Laboratory Manual

MINE VENTILATION

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MINE VENTILATION LABORATORY MANUAL

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01.

DETERMINE THE RELATIVE HUMIDITY OF AIR BY SATIONARY HYGROMETER

AIM OF THE EXPERIMENT:

TO DETERMINE THE RELATIVE HUMIDITY OF AIR BY STATIONARY HYGROMETER OR (WET AND DRY HYGROMETER).

APPARATUS REQUIRED:

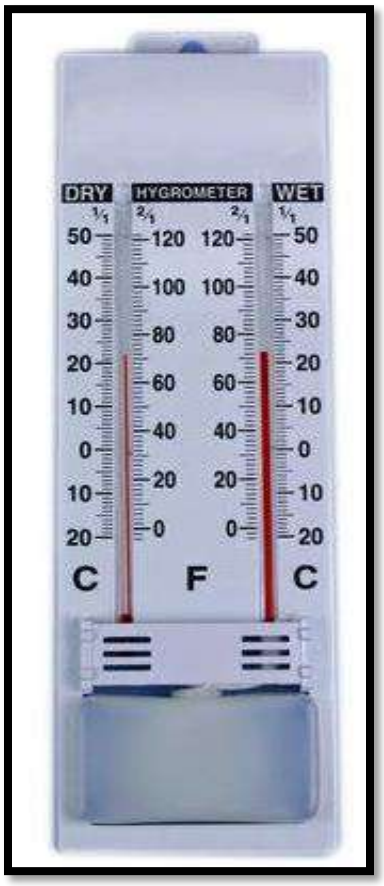
- STATIONARY HYGROMETER.

THEORY:

- HYGROMETER IS AN INSTRUMENT WHICH IS USED TO DETERMINE THE RELATIVE HUMIDITY OF AIR.

RELATIVE HUMIDITY = MASS OF WATER VAPOUR PER m^3 OF AIR .

MASS OF WATER VAPOUR REQUIRED TO SATURATE $1m^3$ OF AIR.



[STATIONARY HYGROMETER / WET & DRY HYGROMETER]

- STATIONARY HYGROMETER IS ESSENTIALLY CONSISTS OF TWO THERMOMETER MOUNTED SIDE BY SIDE ON TWO WAYS,
  - ONE THERMOMETER HAS A DRY BULB AND IT INDICATES THE ACTUAL TEMPERATURE OF SURROUNDING AIR.
  - THE OTHER THERMOMETER HAS A COVERED MOIST BULB WHICH DIPS INTO A SMALL CONTAINER FILLED WITH WATER.

- CONSTANT EVAPORATION OF MOISTURE TAKES PLACE FROM THE WET BULB THEREBY COOLING AT AND BRINGING DOWN ITS TEMPRATURE.
- WHEN THE AIR IS DRY, IT HAVE LOWER HUMIDITY i.e. HAVE LOWER HUMIDITY THERE IS A LARGE DIFFERENCE IN DRY BULB AND WET BULB. WHEN THE AIR IS SATURATED THE TWO READINGS ARE HARDLY ANY DIFFERENCE.
- AFTER GETTING THE HYGROMETER READING OF DRY AND WET BULB THE RELATIVE HUMIDITY CAN BE CALCULATED FROM THE RELATIVE HUMIDITY CONVERSION TABLE.
- THE HYGROMETR MUST BE PLACED IN SLIGHTLY MOVING AIR [1-15 m/sec].

PROCEDURE:

- NOTE THE READING OF ONLY DRY BULB TEMPERATURE IN °C.
- NOTE THE READING OF WET BULB TEMPERATURE IN °C.
- SUBTRACT THE WET BULB READING FROM THE DRY BULB TEMPERATURE READING TO FIND OUT WET BULB DEPRESSION .
- THEN USE THE TABLE.
- NOTE THE DIFFERNCE ALONG THE TOP.
- FOLLOW THIS COLUMN DOWN UNTILL LEVEL WITH DRY BULB READING PERCENTAGE OF HUMIDITY.

CALCULATION:

DRY BULB READING = °C

WET BULB READING = °C

DRY BULB TEMPERATURE – WET BULB TEMPERATURE = [__] °C

AS PER THE TABLE, THE DIFFERENCE IS_____ °C AND DRY BULB TEMPERATURE IS_____ °C .

THE CORRESPONDENCE RELATIVE HUMIDITY FROM THE TABLE IS FOUND TO BE _____%.

[PLACE : , TIME : , DATE : ____/____/____]

CONCLUSION:

THE RELATIVE HUMIDITY OF AIR IN OUR BY USING STAIONARY HYGROMETER IS FOUND TO BE _____ %.

02.

DETERMINE THE RELATIVE HUMIDITY OF ATMOSPHERE

[USING STORROW/WHIRLING HYGROMETER]

AIM OF THE EXPERIMENT:

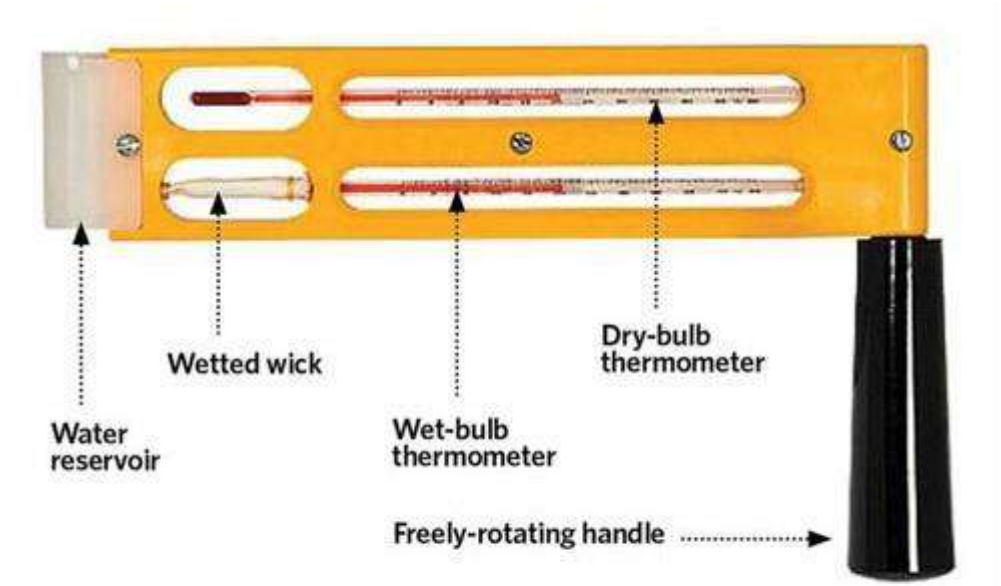
- TO DETERMINE THE RELATIVE HUMIDITY OF AIR BY USING STORROW/WHIRLING HYGROMETER.

APPARATUS REQUIRED:

- STORROW/WHIRLING HYGROMETER.

THEORY:

- TO MEASURE RELATIVE HUMIDITY NEAR WORKING FACE BELOW GROUND REGULARLY, AS THE RISE OF HUMIDITY GIVES AN INTEGRATION DEVELOPING SPONTANEOUS HEATING.
- TO MEASURE WET BULB TEMPERATURE ONCE IN 30 DAYS AT ALL WORKING PLACE IN THE MINE, THE WET BULB TEMPERATURE SHOULD NOT BE EXCEED 35°C.
- HYGROMETER IS AN INSTRUMENT FOR THE MEASUREMENT OF RELATIVE HUMIDITY OF AIR.
- HYGROMETER IS COMMONLY USED IN MINES TO DETERMINE RELATIVE HUMIDITY.
- IT CONSISTS OF TWO THERMOMETERS 15cm LONG MOUNTED SIDE BY SIDE ON A WIDEN FRAME AND FITTED WITH LOOSE HANDLE, IT CAN BE WHEEL ABOUT 360° IN THE ATMOSPHERE TO BE TESTED.
- THE BULB OF ONE THERMOMETER IS OPEN TO THE AIR THAT IS KNOWN DRY BULB THERMOMETER IN THE BULB OF THE OTHER THERMOMETER IS DIPPED INTO THE WATER IN THE CONTAINER WHICH IS FITTED BELOW IT.
- WHIRLING HYGROMETER CONSISTS OF TWO MERCURY FILLED PRISMATIC THERMOMETER WITH LIST COUNT OF 0.5°C AND THE RANGE -5°C-50°C AND ARE MOUNTED SIDE BY SIDE IN A PLASTIC FRAME.
- ONE REVOLVING HANDLE IS FIXED TO THE FRAME IN SUCH A MANNER THAT THE INSTRUMENT CAN BE ROTATED SMOOTHLY AT ABOUT 3 to 4 rev/sec. TO HAVE AN AIR SPEED OF AT LEAST 4 m/sec PAST THE BULBS. ONE OF THE THERMOMETER HAS ITS BULB COVERED WITH A SINGLE LAYER OF THIN COTTON FABRIC.
- WHEN THE TEMPERATURE OF DRY BULB & WET BULB ARE KNOWN, THE PERCENTAGE SATURATION OF THE AIR IS FOUND FROM TABLE (HUMIDITY CHART).



Whirling Hygrometer

PROCEDURE:

- FIRST FILL THE DISTILLED WATER IN THE CONTAINER OF HYGROMETER.
- TAKE INITIAL READING OF BOTH THERMOMETERS.
- THE INSTRUMENT IS TO BE WHIRRLED ABOUT 200rpm FOR ABOUT 1min.
- THEN THE READING OF BOTH THERMOMETERS QUICKLY NOTES.
- AFTER THE READING OF DRY BULB TEMPERATURE AND WET BULB TEMPERATURE, WE CAN CALCULATE THE RELATIVE HUMIDITY PERCENTAGE BY SUBSTRACTING DRY BULB TEMPERATURE TO WET BULB TEMPERATURE.
- WE CAN FIND FINAL RELATIVE HUMIDITY PERCENTAGE FROM THE GIVEN TABULATION.

OBSERVATION:

INITIAL READING OF HYGROMETER (BEFORE WHIRLING)

DRY BULB TEMPERATURE=_____°C

WET BULB TEMPERATURE=_____°C

FINAL READING OF HYGROMETER AFTER WHIRLING (ABOUT 200rpm DURATION 60sec)

DRY BULB TEMPERATURE=_____°C

WET BULB TEMPERATURE=_____°C

CALCULATION:

DRY BULB READING = _____ °C

WET BULB READING = _____ °C

DRY BULB TEMPERATURE – WET BULB TEMPERATURE = [__] °C

AS PER THE TABLE, THE DIFFERENCE IS_____ °C AND DRY BULB TEMPERATURE IS_____ °C .

THE CORRESPONDING RELATIVE HUMIDITY, FROM THE TABLE IS FOUND TO BE _____%.

CONCLUSION:

BY USING WHIRLING HYGROMETER, THE RELATIVE HUMIDITY OF ATMOSPHERE IS FOUND TO BE _____%.

03.

TO DETERMINE THE COOLING POWER OF MINE AIR USING KATA THERMOMETER

AIM OF THE EXPERIMENT:

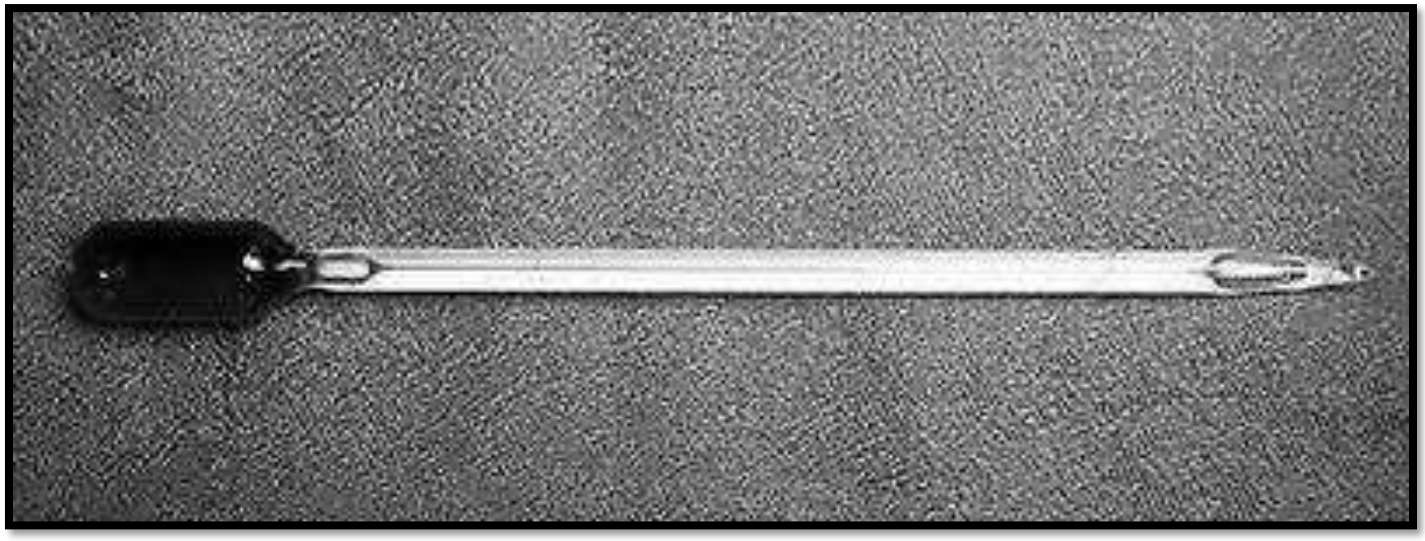
TO DTERMINE THE COOLING POWER OF MINE AIR BY USING KATA THERMOMETER.

INSTRUMENT REQUIRED :

- KATA THERMOMETER

THEORY :

- THE KATA THERMOMETER CONSISTS OF A ALCOHOL THERMOMETER WITH A LARGE BULB 4cm LONG 2cm dia AND STEM 20cm LONG GRADUATED ONLY AT TWO POINT MAINLY AT 38°C & 35°C.
- IT MAY BE USED FOR DRY OR WET READING.



[KATA THERMOMETER]

PROCEDURE :

- FOR WET KATA COOLING POWER READING THE BULB IS FIRST PLACED AT HOT WATER UNTIL THE LIQUID ALCOHOL RISES AND FILL THE UPPER RESERVIOR OF KATA THERMOMETR.
- THEN THE THERMOMETER IS EXPOSED TO AIR AND THE BULB IS SURROUNDED BY A WET MUSLIN CLOTH.
- THEN THE TIME IN "SECONDS" TAKEN FOR THE LIQUID TO FALL FROM 38°C TO 35°C IS OBSERVED.
- IF IN CASE MINISCUS [ALCOHOL] IS BROKEN, KEEP THE BULB IN COLD WATER TILL THE WHOLE COLUMN OF RED ALCOHOL COLLECTS IN THE BULB.
- THE WET COOLING POWER IS THEN FIND OUT BY DIVIDING THE FACTOR MARKED ON THIS INSTRUMENT I.E. KATA FACTOR BY THE NUMER OF SECONDS OBSERVED.

$$\text{COOLING POWER} = \frac{\text{KATA FACTOR}}{\text{TIME IN SEC FOR ALCOHOL TO FALL FROM UPPER TO LOWER MARK}}.$$

- IT IS USED FOR DRY KATA COOLING POWER THEN ABOVE PROCEDURE IS FOLLOWED WITHOUT USING WET MUSLIN CLOTH. THE THERMOMETR IS EXPOSED TO THE MINE ATMOSPHERE DIRECTLY TO THE DRY BULB AND DRY COOLING POWER IS CALCULATED.
- COOLING POWER REFER TO THE WET KATA READNG.

WET KATA READING EFFECT

5	EXTREMELY OPRESSIVE
10	OPRESSIVE
15	LOWEST VALUE FOR SATISFACTORY CONDITION
20-25	BEST CONDITION FOR WORK
30	FEELING UP CHILLED UNLESS WELL CLOTHED
35	UNCOMFORABLY COLD

CONCLUSION :

THE DRY KATA READING GIVES ONLY THE COOLING POWER DUE TO RADIATION AND CONDUCTION BUT THE WET KATA READING INCLUDES THE EFFECT OF THE EVAPORATION AND THUS USED TO COOLING POWER IN REFERENCE TO THE HUMAN BODY.

04.

TO STUDY AND SKETCHING OF AIR CROSSING , VENTILATION DOORS AT PIT TOP, EXPLOSIVE PROOF FIRE STOPPING.

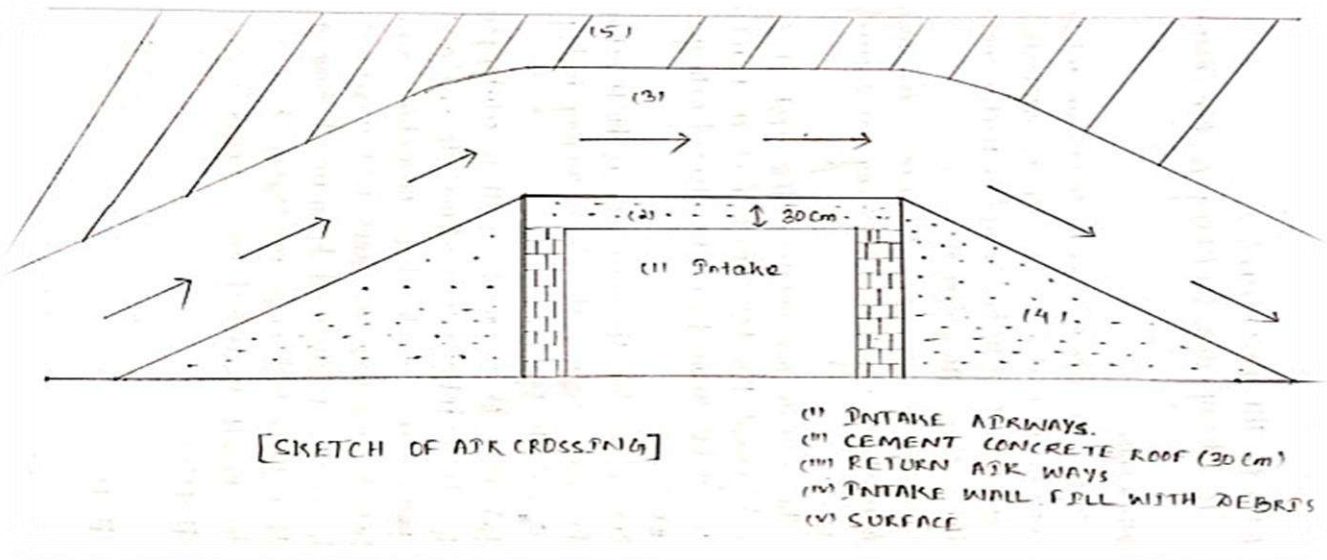
AIM OF THE EXPERIMENT:

TO STUDY AND SKETCHING OF AIR CROSSING & VENTILATION DOORS AT PIT TOP.

WORKING:

01. AIR CROSSING:

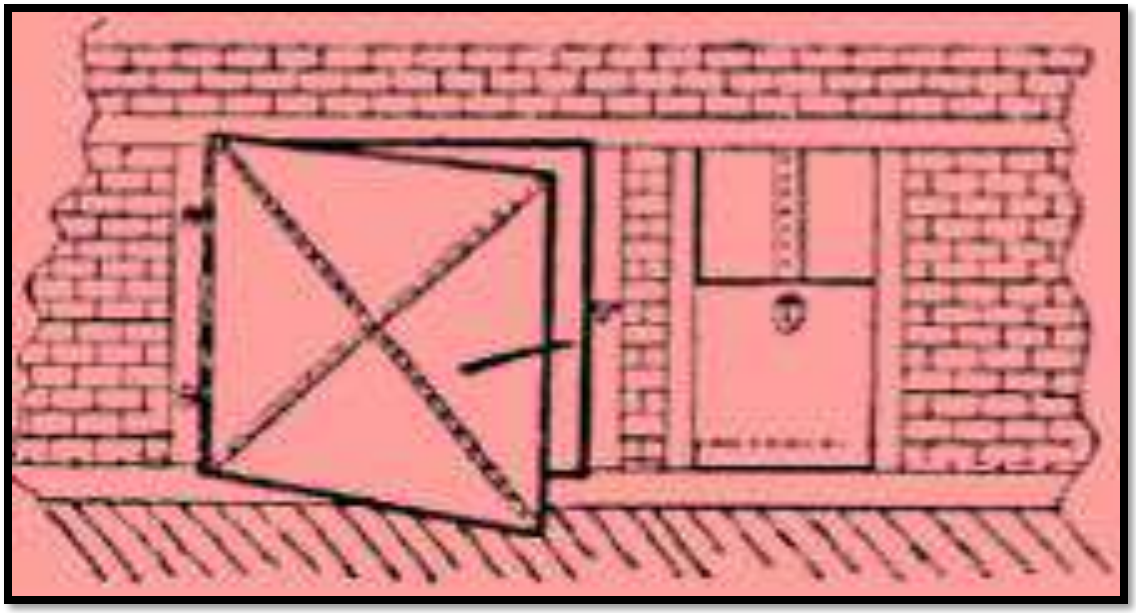
- WHERE A RETURN AIRWAY CROSSES AN INTAKE AIRWAY, AN AIR CROSSING IS BUILT. IF ONE AIR IS DEFLECTED ABOVE OTHER, THE CROSSING IS CALLED AN OVERCAST. IF IT IS DEFLECTED UNDER THE OTHER IT IS CALLED UNDERCAST.
- UNDERCAST ARE UNCOMMON BECAUSE WATER MAY ACCUMULATE .
- ACCORDING TO REGULATION 146 EVERY AIR CROSSING SHOULD BE EXPLOSION PROOF.
- IN SUCH AN AIR CROSSING THE ROOF OF THE LOWER LOWER AIRWAY [INTAKE] IS HEIGHTENED. THE FALLS ROOF MADE OF REINFORCED CEMENT CONCRETE SHOULD BE 30CM THICK, REINFORCED WITH GRIDERS 15cm x 8cm AND WIRES.
- SIDEWALL OF THE LOWER AIRWAY IS BUILT NOT MORE THAN 75cm.



- AREA OF CROSS SECTION OF EITHER AIRWAY IS KEPT NOT MORE THAN 9.3m² [100 SQ.FT].
- THE BACK OF THE INTAKE WALL IS SOLIDLY PACKED WITH DEBRIS FREE FROM INFLAMMABLE MATERIAL TO GIVE A SLOPE NOT STEEPER THAN 1 IN 3 TO THE FLOOR OF RETURN AIRWAY.
- BOTH THE ROADWAYS ARE KEPT WELL SUPPORTED.
- AIR CROSS IS MAINTAINED FROM TIME TO TIME TO KEEP IT LEAK PROOF.
- IT IS INSPECTED ONCE IN 14 DAYS BY A COMPETENT PERSON AND THE RESULT IS RECORDED IN A BOUND PAGED BOOK KEPT FOR THE PURPOSE.

02. VENTILATION DOORS AT PIT-TOP:

- AT PIT TOP THE VENTILATION DOORS ARE USED IN FAN DRIFT AND MOTOR DRIVE HOUSE. THE VENTILATION DOORS MUST BE ARRANGED TO CLOSE AUTOMATICALLY AND THE FRAME OF DOORS IS SO FITTED THAT THE TOP LAYERS ABOUT 50mm-75mm FORWARD IN THE DIRECTION OF AIR PRESSURE. THE DOORS OFCOURSE SHOULD OPEN AGAINST THE DIRECTION OF AIR SO THAT THE AIR PRESSURE NORMALLY KEEPS IT CLOSED.
- THREE DOORS ARE OFTEN USED AS MAIN SEPARATION DOORS NEAR THE SHAFTS, SUCH DOORS ARE PROVIDED IN CORRECTIONS BETWEEN MAIN INTAKE AND MAIN RETURN AIRWAYS. NORMALLY TWO DOORS USED AS AIRLOCK SO THAT ONE IS ALWAYS CLOSED WHEN THE OTHER IS OPEN.
- DOORS SHOULD OPEN ON ONE SIDE, I.E. THE HIGH-PRESSURE SIDE. THEY SHOULD BE SO INSTALLED THAT THEY MAY CLOSE AUTOMATICALLY IF LEFT OPEN. TO MAKE THE DOORS LEAK PROOF THE DOORS SHOULD OVERLAPPED THE FRAME AND PROVIDED WITH GASKET LINING CANVAS OR RUBBER STRIPES .
- A SMALL SHUTTER IS FITTED TO THE DOOR TO RELEAVE THE PRESSURE WHILE THE DOOR IS OPENED. SUITABLE HANDLES ARE PROVIDED ON DOORS TO FACILITATE OPENING OF THE DOORS. A DOOR ATTENDANT MAY BE PROVIDED TO OPERATE THE DOOR SAFELY.



03. EXPLOSIVE PROOF FIRE STOPPING-

CONCLUSION:

FROM THE ABOVE EXPERIMENT WE LEARNT THE SKETCHING CONSTRUCTION AND OPERATION OF **AIR CROSSING , VENTILATION DOORS AT THE PIT-TOP & EXPLOSIVE PROOF FIRE STOPPING**

05.

TO STUDY & USE OF VANE ANEMOMETER, DIGITAL ANEMOMETER, VELOMETER, PITOT STATIC-TUBE MEASUREMENT OF QUANTITY OF AIR FLOW. STUDY OF DIGITAL PRESSURE METER..

AIM OF THE EXPERIMENT:

Study & use of Vane Anemometer, Digital Anemometer, Velometer, Pitot static-tube measurement of quantity of air flow. Study of digital pressure meter.

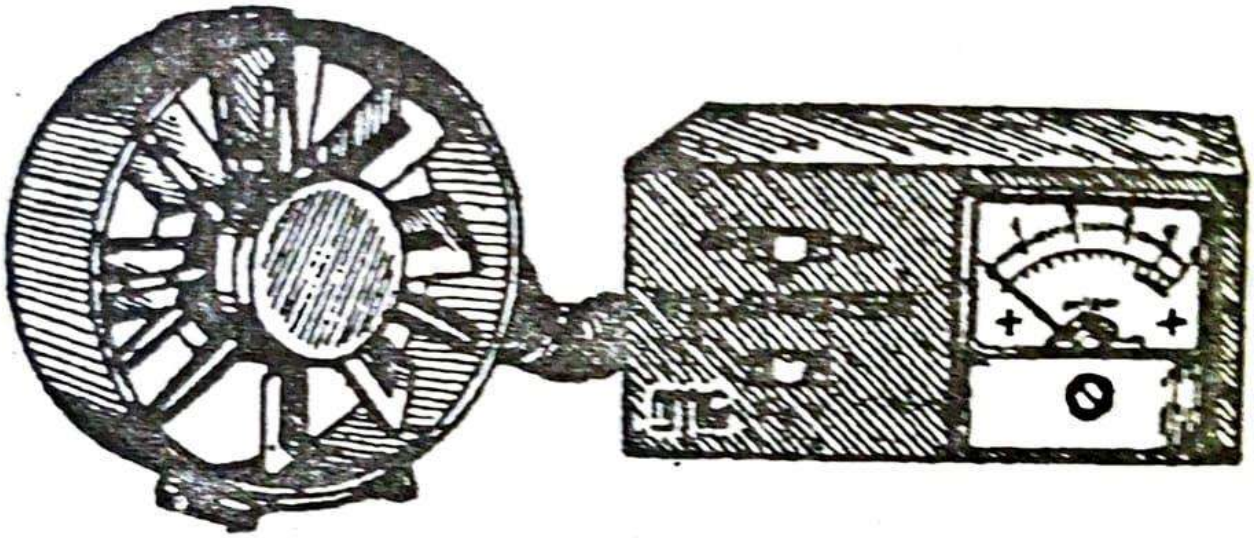
APPARATUS REQUIRED:

- *VELOMETER*
- *VANE ANEMOMETER, STOP-WATCH*
- *DIGITAL ANEMOMETER*
- *PITOT STATIC TUBE WITH PORTABLE MANOMETER*
- *DIGITAL PRESSURE METER*

THEORY:

01. VELOMETER

- THE VELOMETER INDICATES AIR VELOCITY IN METER PER SECOND [m/sec], AT ANY POINT OF OBSERVATION.
- TO FIND THE AIR VELOCITY IN MINE ROADWAY BY VELOMETER , READINGS ARE TAKEN AT NUMBER OF EQUAL SPACE POINTS OVER THE CROSS SECTION AND THE AVERAGE RESULT IS CALCULATED.
- Nanda manufacturing company IS MARKETING A VELOMETER WHICH DIRECTLY READS THE FLOW OF AIR OR GASES.
- THE INSTRUMENT CONSISTS OF A SENSING HEAD AND AN INDICATOR UNIT.
- THE HEAD INCORPORATES A ROTATING VANE TYPE NON-OPTICAL, NON-MAGNETIC AND NON-CONTACT TRANSDUCER WHICH IS UNAFFECTED BY VIBRATIONS, DUST, TEMPRATURE OR HUMIDITY.
- THIS TRANSDUCER GENERATES ELECTRICAL SIGNALS HAVING A FREQUENCY DIRECTLY PROPERTIONAL TO THE RATE OF AIR FLOW THROUGH THE HEAD.
- THESE SIGNALS ARE THEN CONVERTED TO A DIRECT CURRENT, WHICH DRIVES AN INDICATING METER CALIBRATED IN TERMS OF FLOW RATE PER MINUTE OR METERS PER SECOND.
- THIS INSTRUMENT IS PROVIDED WITH A DETACHABLE ORIFICE NOZZLE FOR USE IN HIGHER RANGES OF AIR CURRENT.
- VELOMETERS CAN BE MADE FOR ONE TWO OR THREE RANGES OF VELOCITY, THE LOWEST RANGE BEING **0 to 1.5M /SEC,** AND THE HIGHER RANGES, **0 to 5 M/SEC** AND **0 to 15 M/SEC.**
- VELOMETER IS USEFUL FOR PARTICULARLY MEASURING VERY LOW VELOCITY.
- VELOMETER IS SENT TO ***CIMFAR*** ONCE IN A YEAR FOR RE-CALIBERATION.



Velometer, Directly reads air Velocity. Range 0 – 15 m/s (N.M.C.)

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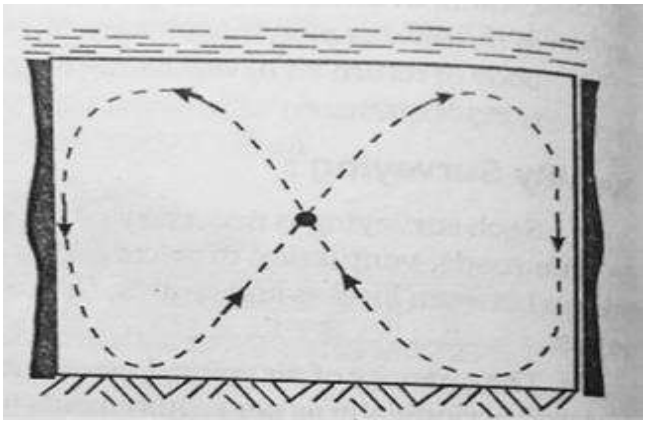
02. VANE ANEMOMETER:

- IT IS AN INSTRUMENT TO DETERMINE THE DISTANCE TRAVELLED BY AIR IN A GIVEN TIME AND IS USED WHERE THE AIR VELOCITIES ARE BETWEEN **60m AND 1000 m/min.**
- THE VANE ANEMOMETER CONSISTS OF A SMALL FAN OR WINDMILL, THE VANES OF WHICH ARE SET AT AN ANGLE OF **40^0 TO 45^0** TO THE DIRECTION OF AIR FLOW.
- THE ROTATING VANE ANEMOMETER CONSISTS OF A PROPELLER OR REVOLVING VANE CONNECTED THROUGH A GEAR TRAIN TO A SET OF RECORDING DIALS THAT INDICATE THE NUMBER OF LINEAR FEET/METER OF AIR PASSING IN A MEASURED LENGTH OF TIME. IT REQUIRES CORRECTION FACTORS AND FREQUENT CALLIBRATIONS, AND IT IS NOT AS ACCURATE AS THE VELOMETER.
- THE GEARS OF THE ANEMOMETER CAN BE ENGAGED OR DISENGAGED BY A CLUTH.
- WHEN USING THE INSTRUMENT IN AN UNDERGROUND ROADWAY IT SHOULD BE HELD AWAY FROM THE BODY OF THE OBSERVER AND THE PLANE OF ROTATION OF THE VANES SHOULD BE AS NEAR AS NORMAL TO THE DIRECTION OF AIR FLOW.
- TO DETERMINE THE VELOCITY OF AIR A STOP-WATCH IS ESSENTIAL IN CONJUCTION WITH AN ANEMOMETER .
- TO DETERMINE THE AVERAGE VELOCITY OF AIR AT ANY POINT OF ROADWAY; NOTE THAT THE READINGS ARE BROUGHT TO **ZERO '0'** ON THE DISPLAY BEFORE STARTING THE OPERATION.
- MOVE THE INSTRUMENT THROUGHOUT THE CROSS-SECTION OF THE ROADWAY AS SHOWN BY THE PATH IN THE GIVEN FIGURE.
- AFTER 3-4 REVOLUTIONS THE READING GIVEN IN THE DISPLAY DETERMINES THE DISTANCE TRAVELLED BY AIR.

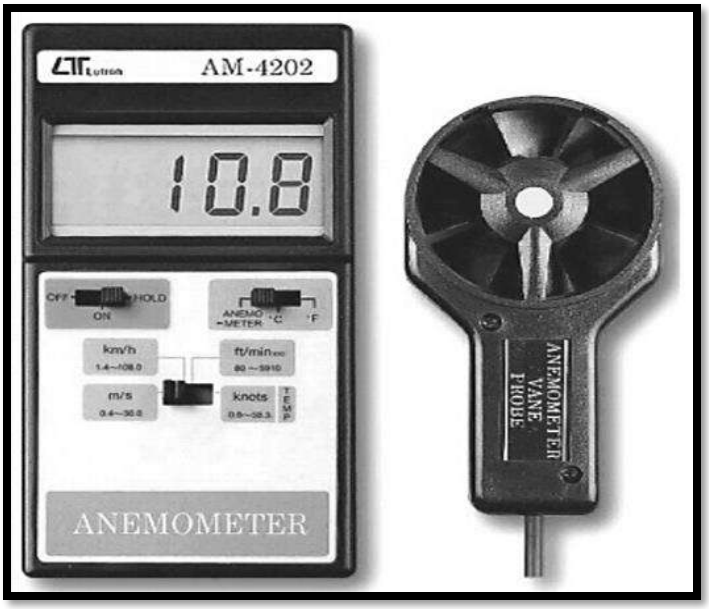
- AFTER **2 TO 4 MINUTES** DECLUTCH THE INSTRUMENT AND SIMULTANEOUSLY STOP THE STOP WATCH .
- TAKE THE READING. THE DIFFERENCE INDICATES THE DISTANCE TRAVELLED BY THE AIR IN THE TIME RECORDED BY THE STOP-WATCH.
- THE AVERAGE VELOCITY OF AIR IS THEN CALCULATED.
- THE WHERE AVERAGE VELOCITY OF AIR HAS TO BE MEASURED SHOULD BE SELECTED ON THE FOLLOWING BASIS:
    - **the roadway should have nearly uniform cross-section for nearly 15m on either side, and it should be straight.**
    - **the cross section should be such that its area can easily be calculated.**
    - **it should be away from bends, junctions and places having sudden changes in cross-section, and free from obstructions which may cause turbulent air flow.**
- THE APPARATUS REQUIRED FOR MEASUREMENT OF VELOCITY INCLUDES; A RECENTLY TESTED ANEMOMETER WITH CORRECTION TABLE, A STOP WATCH, MEASURING TAPE, NOTE BOOK, PENCIL, ETC.

[VANE ANEMOMETER]



[RIGHT DOTTED LINE INDICATES PATH OF ANEMOMETER MOVEMENT]

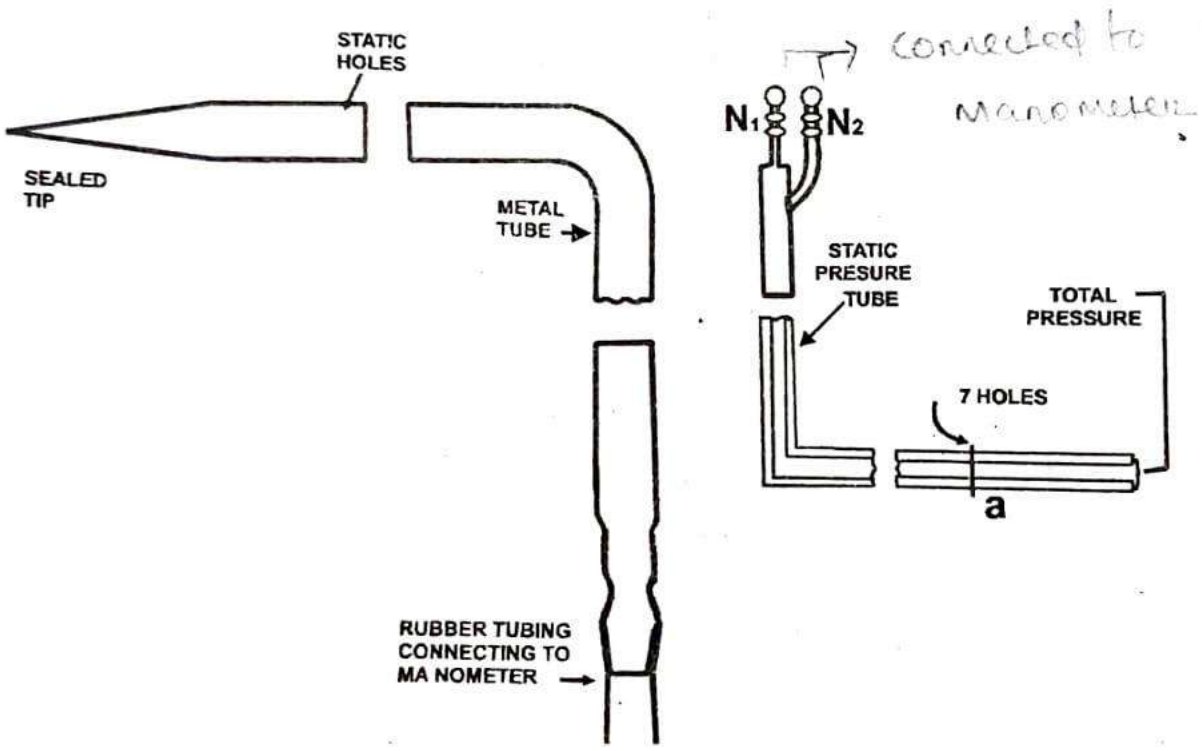
03. DIGITAL ANEMOMETER:



[DIGITAL ANEMOMETER]

- **NANDA MANUFACTURING COMPANY** IS MARKETING AN ELECTRONIC ANEMOMETER WHICH POSSESSES THE FOLLOWING FEATURES:
  - SOLID STATE CIRCUITRY WITH INTEGRATED CIRCUITS.
  - SENSING HEADS : NON-CONTACT TYPE FULLY ENCAPSULATED ELECTRONIC TRANSDUCER USING PRINCIPLE OF CHANGE IN CAPACITANCE
  - INDICATOR UNIT : MEASURING ACCURACY $\pm$2%
  - MEASUREMENT OF IR VELOCITY IN 3 RANGES
    [i] 0.25-25 m/s [ii] 0.25-5 m/s [iii] 0.25-10 m/s
  - THE BATTERY TYPE USED IS **EVEREADY** TYPE **276-P** 2nos.

4. PITOT STATIC-TUBE MEASUREMENT OF QUANTITY OF AIR FLOW-



Pitot tube

Airflow meter of Nanda Manufacturing Co. comprises.
(a) Portable inclined manometer. (b) Pitot static tube.

5. STUDY OF DIGITAL PRESSURE METER-

CONCLUSION:

FROM THE ABOVE STUDY WE CAN KNOW ABOUT THE USE OF VELOMETER, VANE ANEMOMETER & DIGITAL ANEMOMETER.

06.

DETERMINATION OF DUCT CHARACTERISTICS

AIM OF THE EXPERIMENT:

DETERMINATION OF DUCT CHARACTERISTIC.

THEORY:

TO DELIVER AIR TO THE CONDITIONED SPACE, YOU NEED AIR CARRIERS. THESE CARRIERS ARE CALLED DUCTS. THEY ARE MADE OF SHEET METAL OR SOME STRUCTURAL MATERIAL THAT IS NON-COMBUSTIBLE. DUCT SYSTEMS ARE ALSO CLASSIFIED AS HIGH- PRESSURE OR HIGH-VELOCITY DUCT WORK AND LOW PRESSURE OR LOW-VELOCITY DUCT WORK.

DUCTS ARE EITHER ROUND OR RECTANGULAR IN CROSS-SECTION. RECTANGULAR DUCTS USUALLY HAVE THE ADVANTAGE OF SAVING ROOM SPACE AND BEING EASIER TO INSTALL IN WALLS. HOWEVER, WHENEVER POSSIBLE YOU SHOULD USE ROUND DUCTS, WHICH PROVIDE LESS RESISTANCE TO AIR FLOW. ADDITIONALLY, ROUND DUCTS REQUIRE LESS MATERIAL TO CONSTRUCT; THUS, BY USING ROUND DUCTS, YOU CAN SAVE BOTH MONEY AND MATERIAL DURING INSTALLATION.

INITIALLY, AN AIR-HANDLING DUCT IS USUALLY SIZED FOR ROUND DUCTS. THEN, IF RECTANGULAR DUCTS ARE WANTED OR REQUIRED, DUCT SIZES CAN BE SELECTED TO PROVIDE FLOW RATES EQUVALENT TO THOSE OF THE ROUND DUCTS ORIGINALLY SELECTED.

CONSTRUCTION :

WE WILL DISCUSS THE BASIC ROUND AND RECTANGULAR SHEET METAL DUCTS. EMPHASIS IS PLACED ON LAYOUT AND PATTERN REQUIREMENTS.

01. ROUND DUCT:

- STRAIGHT SECTIONS OF ROUND DUCT ARE USUALLY FORMED FROM SHEETS ROLLED TO A PROPER RADIUS AND ASSEMBLED WITH A L0NGITUDINAL GROOVED SEAM. EACH END OF A ROUND SECTION IS SWAGED AND ASSEMBLED EITH THE LARGER END OF THE ADJOINING SECTION BUTTING AGAINST THE SWAGE.
- SECTIONS ARE HELD TOGETHER BY RICEETS, BY SHEET METAL SCREWS OR BY SOLDER. WHERE SOLDER IS NOT USED, DUCT TAPE OR LIQUID RUBBER [DUCT SEALER] SHOULD BE USED AS A COVERING AT ALL JOINTS.
- THE DUCT SYSTEM SHOULD BE CONSTRUCTED IN A WAY THAT AVOIDS ABRUPT CHANGES IN SIZE, DIRECTION, OR OTHER RESISTANCE CONDITIONS THAT CAN CREATE NOISE AND REDUCE THE AIR VOLUME.
- THE NORMAL NOISE LEVEL OF AIR FLOWING THROUGH A DUCT DEPENDS ON THE VELOCITY OF THE AIR THROUGH THE DUCT. THIS CAN BE FURTHER REDUCED BY LINING OR COVERING THE DUCT WITH SOUND ABSORBING MATERIAL.

- THE EXTERIOR OF DUCTS THAT CARRY CONDITIONED AIR CAN BE COVERED WITH HEAT INSULATION MATERIALS TO PREVENT HEAT TRANSFER BETWEEN DUCTS AND THE SURROUNDING AIR. ALL THE MATERIALS USED FOR LINING AND COVERING SHOULD BE NON-COMBUSTIBLE.

[ROUND DUCTS]

02. RECTANGULAR DUCT:

- STRAIGHT SECTIONS OF RECTANGULAR DUCT ARE NORMALLY FORMED BY PERSONNEL IN THE STEEL WORKING RATING. THIS IS NORMALLY ACCOMPLISHED ON BENDING-BRAKE TYPE EQUIPEMENT. THEN THE RECTANGULAR DUCTWORK IS JOINED TOGETHER AS MENTIONED EARLIER.
- STRAIGHT SECTIONS OF DUCT CAN USUALLY BE LAID WITHOUT ANY PATTERN. HOWEVER, A PATTERN IS REQUIRED FOR ELBOWS, TRANSITION, AND JUMP FITTINGS.
- STEEL WORKERS PERFOORM THE TASK BUT YOU ARE THE PLANNER, SO YOU NEED TO BE AWARE OF THE TIME REQUIRED TO DRAW AND FABRICATE THE REQUIRED PATTERNS.
- ALSO BEAR IN THE MIND THAT THIS IS ONE TIME JOB, YOU CAN MAKE THE PATTERN OF PAPER OR CARD BOARD. IF THERE ARE NUMBER OF TO BE CONSTRUCTED WITH THE SAME SIZE AND THE DIMENSION, YOU SHOULD MAKE THE PATTERN OF SHEET METAL.

[RECTANGULAR DUCT]

03. FIBER GLASS DUCT:

- A FIBRE GLASS DUCT IS CONSTRUCTED OF MOLDED GLASS FIBERS COVERD WITH A THIN FILM COATING. THIS COATING IS USUALLY OF ALLUMINIUM, BUT VINYL OR OTHER PLASTIC COATINGS ARE SOMETIMES USED. SINCE THEY ARE MADE OF GLASS FIBRE THEY ARE INHERENTLY INSULATED. ALSO THEY ARE PRIMARILY USED WHERE INSULATION IS A FACTOR .
- FIBRE GLASS NEEDS A MILITARY SPECIFICATIONS FOR A FLAME SPREAD RATING OF LESS THAN 25 AND A SMOKE DEVELOPING RATING OF LESS THAN 50 FOR INSULATION MATERIAL. THE FIBER GLASS DUCTS ALLOWED FOR USE ON NAVY INSTALLATIONS MUS RANGE BETWEEN ¾ INCH TO 2 INCHAES THICK, DEPENDING UPON THE SIZE OF THE DUCT.
- THE NATURE OF A FIBER GLASS DUCT REQUIRES THAT IT BE SUPPORTED WITH 1 INCH BY 1/16 INCH GALVANIZED STEEL STRAP HANGERS SHAPED TO FIT THE DUCT.
- THE APPLICABILITY OF FIBER GLASS DUCTS ON HEATING SYSTEMS IS SOMETIMES LIMITED BY THE ADHESIVE USED ON THE PROTECTIVE OUTER COVERING TO CAUSE IT TO ADHERE TO THE FIBER GLASS MATERIAL. UNLESS ALUMINIUM SURFACE DUCT IS USED, THE SPECIFICATION OF THE DUCT SHOULD BE CHECKED CAREFULLY TO ENSURE THAT IT DOES NOT FAIL WHEN HEATED OVER 250°F.

04. SIZING DUCT SYSTEMS :

THERE ARE NUMEROUS FACTORS THAT YOU NEED TO CONSIDER WHEN SIZING DUCT SYSTEMS. THESE FACTORS CAUSE YOU MAKE MODIFICATIONS AND ADJUSTMENTS THROUGHOUT THE PLANNING AND INSTALLATION PROCESS TO DEVELOP AN EFFICIENT WORKING SYSTEM.

- FIRST, YOU MUST CALCULATE THE AIR VOLUME REQUIRED FOR HEATING AND COOLING THE REQUIRED SPACE. THIS WILL ASSIST YOU DETERMINING THE NECESSARY DUCT SIZE, FAN SIZE, FAN SPEED, AND SO FORTH THAT IS NEEDED TO CIRCULATE THE REQUIRED AIR.
- WHILE DETERMING THE HEATING AND THE COOLING FACTORS, YOU SHOULD THINK IN TERMS OF AIR CIRCULATION THROUGH OUT THE MINE AND IN EACH INDIVIDUAL DISTRICT.
- YOUR FINAL DUCT CALCULATIONS INVOLVE TAKING UNIT PRESSURE DROPS AND TOTAL PRESSURE DROPS THROUGHOUT THE SYSTEM. SOME OF THE MAJOR CONTRIBUTING FACTORS TO THESE PRESSURE DROPS ARE AS FOLLOWS;
    - LENGTH OF DUCT
    - DUCT MATERIAL AND INTERIOR FINISH
    - CHANGES IN DUCT SIZE
    - NUMBER OF ELBOWS

CONCLUSION:

DIFFERENT TYPES OF ” DUCT CHARACTERISTICS “ ARE STUDIED.

07.

TO STUDY OF CONSTRUCTIONAL FEATURES OF AXIAL FLOW AND CENTRIFUGAL FANS.

AIM OF THE EXPERIMENT:

TO STUDY THE CONSTRUCTIONAL FEATURES OF AXIAL FLOW AND CENTRIFUGAL FANS.

THEORY:

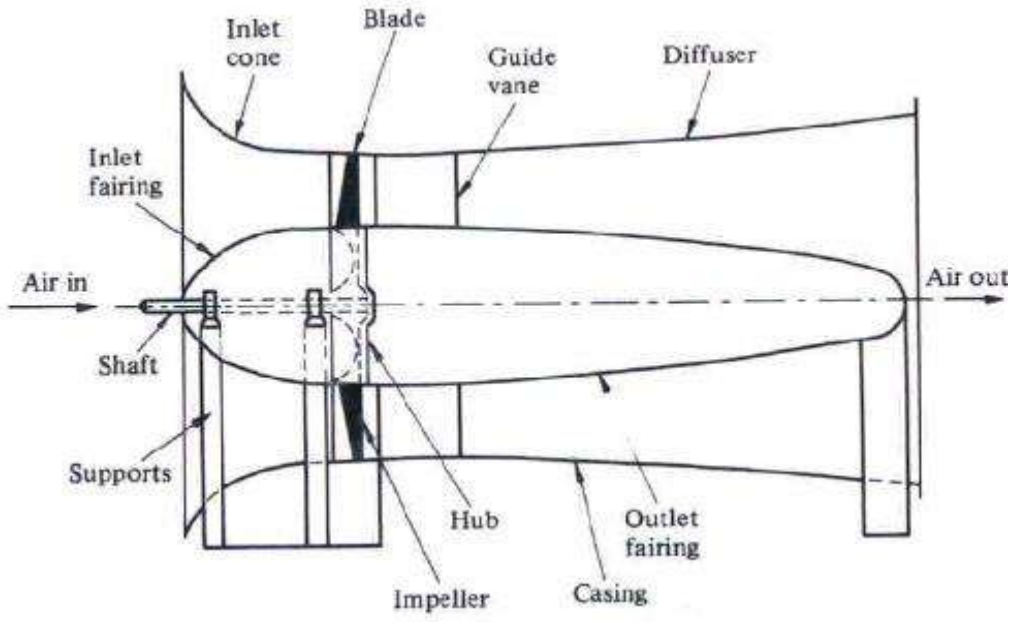
ARTIFICIAL VENTILATION IS PRODUCED IN A MINE BY FANS. A FAN MAY FORCE THE AIR IN A MINE **(FORCING FAN)** OR IT MAY SUCK UP THE AIR FROM IT **(EXHAUST FAN).**

THE FANS USED ARE OF TWO TYPES;

1. CENTRIFUGAL FAN
2. THE AIR SCREW OR AXIAL FLOW FAN

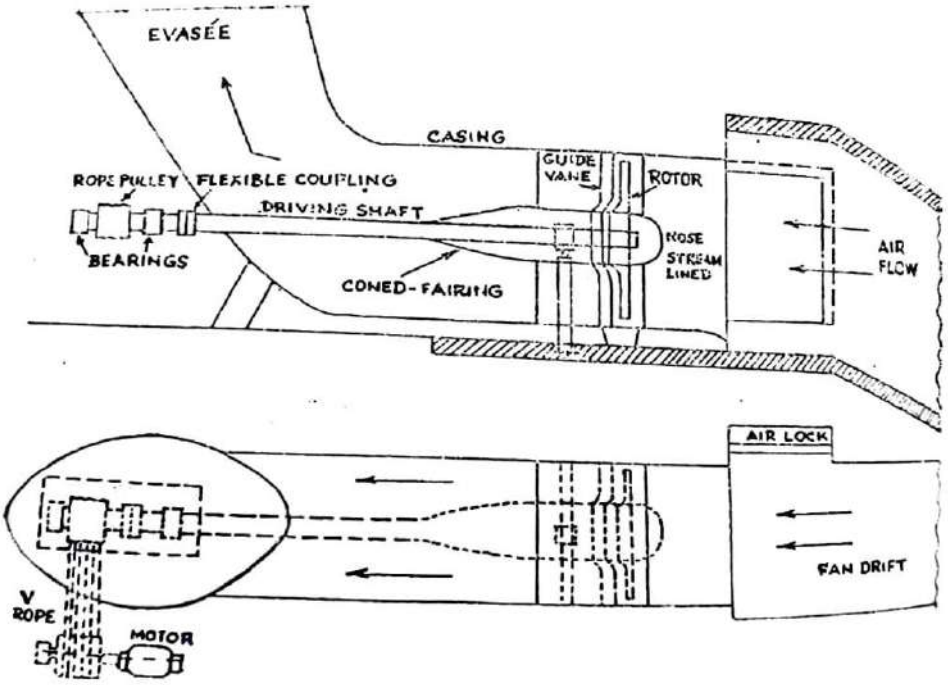
BOTH THESE TYPES CAN BE ARRANGED TO ACT AS FORCING FAN OR AS EXHAUST OR SUCTION FAN.

01. CONSTRUCTION OF AXIAL-FLOW OR AIR-SCREW FANS :



ELEVATION

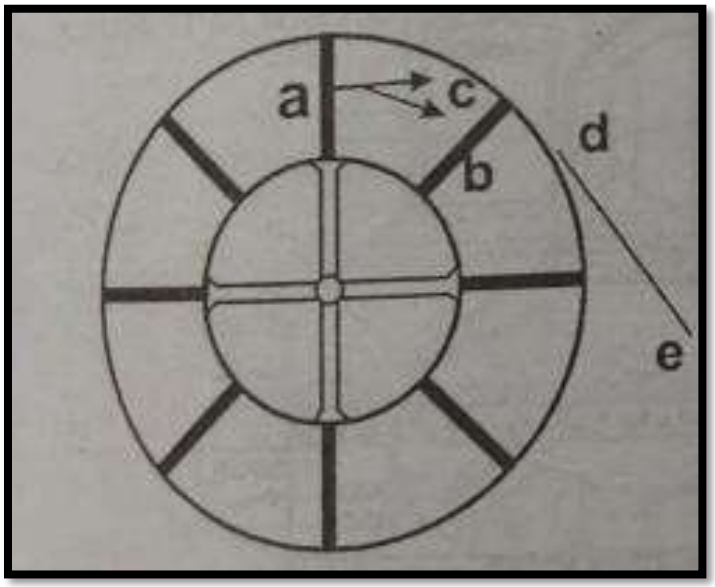
PLAN



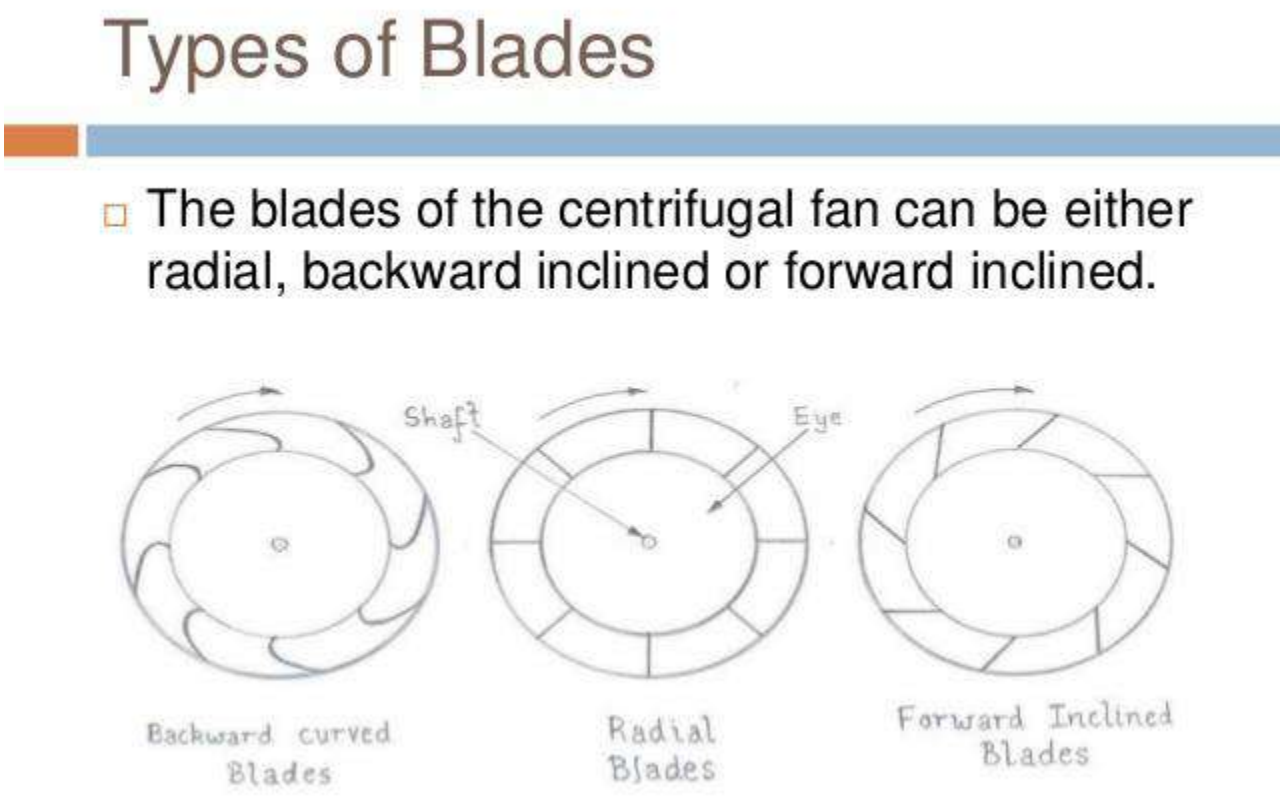
INSTALLATION OF AIR-SCREW FAN

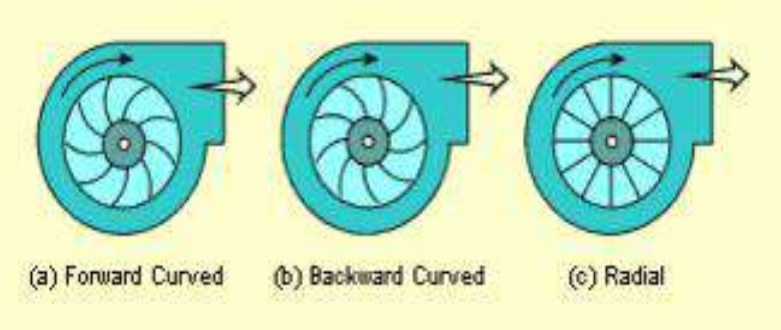
- AN AIR SCREW FAN OR AN AXIAL FLOW FAN PUSHES THE AIR FORWARD IN THE DIRECTION PARALLEL TO THE AXIS i.e. AXIALLY, WITHOUT CHANGING THE DIRECTION OF AIR CURRENT UNLIKE IN THE CENTRIFUGAL FAN.
- AS THE SHAFT AND THE BLADE ROTATE, THE AIR IS PUSHED FORWARD LIKE A FREE BOLT WITHIN A ROTATING NUT CONFINED TO ONE PLACE.
- THE BLADES OF THE ROTOR OF AN AIR-SCREW FAN, ARE SET AT AN ANGLE 10 TO 15 DEGREES TO THE PLANE OF ROTATION.
- THE w.g. DEVELOPED DEPENDS ON THE SPEED OF THE BLADE TIPS.
- AN AXIAL FLOW FAN CONSISTS OF A ROTOR CARRYING A NUMBER OF BLADES SOMEWHAT SIMILAR TO THOSE OF AN AEROPLANE PROPELLER AND REVOLVING WITHIN A CYLINDRICAL CASING.
- THE FAN IS FITTED WITH GUIDE BLADES AT THE OUTLET SO THAT THE MOTION IS PARTIALLY RESTORED TO AXIAL DIRECTION.
- THE CENTRAL PART OF THE ROTOR, FACING THE INCOMING AIR, IS PROVIDED WITH A NOSE SHAPED SHEET STEEL COVER OF FAIRING TO ENSURE STREAMLINE FLOW AT THE INLET.
- CLOSE TO THE GUIDE VANES IS PLACED A CONE SHAPED FAIRING, HELD IN POSITION BY SUPPORTS.
- THE RUNNER AND GUIDE VANES ARE MOUNTED WITHIN SHEET STEEL CYLINDRICAL CASHING, WITH SMALL CLEARANCE BETWEEN BLADES AND CASING.
- THE CASING IS FITTED WITH AN EXPANDING CHIMNEY
- THE AIR-SCREW FAN MAY BE A SMALLER SIZE OF ABOUT 50 CM DIA FOR AUXILIARY VENTILATION.
- LARGER OF SIZES OF 3m OR MORE DIA FOR MAIN VENTILATION.
- SPEED 180-3000 R.P.M.

02. CONSTRUCTION OF CENTRIFUGAL FANS :



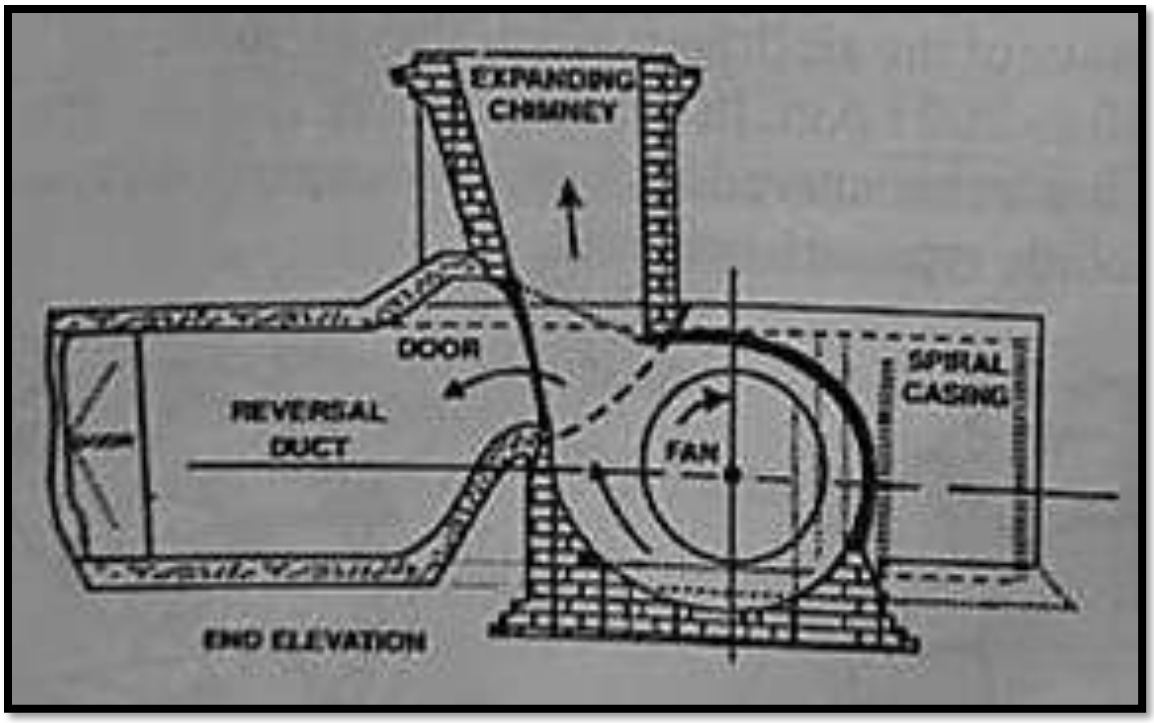
[WORKING PRINCIPLE OF CENTRIFUGAL FAN]





- A CENTRIFUGAL FAN ESSENTIALLY CONSISTS OF A WHEEL CARRYING BLADES OR VANES AT THE PERIPHERY. CONSIDER A PERTICLE OF AIR AT ‘A’ IN GIVEN FIG. WHEN THE BLADES MOVES WITH THE ROTATION OF FAN, IT TENDS TO DRIVE THE PARTICLE IN PARTICULAR CIRCULAR PATH TOWARDS ‘B’.
- THE PARTICLE HOW EVER, HAS INERTIA AND THEREFORE TRIES TO MOVE IN A STRAIGHT LINE IN THE DIRECTION ‘AC’. THE EFFECT OF TWO MOTIONS IS THAT IT FOLLOWS AN INTERMIDIATE PATH AND IS FINALLY THROWN CLEAR BEYOND THE TIP OF THE BLADE IN THE DIRECTION APPROX. TANGENTIAL TO THE CIRCUMFERENCE AS SHOWN BY THE ARROW ‘DE’.
- AS THE BLADES ACT SIMULTAENOUSLY ON ALL THE AIR IN CONTACT TO WITH THEM AND ARE DRIVING THE AIR BEYOND THE PERIPHERY DURING THE ROTATION, THERE IS A SUCTION EFFECT AT THE CENTRE OF THE FAN WHEEL ON WHERE AIR ENTERS TO TAKE PLACE OF THE AIR DRIVEN OUT OF THE PERIPHERY.
- THE SPPED OF THE FAN VARIES FROM **100-300rpm**. IN ACTUAL PRACTICE THE BLADES OF THE FAN ARE NOT EXACTLY RADIAL, BUT EITHER CURVED BACKWARD OR CURVED FORWARD, THROUGH THE BACKWARD CURVED BLADE TYPES ARE COMMON.

SIROCCO FAN :



- THIS IS THE COMMON TYPE OF CENTRIFUGAL FAN USED IN MANY OF OUR MINES. THE FAN WHEEL IS CYLINDRICAL HAVING 64 BLADES IN SINGLE INLET AND 128 BLADES IN A DOUBLE INTLET FAN. THE BLADES ARE NEARLY 160MM DEEP AND ARE CUP SHAPED [GIVEN FIG] SHOWS THE INSTALLATION OF A SIROCCO FAN.
- THE PURPOSE OF THE SPIRAL CASING IS TO ENCLOSE THE FAN WHEEL AND PREVENT RE-ENTRY OF THE DISCHARGED AIR. THE CROSS- SECTIONAL AREA OF THE SPIRAL CASING GRADUALLY INCREASES TO ACCOMMODATE THE PROGRESSIVE INCREASE IN THE QUANTITY OF AIR DISCHARGED BY THE FAN WHEEL.
- THE EVASSE WHICH IS A PASSAGE OF INCREASING CROSS-SECTION FOR THE AIR DISCHARGED BY THE FAN, IS PROVIDED TO REDUCE THE FINAL VELOCITY OF DISCHARGE TO A MINIMUM. THIS HELPS SMOOTH FLOW OF AIR AND SOME OF THE VELOCITY ENERGY IN IT IS TRANSFORMED INTO PRESSURE ENERGY.
- THE WATER GAUGE WHICH THE FAN MOTOR HAS TO DEVELOP IS, THEREFORE, REDUCED TO THAT EXTENT AND THE EXPENDITURE OF POWER IS ACCORDINGLY SAVED. A WELL DESIGNED EVASEE THUS INCREASES THE EFFICIENCY OF THE FAN AND REDUCES COST OF POWER FOR A GIVEN QUANTITY OF AIR.

CONCLUSION:

THE CONSTRUCTIONAL FEATURES OF AXIAL-FLOW FAN & CENTRIFUGAL FAN ARE STUDIED.

08.

DETERMINATION OF FAN CHARACTERISTIC CURVE.

AIM OF THE EXPERIMENT:

DETERMINATION OF FAN CHARACTERISTIC CURVE.

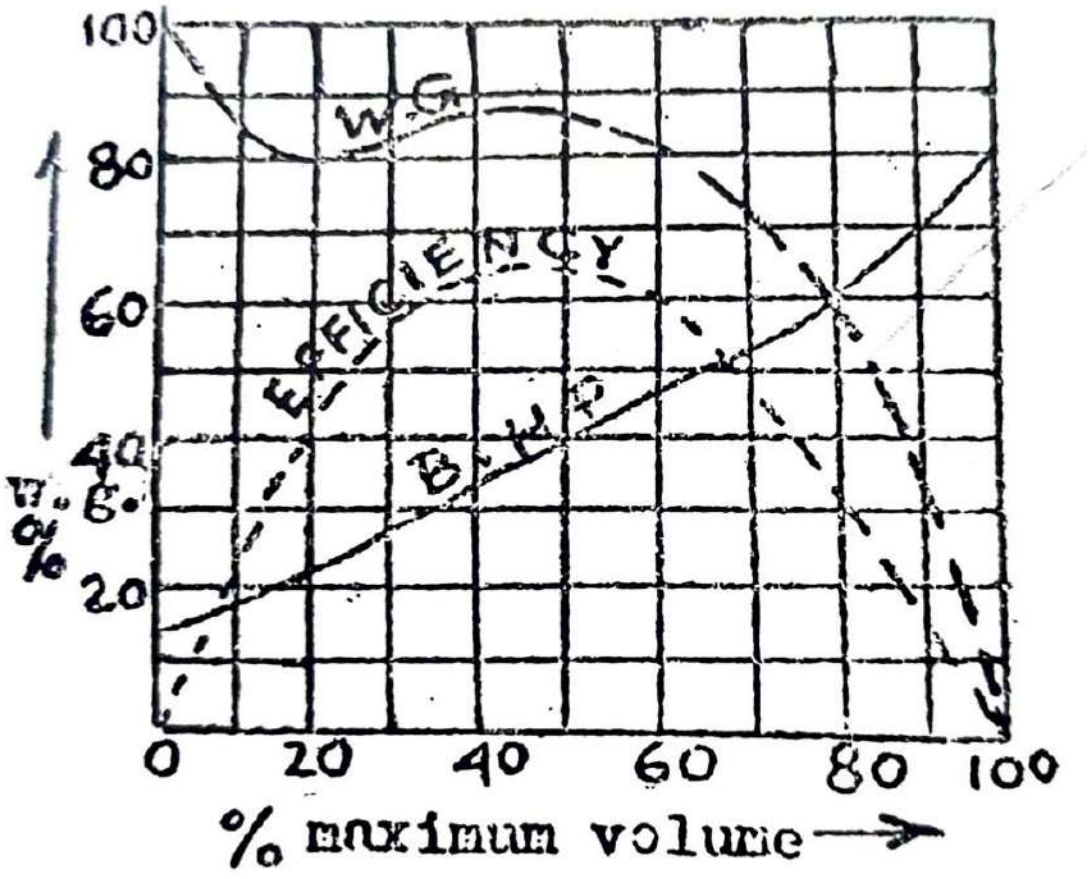
THEORY:

A “CHARACTERISTIC CURVE” IS A CURVE WHICH SHOW HOW THE MAGNITUDE OF ONE QUANTITY VARIES WITH THE CHANGES IN SOME OTHER RELATED QUANTITY. IT SHOWS THE VARIATION IN

[i] THE FAN DRIFT W.G.,
[ii] THE B.H.P. DEVELOPED BY THE DRIVING MOTOR
[iii] THE MECHANICAL EFFECIENCY OF THE FAN, ON THE BASIS OF VOLUMES .

THE FIGURES SHOW THE CHARACTERISRIC CURVES OF DIFFERENT TYPES OF FAN.

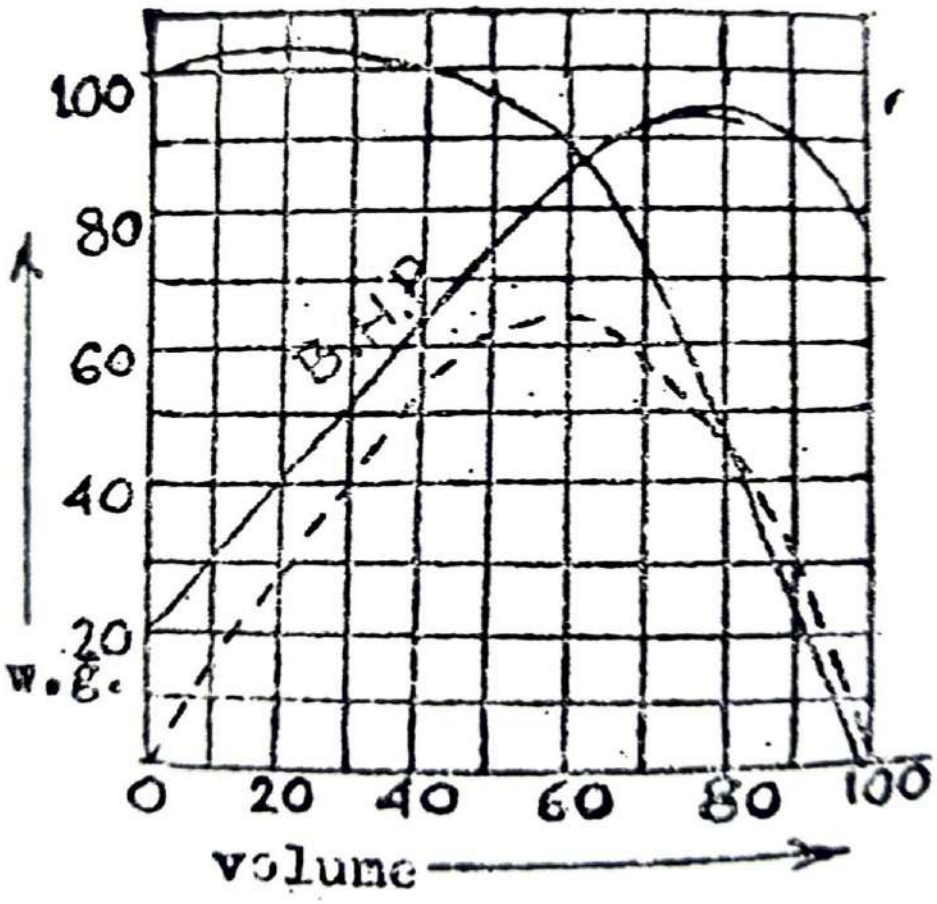
[i] FORWARD BLADED CENTRIFUGAL FAN:



Forward-Bladed

- THE PRESSURE OR VOLUME OR P-V CURVE, ALSO KNOWN AS W.G. CURVE AND ”FAN CHARACTERISTIC”, SHOWS THAT AFTER PRILIMINARY FALL AT LOW VOLUMES, THE W.G. REMAINS FAIRLY CONSTANT FOR AWIDE RANGE OF VOLUMES AND THEN FALL STEEPLY AS MAXIMUM VOLUME IS REACHED. THE WG. READING WOULD BE ZERO[0] WITH FAN WORKING ON OPEN AIR.
- THE POWER CHARACTERISTIC OR B.HP. CURVE OF THE FAN RISES STEADILY AT LOW VOLUMES BUT STEEPENS AT HIGH VOLUMES ,SO THAT IF FOR ANY REASON THE MINE RESISTANCE DEACREASES, I.E. IF THE VOLUME OF AIR INCREASES, THE MOTOR WILL BE OVERLOADED. HENCE, THE FAN IS UNSUITABLE WHEN THERE ARE CHANGES OF SUDDEN SHORT CIRCUITING OR SUDDEN CHANGES IN THE MINE RESISTANCE.
- THE MAXIMUN EFFECIENCY OF A FORWARD BLADED FAN IS ONLY ABOUT 72%, AND THIS OCCURS AT A CERTAIN POINT WHEN THE FAN IS OPERATING ON A FLAT PORTION OF W.G. CURVE. IT FOLLOWS THE SMALL CHANGES IN THE W.G. WILL CAUSE QUITE LARGE VARIATIONS IN VOLUME, POWER AND EFFECIENCY, A CONDITION WHICH IS UNDESIRABLE.

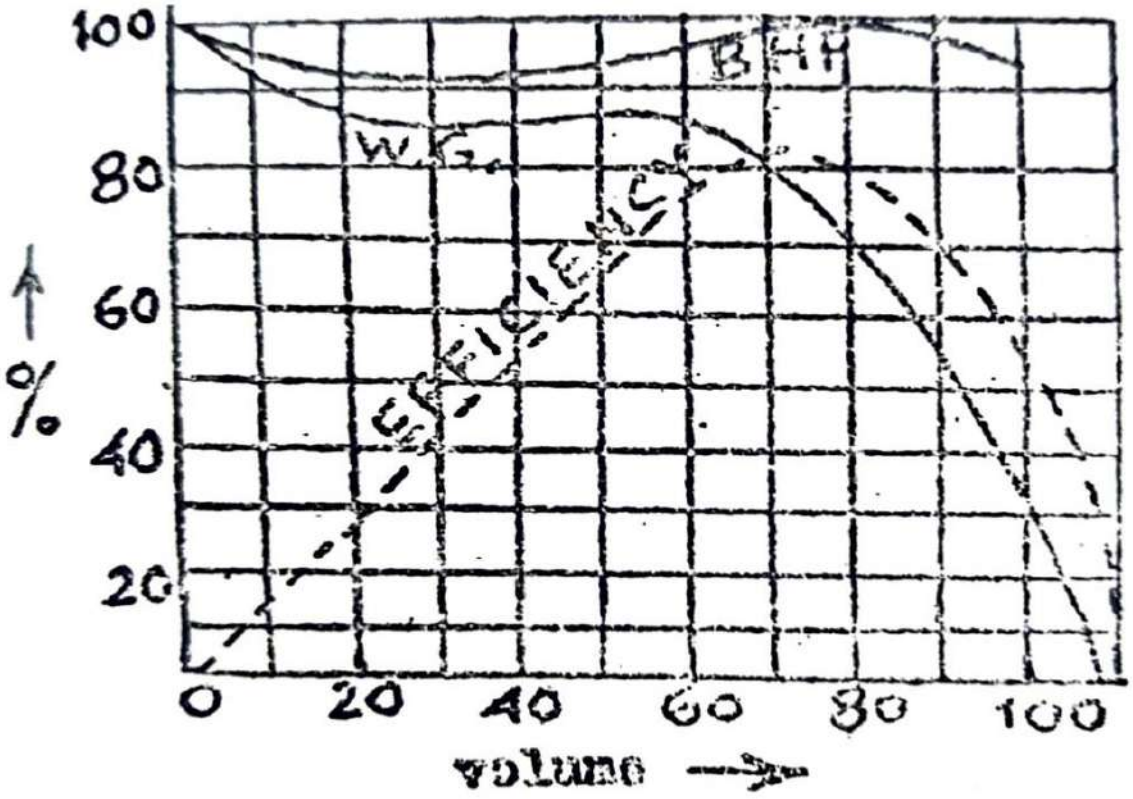
[ii] BACKWARD BLADED CENTRIFUGAL FAN:



Backward-Bladed

- A SET OF CURVES FOR A MODERN AEROFOIL BLADED CENTRIFUGAL IS SHOWN IN THE FIG.
- THW W.G. CURVES FALLS FAIRLY STEADILY FORM A MAXIMUM PRESSURE AT LOW VOLUME AT AND TO ZERO AT MAXIMUM VOLUME. THE FAN IS WORKING ON STEEPLY FALING PART OF THE W.G, CURVE AND CONSIDERABLE VARIATIONS IN PRESSURE WILL CAUSE COMPARATIVELY SMALL CHANGES IN THE VOLUME AND POWER AND SMALL REDUCTION IN EFFECIENCY.
- THE B.H.P CURVE IS ALMOST A RISING STRAIGHT LINE PASSING ABOVE THE ORIGIN TENDING TO FLATTEN AND THEN FALLING AS THE VOLUME INCREASES. IT SHOWS THAT POWER INCREASES WITH INCREASE OF VOLUME BUT AS THE MAXIMUM VOLUME IS APPROACHED, POWER BECOMES ALMOST CONSTANT AND THEN DECREASES. THUS, IT INDICATES THE "NON-OVERLOADING CHARACTERISTIC" OF THE FAN.
- THE EFFECIENCY CURVE SHOWS THAT THE MAXIMUM EFFECIENCY IS 85% IN THIS CASE, THE CURVE IS REASONABLE FLAT TOPPED AND A HIGH EFFECIENCY [SAY 80%] IS MAINTAINEDWITH VOLUMES OVER A WIDE RANGE. THE FAN IS THEREFORE SUITABLE TO A MINE IN WHICH THE RESISTANCE VARIES OVER A CONSIDERABLE WIDE RANGE.

[iii] FIXED-PITCH AXIAL-FLOW FAN:



Axial-Flow

- THE W.G. CURVE SHOWS THE MAXIMUM W.G. IS DEVELOEPED AT ZERO VOLUME, THERE AFTER FALLING A CONSIDERABLY AND RISING AGAIN, SUBSIQUENTLY FALLING RAPIDLY TO THE ZERO IN OPEN AIR WHEN THE VOLUME IS MAXIMUM WITH MINIMUM MINE RESISTANCE. TO LEFT OF 50% VOLUME, THE FAN WILL OPERATE IN A THROTTLED AND STALLED CONDITION. THE BEST OPERATING RANGE OF THE FAN LIES TO THE RIGHT WHERE THE FLOW CONDITIONS ARE STABLE. THE OPERATING POINT OF THE FAN AT MAXIMUM EFFECIENCY LIES ON THE STEEPLY FALLING PART OF THE CURVE.
- THE B.H.P. CURVE SHOWS THE MAXIMUM POWER IS DEVELOPED AT THE MAXIMUM EFFECIENCY AND DROPS ON EITHER SIDE. THE FAN IS THEREFORE SAID TO HAVE A NON-OVERLOADING CHARACTERISTIC.
- THE EFFECIENCY CURVE SHOWS THAT THE MAXIMUM EFFECIENCY IS 82% BUT A HIGH EFFECIENCY IS MAINTAINED OVER A LIMITED RANGE OF VOLUMES. AXIAL FLOW FANS FITTED WITH VARIABLE PITCH BLADES GREATLY EXTENDS THE RANGE OF DUTY OVER WHICH A HIGH EFFECIENCY IS MAINTAINED.

CONCLUSION:

DIFFERENT TYPES OF “FAN CHARACTERISTIC CURVE” ARE STUDIED.

09.

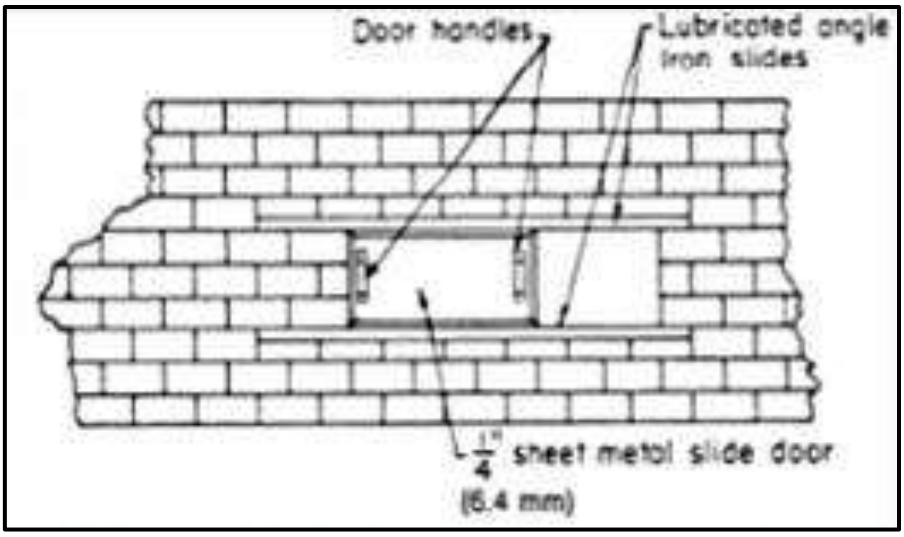
TO STUDY AND SKETCHING OF REGULATOR AND AIR-LOCKS

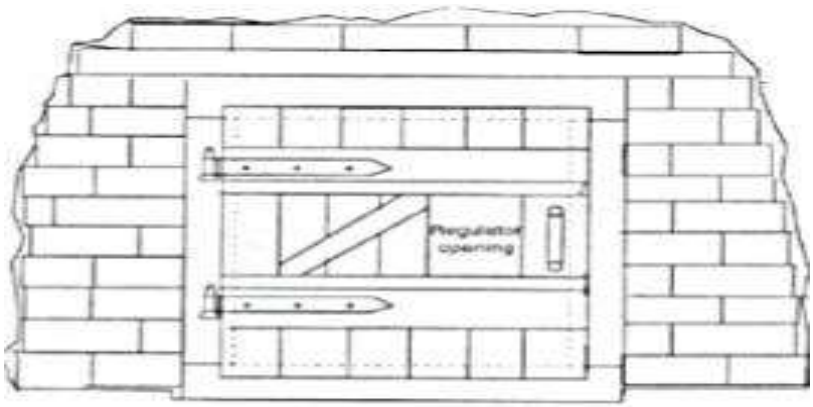
AIM OF THE EXPERIMENT:

TO STUDY AND SKETCHING OF REGULATOR AND AIR LOCK.

STUDY & SKETCHING:

01.REGULATOR:



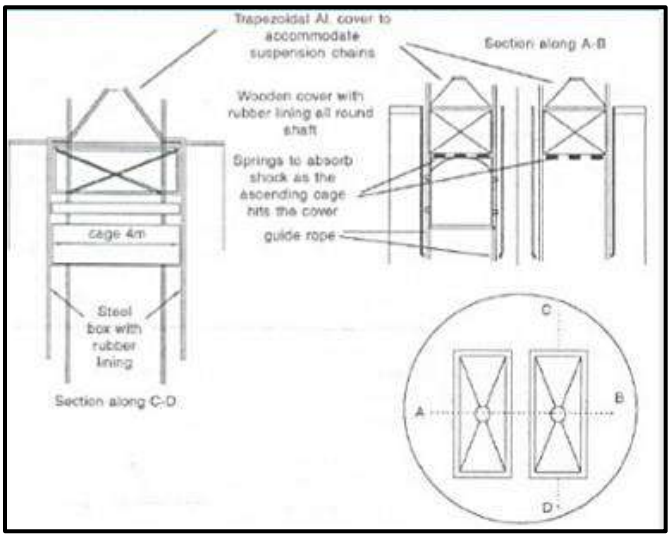


[REGULATOR]

- A REGULATOR IS A WINDOW OF ADJUSTABLE OPENING IN A BRICK STOPPING.
- THE SHUTTER OF THE REGULATOR CAN BE LOCK IN POSITION TO PREVENT TEMPERING BY WORKERS.

- INTRODUCTION OF REGULATOR IN A ROADWAY INCREASES THE RESISTANCE OF AIR CURRENT.
- THEREFORE THEY ARE USED ON THE RETURN CLOSE OF DISTRICT, WHEN VENTILATION WAS TO BE REDUCED AND FIXED IN A PLACE WHEN ALL THE AIR OF THE DISTRICT HAS TO BE PASSED.
- A REGULATOR CAN NOT BE PLACED ON HAULAGE ROAD.
- THE REGULATOR HAS THE EFFECT OF REDUCING THE AIR FLOW IN THE SPLIT AT THE SAME TIME INCREASE THE VOLUME OF AIR FLOWING IN THE UNREGULATED SPEED .
- IF THE A RETURN AIRWAY IS COMMON TO TWO DISTRICTS AND ONE OF THE DISTRICT HAS TO BE REGULATED,THE REGULATOR MUST BE PLACED IN THE INTAKE AIRWAY OF THE SPLIT TO BE REGULATED.
- THE REGULATOR IS FITTED IN A STOPPING AND SHOULD THEREFORE FITTED IN A VENTILATION DOOR.

02. AIR LOCK:



(GUILLOTINE TYPE OF AIR-LOCK DOORS AT PIT TOP) **(GERMAN TYPE AIR-LOCK DOORS AT PIT TOP)**

- THE AIR LOCKS CONSISTS OF ONLY COVERING AT THE TOP OF THE SHAFT WHICH IS LIFTED UP BY THE OPENING CAGE.
- IN THIS DESIGN HEAVY LEAKAGE OF AIR AS MUCH AS 30% OF AIR CIRCULATED BY THE MECHANICAL VENTILATOR TAKES PLACE WHEN CAGE IS RESTING AT THE PIT TOP.
- SUCH DESIGN OF AIR LOCK THEREFORE CANNOT BE CONSIDERED AS SUITABLE.

<u>THUS SUITABLE AIR LOCKS ARE:</u>

I. STANDARD TYPE AIR LOCK, THE TOP OF THE SHAFT AND ENCLOSING PART OF THE TOP

II. *GULLOTINE TYPE OF AIR LOCK WHICH ARE PROVIDED IN VERTICAL STEEL BOX FITTED WITHIN THE HEAD GEAR.*

III. *GERMAN TYPE AIR LOCKS BELOW BANKING LEVEL.*

- COMPARE TO THE OTHER AIR LOCK GERMAN TYPE AIR LOCK IS NOT CONSTRUCTED ABOVE THE BANKING LEVEL.
- THE PIT TOP IS COMPLETELY COVERED WITH STEEL JOISTS AND THICK WOODEN PLANKS EXCEPT FOR TWO RECTANGULAR OPENING FOR PACKAGE OF THE CAGES.
- THE PIT TOP BANKING IS FLUSH WITH THE PIT TOP COVERING AND THE SPACE BETWEEN THE SHAFT WALLS AND PIT TOP WOODEN COVERING IS SEALED BY RUBBER LININGS.
- A TRAPEZOIDAL SHAPE COVERING OF ALLUMINIUM RESTS ON THE PIT TOP COVERING THE SHAFT MOUTH, WHEN THE CAGE IS START MOVING TOWARDS THE SHAFT BOTTOM .
- IT CAN BE LIFTED BY THE ASCENDING CAGE.
- THE SMALL OPENING AT THE TOP OF THE TRAPEZOIDAL ALLUMINIUM BOX IS COVEREED BY THE SEPARATE WOODEN LID WITH SMALL HOLE FOR THE WINDING ROPE.
- WHEN ASCENDING CAGE IS APPROACHES TO THE BANKING LEVEL THE SAFETY HOOK FIRST LIFTS THE WOODEN LID OVER THE ALLUMINIUM BOXING WHICH IS ITSELF LIFTED BY THE ASCENDING CAGE LATER.
- THE SPACE OF GUIDE ROPES BETWEEN ADJACENT CAGE IS ALSO COVERED WITH WOODEN FRAME LINED RUBBER SHEEST AND SMALL OPENING ARE PROVIDED FOR THE GUIDED ROPE.
- THE RUBBER LINING AT VARIOUS OPENINGS IS PROVIDED TO PREVENT LEAKAGE OF AIR.

CONCLUSION:

FROM THE ABOVE EXPERIMENT WE HAVE LEARNT THE SKETCHING CONSTRUCTION AND OPERATION OF AIR LOCKS & REGUATOR.

10.

STUDY AND USE OF DIGITAL ANEMOMETER

AIM OF THE EXPERIMENT :

TO STUDY AND USE DIGITAL ANEMOMETER .

THEORY :

- THE ANEMOMETER INDICATES AIR VELOCITY IN METERS PER SECOND, m/sec AT ANY POINT OF OBSERVATION.
- TO FIND THE AIR VELOCITY IN MINE ROADWAY BY ANEMOMETER, READING ARE TAKEN A NUMBER OF EQUAL SPACE POINTS OVER THE CROSS-SECTION AND THE AVERAGE RESULT IS CALCULATED.
- THE INSTRUMENT CONSISTS OF AN ALLUMINIUM OR FIBRE VANE MOUNTAINED IN A ZWALLED BEARING IN A CASE AND A DIGITAL DISPLAY METER IS PROVIDED FOR VELOCITY READING.
- IT HAS A SENSING HEAD AND A DISPLAY UNIT.
- THE VELOCITY CAN BE MEASURED IN **Km/h, ft/min or m/s.**

DIGITAL ANEMOMETER

USES :

- APART FROM MINE VENTILATION SURVEY, SOMEONE WITH A SAILBOAT WHO WANTS TO MEASURE THE WIND SPEED BEFORE THEY GO SAILING OR WINDSPEED AND DIRECTION DURING SAILING.
- HVAC(**heating, ventilation, and air conditioning)** INSTALLATION AND REPAIR PERSONNEL WANTING A SCIENTIFIC WAY TO MEASURE AIRFLOW IN AN AIR CONDITIONING, HEATING OR VENTILATION UNIT FOR HOME INSPECTORS AND FACILITY MANAGERS.
- HUNTERS, SPORTS SHOOTERS/TARGET SHOOTERS AND ARCHERS (AS WELL AS THOSE IN THE MILITARY) WANTING A QUICK WAY TO CHECK GROUND CONDITIONS OR WIND DIRECTION AND SPEED.
- PARAGLIDERS WHO WANTS TO CHECK CONDITIONS BEFORE LAUNCHING.

CONCLUSION:

DIGITAL ANEMOMETER IS STUDIED WITH ITS USES .

11.

MEASURMENT OF QUANTITY OF AIR FLOW BY DIGITAL ANEMOMETER

AIM OF THE EXPERIMENT:

MEASURMENT OF QUANTITY OF AIR FLOW BY DIGITAL ANEMOMETER.

INSTRUMENT REQUIRED:

- DIGITAL ANEMOMETER

THEORY:

- THE ANEMOMETER INDICATES AIR VELOCITY IN METERS PER SECOND, m/sec AT ANY POINT OF OBSERVATION.
- TO FIND THE AIR VELOCITY IN MINE ROADWAY BY ANEMOMETER, READING ARE TAKEN A NO. OF EQUAL SPACE POINT OVER THE CROSS-SECTION AND THE AVERAGE RESULT IS CALCULATED.
- THE INSTRUMENT CONSISTS OF AN ALLUMINIUM OR FIBRE VANE MOUNTAINED IN A ZWALLED BEARING IN A CASE AND A DIGITAL DISPLAY METER IS PROVIDED FOR VELOCITY READING.
- IT HAS A SENSING HEAD AND A DISPLAY UNIT.
- THE VELOCITY CAN BE MEASURED IN **Km/h, ft/min or m/s or KNOT.**

PROCEDURE:

- WE CAN HOLD THE DEVICE (SENSING HEAD) IN THE AIRWAY/ ROADWAY, WHERE AIR VELOCITY IS TO BE DETECTED. THE VANE ROTATES, & THE DEFLECTION IS PROPORTIONAL TO THE AIR VELOCITY AND THE RESULT IS SHOWN BY THE INDICATOR (DISPLAY UNIT) ON THE SCALE OF m/sec OR km/hr OR ft/min OR knots.
- SIMILAR WAY WE CAN TAKE READING IN NUMBER OF POINTS OF THE MINE ROADWAY AND THE FINAL RESULT WILL BE THE AVERAGE OF ALL RESULTS.

OBSERVATION:

THE INSTRUMENT ANEMOMETER IS TO BE HELD IN THE DETERMINED LOCATIONS (POINTS) FOR MEASUREMENT OF AIR VELOCITY. A NUMBER OF OBSERVATIONS ARE TAKEN.

OVSERVATION 1. _____*m/s*

OVSERVATION 2. _____*m/s*

OVSERVATION 3. _____ *m/s*

OVSERVATION 4. _____ *m/s*

OVSERVATION 5. _____ *m/s*

OVSERVATION 6. _____ *m/s*

OVSERVATION 7. _____ *m/s*

OVSERVATION 8. _____ *m/s*

OVSERVATION 9. _____ *m/s*

OVSERVATION 10. _____ *m/s*

_____

AVERAGE VELOCITY = _____***m/s***

CONCLUSION:

FROM THE ABOVE EXPERIMENT THE AVERAGE AIR VELOCITY IN THE DESIRED LOCATION (ROADWAY/AIRWAY) IS _____ **m/sec.**