# United States Patent [19]

**Hagen et al.**

[11] **3,747,388**

[45] **July 24, 1973**


[54] **COOLING ARRANGEMENT FOR WIRE DRAWING MACHINES**


[75] Inventors: **Werner Hagen**, Penzendorf; **Paul Diehl**, Herborn, both of Germany

[73] Assignee: **Maschinenfabrik Herborn Kommanditgesellschaft**, Herborn/Dillkreis, Germany



[22] Filed: **Apr. 29, 1971**

[21] Appl. No.: **138,725**

[30] **Foreign Application Priority Data**

Apr. 29, 1970 Germany ..... P 20 20 926.1

[52] **U.S. Cl.** ..... **72/286**, 72/342, 165/89, 165/106

[51] **Int. Cl.** ..... **B21c 9/00**

[58] **Field of Search** ..... 165/89, 90, 104, 165/106; 72/286, 289, 342



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,024,768 | 12/1935 | Johnson | 72/286 X |
| 1,672,036 | 6/1928 | Oltman | 165/89 |
| 1,390,714 | 9/1921 | Hodgson | 72/286 |
| 3,368,382 | 2/1968 | Fleshman | 72/289 |
| 2,909,849 | 10/1959 | Hornbostel | 165/89 X |
| 2,547,086 | 4/1951 | McDermott | 165/89 X |
| 2,844,887 | 7/1958 | Hornbostel | 165/89 X |



*Primary Examiner*—Albert W. Davis, Jr.

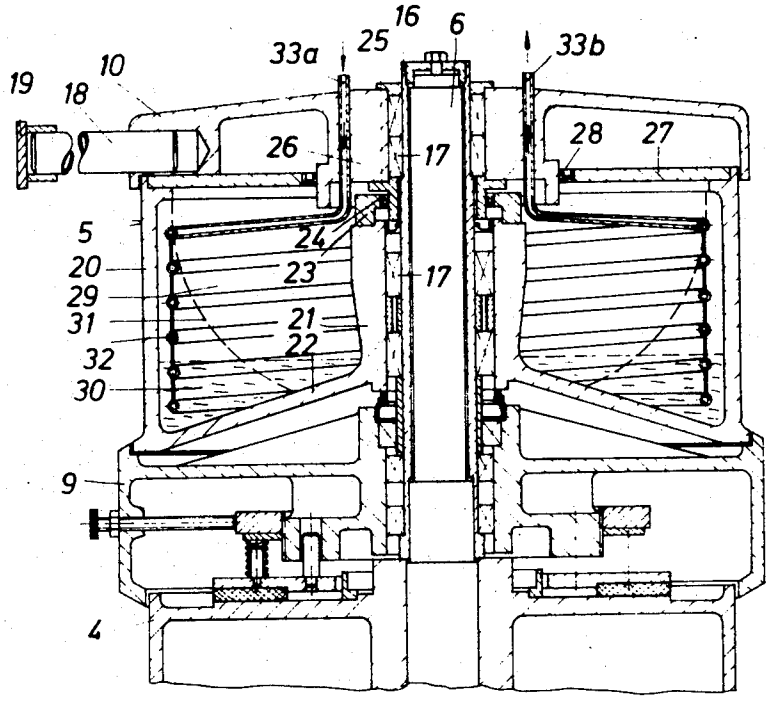
*Attorney*—Woodhams, Blanchard and Flynn



[57] **ABSTRACT**

Apparatus for cooling the wire in a wire drawing machine, particularly by cooling one or more of the drums around which the wire is wrapped. A drum around which the wire is wrapped, either a pulling drum or a storage drum, is made hollow and filled with a first fluid cooling medium. A liquid conductive heat exchanger is placed within said first cooling medium within said drum and extends through suitable means outwardly therefrom. A second cooling medium is caused to flow through said heat exchanger for extracting heat from said first cooling medium. Thus heated wire from a drawing die is wrapped around said drum, yields at least a substantial portion of its heat to said drum which heat is then absorbed by the first cooling medium and extracted therefrom and carried to suitable disposable means by the second cooling medium.


**6 Claims, 3 Drawing Figures**



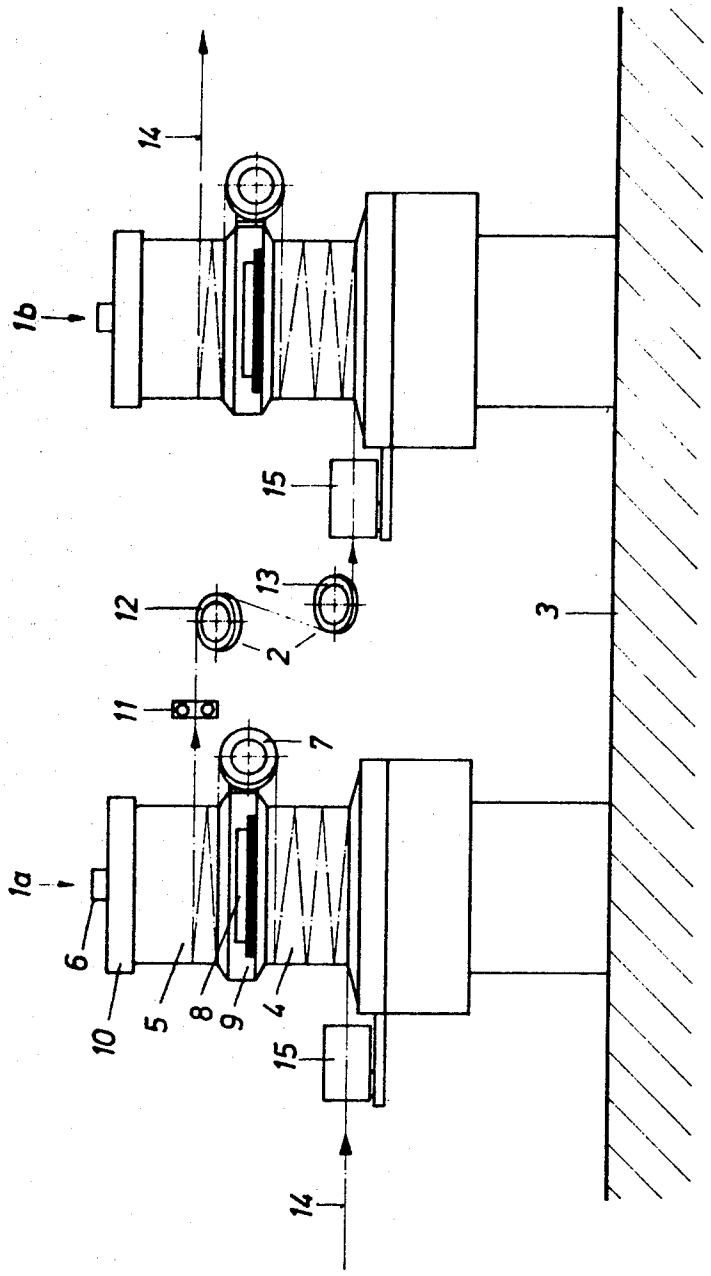



FIG. 1

INVENTORS
WERNER HAGEN
PAUL DIEHL
BY
Woodhams, Blanchard and Flynn
ATTORNEYS

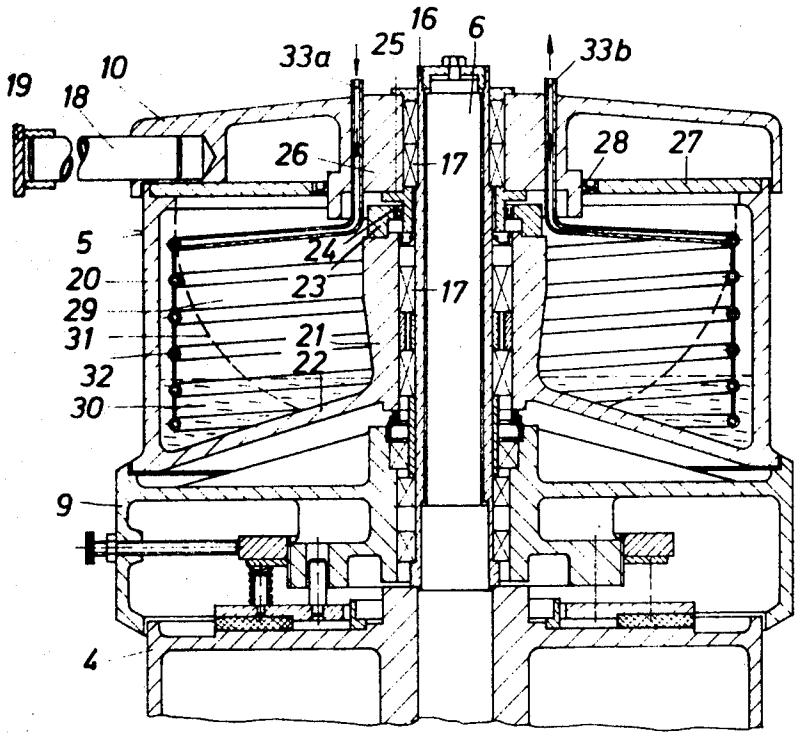



FIG. 2

INVENTORS
WERNER HAGEN
PAUL DIEHL
BY
Woodhams, Blanchard & Flynn
ATTORNEYS

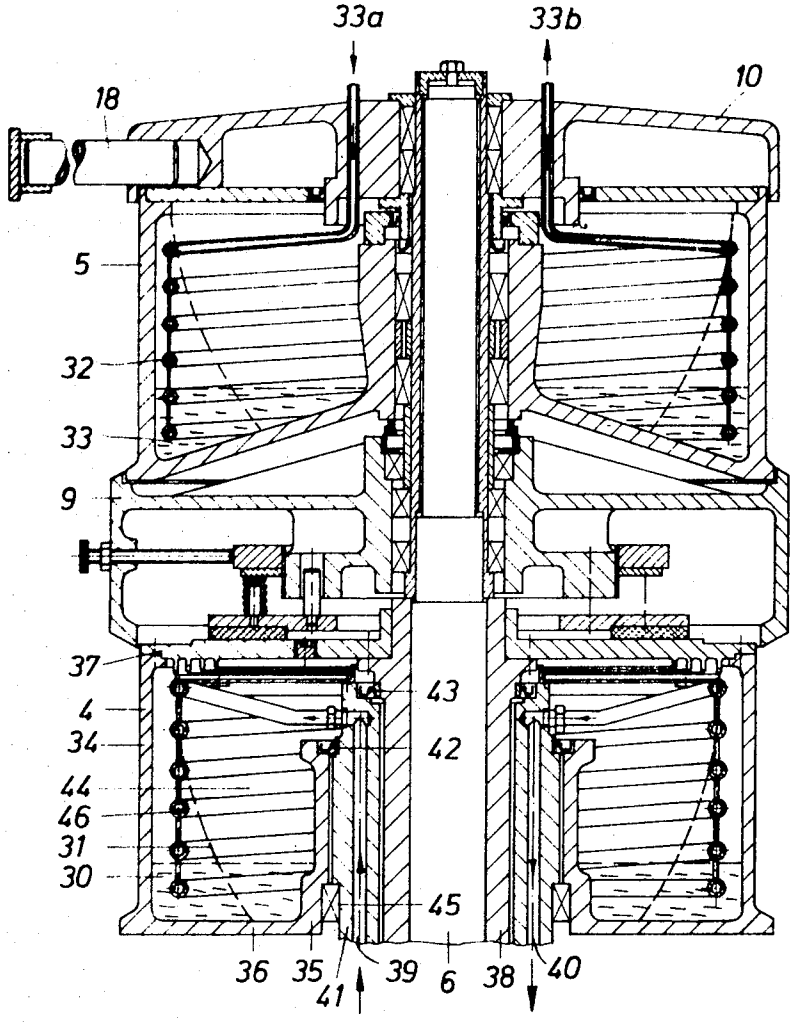



FIG. 3

INVENTORS
WERNER HAGEN
PAUL DIEHL
BY
Woodhams, Blanchard & Flynn
ATTORNEYS

# COOLING ARRANGEMENT FOR WIRE DRAWING MACHINES

The invention relates to a cooling arrangement for wire drawing machines wherein cooling of the wire itself is accomplished by cooling the pulling or storage means receiving the wire.

The heating of the wire which occurs during the drawing operation, namely during the deformation of the wire in the wire drawing dies, is sufficient that at high drawing speeds the wire must be cooled between each drawing step. If the wire, because of the nature of the drawing means, is not permitted to contact a liquid, the wire can only be cooled by means of an air stream directed onto the drawing or storage means. However, this cooling is not sufficient at very high drawing speeds. In such cases it is common to spray water against the inner wall of the drawing or storage means. However, difficulties are encountered in connection with such cooling as to the effective isolation of the remaining parts of the machine, particularly the bearings of the machine, against the cooling water. This difficulty is overcome by the invention.

A cooling arrangement for the drawing or storage means of a wire drawing machine is so constructed according to the invention that the cylindrical drawing or storage drum is closed and both the bottom and top thereof, is filled with a first cooling medium and within the drum there is arranged a heat exchanger through which a second cooling medium flows and which discharges the heat absorbed by the first cooling medium. In the cooling arrangement according to the invention, the second cooling medium flows in a closed cycle so that it can be easily sealed. The sealing of the first cooling medium which partially fills the interior of the drum can likewise be easily accomplished.

Two exemplary embodiments of the invention are described hereinafter with reference to the drawings, in which:

FIG. 1 is a schematic illustration of two drawing steps of a double drum drawing machine;

FIG. 2 is a longitudinal cross-sectional view of a cooling arrangement according to the invention for the storage drum of a double drum drawing machine; and

FIG. 3 is a cross-sectional view of a double drum in which the drawing drum and the storage drum are cooled by the cooling arrangement of the invention.

Two similarly constructed drawing devices **1***a* and **1***b* of a wire drawing machine are illustrated in FIG. **1**. A guide mechanism **2** for the wire is arranged between said drawing devices. The drawing devices **1***a* and **1***b* are positioned on a common frame **3**.

Each drawing device has a double drum comprising a drawing drum **4** positioned below and storage drum **5** positioned above. Both drums **4** and **5** are arranged on a common shaft **6**, namely the drawing drum **4** is fixedly connected to the shaft **6** while the upper drum **5** is freely rotatable about this shaft **6**. Each drawing device has a differential guide roller **7** which is rotatably supported at the end of an arm which is not illustrated in the drawings. Said arm is secured on a ring **9** which is rotatable about the shaft **6** against a friction force. The remaining fixture is illustrated at **8** and assures at all times a tension of the wire rotating around the wire roller **7**. An electric brake or return-feed locking mechanism (not illustrated) is arranged within the upper drum **5** and a fixedly arranged cover **10** is provided above said drum. A control mechanism is identified by the numeral **11** and indicates the amount of wire accumulation on the upper drum **5**. Wire guide rollers **12** and **13** guide the wire **14** to the next drawing device. The dies of both drawing devices are identified with reference numeral **15**.



FIG. **2** illustrates in a cross-sectional view the storage drum **5** and the upper end of the drawing drum **4** and also the ring **9** and cover **10**. The drum **5** and the cover **10** are freely rotatable about the shaft **6** or about a pipe **16** which is secured on the shaft **6**. The individual bearings are identified by reference numeral **17** and the numeral **18** identifies a rod which prevents a rotation of the hood **10** and is secured on a frame **19**.

The drum **5** consists substantially of a shell **20** and a hub **21** which are both connected by a bottom **22**. A ring **23** with a sliding seal **24** is positioned on the hub **21**. This seal abuts a ring **25** which is connected to the hub **26** of the hood **10**. The drum **5** is covered above by a lid **27**. This lid has a central opening for penetration by the hub **26** of the hood **10**. A sliding seal **28** is positioned between said hub and the lid **27**. The seals **24** and **28** isolate in a liquid-tight manner the zone **29** within the hood **5**. This zone is filled partly with a cooling medium **30** which adjusts during the rotation of the drums according to the parabolic line **31** and thus cools the inside wall of the shell **20** of the drum **5**.

A cooling coil **32** is arranged in the zone **29**, the feed and discharge line **33***a* or **33***b* of which is quided outwardly through openings of the hub **20** of the stationary hood **10**. The cooling coil operates as a heat exchanger. A second cooling medium which serves for cooling the cooling fluid **30** is conducted through said coil **32**.

The cooling fluid **30** absorbs the heat transmitted from the wire to the shell **20** and keeps the surface temperature of this shell sufficiently low that there is a considerable temperature drop from the wire to the shell whereby the wire is effectively cooled in a very short period of time. The heat exchanger **32** is illustrated in this exemplary embodiment for reasons of simplification as a cylindrical spiral with the shaft **6** as axis. Since the liquid **30**, upon a rotation of the drum **5**, rotates approximately at the same speed as the drum **5**, a difference in speed occurs between the heat exchanger **32** and the cooling fluid **30** and thereby a turbulence in the fluid which very strongly assists the heat exchange between the cooling fluid and heat exchanger. This turbulence in the cooling fluid further assists the exchange of the heat between the cylinder wall **20** and the cooling fluid **30** by the constant renewal of the cooling medium in contact with the wall.

The cooling medium **30** consists advantageously of a heat-resistance fluid with a great heat capacity and heat conductivity. The cooling means in the heat exchanger **32** may be gaseous, for example air or hydrogen, or may be liquid, depending on the output of the drawing machine.

A double drum is illustrated in FIG. **3** in which the inventive cooling arrangement is arranged both in the storage drum and also in the drawing drum.

The parts carried over from FIGS. **1** and **2** are identified in FIG. **3** with the same reference numerals as in FIGS. **1** and **2** as for example the upper storage drum **5** and the ring **9** carrying the differential guide roller **7**. The lower drawing drum **4** which is fixedly connected to the shaft **6** consists substantially of a shell **34** and a hub **35** which are connected by a bottom **36**. The draw-

ing drum 4 is closed at its top by a lid 37 which connects the shell 34 fixedly with a sleeve 38. Said latter is positioned and fixed against rotation on the shaft 6. A stationary length of pipe 41 provided with the channels 39 and 40 for the feed and discharge of a cooling medium and is arranged between the rotating sleeve 38 and the hub 35 of the drawing drum 4, which length of pipe is sealed off against the hub 35 by a seal 42 and against the sleeve 38 by a seal 43 and thus forms a liquid-tight zone 44 in the drawing drum 4. The hub 35 is supported at its lower end above a bearing 45 on the length of pipe 41.

A cooling coil 41 is arranged in the zone 44 in the same manner as in the storage drum 5, said cooling coil being connected to the channels 39 and 40 in the pipe 41. The cooling is carried out here in the same manner as discussed in connection with the description of FIG. 2.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a wire drawing machine having a wire drawing drum and a wire storage drum, at least one of the drums having a cooling apparatus, the combination comprising:

a stationary vertically extending spindle means;

annular, upwardly opening, chamber means rotatably mounted on said spindle means, said annular chamber means having a hollow inner wall, the interior of which receives at least a portion of said spindle means, a bottom wall secured to said inner wall and extending outwardly therefrom and an upstanding outer wall secured to said bottom wall, the outer surface of said upstanding wall defining a drum surface for engaging said wire;

bearing means adapted to rotatably support said annular chamber means on said spindle means;

means defining a first coolant housed within said annular chamber means and adapted to absorb heat from said outer wall when said wire is in engagement therewith;

means defining an inlet passageway and an outlet passageway to said annular chamber means in said spindle means, said inlet passageway and outlet passageway being spaced from said first coolant and providing a passageway for a second coolant;

annular heat exchanger means stationarily mounted in said first coolant means in said annular chamber means, said heat exchanger means having an inlet connected to said inlet passageway and an outlet connected to said outlet passageway so that said second coolant is permitted to remove heat from said annular heat exchanger means, whereby said annular heat exchanger means removes the heat in said first coolant means to maintain the effectiveness of said first coolant means in maintaining said outer wall cool to thereby remove the heat from said wire engaging said outer wall.

2. The combination of claim 1, wherein the cooling apparatus comprising said first coolant and said heat exchanger means is arranged in said storage drum.

3. The combination of claim 2, wherein a second cooling apparatus means is also arranged in said drawing drum.

4. The combination of claim 1, wherein said heat exchanger means consists of a cylindrically wound cooling coil.

5. The combination according to claim 1, including cover means for covering said open top of said annular chamber means.

6. The combination according to claim 1, wherein said bearing means rotatably supports said inner wall of said annular chamber means.

* * * * *