

high tension fuses, for the former galvanic batteries and quantity dynamos, for the latter tension dynamos and frictional machines. Method of using each kind. Calculation of battery power.

*Circuit.* Various arrangements of divided and continuous circuits. Jointing wires.

*Connecting up* and arrangements to be made for firing.

Statement of the testing (electrical or otherwise) to be performed to ascertain that everything is in working order.

*Electrical testing* (to the extent possible with the instruments contained in the "Field Service jointing and testing box").—Description and use of the instruments contained in this box, namely: Leads (making connections), 3-coil galvanometer, Firing resistance coils, Test cell, etc.

Testing source of electricity, batteries and quantity dynamos; testing strength and measuring internal resistance by the fusion of platinum wire. Tension dynamos, measuring length of spark by means of micrometer attached to machine; minimum length of spark allowable.

Testing line wire. For continuity and insulation resistance by means of 3-coil galvanometer. Detecting position of fault.

Testing completed circuit. Measurement of resistance of circuit by Wheatstone bridge attached to firing coils. Pricker test to locate a fault.

PRECAUTIONS to be adopted when using explosives and to ensure explosion.

APPLICATION. *Mining.*

*Hasty demolitions.* Walls, Houses, Bridges, Cutting down trees, Cutting through iron in various cases. Demolition of stockades.

#### PIONEER DUTIES.

Communications considered under three heads: Making, Destroying, Restoring.

COMMUNICATIONS FOR THE CONVEYANCE OF MEN, HORSES AND MATERIALS.

#### CONSTRUCTION.

*BRIDGING* (Railway bridging omitted).—Object, requirements, methods of determining dimensions of opening, considerations regulating the class of bridge to be made according to the nature and dimensions of the opening, namely: Frame and suspension bridges for narrow deep openings, Trestle bridges for shallow wide openings, and floating bridges for wide openings containing deep water.

Approximate rules for rapidly calculating the dimensions of spars when the stress in them is known.\* General considerations as regards the roadway, road-bearers, trussed beams, chesses, ribands, rack-lashings, shore ends.

*Methods of connecting spars together*, lashing, tree-nails, spikes and dogs.

*Plant used for bridging.*—Tackle, Spanish windlass, derricks, shears, gyns, earth anchors of various holding power.

*Frame bridging.*—General description of such bridges. Materials required; Detail of construction; method of erecting and calculation of stresses for the following kinds of frame bridges: Single lock, double lock, single sling, ordinary and stiffened, treble sling, in each case with and without vertical frames at shore ends.

*Trestle bridging.*—General description of such bridges; materials required; detail of construction; method of making and calculation of stresses for the following kinds of trestles: Two-legged, four-legged and tripod. Advantages and disadvantages of each kind. Forming up into bridge.

Miscellaneous methods of obtaining points of support, crib piers, piles, &c.

*Floating bridges.*—General description of such bridges; materials required; detail of construction; method of making calculations of dimensions and buoyancy required for floating bridges composed of pontoons, barrel piers of various kinds,

\* Accurate methods are given in the Mathematical and Civil Engineering Course.