CLAIMS

1. A refrigerant vapor compression system comprising:

a compression device having at least a first compression stage and a second compression stage arranged in series refrigerant flow relationship;

a first refrigerant heat rejection heat exchanger disposed intermediate the first compression stage and the second compression stage for passing refrigerant passing from the first compression stage to the second compression stage;

a second refrigerant heat rejection heat exchanger disposed downstream with respect to refrigerant flow of the second compression stage;

a bypass line positioned at at least one of a discharge outlet port of the first compression stage and a discharge outlet port of the second compression stage;

a bypass valve disposed in the bypass line, the bypass valve allowing or preventing refrigerant flow through the bypass line;

wherein when the bypass valve allows refrigerant flow through the bypass line, at least one of the first compression stage and the second compression stage is bypassed and at least one of the first refrigerant heat rejection heat exchanger and the second refrigerant heat rejection heat exchanger is bypassed.

2. The refrigerant vapor compression system of claim 1 further comprising:

a refrigerant line connecting the discharge outlet port of the first compression stage to an inlet of the first refrigerant heat rejection heat exchanger;

wherein the bypass line connects the discharge outlet port of the first compression stage to an suction inlet port of the first compression stage; and

the bypass line connects the refrigerant line to the suction inlet port of the first compression stage.

3. The refrigerant vapor compression system of claim 1 further comprising:

a refrigerant line connecting the discharge outlet port of the second compression stage to an inlet of the second refrigerant heat rejection heat exchanger;

wherein the bypass line connects the discharge outlet port of the second compression stage to an suction inlet port of the second compression stage; and

the bypass line connects the refrigerant line to the suction inlet port of the second compression stage.

4. The refrigerant vapor compression system of claim 1 wherein:

the bypass line includes a first bypass line and a second bypass line, the first bypass line connecting the discharge outlet port of the first compression stage to an suction inlet port of the first compression stage, the first bypass line connecting the discharge outlet port of the second compression stage to an suction inlet port of the second compression stage;

the bypass valve includes a first bypass valve and a second bypass valve, the first bypass valve disposed in the first bypass line, the first bypass valve allowing or preventing refrigerant flow through the first bypass line, the second bypass valve disposed in the second bypass line, the second bypass valve allowing or preventing refrigerant flow through the second bypass line; and

when the first bypass valve allows refrigerant flow through the first bypass line and the second bypass valve allows refrigerant flow through the second bypass line, each of the first compression stage, the second compression stage, the first refrigerant heat rejection heat exchanger and the second refrigerant heat rejection heat exchanger is bypassed.

5. The refrigerant vapor compression system of claim 4 further comprising:

a first refrigerant line connecting the discharge outlet port of the first compression stage to an inlet of the first refrigerant heat rejection heat exchanger;

wherein the first bypass line connects the first refrigerant line to the suction inlet port of the first compression stage.

6. The refrigerant vapor compression system of claim 5 further comprising:

a second refrigerant line connecting the discharge outlet port of the second compression stage to an inlet of the second refrigerant heat rejection heat exchanger;

the second bypass line connecting the second refrigerant line to the suction inlet port of the second compression stage.

7. The refrigerant vapor compression system of claim 1 further comprising:

an economizer disposed downstream with respect to refrigerant flow of the second refrigerant heat rejection heat exchanger;

a vapor injection line communicating refrigerant from the economizer to a suction inlet port of the second compression stage.

8. The refrigerant vapor compression system of claim 7 further comprising:

a refrigerant heat absorption heat exchanger disposed downstream with respect to refrigerant flow of the economizer;

an outlet of the refrigerant heat absorption heat exchanger coupled to the suction inlet port of the first compression stage.

9. The refrigerant vapor compression system of claim 7 wherein:

the economizer is a flash tank economizer.

10. The refrigerant vapor compression system of claim 7 wherein:

the economizer is a refrigerant-to-refrigerant heat exchanger.

11. The refrigerant vapor compression system of claim 1 wherein:

the refrigerant comprises carbon dioxide.

12. The refrigerant vapor compression system of claim 1 further comprising at least one fan operatively associated with the first refrigerant heat rejection heat exchanger and the second refrigerant heat rejection heat exchanger for moving a flow of air through the first refrigerant heat rejection heat exchanger and the second refrigerant heat rejection heat exchanger.

13. A refrigerated container for use in transporting perishable goods including a refrigeration system incorporating the refrigerant vapor compression system as recited in claim 1.

14. A refrigerant vapor compression system comprising:

a compression device having at least a first compression stage and a second compression stage arranged in series refrigerant flow relationship;

a refrigerant heat rejection heat exchanger disposed downstream of one of the first compression stage and the second compression stage;

a bypass line;

a bypass valve disposed in the bypass line, the bypass valve allowing or preventing refrigerant flow through the bypass line;

wherein when the bypass valve allows refrigerant flow through the bypass line, at least one of the first compression stage and the second compression stage is bypassed and the refrigerant heat rejection heat exchanger is bypassed.

CLAIMS

1. A refrigerant vapor compression system comprising:

a compression device having at least a first compression stage and a second compression stage arranged in series refrigerant flow relationship;

a first refrigerant heat rejection heat exchanger disposed intermediate the first compression stage and the second compression stage for passing refrigerant passing from the first compression stage to the second compression stage;

a second refrigerant heat rejection heat exchanger disposed downstream with respect to refrigerant flow of the second compression stage;

a bypass line positioned at at least one of a discharge outlet port of the first compression stage and a discharge outlet port of the second compression stage;

a bypass valve disposed in the bypass line, the bypass valve allowing or preventing refrigerant flow through the bypass line;

wherein when the bypass valve allows refrigerant flow through the bypass line, at least one of the first compression stage and the second compression stage is bypassed and at least one of the first refrigerant heat rejection heat exchanger and the second refrigerant heat rejection heat exchanger is bypassed.

2. The refrigerant vapor compression system of claim 1 further comprising:

a refrigerant line connecting the discharge outlet port of the first compression stage to an inlet of the first refrigerant heat rejection heat exchanger;

wherein the bypass line connects the discharge outlet port of the first compression stage to an suction inlet port of the first compression stage; and

the bypass line connects the refrigerant line to the suction inlet port of the first compression stage.

3. The refrigerant vapor compression system of claim 1 further comprising:

a refrigerant line connecting the discharge outlet port of the second compression stage to an inlet of the second refrigerant heat rejection heat exchanger;

wherein the bypass line connects the discharge outlet port of the second compression stage to an suction inlet port of the second compression stage; and

the bypass line connects the refrigerant line to the suction inlet port of the second compression stage.

4. The refrigerant vapor compression system of claim 1 wherein:

the bypass line includes a first bypass line and a second bypass line, the first bypass line connecting the discharge outlet port of the first compression stage to a suction inlet port of the first compression stage, the second bypass line connecting the discharge outlet port of the second compression stage to a suction inlet port of the second compression stage;

the bypass valve includes a first bypass valve and a second bypass valve, the first bypass valve disposed in the first bypass line, the first bypass valve allowing or preventing refrigerant flow through the first bypass line, the second bypass valve disposed in the second bypass line, the second bypass valve allowing or preventing refrigerant flow through the second bypass line; and

when the first bypass valve allows refrigerant flow through the first bypass line and the second bypass valve allows refrigerant flow through the second bypass line, each of the first compression stage, the second compression stage, the first refrigerant heat rejection heat exchanger and the second refrigerant heat rejection heat exchanger is bypassed.

5. The refrigerant vapor compression system of claim 4 further comprising:

a first refrigerant line connecting the discharge outlet port of the first compression stage to an inlet of the first refrigerant heat rejection heat exchanger;

wherein the first bypass line connects the first refrigerant line to the suction inlet port of the first compression stage.

6. The refrigerant vapor compression system of claim 5 further comprising:

a second refrigerant line connecting the discharge outlet port of the second compression stage to an inlet of the second refrigerant heat rejection heat exchanger;

the second bypass line connecting the second refrigerant line to the suction inlet port of the second compression stage.

7. The refrigerant vapor compression system of claim 1 further comprising:

an economizer disposed downstream with respect to refrigerant flow of the second refrigerant heat rejection heat exchanger;

a vapor injection line communicating refrigerant from the economizer to a suction inlet port of the second compression stage.

8. The refrigerant vapor compression system of claim 7 further comprising:

a refrigerant heat absorption heat exchanger disposed downstream with respect to refrigerant flow of the economizer;

an outlet of the refrigerant heat absorption heat exchanger coupled to the suction inlet port of the first compression stage.

9. The refrigerant vapor compression system of claim 7 wherein:

the economizer is a flash tank economizer.

10. The refrigerant vapor compression system of claim 7 wherein:

the economizer is a refrigerant-to-refrigerant heat exchanger.

11. The refrigerant vapor compression system of claim 1 wherein:

the refrigerant comprises carbon dioxide.

12. The refrigerant vapor compression system of claim 1 further comprising at least one fan operatively associated with the first refrigerant heat rejection heat exchanger and the second refrigerant heat rejection heat exchanger for moving a flow of air through the first refrigerant heat rejection heat exchanger and the second refrigerant heat rejection heat exchanger.

13. A refrigerated container for use in transporting perishable goods including a refrigeration system incorporating the refrigerant vapor compression system as recited in claim 1.