

## B04C

**APPARATUS USING FREE VORTEX FLOW, e.g. CYCLONES** ({centrifugal separation of water from steam [B01D 45/12](#);} jet mills [B02C 19/06](#); {wind sifters [B07B 7/00](#);} cyclonic type combustion apparatus [F23](#); {vortex burners for cyclone-type combustion apparatus [F23D 1/02](#); cyclonic type combustion apparatus for gas turbines [F23R 3/00](#)})

### Definition statement

*This place covers:*

Apparatus for separating or like treating (e.g. drying, extracting, purifying) in which centrifugal or centripetal effects are generated by free vortex flow, otherwise than by rotary bowls, rotors or curved passages. The free vortex flow generated may follow a flat spiral, have an unchanged or constant axial direction, or have a reversible axial direction.

The mixtures treated are composed of the following physical states of matter:

- Liquid/liquid, liquid/gas or gas/gas mixtures.
- Solid/liquid or solid/gas mixtures; or combinations of such apparatus with other devices, e.g. fans.

Accessories for such devices e.g. safety or control devices.

### References

#### Limiting references

*This place does not cover:*

Combinations of cyclones with filters, for separating particles from gases or vapours	<a href="#">B01D 50/00</a>
Combinations of cyclones with electrostatic precipitating arrangements	<a href="#">B03C 3/14</a>
Cyclonic type combustion apparatus using fluent fuel	<a href="#">F23C 3/00</a>
Vortex burners e.g. for cyclone-type combustion apparatus	<a href="#">F23D 1/00</a>

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Arrangement or disposition of cyclones or other devices with centrifugal action, in suction cleaners	<a href="#">A47L 9/16</a>
Separation of non-miscible liquids by centrifugal force	<a href="#">B01D 17/0217</a>
Degasification of liquids in which centrifugal movement is caused by a vortex, e.g. using a cyclone, or by a tangential inlet	<a href="#">B01D 19/0057</a>
Separating dispersed particles from gases or vapours by centrifugal forces	<a href="#">B01D 45/12</a>
Separating dispersed particles from gases or vapours by centrifugal forces generated by the winding course of the gas stream	<a href="#">B01D 45/16</a>
Separation of isotopes of the same chemical element by centrifuging	<a href="#">B01D 59/20</a>
Chemical or physical processes in general, conducted in the presence of fluids and solid particles; separating solid material from the gas/liquid stream using cyclones	<a href="#">B01J 8/0055</a>
Jet mills	<a href="#">B02C 19/06</a>

Magnetic or electrostatic separators of solid materials or fluids; Separation by high-voltage electric fields	<a href="#">B03C</a>
Centrifuges	<a href="#">B04B</a>
Selective separation of solid materials carried by or dispersed in gas currents, using centrifugal force	<a href="#">B07B 7/08</a>
Catalytic cracking with preheated moving solid catalysts according to the "fluidised-bed" technique	<a href="#">C10G 11/18</a>
Purification of the pulp suspension by mechanical means with the aid of centrifugal force in cyclones	<a href="#">D21D 5/24</a>
Mounting or connecting of lubricant purifying means relative to a machine or engine	<a href="#">F01M 11/03</a>
Crankcase ventilating or breathing having means for purifying air before leaving crankcase, e.g. removing oil	<a href="#">F01M 13/04</a>
Exhaust or silencing apparatus for machines or engines having means for removing solid constituents of exhaust, using inertial or centrifugal separators, e.g. of cyclone type	<a href="#">F01N 3/037</a>
Fluid dynamics in general	<a href="#">F15D</a>
Component parts or details of steam boilers; steam-separating arrangements using centrifugal force	<a href="#">F22B 37/32</a>
Arrangement of devices for treating smoke or fumes of purifiers for removing solid particulate material from the gasflow using cyclone separators	<a href="#">F23J 15/027</a>
Compression machines, plant or systems using vortex effect	<a href="#">F25B 9/04</a>
Fluidised-bed furnaces; cyclones or chain of cyclones	<a href="#">F27B 15/003</a>
Investigating or analysing materials by determining their physical or chemical properties, e.g. while the centrifugal or centripetal effects generated by a vortex flow are acting on the sample	<a href="#">G01N</a>

## Glossary of terms

*In this place, the following terms or expressions are used with the meaning indicated:*

Vortex finder	overflow duct, which is the discharging outlet for the lighter fluid phase.
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## B04C 1/00

**Apparatus in which the main direction of flow follows a flat spiral{; so-called flat cyclones or vortex chambers}**

### Definition statement

*This place covers:*

Flat cyclones or vortex chambers and cyclones where the inlet extends substantially over the whole height of the vortex chamber.

## References

### Limiting references

*This place does not cover:*

Arrangements with curved passages	<a href="#">B01D 45/16</a>
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## B04C 3/00

Apparatus in which the axial direction of the vortex {(flow following a screw-thread type line)} remains unchanged {Also devices in which one of the two discharge ducts returns centrally through the vortex chamber, a reverse-flow vortex being prevented by bulkheads in the central discharge duct (combined with other devices [B04C 9/00](#))}

### Definition statement

*This place covers:*

Cyclones where the direction of flow does not change, the fluid enters the cyclone on an upstream side and the separated phases are discharged on the downstream side.

## B04C 5/00

Apparatus in which the axial direction of the vortex is reversed {(combined with other devices [B04C 9/00](#))}

### Definition statement

*This place covers:*

Cyclones where the axial direction of the lighter fluid is reversed. The direction of flow does change, the fluid enters the cyclone on an upstream side and the separated heavier fluid is discharged on the downstream side, the lighter fluid travels back to the upstream side of the cyclone.

## B04C 5/24

Multiple arrangement thereof {(combination types according to other /00 groups, [B04C 7/00](#))}

### Definition statement

*This place covers:*

Combinations of reverse flow cyclones of series flow and parallel flow where the features of the interactive connection are important.

## B04C 7/00

**Apparatus not provided for in group [B04C 1/00](#), [B04C 3/00](#), or [B04C 5/00](#);  
Multiple arrangements not provided for in one of the groups [B04C 1/00](#),  
[B04C 3/00](#), or [B04C 5/00](#); Combinations of apparatus covered by two or more of  
the groups [B04C 1/00](#), [B04C 3/00](#), or [B04C 5/00](#)**

### Definition statement

*This place covers:*

All cases where the combination of different types of cyclones like a through flow type cyclone ([B04C 3/00](#) and sub-groups) and a reverse flow type cyclone ([B04C 5/00](#) and sub-groups) is claimed. Details relating to the one or the other type are classified in the relevant groups of the specific cyclone.

## B04C 9/00

**Combinations with other devices, e.g. fans, {expansion chambers, diffusors, water locks} (with filters [B01D 50/00](#))**

### Definition statement

*This place covers:*

Combinations of cyclones with expansion chambers, diffusors, water locks or sieves.

Combinations of cyclones with internally or externally arranged rotors like fans, ventilators, blowers, impellers, pumps.

Combinations of cyclones with internally or externally arranged filters.

Combinations of cyclones with electrostatic separation equipment.

Cyclones with injection or suction of liquid or gas into the cyclone chamber.

## B04C 11/00

**Accessories, e.g. safety or control devices, not otherwise provided for {, e.g. regulators, valves in inlet or overflow ducting} (with electrostatic precipitating arrangements [B03C 3/14](#))**

### Definition statement

*This place covers:*

Control arrangements per se, regulators, valves in inlet and/or overflow ducting.