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model FallingParticleReceiver
  extends Icons.CavityReceiver;
  //Variables
  parameter Types.Temperature T_o = 20 + 273.15;
  parameter Types.Temperature T_s_0 = 20 + 273.15 "initial
temperature";
  Types.MassFlowRate m_dot_s_in "inlet mass flow rate";
  Types.MassFlowRate m_dot_s_out "outlet mass flow rate";
  Types.Temperature T_s_in "inlet particle temperature";
  Types.Temperature T_s_out(start = T_s_0) "outlet particle
temperature";
  Types.Enthalpy h_s_in "inlet particle enthalpy";
  Types.Enthalpy h_s_out "outlet particle enthalpy";
  Types.Density rho_s "density";
  Types.SpecificHeatCapacity cp_s "specific heat capacity";
  Types.Heat Q_solar "solar irradiance";
  Types.Heat Q_rerad "reradiation heat loss";
  Types.Heat Q_in "receiver net input";
  parameter Types.Area A_ap = 1 "aperture area";
  Types.Fraction eta_rec "receiver efficiency";
  parameter Types.Volume V_rec = 1 "receiver volume";
  parameter Types.Fraction sigma_sb = 5.67 * 10 ^ (-8) "stephan
boltzman constant";
  parameter Types.Fraction eps_s = 0.88 "emissivity";
  parameter Types.Fraction abs_s = 0.92 "emissivity";
  FallingParticleReceiverSystem.Interfaces.ParticleFlow
ParticleInlet annotation(
  Placement(visible = true, transformation(origin = {0, 80},
extent = {{-10, -10}, {10, 10}}, rotation = 0),
iconTransformation(origin = {0, 80}, extent = {{-10, -10}, {10,
10}}, rotation = 0)));
  Interfaces.ParticleFlow ParticleOutlet annotation(
  Placement(visible = true, transformation(origin = {0, -80},
extent = {{-10, -10}, {10, 10}}, rotation = 0),
iconTransformation(origin = {0, -80}, extent = {{-10, -10}, {10,
10}}, rotation = 0)));
  Modelica.Blocks.Interfaces.RealOutput OutletTemperature
annotation(
  Placement(visible = true, transformation(origin = {-80, -
78}, extent = {{-10, -10}, {10, 10}}, rotation = 180),
iconTransformation(origin = {-80, -60}, extent = {{10, -10}, {-
10, 10}}, rotation = 0)));
  Modelica.Blocks.Interfaces.RealInput MassFlow annotation(
  Placement(visible = true, transformation(origin = {-80, 60},
extent = {{-10, -10}, {10, 10}}, rotation = 0),
iconTransformation(origin = {-80, 60}, extent = {{-10, -10},
{10, 10}}, rotation = 0)));

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equation
//Connections
m_dot_s_in = ParticleInlet.m_dot;
m_dot_s_out = -ParticleOutlet.m_dot;
T_s_in = ParticleInlet.T;
T_s_out = ParticleOutlet.T;
T_s_out = OutletTemperature;
m_dot_s_in = MassFlow;
//Mass balance
m_dot_s_in = m_dot_s_out;
//Heat balance
Q_rerad = A_ap * sigma_sb * eps_s * (T_s_out ^ 4 - T_o ^ 4);
Q_in = Q_solar * abs_s - Q_rerad;
V_rec * rho_s * cp_s * der(T_s_out) = m_dot_s_in * h_s_in +
Q_solar * abs_s - m_dot_s_out * h_s_out - Q_rerad;
eta_rec * (Q_solar * abs_s) = m_dot_s_out * h_s_out -
m_dot_s_in * h_s_in;
//Properties
h_s_in = Media.Particle.Enthalpy(T_s_in);
h_s_out = Media.Particle.Enthalpy(T_s_out);
cp_s = Media.Particle.SpecificHeat(T_s_out);
rho_s = Media.Particle.Density();
end FallingParticleReceiver;

```