In[14]:=
```
αL = 1.3 × 10^5;
βR = 1.0 × 10^5;
AL = 0.1^2 π / 4;
AR = 0.09^2 π / 4;
κ = 1.4; R = 287; cV = R / (κ - 1);
ρ0 = 1.2;
```

In[1]:=
```
Eq1 = pL + ρL aL vL - αL;
Eq2 = pR - ρR aR vR - βR;
Eq3 = ρL AL vL - ρR AR vR;
Eq4 = ρL AL vL^2 + pL AR - (ρR AR vR^2 + pR AR);
Eq5 = (ρL eL vL + pL vL) AL - (ρR eR vR + pR vR) AR;
Eq6 = aL - Sqrt[κ R TL];
Eq7 = aR - Sqrt[κ R TR];
Eq8 = eL - (cV TL + vL^2 / 2);
Eq9 = eR - (cV TR + vR^2 / 2);
Eq10 = pL - ρL R TL;
Eq11 = pR - ρR R TR;
Eq12 = ρR - ρ0;
```

In[20]:=
```
sols = NSolve[{Eq1 == 0, Eq2 == 0, Eq3 == 0, Eq4 == 0, Eq5 == 0,
    Eq6 == 0, Eq7 == 0, Eq8 == 0, Eq9 == 0, Eq10 == 0, Eq11 == 0, Eq12 == 0},
   {pL, pR, vL, vR, aL, aR, ρL, ρR, eL, eR, TL, TR}];
sols[[3]]
```

Out[21]=
```
{ρR → 1.2, TL → 338.209, TR → 337.971, aR → 368.506, eR → 243182., aL → 368.636,
 eL → 243114., pL → 116714., pR → 116397., ρL → 1.20242, vR → 37.0806, vL → 29.975}
```

In[13]:=
```
{Eq1, Eq2, Eq3, Eq4, Eq5, Eq6, Eq7, Eq8, Eq9, Eq10, Eq11, Eq12} /. {vL → 0, vR → 0}
```

Out[13]=
```
{pL - αL, pR - βR, 0, AR pL - AR pR, 0, aL - Sqrt[R TL κ],
 aR - Sqrt[R TR κ], eL - cV TL, eR - cV TR, pL - R TL ρL, pR - R TR ρR, -ρ0 + ρR}
```

```
Eq4 = mp vL + pL AR - (mp vL + pR AR);
```