CENTRIFUGAL FANS
AND SOME EARLY VENTILATING MACHINES

BRIAN ROBERTS
"The quantity of air delivered in one minute by a screw 4 ft diameter, performing 500 revolutions per minute, was tested by the writer, by a delicate anemometer, and found to exceed 500 cubic feet."

[Useful Hints on Ventilation, W Walker, Manchester, 1850]
Making fan blades tipped with goose feathers, De Re Metallica, 1556.

CENTRIFUGAL FANS & EARLY VENTILATING MACHINES
From the CIBSE Heritage Group website and Archives.
BMR, Budleigh Salterton 2020

Agricola 3, Alldays & Onions 6, American Blower 7,
Briggs 10, Buttnar Werke 11, Buffalo Forge 12,

Capell 13, Combes 13, Davidson 14, Eck 18,
Fabry 19, Fournier & Cornu 19, Guibal 20,

Harze 21, Howden 21, Huyett & Smith 23,
Keith 24, Kley 25, Levet 25,

Matthews & Yates 1,24, Mortier 28, Musgrave 29,
Peclet 30, Pelzer 31, Rateau 32,

Ser 33, Sirocco 34, Standard & Pochin 35,
Sturtevant 36, Sulzer 40, Sutcliffe 41,
Waddle 43, Walker 2,44,
Hand-operated fans for mine ventilation, Germany, 1556.
Wind-assisted and hand-operated mine ventilation fans, Germany, 1556.
ALLDAYS & ONIONS

Climax Low Velocity Fans.
[JIHVE, April-May, 1942]

Ultra Quiet Fans.
[JIHVE, Sept-Oct, 1944]
American Blower

1902 advertisements
“ABC” Fan System
OF
Heating and Ventilation

Provides a uniform degree of heat.
Furnishes ample ventilation.
First cost and operating expenses low.

Suitable for
Factories,
Churches,
Schools,
Hospitals,
Theatres,

In fact, large buildings of all types.
The most complete line of heaters and fans
On the market. Catalogues on request.

American Blower Company

1910
Feeding air to a 3000° inferno

1. 3000°F—That's really hot! And it has to be to create enough steam to drive generators that supply an entire city with electricity. How's it done? Huge American Blower Mechanical Draft Fans supply the necessary air to boilers for proper combustion. American Blower Cylindrical Fluid Drives provide adjustable speed control for the mechanical draft fans and boiler feed pumps.

2. The world’s largest power plant uses an efficient American Blower Ash-Precipitator to remove fly ash from the smoke. In industry, American Blower Dust Collectors remove valuable materials from air.

3. American Blower supplies air-handling equipment to many manufacturers and remidators of air conditioning equipment. The newly-renovated Capitol building is now equipped with efficient American Blower Fans.

4. Wherever your business model’s needs include air conditioning, or air handling equipment, consult your nearest American Blower branch office. They are conveniently located in all principal cities to serve your needs.

American Blower Corporation, Detroit 32, Michigan • Canadian Brook Company, Ltd., Windsor, Ontario
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

1963
Fan rotor used at the US Capitol, Washington DC, 1857. Designed by Robert Briggs, 14 feet diameter, cast-iron central cone, wooden vanes, operated without a casing.

[Building Early America, chap 10 by Eugene S Ferguson, 1976]
BUFFALO FORGE

Buffalo Forge Company

Buffalo Fan System of Heating and Ventilating.
For Schools, Churches, Theatres, and all Public and Industrial Buildings.

Buffalo Forge Company ENGINES
For Electric Light and Power Service.
Simplicity of Design.
Durability of Construction.
Close Regulation.
Smooth Cool Running at Sustained High Speed.
Horizontal, Vertical, Simple, Compound, Belted, Direct-Connected.

Buffalo Forge Company, BUFFALO, N.Y., U.S.A.

Buffalo Fan System, Buffalo Forge, Buffalo, NY.
[Heating and Ventilating Buildings, Prof. Rollo C. Carpenter, 1910]
CAPELL: COMBES

Capell

Large Continental Capell Centrifugal Fan,
Formed of two fans, one outside the other, c.1900.
[The Fan, Chas H Innes, 1916]

Combès

Combès' Fan with Backward-Curved Blades fitted to
one side of a Rotating Disc, 1854.
[Building Services Engineering, Billington & Roberts, 1982]
Davidson of Belfast patented his Sirocco multiblade centrifugal fan in 1898, which proved to be one of the most successful of all times and extremely quiet in operation.

[Engineering Review, 1908]
54. DESIGN OF THE MULTIVANE IMPELLER  
(SIROCCO RUNNER)

In many applications a choice of fan is governed by the space available for its installation and the permissible noise level. One requires a design giving a minimal value for the coefficient $\delta$. This problem was solved by the design of the multivane impeller. It is some 60 years old and is widely known. Its main features are its large diameter ratio, large relative width, and number of blades which are of the forward-curve design, thus forming a "drum". The original design of the Sirocco fan had the following dimensions:

$$d_1/d_2 = 0.875; \quad h = \frac{3}{4} d_2; \quad \beta_1 = 64^\circ; \quad \beta_2 = 22^\circ; \quad z = 54.$$ 

The blades were formed precisely as circular arcs.

This design received no attention in the field of research. Although the circular arc was blamed for the poor efficiency ($\eta = 50\%$), it has enjoyed a success unrivalled by any other design and has been manufactured in greater numbers than any other form of flow machine. Apart from its compactness it is remarkably silent in operation. There is no other fan which operates as silently at comparable pressures. One will find quiet operation a criterion in many applications even if it is at the expense of efficiency. In this aspect the multivane impeller fulfils unchallenged an important operational problem that is no less important today than it was in previous years.

This impeller differs quite considerably from others, and there is a lack of fundamental knowledge of the design and calculations.

This is the Introductory Note on the design of the Sirocco Impeller from the textbook "Fans, Bruno Eck, Pergamon Press, Oxford, 1973."

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The Davidson Ventilating Fan Co.

\[ \text{THE DAVIDSON VENTILATING FAN CO.} \]

\[ \text{MANUFACTURERS OF} \]

\[ \text{FANS, BLOWERS, MOTORS AND ENGINES.} \]

\[ \text{ENGINEERS and CONTRACTORS.} \]

\[ \text{Estimates and Specifications Carefully Furnished.} \]

\[ \text{MAIN OFFICE:} \]
\[ \text{Cort, OLIVER & MILK STREETS,} \]
\[ \text{BOSTON, MASS.} \]

\[ \text{NEW YORK CITY OFFICE:} \]
\[ \text{113 LIBERTY STREET.} \]

Davidson, Boston and New York.
[Ventilation and Heating, J S Billings, 1896]
DAVIDSON

An entirely new departure in Fan Construction.

DAVIDSON'S PATENT

"SIROCCO"
CENTRIFUGAL

... FAN...

DISCHARGES THREE TIMES MORE AIR PER REVOLUTION THAN ANY OTHER CENTRIFUGAL FAN OF EQUAL DIAMETER.

Further information on application to

DAVIDSON & Co., Ltd.,
SIROCCO ENGINEERING WORKS, BELFAST.

TRADE

SIROCCO
MARK

FANS

You will find exactly the right type and size of Fan you need in the extensive range of "Sirocco" Fans we build. We will assist you in the selection and furnish you with a Fan that will do your work efficiently and well.

Sirocco Service is at your Service.

DAVIDSON & Co., LIMITED.
Sirocco Engineering Works - Belfast, Ireland.

LONDON - GLASGOW - CARDIFF - BIRMINGHAM - BIRMINGHAM - NEWCASTLE.
Sirocco Engineering Company of New York
The Company obtained the U.S. rights to market Samuel Davidson’s centrifugal fan. During the first decade of the 20th century, the Sirocco fan went through numerous modifications, including changes to the blade design and the production of single-inlet and double-inlet configurations. In 1908, the Sirocco rights were sold to the American Blower Company.

Sirocco Engineering promoted Davidson’s Patent Sirocco Centrifugal Fans (Engineering Review, September 1906)
Early Mine Fan with Radial impeller, date unknown.
Westfalia-Dinnendahl-Gröppel, Bochum.
[Fans, Bruno Eck, 1973]
Contra-Rotating Blower, early 19C, of Fabry who was the ventilation engineer at the Charleroi mines.

[Building Services Engineering, Billington & Roberts, 1982]

Centrifugal Fan, French Patent of 18 February 1896. Forerunner of the modern narrow-blade multivane fan with curved blades on a central revolving disc and an unobstructed inlet.

[Building Services Engineering, Billington & Roberts, 1982]
Fan, c. 1878, invented by the Frenchman Guibal in 1860. [Heat & Cold, Donaldson & Nagengast, ASHRAE, 1994]

Guibal Fan and Chimney or Venturi Discharge Expander. [Building Services Engineering, Billington & Roberts, 1982]
While manufacturing their own range of fans, Howden acquired both Davidson and Sturtevant
HUYETT & SMITH

The Huyett & Smith Mfg Co

THE SMITH HOT BLAST APPARATUS
For Heating and Ventilating Buildings of All Kinds.

MANUFACTURED BY
THE HUYETT & SMITH MFG. CO.,
HEATING AND VENTILATING ENGINEERS.
CHICAGO, NEW YORK, BOSTON.

DETROIT, MICHIGAN.

Hot Blast Apparatus.
[Ventilation and Heating, J S Billings, 1896]

Smith Combined Motor and Ventilating Fan, Patented 1888.
[Heat & Cold, Donaldson & Nagengast, ASHRAE, 1994]
James Keith

1906.
"Keith" Fan Wheel.

Loose blade, showing blade form and proportions.

British Patent
No. 16048, A.D. 1906.

Keith Patent Fan Wheel of 1906.
KLEY: LEVET

Kley Ventilator with Radial, Plane Vanes and Two Spiral Inflow Passages.
[The Fan, Chas H Innes 1916]

Levet Centrifugal Fan, French Patent of 28 April 1890.
[Building Services Engineering, Billington & Roberts, 1982]
Walter Yates, President IHVE 1909

Delivery of M&Y Fans from Swinton, Manchester to Stuart Street Electricity Station, 1890s.
[BSE, 1, 45, April 1977]
Cyclone Fans, M&Y, Swinton, Manchester.
[Year Book of the Heating & Ventilating, 1948]

Large M&Y Centrifugal Fan ready for delivery, probably 1960s.
[BSE. 1, 45, April 1977]
[Building Services Engineering, Billington & Roberts, 1982]

Mortier Diametral Fan manufactured by Louis Galland of Chalon-sur-Saône, c.1900.  
[The Fan, Chas H Innes, 1916]
MUSGRAVE

Henry Musgrave 1827-1922

Musgrave Fans, St Ann's Works, Belfast.
[Year Book of the Heating and Ventilating Industry, 1948]
PECLET

J Claude Eugène Peclét, 1793-1857

Combes Forward/Backward-Bladed Blower.
[Tratté de la Chaleur, E Peclét, Paris, 1844]
Continental Centrifugal Fan, c.1900
[The Fan, Thom H Innes, 1916]
Rateau Mixed-Flow Fan as used in Belgium, c.1900.
[The Fan, Chas H Innes, 1916]
Prof Marie Antoine Ser

Ser Centrifugal Fan of 1878, French Patent of 1884.
[Heat & Cold, Donaldson & Nagengast, ASHRAE, 1994]

Ser Centrifugal Fan of 1878,
[The Fan, Chas H Innes, 1916]
Sirocco Engineering Co

Heating—Cooling
Mechanical Draft for Boilers
Davidson's Patent
Sirocco
Centrifugal Fans
Sirocco Engineering Co.
22 Thames Street, New York

Davidson of Belfast, Patent Sirocco Centrifugal Fan.
[Engineering Review, Sept 1906]
The Standard & Pochin Bros Ltd

THE STANDARD & POCHIN BROS. LTD.
Evington Valley Road, Leicester
Telephone: 36114/5 (2 lines)
Branches: London • Birmingham • Manchester • Glasgow

FANS
and ANCILLARY EQUIPMENT for HEATING and VENTILATING ENGINEERS

PUBLICATIONS AVAILABLE UPON REQUEST

- 150 = "Calorad" Radiators
- 153A = P.K. Pressure Fans
- 154 = "Variform" Fans
- 155 = "LeXtra" Roof Ventilators
- 159 = Multivane Fans
- 174 = "Calorhis" Unit Heaters
- 175 = Small Fans
- 177 = P.R. Uniform Pulley Mounted Fans
- 182 = Wood Refuse Removal Plant and Equipment
- 184 = C.R. Uniform Pulley Mounted Fans
- 185 = "Flatfin" Air Heaters

Other products include—
"Flatfin" Gilled Tubs, Air Filters, Cyclones, "Goodwood" Wood Refuse Stoker, Dental Dust Collecting Units

S&P Fans, Evington Valley Road, Leicester.
STURTEVANT

Benjamin Franklin Sturtevant

STURTEVANT STEEL PRESSURE BLOWER,
For Cupola Furnaces and Forges.
The blower which excels all others, producing maximum results with minimum power. Used by the largest establishments in the country, where the strongest blast is required.

STURTEVANT PATENT IMPROVED FAN BLOWER,
For Steam Boilers, Puddling and Heating Furnaces.

STURTEVANT PATENT EXHAUST FAN,
For removing Shavings and Dust from Wood-working Machines, Dust from Sand and Foundry Wheels, and for Ventilation.

B. F. STURTEVANT, Patentee and Sole Manufacturer,
70 & 72 Sudbury St., Boston, Mass.

The Sturtevant Company was operating by 1872.
[Heat & Cold: Mastering the Great Indoors, Barry Donaldson & Bernard Nagengast, ASHRAE, 1994]
B F Sturtevant Company

STURTEVANT
Blowers of all Descriptions.

Steam Hot Blast Apparatus for Positive Ventilation and Heating.

Generating Sets for General Lighting and Power Requirements.

Steam Traps and other Sundries required for the Complete Equipment of Heating and Ventilating Installations.

B. F. STURTEVANT CO.
BOSTON, MASS.

Blowers of all Descriptions, Sturtevant, Boston, Mass.
[Heating and Ventilating Buildings, Prof Rolla C Carpenter, 1910]
STURTEVANT

VENTILATION AND HEATING

FIG. 18. CONE WHEEL.

Cone Wheel Fan.
[Ventilation and Heating, B F Sturtevant, Boston, Mass, 1906]
Steel Plate Fans: Electric (top) and Steam.
(Ventilation and Heating, B F Sturtevant, Boston, Mass, 1906)
Sulzer Brothers

Fan made completely of wood by Sulzer Bros for handling corrosive fume-laden air, date unknown.
[Fans, Bruno Eck, 1973]

Large Axial-Flow Fan made by Sulzer Bros.
Duty 60 m³/s at 9 mm wg.
[Fans, Bruno Eck, 1973]
SUTCLIFFE

Oswald Stott, President IHVE 1926-27

Sutcliffe Steel Plate Belt-Driven Fans.
[The Practice of Ventilation, J D Sutcliffe, 1906]
SUTCLIFFE INDUCED DRAUGHT FAN.
FANS DIRECT COUPLED TO STEAM ENGINES.

Three-quarter Housing Type, with Water-cooling Bearing and Special Grillage for Over-hung Fan Wheel and Direct-coupled Engine.
All our Fans are fitted with Ring-rolling Ball and Socket Bearings.

In application and usage our Steam-driven Fans are identical with our Pulley Fans. The direct-connected Engine makes them independent, and variation in speed is easily attainable. Fans can be run with Horizontal or Vertical Engines, or with Electric Motors as preferred.

Sutcliffe Steam Engine Driven Induced Draught Fans. [The Practice of Ventilation, J D Sutcliffe, 1906]
Waddle Colliery Fan, Llanelli 1864.
with a so-called expanding rim.
[The Fan, Chas H Innes, 1916]
Fan Impeller (above) and Fan Installed by Walker Bros, Wigan, c.1934. Mersey Tunnel Ventilation, Liverpool. [Heating & Ventilating Engineer, April 1934 (above) And Heritage Group Collection]