuously with the word “EXPLOSIVES” and kept in a dry, secure lock-up shed.

**Safety Fuse** consists of a core of fine gunpowder enclosed with alternate layers of textile yarn and bitumen and coloured with a yellow paint pigment for identification purposes. The manufacture of fuse is supervised by artisans with a lifetime of experience at the job and the approved type of wooden receptacle for keeping and carrying explosives

![Approved type of wooden receptacle for keeping and carrying explosives](image)
Carrying box sold by disposal stores for 7s. 6d.

Chemist defers to their expert knowledge. The result is a very reliable product which burns evenly at 90 seconds per yard with very little variation. It is durable and water-proof and will keep for years. There are however two sources of damage which the farmer should bear in mind. Sharp kinks may damage the powder core and cause it to cease burning at that point so that fuse should always be kept in the coil and protected from mechanical damage. Bitumen is easily penetrated by certain solvents including kerosine, diesel and fuel oils and fuse which has been in contact with any oil may fail to burn and should not be used. It should be destroyed by burning on an open fire.

Detonators are small tubes of aluminium charged with very sensitive explosive compositions which are fired by the “spit” of a fuse to give a powerful explosion. The composition is compacted into the tube under high pressure and the modern detonator is reasonably safe. They are, however, spark or flame sensitive and a speck of hot tobacco ash falling into a detonator can cause ignition. The composition is also sensitive to friction and can be exploded by inserting sticks or any hard object into the open end. Although detonators have been dropped without explosion, there is no guarantee that they will not explode and dropping is definitely an unsafe act which should be avoided. They keep well and even after several years, or after wetting by water, they must still be treated with all due respect.

It is a general rule that detonators should not be stored close to other explosives; a separate box should be provided, marked clearly and kept in a locked cupboard or drawer. Detonators are always a danger to children who instinctively insert sticks or nails into the open end. The result is severe injury to the hands and possibly the loss of an eye. It is the responsibility of all to keep detonators in a locked place and never to leave them about.

**Purchasing Explosives**

The farmer should not purchase more than is required for the work in hand so as to avoid storage and possible deterioration. It is best to obtain small quantities as required from a licensed store and if your nearest store is not licensed then application for such license can be made to the Explosives Branch Mines Department.

If larger quantities are required for a particular job the licensed store will order them from Perth or supplies may be obtained direct from Woodmans Point Explosives Reserve between 11 a.m. and 12 noon every Wednesday. No special permit is required but the officer in charge will limit purchase to two cases when carried in a small vehicle; he will also require that no flammable goods are carried at the same time and may refuse delivery if the vehicle or load is obviously unsafe for carrying explosives. Since a farmer generally has no magazine license, his storage should be limited to one case or one day’s supply and deliveries at the Reserve will be limited accordingly. There is, of course, nothing to prevent the farmer ordering direct from the Perth agents for delivery by rail to his nearest
Licensing

Licenses under the Explosives Act are required for importation of explosives, for selling explosives and for storing a quantity of more than one case. The farmer is concerned only with storage and can usually work with quantities which are exempt from licensing. He is however, still required under the Act to provide a secure receptacle and to protect the explosives against theft or fire hazard. Two cases may be stored under license in an approved receptacle but for more than two cases a detached and approved magazine is required. Under common law a person may be held responsible for negligence in respect of any dangerous material which causes injury to another party. Explosives should therefore be kept securely and never left on the job or in places where they might be the cause of an accident. This applies especially to detonators which are small enough to be overlooked but can cause severe injury to children who may find them.

The Explosives Branch is always willing to answer any enquiries with regard to licensing, storage or disposal of explosives. Any mishap or accident with explosives should be reported and also any instance in which explosives are received in doubtful condition. Such enquiries or reports should be addressed to The Chief Inspector of Explosives, Mines Department, Perth.

In the next article it is intended to discuss the safe keeping of small amounts of explosive on the farm, the correct manner of preparing charges and some useful applications of explosives in the field of agriculture.
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