Introduction of Products

INDOOR USE ELECTRIC AIR FILTER "FUJI LUFT FILTER"

I. PREFACE

Recently with the progress of civilization considerable quantity of dusts is discharged into atmosphere, and especially in large cities and industrial areas it becomes problemable that the dust excert bad influences upon man's health, quality of goods, maintenance of precision machines etc.

Size of dust floating in the atmosphere covers large range from 0.1 μ to over 10 μ in their diameters, but the dusts smaller than 10 μ are hardly collected with former mechanical dust collector.

The electric air filter which has been developed by our company for several years for the intension of air cleaning of offices, department stores, banks, display rooms, working rooms, laboratories etc. has high reputation among many quarters. With the consideration of increase of demand we have further improved it and completed two types of new series air filters, i. e., cabinet type Luft Filter for small room air cleaning and framework type Luft Filter for large space air cleaning such as of large buildings, and outline of them is described in the following columns.

II. DUST-COLLECTING UNIT

Dust-collecting principle of Luft Filter is of electric precipitating method and is fundamentally equal to that of cottrell precipitator, but the latter generates harmful gases such as ozone, nitrogen peroxide etc. which still contaminate fresh air, while Luft Filter has 2-steps charging method having such a construction as consisting of ionizing part in which ions are generated and attracted to dust particles and dust-collecting part in which charged dust particles are caught, thus eliminating the generation of harmful gases. Furthermore, in order to raise the dust-collecting efficiency dust-collecting unit of Fuji Luft Filter is devided into two parts, i. e., primary dust-collecting part installed at flow-in side of air and secondary dast-collecting part installed at flow-out side. The former is for rough collection of dusts and the latter is for fine collection.

On high tension electrodes about 12 kV of positive polarity voltage is applied and as the gaps between electrodes is made small in case of secondary dust-collecting part, electric field density is stronger,

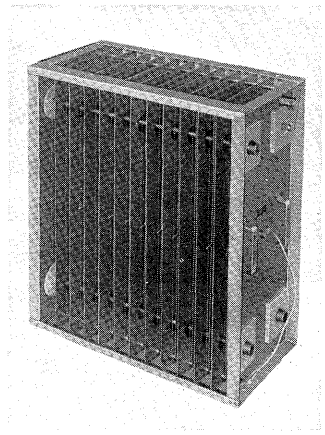

Fig. 1. Outer view of precipitator unit (first precipitating part)

which produces high dust-collecting efficiency. Consequently, it has such merits as high efficiency because only small quantity of dusts is again distributed out of collected dusts and suitable washing because the dusts are not collected only around the flow-in part but they are uniformly collected on the whole electrode. Fig. 1 shows the outside view of primary dust-collecting part.

As for air flow for each dust collecting unit, 25 m^3/min and 40 m^3/min in case of cabinet type and 40 m^3/min and 50 m^3/min in case of framework type are manufactured. They are suitablly combined according to the total required air flow.

Dust-collecting unit is made of corrosion-resistant aluminum plate because of property of corrosion-resisting and light weight, and is easy to handle because even the heaviest one of dust-collecting unit only weighs about 25 kg.

III. STRUCTURE AND SPECIFICATION OF LUFT FILTER

1. Cabinet Type Luft Filter

Cabinet type Luft Filter is designed to be used for the small room having required air flow of less than 160 m^3/min, has an elegant outside cabinet as shown in Fig. 2, and is provided with washing device and adhesive- spaying device on its flow-in side as well as dust-collecting units. In the air duct connecting section it is provided with flow-adjusting net

at the flow-in side and with drip-proof filter at the flow-out side to prevent the washing drop coming into the duct.

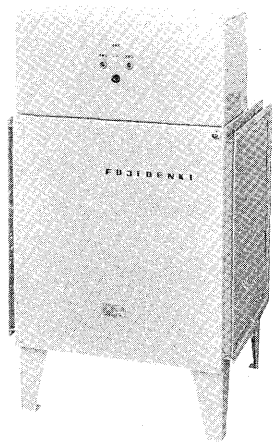

Fig. 2. Outer view of type LFC 110E Luft Filter

Power source apparatus is contained in a compact cabinet as will be described in following column and generally mounted on the main cabinet, but it can also be mounted separately on the floor or wall.

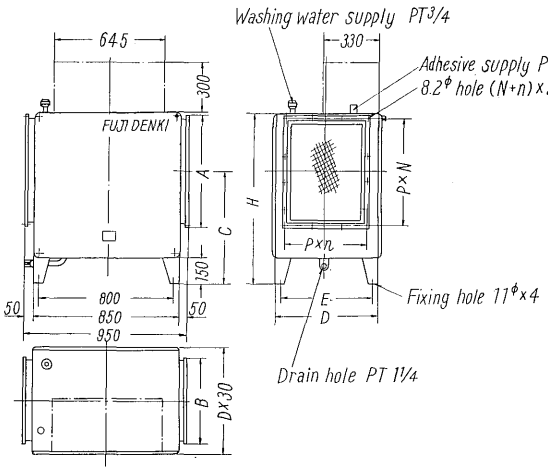

Fig. 3. Outline dimensions of cabinet type Luft Filter

There are 6 kinds of cabinet type Luft Filter as standard as listed in table 1, outside dimensions of which are shown in Fig. 3.

2. Framework type Luft Filter

Framework type Luft Filter is suitable for air cleaning of large buildings, factories and other large spaces. Luft Filter for building is generally required to have an extremely large air flow, while it is also required to be small size especially in its floor space because it is installed in small machine room of building. Since dust-collecting unit of Fuji Luft Filter is made small as mentioned above and combination of two kinds of $40\,m^3$/min, and $50\,m^3$/min capacity unit makes it possible to produce the various capacities of Luft Filter with fine steps, suitable selection of capacity to each required air flow can be easily done.

The framework type Luft Filter has such a construction that inside the frame constructed in the shape of hive dust-collecting units are inserted, thus making it easy to take out the each unit on inspection. It has also merit of easy installation at site, which saves installtion work.

Power source is supplied from a power source apparatus having current capacity suitable for air flow capacity. Only one high tension lead wire is needed between the main cabinet and the power source cabinet.

Washing device is installed at the flow-in side and is generally mounted in the duct separated from frame itself. In the case of large Luft Filter it is difficult to wash the whole units at the same time because of limitation of washing water quantity. In this case each unit is provided with solenoid valve and wash-control panel is separately supplied to make such a wash-control that the solenoid valves are automatically changed over by time relays in order from up to down. Duct is easily connected to the frange on cabinet. As in the case of cabinet type, flow-adjusting net is mounted at the flow-in side and drip-proof filter at the flow-out side. When frame is installed, drainage waterway provided with float valve on its end to prevent bad smell from drainage must be settled.

Type	LFC 101 E	LFC 110 E	LFC 111 E	LFC 210 E	LFC 211 E	LFC 220 E
A	660	660	660	1280	1280	1280
B	420	580	950	580	950	1110
C	650	650	650	960	960	960
D	440	600	980	600	980	1147
E	390	550	937	550	937	1097
H	1000	1000	1000	1620	1620	1620
P	212	212	212	210	210	210
N	3	3	3	6	6	6
P	132	185	185	185	185	2176
n	3	3	3	3	5	5

(dimensions in mm)

IV. FEATURES AND SPECIFICATION OF LUFT FILTER POWER SOURCE

Since the same voltage is applied on the primary and secondary dust-collecting parts as a power source of Luft Filter, simple connection is available as shown in Fig. 4. One of the features of this power source is adopting highly efficient Fuji selenium rectifier instead of electronic tubes so far used. For this reason life becomes semi-permanent, maintenance easy, heater wiring unnecessary, which causes less power consumption to such an extent as less than 0.7 w for 1 m³/min. Another feature of power source is adopting a current-limiting reactor by which primary current is instantaneously eliminated when arc flash-over occurs caused by invasion of something like an extraordinary large dust and at the instant when the cause of flash-over is removed normal working condition can be automatically regained, that is, operation is stabilized by adopting the current limiting reactor.

Operating condition can be sufficiently superuised with only two neon lamps, i. e., pilot lamp for power source indication and signal lamp for short-circuit indication. When the short-circult signal lamp lights for a while, it means the short-circuit of high tension side caused by invasion of large dust or some mechanical trouble. At this time operation must be stopped and inspection be carried out.

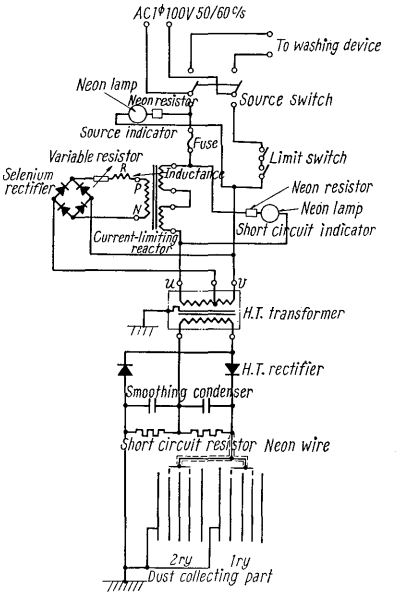

Fig. 4. Connection diagram of Luft Filter

Table 1. Specification of cabinet type Luft Filter

Spec. \ Type	LFC 101 E		LFC 110 E		LFC 111 E		LFC 210 E		LFC 211 E		LFC 220 E	
Air flow (m³/min)	rated 25	max. 30	rated 40	max. 48	rated 65	max. 78	rated 80	max. 96	rated 130	max. 156	rated 160	max. 192
Dast-collecting efficiency (%)	90	85	90	85	90	85	90	85	90	85	90	85
Wind loss (mmAg)	5	7	5	7	5	7	5	7	5	7	5	7
Avaialble mininum dust (μ)	0.1		0.1		0.1		0.1		0.1		0.1	
Power source (AC)	100V 50/60 c/s		100V 50/60 c/s		100V 50/60 c/s		100V 50/60 c/s		100V 50/60 c/s		100V 50/60 c/s	
Power consumption (W)	17		25		42		50		84		100	
Suitable room space (m³)	under 500		under 800		under 1,300		under 1,600		under 2,600		under 3,200	
Airflow direction	horizontal right or left		horizontal right or left		horizontal right or left		horizontal right or left		horizontal right or left		horizontal right or left	
Washing water quantitiy (*l*/time)	35		50		85		100		170		200	
Washing time (min/time)	5		5		5		5		5		5	
Washing water pressure (kg/cm²)	over 2		over 2		over 2		over 2		over 2		over 2	
Amount of adhesive oil (*l*/time)	over 0.5		over 0.5		over 1.0		over 1.0		over 1.5		over 2.0	
Power source weight (kg)	50		50		50		50		50		50	
Cabinet weight (kg)	80		100		150		180		240		300	

An example of type indication

L F C 2 1 1 E

- E ····· Improvement mark
- 1 ····· Number of 25 m³/min, unit
- 1 ····· Number of 40 m³/min, unit
- 2 ····· Number of dust-collecting unit stack
- LFC ····· Cabinet type Luft Filter

Table 2. Specification of frame work type Luft Filter

(Unit : m³/min)

No. of unit 40 (m³/min)	No. of unit 50 (m³/min)	Height (mm) / width (mm)	2 stage	3 stage	4 stage	5 stage	6 stage	7 stage	8 stage
			1340	1960	2680	3300	3920	4640	5260
2	0	1200	160	240					
1	1	1320	180	270					
0	2	1440	200	300					
3	0	1750	240	360					
2	1	1870		390	520				
1	2	1990		420	560				
0	3	2110		450	600				
4	0	2300		480	640	800			
3	1	2420		510	680	850			
2	2	2540		540	720	900			
1	3	2660			760	950			
0	4	2780			800	1000	1200		
4	1	2970			840	1050	1260		
3	2	3090			880	1100	1320		
2	3	3210			920	1150	1380		
1	4	3330			960	1200	1440	1680	
0	5	3450			1020	1250	1500	1750	
4	2	3740				1300	1560	1820	
3	3	3860				1350	1620	1890	
2	4	3980				1400	1680	1960	2280
1	5	4100				1450	1740	2030	2030
0	6	4220				1500	1800	2100	2400
4	3	4410					1860	2170	2480
3	4	4530					1920	2240	2560
2	5	4650					1980	2310	2640
1	6	4770					2040	2380	2720
0	7	4890					2100	2450	2800
4	4	5080					2160	2520	2880
3	5	5200						2590	2960
2	6	5320						2660	3040
1	7	5440						2730	3120
0	8	5560						2800	3200

1. Air flow in the table shows that at the efficiency more than 90 %. If the efficiency of more than 85 % is allowed, air flow becomes 120 % of the above value.
2. The above table only covers the combinations of units within the range of width to height of flange, $0.7 \leqq W/H \leqq 1.3$. Inside the thick line means the range, $0.8 < W/H < 1.2$.
   The combiniations other than the above range are non-standard, but can be manufactured.
3. An example of type indication

LFW 8 3 4 E
- E ..... Improvement mark
- 4 ..... Number of 50 m³/min, unit
- 3 ..... Number of 40 m³/min, unit
- 8 ..... Number of dust-collecting unit stack
- LFW ..... Framework type Luft Filter

4. An example of type selection
   For the air flow of 2000 m³/min., either of LFW 834 E or LFW 744 is suitable, but one of them is selected in accordance with installing condition.

Fig. 5 shows specification and outline dimensions of power source apparatus. As for mounting method, type A of the figure is mounted on the cabinet or wall, type B is on the floor or wall and type C is on the floor, as standard.

V. PROTECTION AGAINST HIGH VOLTAGE

Since Luft Filters are widely used in various accessible places though it has charged part with high voltage approximately 12 kV, ample consideration has been paid on its protection against high voltage. That is, cabinet type Luft Filter is provided with a safety screw and a short-circuit switch on its cover. The cover cannot be opened untill electric circuit is disconnected by means of a limit switch interlocked with the safety screw, and the short-circuit switch operates to make the high tension electrode grounded just when the cover is taken off, which assures safety and removes fear of danger on handling. In the case of framework type Luft Filter the door of duct is provided with a limit switch which disconnect automatically the main circuit when door is opened, and furthermore another switch is opened to protect against fault operation of interlock. Inside the duct it is also provided with grounding rod with which high tension electrode is grounded before touching the electrode, so that handling can be done with high safety.

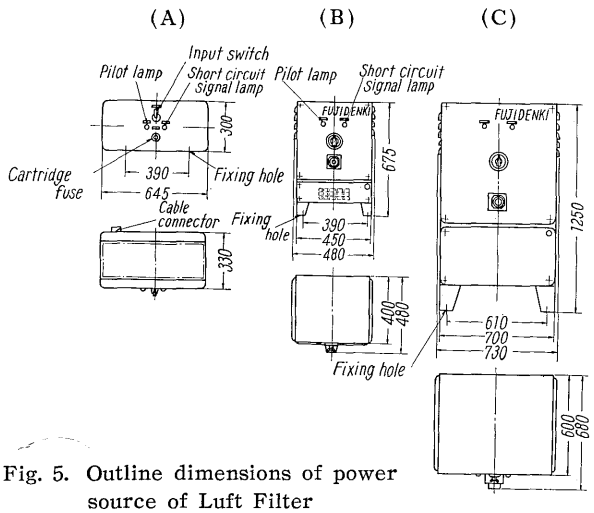

Fig. 5. Outline dimensions of power source of Luft Filter

VI. EFFICIENCY

Efficiency in this case denotes the percentage of dust quantity removed with Luft Filter to the total dust quantity passed through Luft Filter and is the most important figure to represent the ability of air filter.

There are various methods to measure the efficiency of air filter such as weight method, counting method, contamination method etc. of which we have adopted the dust spot test method approved by the U. S. Bureau of Standards, the most reliable method in these days. This is the method comparing optically the contamination of air at flow-in side and at flow-out side on a filter paper. Fig. 6 shows result of our Luft Filter measured by the dust spot tester method which coincides fully with the result of calculation.

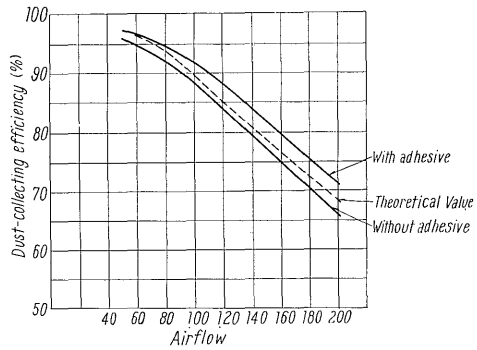

Fig. 6. Efficiency curve of Luft Filter

Luft Filter has the efficiency of more than 90 % at the rated air flow, but it changes as shown in Fig. 6 when Luft Filter is used at other than rated air flow. Also, after long operation dusts accumulate on dust-collecting electrode and become liable to distribute again, which lower the efficiency. In such a case washing is necessary. Interval of washing is a half month to one month in general service condition and a week to two weeks in heavy dust condition.

Type	capacity of DC current	Capacity of LuftFilter	Outline diagram	Type of rectifier
I	3 mA	25~ 80 m³/min	Fig. A	Fuji rod type selenium rectifier
II	6 mA	80~ 160 m³/min	Fig. A	〃
III	30 mA	160~ 800 m³/min	Fig. B	Fuji H.T. ring type (oil-immersed)
IV	50 mA	800~1300 m³/min	Fig. C	Fuji radiator type (oil-immersed)
V	100 mA	1300~2600 m³/min	Fig. C	〃
VI	160 mA	2600~4200 m³/min	Fig. C	〃

VII. CONCLUSION

Outline of Fuji Luft Filter is described in the forgoing column and principal features can be summarized as follows.

1. No matter what characters small dusts have, Luft Filter has high dust-collecting efficiency.
2. By adopting 2-steps dust-collecting system dust-collecting unit can be made small.
3. Since the power source is provided with a current-limiting reactor and a selenium rectifier, stable operation, easy maintenance and semi-permanent life is obtained.
4. Power consumption is very small, causing less maintenance fee.
5. Double or tripple protection against high voltage makes it quite safe.

In this article only the outline of Fuji Luft Filter is introduced, and we wish it will serve good reference to know the features of Fuji Luft Filter and to use air filters to the customer.

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