Fabric Filter Information

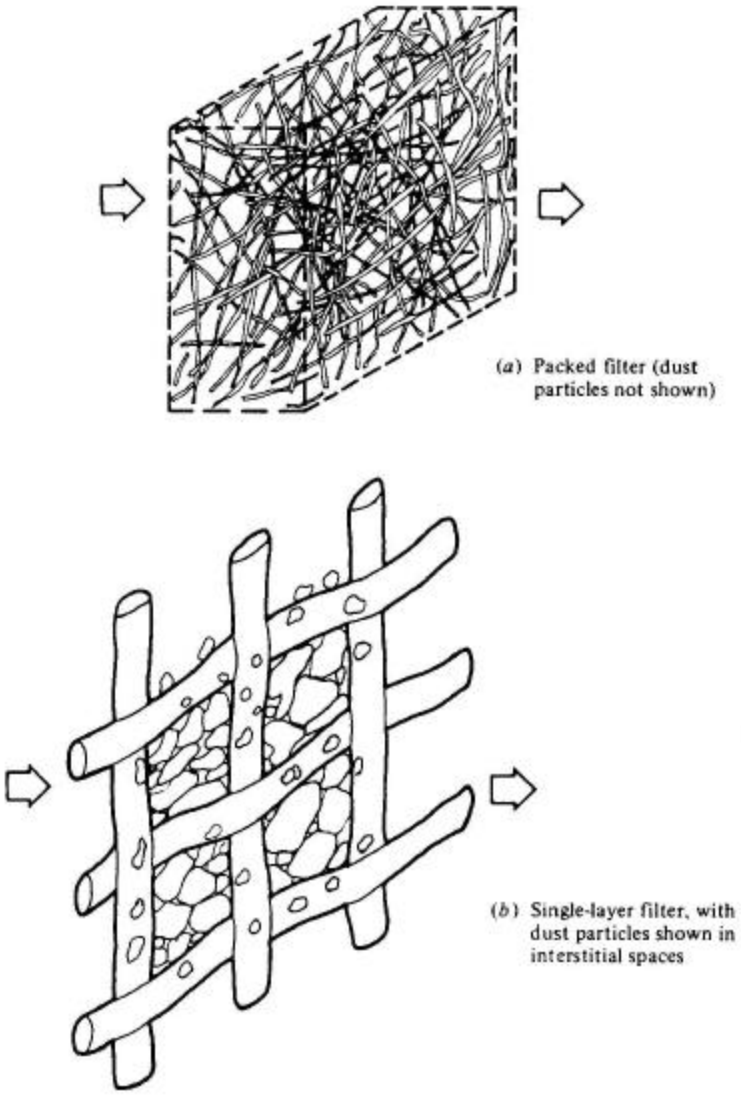
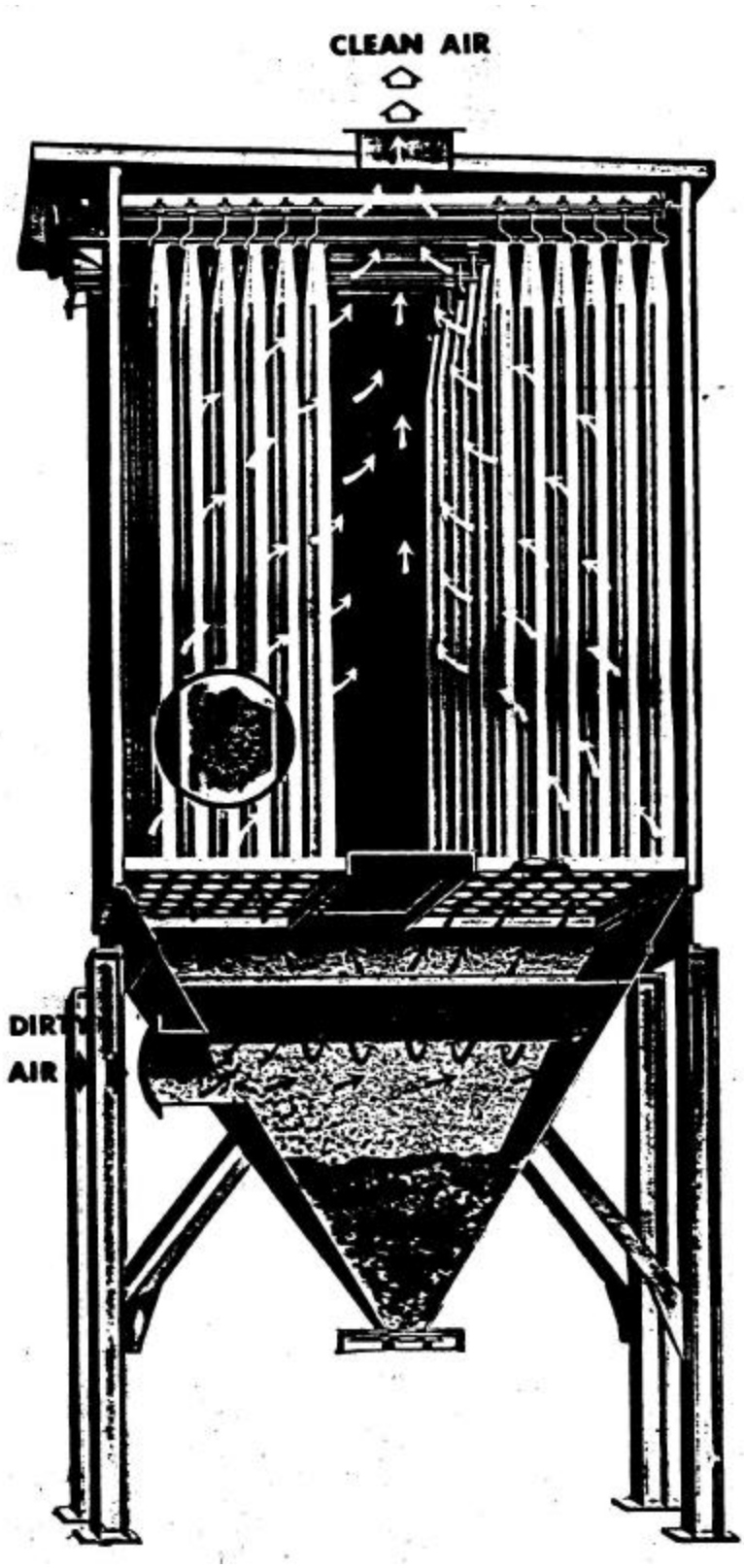
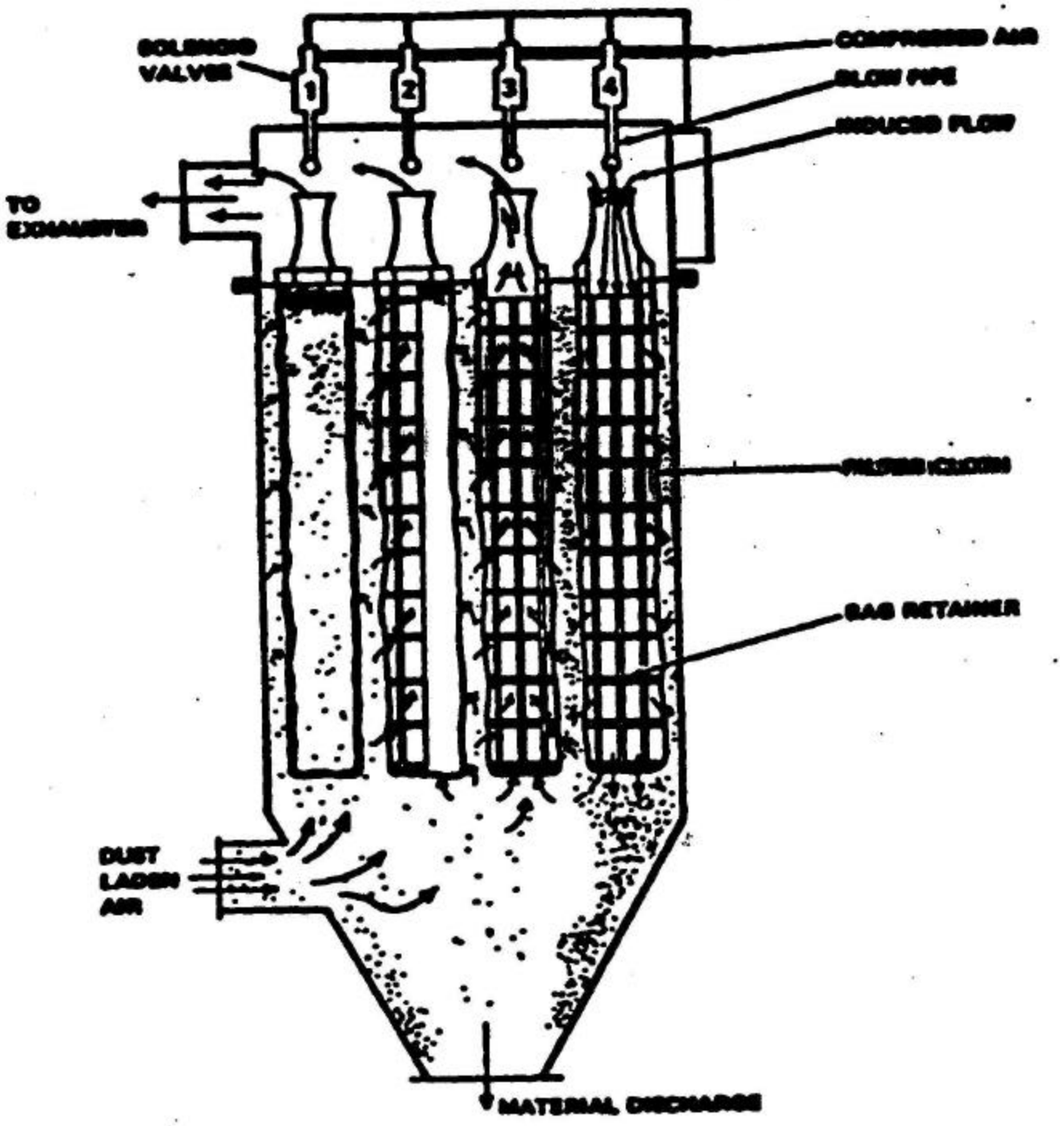


FIGURE 10-1
Filter element in packed and single-layer filters.

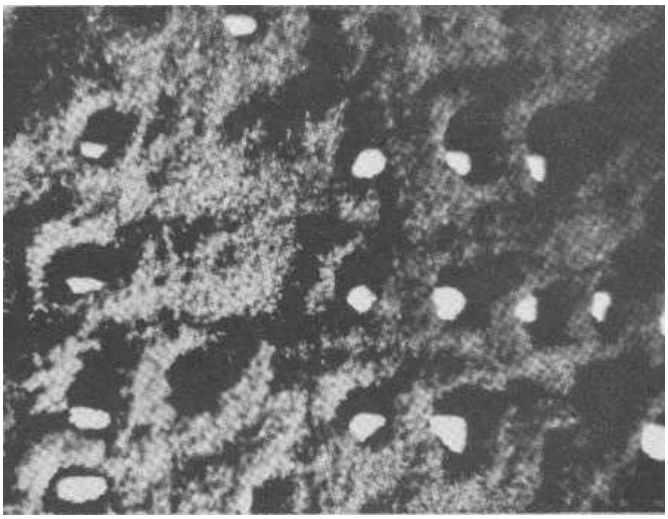
Whereas media filters collect particles within the depth of the filter (top picture) fabric filters develop a dust deposit on the surface of the fabric. Previously collected dust acts as a filter for newly-arriving particles.



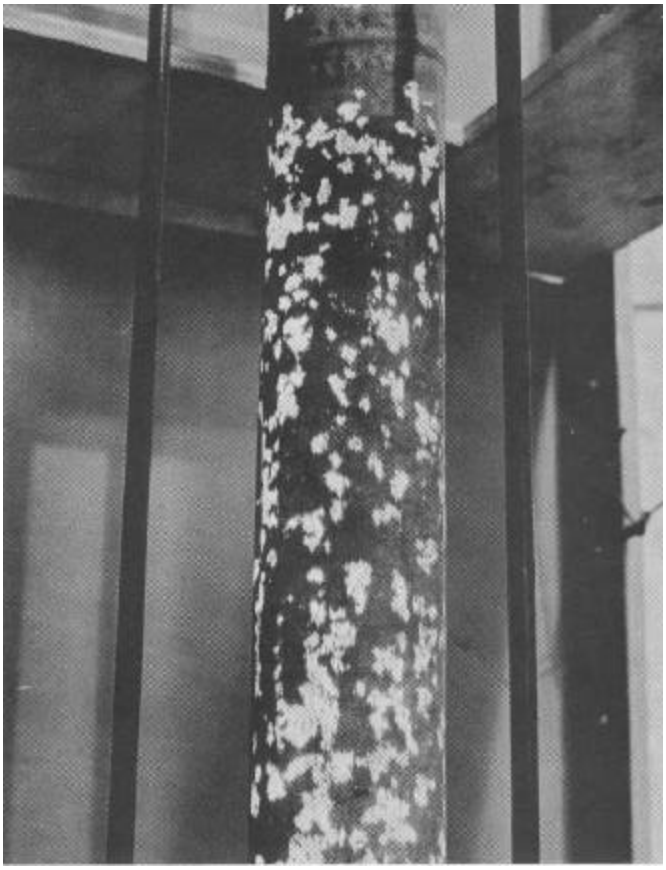
Fabric filter cleaned by reverse air and shaking the bags.



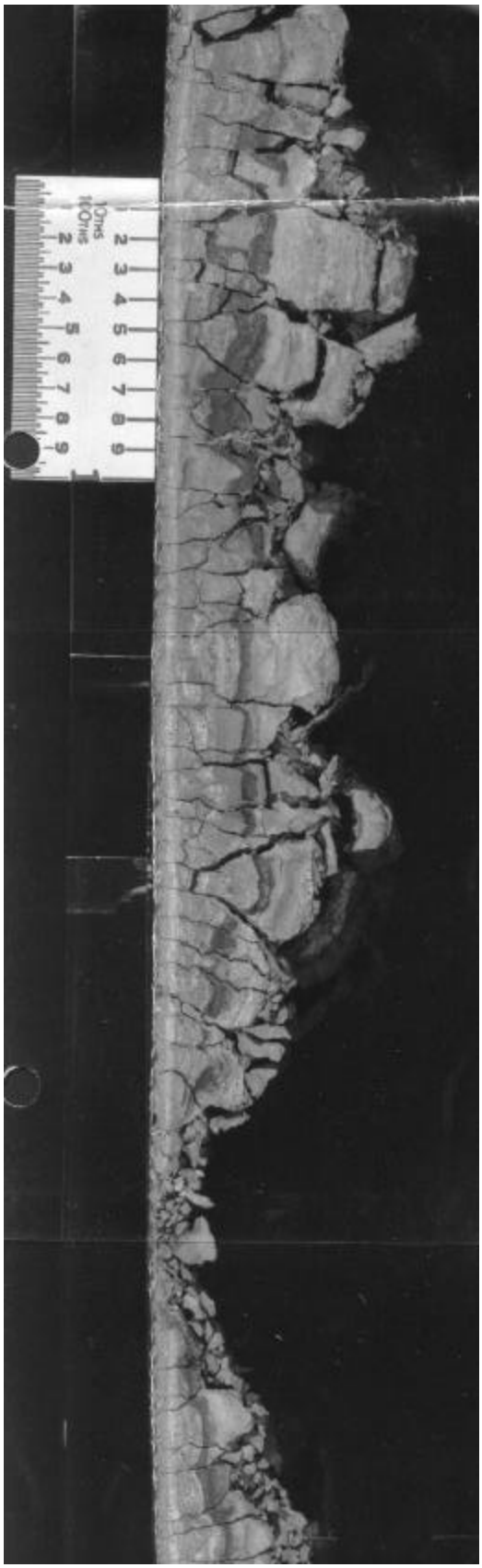
Pulse-jet filter. This fabric filter cleaned by a pulse of compressed air at the top of each bag.



Shaker or reverse-air cleaned filters can let particles pass through if pinholes form in the dust deposit. This photograph shows pinholes that have formed at the intersections of yarns in the woven fabric.



This photograph was produced by putting a fluorescent light inside a bag cleaned by reverse air and shaking. The photo shows that the bag has not been cleaned uniformly. Dust has come away from the bag in some areas, but remains on the bag in other areas.



This photograph shows the dust deposit on the interior of a woven fabric bag that was used in a fabric filter located at a coal-fired power plant. To make the photograph, a circular slice was cut from it, perpendicular to its long axis. The slice was then cut and placed flat.

Some of the cracks in the dust deposit may have been caused when the bag was opened and made to lie flat for the photograph. Other cracks may have been formed as the bag was cleaned. Gas flow would go preferentially through the cracks instead of through the dust.

Note that the dust deposit is very thick. Note also that the thickness of the deposit varies substantially with location around the bag.

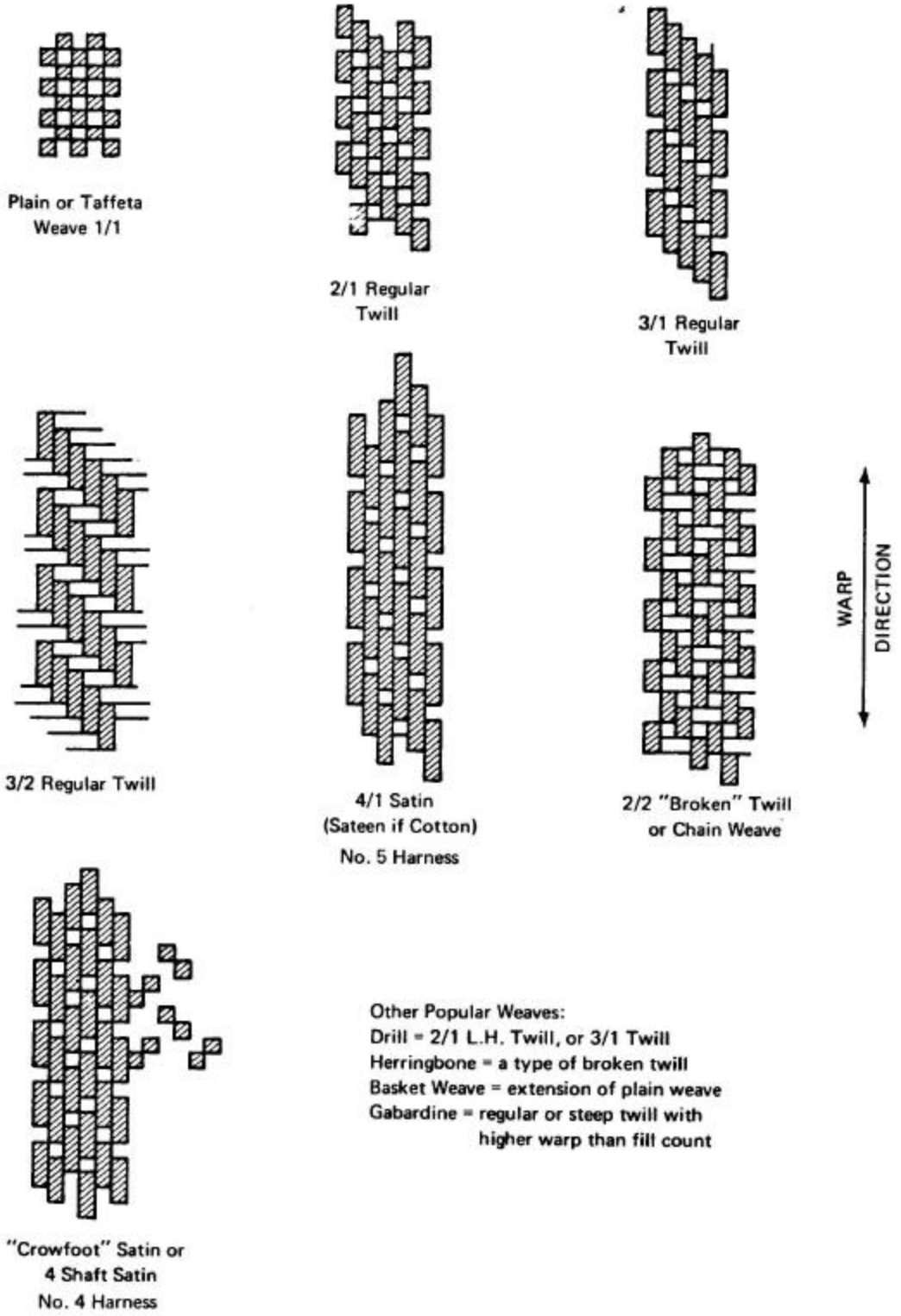


Figure 1. Organization of Popular Filter Fabric Weaves

This diagram illustrates weaves used for woven fabric bags of the type used in reverse air or shaker-cleaned filters.

TABLE II

RELATIVE PROPERTIES OF POPULAR FIBERS

RESISTANCE TO DRY HEAT		RESISTANCE TO MOIST HEAT		RESISTANCE TO ABRASION		RELATIVE TENSILE STRENGTH	SPECIFIC GRAVITY
Glass	550°	Glass	E	Nylon	E	Nylon	1.14
Teflon	400°	Teflon	E	Dacron	E	Polypro	0.90
Nomex	400°	Nomex*	E	Polypro	E	Dacron	1.38
Dacron	275°	Orlon	G	Nomex	E	Glass	2.54
Orlon	260°	Nylon*	G	Orlon	G	Polyeth	0.92
Rayon	200°	Rayon	G	Dynel	G	Rayon	1.52
Polypro	200°	Cotton	G	Rayon	G	Nomex	1.38
Nylon	200°	Wool	F	Cotton	G	Cotton	1.50
Wool	200°	Dacron*	F	Acetate	G	Dynel	1.30
Cotton	180°	Polypro	F	Polyeth	G	Orlon	1.14
Dynel	160°	Polyeth	F	Wool	F	Wool	1.32
		Dynel	F	Teflon	F	Teflon	2.10
		Acetate	F	Glass	P	Acetate	1.33

RESISTANCE TO MINERAL ACIDS		RESISTANCE TO ALKALIES		RELATIVE STAPLE FIBER COST		RELATIVE FILAMENT FIBER COST	
Glass**	E	Teflon	E	Teflon	7.0	Teflon	54.
Teflon	E	Polypro	E	Nomex	3.2	Nomex	16.
Ploypro	E	Nylon	G	Glass	6.	Acrylic	5.
Polyeth	G	Nomex	G	Orlon (Acrylic)	5.	Dacron	3.
Orlon	G	Cotton	G	Wool	5.	Nylon	3.
Dacron	G	Dynel	G	Nylon	5.	Polypro	2.8
Dynel	G	Polyeth	G	Dynel	4.	Polyeth	2.3
Nomex	F	Dacron	F	Dacron	3.5	Rayon	1.6
Nylon	P	Orlon	F	Acetate	2.0	Acetate	1.4
Rayon	P	Rayon	F	Rayon	1.5	Glass	1.0
Cotton	P	Acetate	P	Cotton	1.0		
Acetate	P	Glass	P				
Wool	G	Wool	P				

* These fibers are degraded in hot, moist atmospheres: Dacron is affected most, Nomex next, Nylon the least.

** Glass is destroyed by gaseous HF at dew point temperatures.

Note: The above ratings are intended only as a general guide.
E = Excellent G = Good F = Fair P = Poor

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erally used with reverse jet-type fabric filters, where cleaning is more intensive and frequent.

POPULAR WEAVES

Please refer to Figure No. 1 for a graphic display of the more widely used weaves or fabric organizations. These are listed in the decreasing order of their interlacing or yarn engagement (increasing sum of "overs" and "unders").

Plain or taffeta	1/1
Regular twill	2/1
Regular twill	3/1
Broken twill (chain)	2/2
Crowfoot (4 shaft satin)	3/1
Regular twill	3/2
Satin (sateen)	4/1
Satin up to	7/1

Generally speaking, the lower the sum of the over and un-

This table lists properties of fibers used to make filter bags.

Table 1 Values of K_2 Specific Cake Resistance

Application	Fabric	Cleaning	G/C, ft/min	G/C, m/min	K_2, in. H_2O ft-min/lb	K_2, N-min/g-m
Abrasives	Polyester	S	3	0.92		0.033
Alumina	Polyester	S	1.9	0.58		
			2.25	0.67	0.2	0.033
Aluminum	Cotton, nylon	S				
Aluminum hydrate	Polyester	P	1	0.30	0.2	0.033
Aluminum oxide	Cotton	S	2	0.61		
Asphalt plant drier	Glass, Nomex, cotton, wool	P, R, S	2.5–7.5	0.76–2.23	1.7	0.284
Asbestos	Cotton, nylon	S	2.75	0.84	2.18	0.364
Baking powder			2.5	0.76		
Bauxite	Cotton		2.5	0.76		
Beryllium sinter	Polypropylene, acrylic	P, S	6–20	1.83–6.1		
Bismuth and cadmium	Cotton		6–8	1.83–2.44	2.7	0.451
B.O.F.	Cotton, polyester	R, S	1.8–4.5	0.55–1.37	120–233	20.04–38.91
Bronze powder			2.0	0.61		
Buffing operation			3.0–3.25		0.92–0.99	
Calcimine			2.6	0.79		
Calcium sulfate	Polyester		7.5	2.28	0.4	0.067
Carbon	Acrylic		2.0	0.61		
Carbon black	Glass, Nomex Teflon, acrylic	R, S	1.1–1.6	0.34–0.49	22–56	3.67–9.35
Cement	Cotton, glass, acrylic, polyester	R, S	1.5–2.1	0.46–0.64	12–70	2.00–11.69
Cement	Cotton	R	2.5	0.76	350	58.34
Ceramics		S	2.5	0.76		
Charcoal		S	2.25	0.69		
Chocolate		S	2.25	0.69		
Chrome ore		S	2.5	0.76		
Chrome salts	Wool		2.4	0.73	15	2.51
Clay	Cotton	S	2.25	0.69		
Cleanser		S	2.25	0.69		
Cocoa		S	2.25	0.69		
Coke		S	2.25	0.69		
Copper	Glass, acrylic	S	0.6–2.7	0.18–0.82	15–65	2.51–10.86
Corn					0.62–8.8	0.10–1.47
Cork		S	3.0	0.92		
Cosmetics		S	3.0	0.92		
Cotton		S	3.5	1.07		
Dolomite	Polyester	R	3.3	1.00	670	112
Electric furnace	Glass, acrylic	R, S	1.5–4.0	0.46–1.22	45–715	7.5–119
Feldspar		S	2.5	0.76	6.30–27.3	1.05–4.56
Fertilizer		S	2.0–2.4	0.61–0.73		
Flint		S	2.5	0.76		
Flour	Cotton		2.5	0.76	4.3	0.717
Fly ash (coal)	Glass, Teflon	P, S, R	1.9–6.0	0.58–1.8	7–15	1.17–2.51
Fly ash (oil)	Glass	R	6.5–7.7	1.98–2.35	4.7	0.79
Fly ash (oil)	Glass	R	6	1.82	127	21.12
Fly ash (incinerator)	Glass, Teflon	P, S, R	2–6	0.61–1.83		

Table 1 Cont.

Application	Fabric	Cleaning	G/C, ft/min	G/C, m/min	K_2, in. H_2O ft-min/lb	K_2, N-min/g-m
Fly ash (incinerator)	Glass	R	2.5	0.76	180	30.00
Foundry	Glass, polyester, polypropylene, nylon	S	2.1	0.64	0.62–120	0.10–20
Glass	Polyester	S	2.5	0.76		
Grain	Cotton	S	3.25	0.99		
Granite		S	2.0	0.61		
Graphite		S	2.0	0.61		
Grinding dust		S	2.25	0.69		
Gypsum	Cotton, acrylic	S	2.5	0.76	6.3–18.9	1.05–3.16
Hypochlorite mfg.	Acrylic	P	3.3	1.0	15	2.51
Iron ore		S	2.0	0.61		
Iron oxide	Nomex	P	2.1	0.64	121	20.17
Iron oxide		S	2.0	0.61		
Iron oxide	Acrylic, polyester	R, S	1.4–3.3	0.43–1.00	3–715	0.50–119
Iron oxide, Zinc oxide	Glass	R	1.9	0.58	66	11.00
Kish	Polyester	S	2.5	0.76	230	38.34
Lampblack		S	2.0	0.61	47.2	7.88
Lead blast furnace	Polyester	R, S	1.0	0.31	57	9.52
Lead dust	Acrylic		2.4–35	0.73–10.7		
Lead oxide	Acrylic	S	2.25	0.69		
Lead oxide	Polyester	R, S	1.0	0.30	57	9.50
Leather dust		S	3.5	1.07		
Lime kiln	Glass	R	2.3	0.70	9	1.50
Limestone		S	2.75	0.84		
Magnesium trisilicate			0.5	0.15		
Manganese		S	2.25	0.69		
Marble		S	3.0	0.92		
Mica	Cotton	S	2.25	0.69		
Milk powder					4.5	0.75
Molybdenum	Wool					
Oats					1.58–11.0	0.26–1.84
Oyster shell		S	3.0	0.92		
Paper		S	3.5	1.07		
Perlite	Polyester, glass	S	3	0.92		
Pigments	Cotton	S	2.0	0.61	2.3–2.9	0.38–0.48
PVA	Wool	R	10	3.05	25	4.18
PVC	Wool, polyester					
Plastics		S	2.5	0.76		
Quartz		S	2.75	0.84		
Resin	Cotton	S	2.7	0.82	0.62–25.2	0.10–4.21
Rock dust		S	3.25	0.99		
Sand, scale	Cotton		5.0	1.52	3	0.50
Sanding machine		S	3.25	0.99		
Silica	Nomex	S	2.75	0.84		
Sinter dust	Glass	R	2.3	0.70	12.5	2.08
Soap	Polyester, acrylic	S	2.25	0.69	1.6–3.1	0.27–0.52
Soapstone		S	2.25	0.69		
Starch	Cotton, wool	S	2.25	0.69		
Stucco	Cotton, polyester	R, S	3.4	1.04	9	1.50
Sugar		S	2.25	0.69		

Application	Fabric	Cleaning	G/C, ft/min	G/C, m/min	K_2, in. H_2O ft-min/lb	K_2, N-min/g-m
Talc		S	2.25	0.69		
Titanium dioxide	Cotton, acrylic				94–206	15.7–34.4
Tobacco	Cotton, polyester	S	3.5	1.07	36	6.01
Wood	Cotton	S	3.5	1.07	2.8–6.3	0.47–1.05
Zinc	Acrylic, cotton, Nomex	R, S	1.8–3.0	0.55–0.92	7–50	1.17–8.35
Zinc oxide					15.7	2.62
Zinc oxide	Glass	R, S	0.6	0.18	40	6.67
Zinc oxide and lead chloride	Glass	R	1.2	0.36	18.5	3.08

Note: Table compiled from various sources. For a given application other fabrics, cleaning methods, and gas-to-cloth (G /C) ratio may be used. Many other sources use baghouses. Many cotton applications have been replaced by polyester.
Key: S = shake; P = pulse-jet; R = reverse air.

This table lists values of the specific resistance of the dust deposit, K2, for fabric filters collecting various kinds of dust. The data are from measurements taken in the field.

See: Calvert, S. and H. Englund, Handbook of Air Pollution Technology, Wiley, New York, 1984.