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PROVINCIAL EXAMINATIONS, 1906:

—MANAGERS.—VENTILATION.—

Ques. 1—What is the smallest quantity of air in circulation per minute, required to make safe a section of a mine under the following conditions: In the section there are two levels or entries and 55 rooms. The entries are 9 feet, and the rooms 22 feet wide; the height of the coal is 6 ft., and the working faces are known to give off CH_4 gas at the rate of 6 cubic feet per square foot per hour.

Ans. 1—The area of cross section of the two entries is $2(9 \times 6) = 108$ sq. ft. If levels advance at the rate of say 4 ft. per day it is fair to assume that the transpiration of gas will be equally strong over twice this area or 216 sq. ft. The area of cross section for 55 rooms is $55(6 \times 22) = 7260$ sq. ft. It is safe here to assume that transpiration takes place over say 8000 sq. ft. of surface. Total area $= 8000 + 216 = 8216$ sq. ft.. Quantity of gas produced $= 8216 \times 6 \div 60 = 821.6$, say 825 cubic ft. per minute. Now having a mine giving off such a quantity of gas I would reduce percentage of gas in return airway to 1 per cent. or if dusty mine to ½ per cent. which would be 825×99 parts air $- 825 = 80850$ cubic ft. per minute in the intake or for dusty mine 825×99.5 parts air $- 825 = 82087$ cubic feet per minute.

Ques. 2—Under what conditions may after damp become explosive.

Ans. 2—When after-damp contains a considerable amount of carbonic-oxide gas (CO) an explosive mixture is formed upon contact with air or when coal dust is present in suspension in the air. It sometimes occurs also that a considerable amount of unburned marsh gas is still present in the after-damp which only requires the addition of fresh air to make explosive.

Ques 3—A mine is ventilated through two airways of equal length. One airway, A, intake and return, being 6 x 9 feet, and the other, B, 6 x 12 feet; the total quantity of air in circulation is 60,000 cubic feet per minute. A regulator is placed in B, and so adjusted as to make the circulation in that airway 30,000 cubic feet per minute. What effect has this regulator on the ventilation of airway A, and on the fan, and on the fan engine.

Ans. 3—Total quantity of air in circulation before regulator is placed = 60,000 cubic feet. Its natural division would be about as follows: Split A, 25000, Split B, 35000 cub. ft. By placing a regulator in B to reduce quantity to 30,000 would increase total mine resistance which would reduce total quantity of air. There will be an increase in volume in split A but it will not equal the decrease in B. With the same steam supplied to the engine running the fan the speed of fan will be increased because owing to increase in mine resistance less quantity of air is passing through the fan which handles less weight of air per minute, This decrease is made up by an increased speed of fan and of the engine resulting also in a slight increase in power applied.

Ques. 4—What are the different means used to produce ventilation? Describe each fully.

Ans. 4—There are various means to produce ventilation. I will confine myself to a few of the principal ones, viz: the Water-fall, Steam jat, Furnace and Fan.

The Water-fall consists sometimes of a perpendicular pipe perforated at the top so as to allow air in and is taken down with the water or sometimes a whole shaft is used having some brush matting so as to scatter the water into a spray. This means of ventilation is not used very much only in the case of driving smoke out of shafts after blasting or where the water could run out of mine by itself in a water level.

The Steam jet consists of a pipe led down into the shaft and led around the perimeter of the shaft. This pipe is full of small holes so as to allow steam to escape in a series of jets. This means of ventilation is not used only in case of emergency, such as to restore ventilation after an explosion or something going wrong with the fan. It is not a very commendable means of ventilation for reasons given in case of water-fall.

The Furnace consists of a large fire built near the bottom of the upcast shaft, incased with brick having burnt ashes or sand between the brick and the coal. It causes ventilation by raising the temperature in the upcast shaft, causing it to ascend. It can be used to best advantage in non-fiery mines and deep shafts, because the larger the heating columns the better.

The Fan is the best means of producing ventilation. It is composed of a number of arms or blades; they are partly encased in a casing which is either brick or iron, around the shaft. Sometimes there are two orifices of entry. The fan turning the blades throws the air off the tips of the blades with such a velocity that it takes the pressure off the centre of fan around shaft which causes the return air to rush in to be thrown off by the blades. It is by far the best means of ventilation we have to-day.

Ques. 5—If 30,000 cubic ft. of air is being produced in an airway 1200 feet long 8 x 5 feet, how many cubic feet would be produced if the air were split into three splits, the first being the dimensions given above, the second 1500 feet long, 8 x 7 ft., the third 1800 feet long, 9 x 6 ft., the power remaining the same.

Ans. 5—Use formula $U = KSV^3$ and for airway passing 30,000 cubic ft.

$U = 30{,}000 \div 40 = 750$ cubic feet per minute.

$\therefore U = .0000000217 \times 31200 \times 750^2 = 285626.25$ ft. lbs.

Power remaining the same for 3 airways.

		Area	Rubbing surface
1st. split	8 x 5 x 12000	40	31200
2nd. "	8 x 7 x 15000	56	45000
3rd. "	9 x 6 x 18000	54	54000
	Total	150	130200