

## SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

### F22 STEAM GENERATION

**F22D PREHEATING, OR ACCUMULATING PREHEATED, FEED-WATER; FEED-WATER SUPPLY; CONTROLLING WATER LEVEL; AUXILIARY DEVICES FOR PROMOTING WATER CIRCULATION WITHIN BOILERS** (chemical treatment of water, e.g. purification, C02F; enclosed heat-exchange apparatus in general F28D; controlling in general G05)

#### 1/00 Feed-water heaters, e.g. preheaters

- 1/02 • with water tubes arranged in the boiler furnace, fire tubes, or flue ways (heat-exchange tubes in general F28F)
- 1/04 • • the tubes having plain outer surfaces, e.g. in vertical arrangement
- 1/06 • • • in horizontal arrangement
- 1/08 • • the tubes having fins, ribs, gills, corrugations, or the like on their outer surfaces, e.g. in vertical arrangement
- 1/10 • • • in horizontal arrangement (hollow fire-bars, grates, or the like used as water tubes F23H 3/02)
- 1/12 • • Control devices, e.g. for regulating steam temperature
- 1/14 • • Safety or venting devices (safety devices for boilers in general F22B 37/42)
- 1/16 • with water tubes arranged otherwise than in the boiler furnace, fire tubes, or flue ways
- 1/18 • • and heated indirectly
- 1/20 • • and directly connected to boilers
- 1/22 • • and provided for rotary movement
- 1/24 • with fire tubes or flue ways traversing feed-water vessels
- 1/26 • with means, other than tubes, to separate water and heating medium, e.g. bulk heaters without internal flues or tubes, jacketed smoke-boxes or flues
- 1/28 • for direct heat transfer, e.g. by mixing water and steam
- 1/30 • • with stages, steps, baffles, dishes, circular troughs, or other means to cause interrupted or cascading fall of water
- 1/32 • arranged to be heated by steam, e.g. bled from turbines
- 1/34 • • and returning condensate to boiler with main feed supply
- 1/36 • Water and air preheating systems
- 1/38 • • Constructional features of water and air preheating systems
- 1/40 • Combinations of exhaust-steam and smoke-gas preheaters (for locomotives F22D 1/42)
- 1/42 • specially adapted for locomotives
- 1/44 • • Smoke-gas preheaters
- 1/46 • • Exhaust-steam preheaters
- 1/48 • • Details

- 1/50 • incorporating thermal de-aeration of feed-water (de-aeration produced in the course of direct heat transfer F22D 1/28; thermal de-aeration of water per se B01D 19/00, C02F 1/20; valves for venting F16K 24/04) [3]

#### 3/00 Accumulators for preheated water

- 3/02 • arranged within combustion chambers
- 3/04 • combined with steam accumulators
- 3/06 • directly connected to boilers
- 3/08 • specially adapted for locomotives (locomotive boilers F22B 13/06)
- 3/10 • • Control devices (controlling water feed to boilers, or water level F22D 5/00)

#### 5/00 Controlling water feed or water level; Automatic water feeding or water-level regulators (steam traps F16T; measuring or indicating instruments G01; for indicating water level G01F; level control in general G05D 9/00)

- 5/02 • with an intermediate compartment from which the water is fed by gravity after mechanically moving the compartment, the movement being controlled according to water level
- 5/04 • with pivoting buckets
- 5/06 • with receptacles external to, but in free communication with, the boilers and adapted to move up and down in accordance with change in water level
- 5/08 • with float-actuated valves
- 5/10 • • and with pistons or membranes unitary with the feed inlet valves
- 5/12 • • and with dipping tubes
- 5/14 • responsive to thermal expansion and contraction, e.g. of solid elements
- 5/16 • • of fluids
- 5/18 • for varying the speed or delivery pressure of feed pumps
- 5/20 • • without floats
- 5/22 • • with floats
- 5/24 • with electric switches
- 5/26 • Automatic feed-control systems (automatic safety devices F22B 37/42; controlling in general G05)
- 5/28 • • responsive to amount of steam withdrawn; responsive to steam pressure
- 5/30 • • responsive to both water level and amount of steam withdrawn or steam pressure
- 5/32 • • influencing the speed or delivery pressure of the feed pumps
- 5/34 • • Applications of valves (valves per se F16K)

F22D

- 5/36

- • for feeding a number of steam boilers designed for different ranges of temperature and pressure
- 7/00

**Auxiliary devices for promoting water circulation**  
(adaptation of boilers for promoting water circulation F22B 37/34)
- 7/02

- Saddles or like directing plates fitted to furnace tubes
- 7/04

- Injectors for water or steam
- 7/06

- Rotary devices, e.g. propellers
- 7/08

- • Arrangements of pumps, e.g. outside the boilers
- 7/10

- • • within the boilers
- 7/12

- Control devices
- 7/14

- specially adapted for locomotive boilers
- 11/00

**Feed-water supply not provided for in other main groups**
- 11/02

- Arrangements of feed-water pumps (F22D 11/06 takes precedence; pumps per se F04)
- 11/04

- • with means to eliminate steam formation
- 11/06

- • for returning condensate to boiler