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IIT(BHU) VARANASI

STUDENTS' NOTES

UNDERGROUND MINE ENVIRONMENT

FIFTH SEMESTER

TOPIC-SELECTION OF MINE FAN

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Selection of Main Fan

Major Factors:-

(i) Quantity requirement at various periods during life of mine.

(ii) Head requirement

(iii) Possibility of and range of ~~main~~ mine characterstic curve.

(iv) Altitude and Temperature

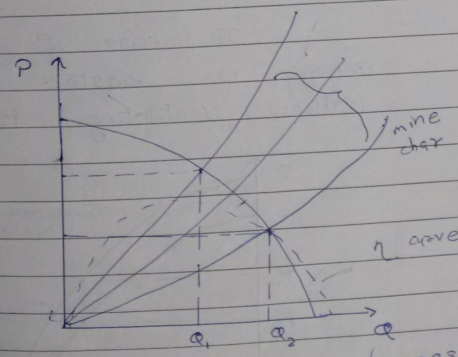
(v) Reversal of air current required or not

(vi) Type and speed of motive power

(vii) Sound Emmission

(viii) Initial & running cost

(ix) Size of fan & space occupied



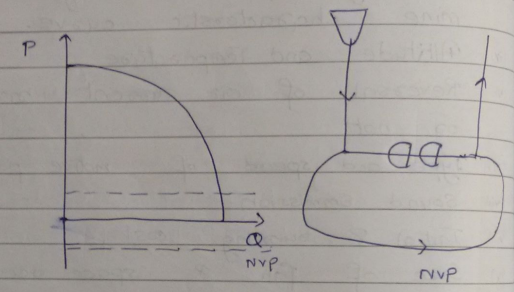
The mine characterstic changes every 5 year so there is change of Q

G.B. Mishra

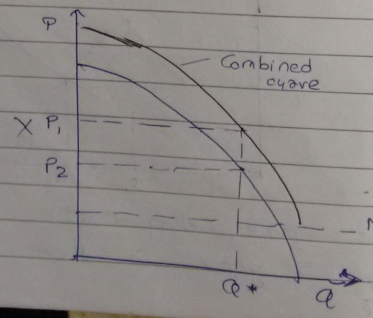
Auto expansion.

- Efficiency & Power has to be considered for the life of mine.

- In case of exhaust fan instal the volume is more due to high temperature (≈ 1%)



- In case of forcing fan energy is wasted to overcome Natural ventilating Pressure (NVP)



A small fan can also be used. NVP is favourable

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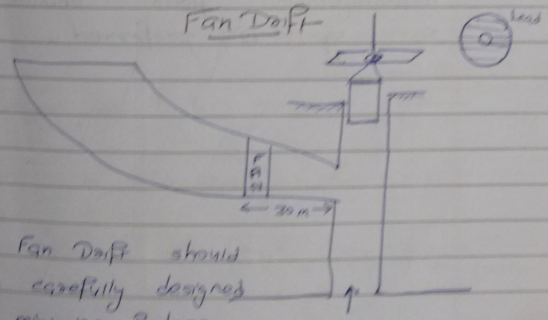
- Noise is a function of speed and since axial flow fan operate at high speed it creates noise

But, now aerofoil design is available which can keep noise level within limits.

- Axial flow fan have high initial cost but running cost is low (ie power consumption) due to high speed (natural high speed of elec. motors) and axial flow fan have low dimensions.

- Power is dependent on Density so to check power altitude of fan has to be checked.

Fan Draft



Fan Draft should be carefully designed to minimise P loss

Q. A fan circulates $50 m^3/sec$ of air thro
a mine having a resistance 0.3 N
Power input to motor = 75 kW

① What is combined efficiency of fan
motor combined ($\eta_{combined}$)

Air Power
Electrical Power

Air Power = PQ = $(RQ^2)Q$ = RQ^3

② It is deviced to increase the quantity
to $65 m^3/s$. Using 150 kW motor
Examine the combination.

Q ① A fan runs at 300 rpm and
To increase the quantity of
air speed of motor is increased to
400 rpm. Calculate water gauge

② What is fan efficiency?

Forcing vs Exhaust

In metal mine we can go for
either forcing or exhaust but in
coal mine we go only for
exhaust fan.

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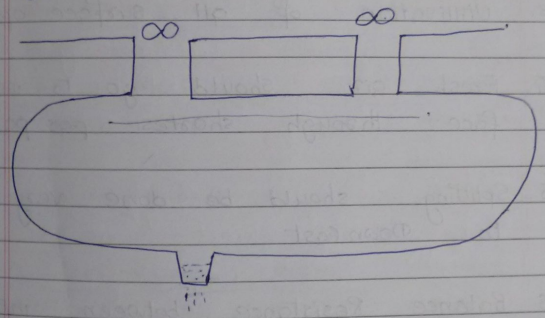
Exhaust

- Exhaust system avoids neccessity of providing air locks
- Greater power saving is possible by installation of erasee in exhaust system
- Rising atmospheric pressure w/g in event of failure of fan or power will minimise / retard liberation of strata gases.



Chances of increases in CH_4 conc. is very high in forcing fan.

Forcing

i) Fan handles fresh air, maintenance is easy
ii) It handles less Q are compared to exhaust fan so fan is small & contact.

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10. Natural Ventilating Pressure has to be taken into account

11. Cost of Ventillation for feasible plan and the lowest one has to be selected

12. Implementation Document (Schedule has to be updated time to time)

Air Requirement

1. Breathable air should be supplied to workers.

2. Oxygen % should be not less than 19%

3. The impurities in mine (CH_4) should be minimised (0.75% max in return and 1.25% anywhere in mine)

   CO - 50ppm

   NOx - 5 ppm

   Pathogenic Dust - $3 mg/m^3$

4. Diluting heat and humidity

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5. Producing sufficient face air velo
CMR 136 (A)

Based on production = $2.5 m^3/t$
Based on manpower = $6 m^3$ /person (iv)
in largest shift
we take higher value and
will adjust properly.

(v)

(i) Other Parts
Long Heading, Blasting Fumes.
DGMS Reg 30 (1973) 7 50 m the
NO_x, CO
5ppm 50ppm
so that the mas (vi)
should be cleared conc. is less tha
within 5 min that.

$$Q = \frac{mq}{ct}$$ (vii)

m = Mass of explosive
q = vol. gas per unit mass exp
c = allowable conc.
t = time to clear

(ii) Internal Haulage, Pump Hoist, Internal Ho
etc require min. $2.3 m^3/s$

(iii) Battery Charging station - Fresh air
to dilute H_2 gas and there

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can be sparking, so 4.7 m^3/s is needed.

(iv) Diesel Operated machines - Problem is exhaust gases CO, SO_2, NO_x etc. Minimum 4.7 m^3/s of air on an ave. is required

(v) Leakages through stoppings, air lock fan drift. (10 - 20 m^3/s) (1.4 m^3/s)
Vol. η should be (40 - 50 %)
· Air lock - 1.4 m^3/s ·

(vi) Exhaust type fan -> Expansion of gas takes place 1% for 100 m

(vii) The air should be within permissible limit DGMS Cir No. 42, 1974, and high vel may lead to dust.

a) Ventilation shaft not provided with winding equipment - 15 m^3/s
b) No man winding 12 m^3/s
c) Vertical shaft with man winding 8 m^3/s
d) Haulage road other than conveyor 8 m^3/s
e) Other Roadway 6 m^3/s
f) Conveyor Road - Loading & Transfer Point 4 m^3/s
g) Working face - 4 m^3/s

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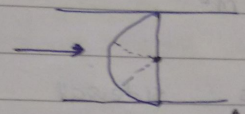
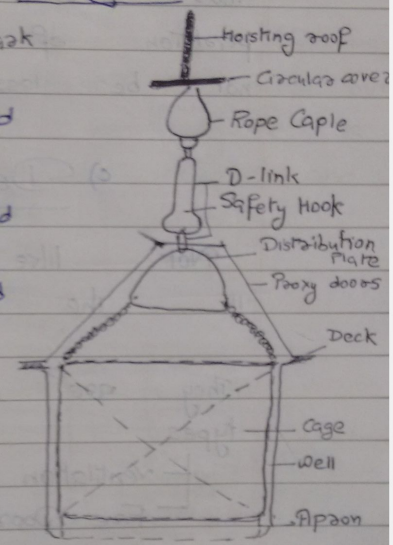
Doors must be of self closing type to prevent short circuit of air flow.

Ways to achieve self closing doors →
a) Doors frame not installed vertical
b) Door should open in high pressure side



Symbol	Name	Remark
	Water dam	Red
	Brattice	Red
	Doors	Red
	Ventilation Stoping	Red
	FIRE DAM SEAL OR STOPING	Red
	Air Crossing	Red



German type shaft top closing.

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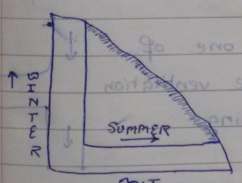
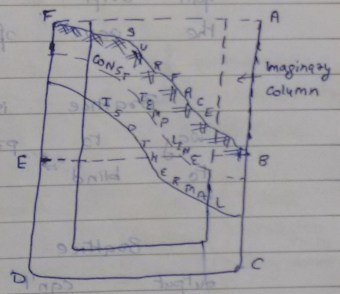
Natural Ventilation

Flow of air through mine working by purely natural means is called natural ventilation.

Cause of Nat. Ventilation

- Temperature → The difference in densities in the U.C and D.C is mainly caused by heating and rarefaction of air in the mine working due to addition of heat from rocks, men, machine light, spontaneous heating





- Moisture Content → Addition of moisture in D.C shaft decreases the density of air as moisture is lighter than air, but this also causes evaporative cooling of the D.C air and consequent increase in density so much so that in effect evaporation of moisture in

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