April 30, 1957 A. S. SOBEK 2,790,230

LIQUID-JET DESCALER FOR FORGING BLANKS

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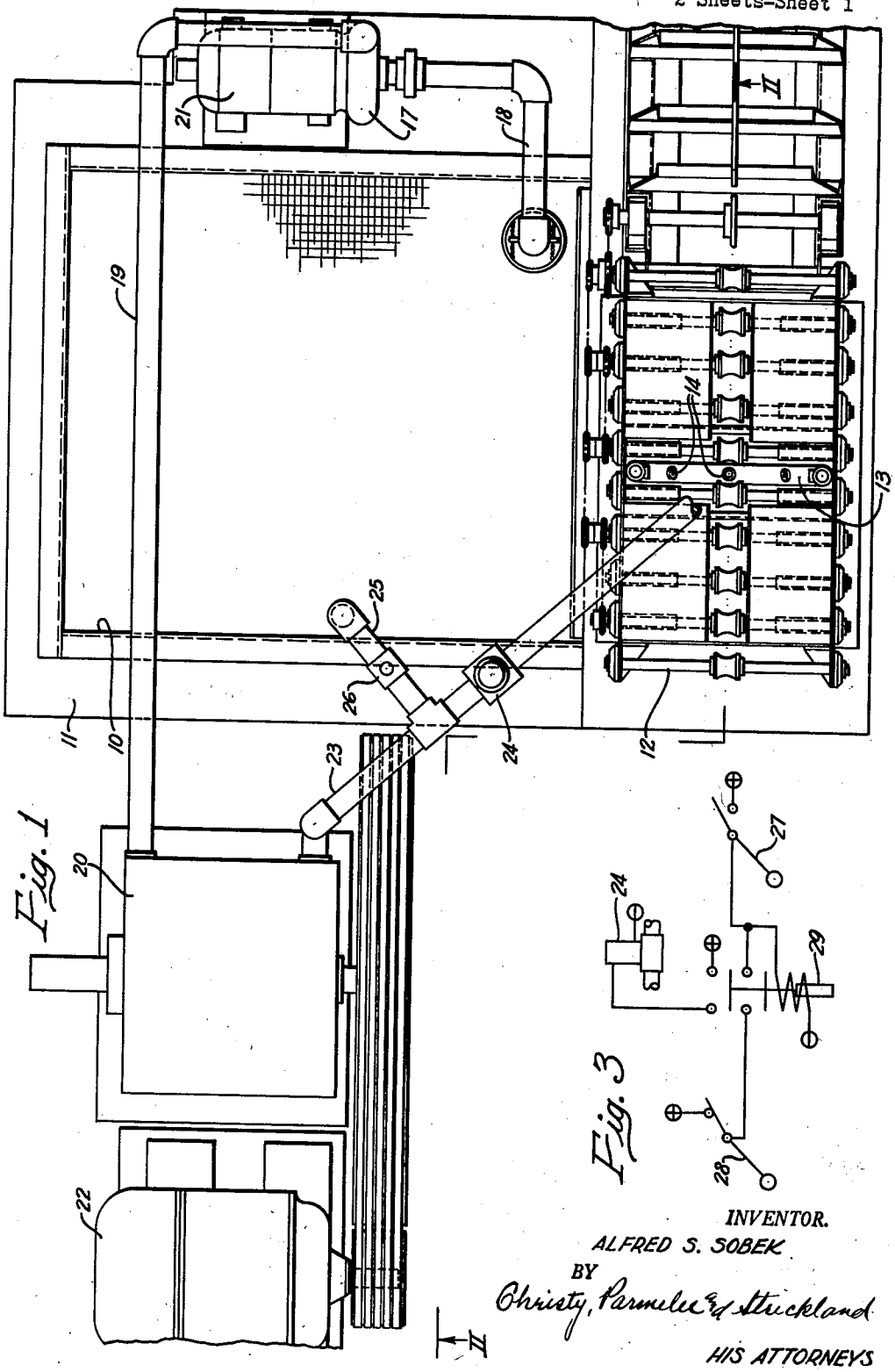


Fig. 1

Fig. 3

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Fig. 2

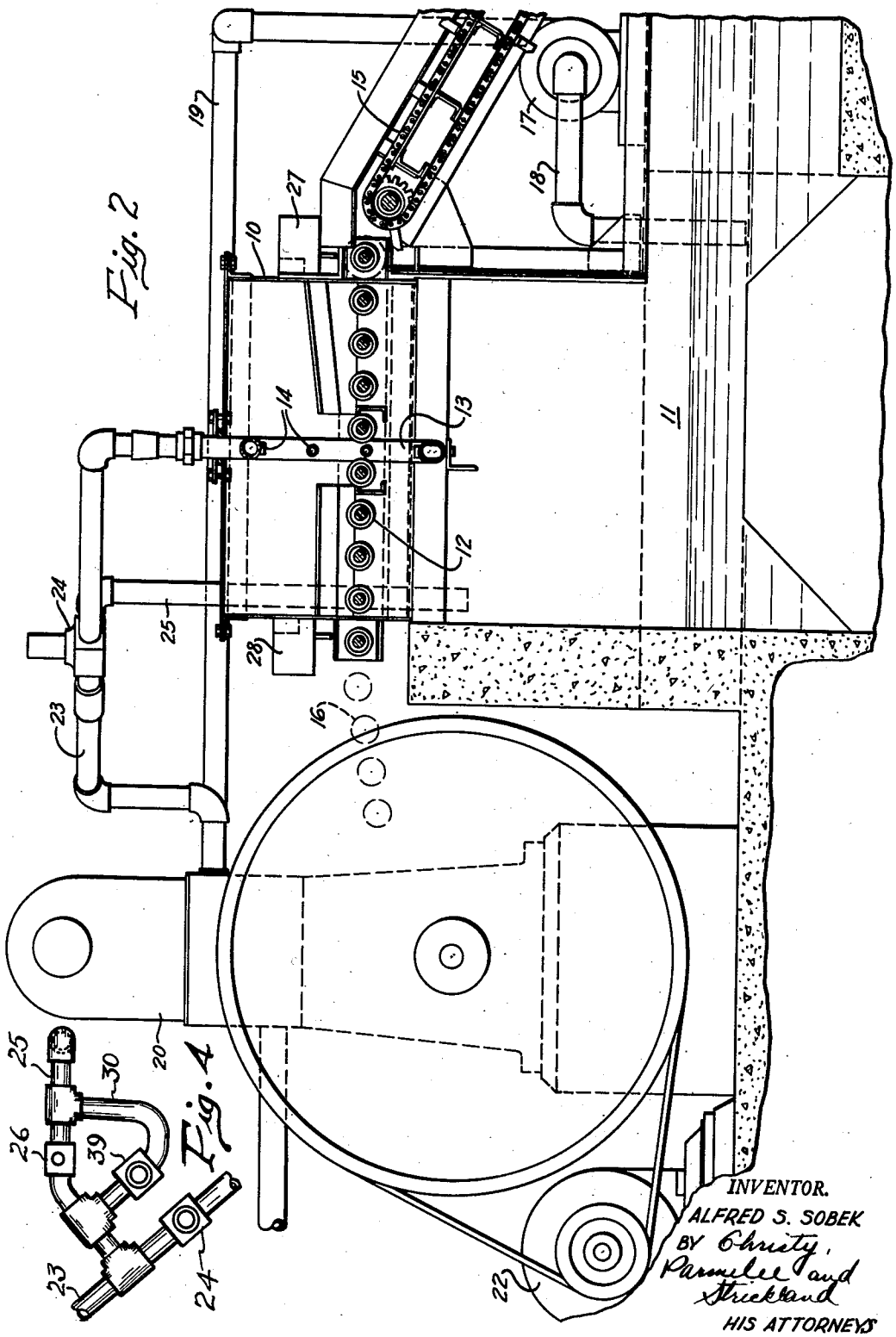


Fig. 4

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LIQUID-JET DESCALER FOR FORGING BLANKS

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Application April 3, 1953, Serial No. 346,578

2 Claims. (Cl. 29—81)

This invention relates to apparatus for producing high-velocity liquid jets effective to remove the scale formed on forging blanks during the heating thereof. More particularly, the invention concerns the liquid-circulating system including pumps and automatic means for operating a valve controlling the liquid flow.

High-velocity liquid jets have proved effective for descaling masses of metal heated to forging or rolling temperatures. To produce such jets, a source of liquid under high pressure is required. The usual installations include large accumulators or tanks in which a column of liquid is maintained under pressure. Such tanks or chambers are costly because of the high pressure to which they are subject and the resulting liability to leakage at the joints, the prevention of which necessitates special precautions in manufacture.

I have invented apparatus for supplying liquid under the high pressure required for effective descaling, and automatically controlling it, without the use of large accumulator chambers for building up a quantity of liquid under the desired pressure. In a preferred embodiment, I employ a continuously operating high-pressure pump to deliver liquid to a plurality of nozzles directed toward the path of travel of the articles to be descaled, such as forging billets or blanks. I provide an electro-magnetic valve controlling the flow of liquid to the nozzles and flag switches or the like actuated by the advancing workpieces, to operate the valve so as to insure a flow of liquid from the nozzles whenever a workpiece is in position to be descaled. The system includes a primary pump drawing liquid from a sump below the nozzles and delivering it to the high-pressure pump.

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating a present preferred embodiment. In the drawings,

Fig. 1 is a plan view with parts omitted for clearness;

Fig. 2 is a vertical section taken along the plane of line II—II of Fig. 1, with parts in elevation;

Fig. 3 is a diagram of the circuit for the electromagnetic valve; and

Fig. 4 is a view showing a modification in the valves of the apparatus.

Referring now in detail to the drawings and, for the present, to Figs. 1 and 2, a descaling chamber **10** mounted over a sump tank **11** is provided with a roller conveyor **12** and a nozzle ring **13** surrounding it. The ring **13** is fitted with a plurality of nozzles **14** directed toward the path of articles moving along the conveyor. Forging blanks or other masses of metal, after being heated to the desired temperature while passing through a furnace of any suitable type, are transferred from the furnace to conveyor **12** by an elevating flight conveyor **15**. After passing through the chamber **10**, the blanks pass along a

delivery conveyor **16** to the forging press or other hot-working apparatus.

Descaling liquid such as water is drawn from tank **11** by a primary pump **17** through a suction or inlet line **18** and is delivered through a main delivery or discharge line **19** to the inlet of a high-pressure, multi-cylinder secondary pump **20**. Pump **17** is driven by a directly connected motor **21**. Pump **20** is driven by a motor **22** through V-belts and pulleys. Ring **13** is connected to the outlet of pump **20** by a discharge line **23** controlled by a solenoid shut off valve **24**. A by-pass delivery line **25** connected to discharge line **23** between pump **20** and valve **24** leads to tank **11** and includes a relief valve **26**. Pump **17** supplies water at low pressure such as 15 p. s. i. to pump **20**, and the latter delivers water to the ring **13** at a greatly increased pressure such as 1500 p. s. i. or more. The flow of water from pump **20** to the ring, of course, is controlled by electro-magnetic valve **24**. Valve **26**, furthermore, is adjusted to open under the discharge pressure of pump **20** when valve **24** is closed and to close when valve **24** is open. The output of pump **20** is thus continuous, being diverted to the tank **11** when not being used in descaling.

For controlling valve **24**, I provide a flag switch **27** at the approach or entrance to the chamber adapted to be actuated by each workpiece entering the chamber. The switch **27** may be a time-delay switch of known type, arranged to hold the valve **24** open while the workpiece is moving through the descaling chamber. Alternatively, I may provide two flag switches **27** and **28** at the entrance and exit ends, respectively, of chamber **10**, adapted to be actuated by the workpieces as they enter and leave the chamber. Fig. 3 shows the circuit for the switches and the operating coil of the valve. As there shown, switch **27**, when actuated by an entering workpiece, closes its contact completing a circuit for a relay **29**. This relay, at its upper contact, completes a circuit for the valve-operating coil. At its lower contact, the relay completes a holding circuit for its own winding through the contact of switch **28** which is closed until such switch is actuated. Energization of the coil of valve **24** causes it to open. The resulting reduction of pressure in line **23** permits valve **26** to close. The latter is open, of course, so long as pump **20** is operating and valve **24** is closed. The opening of valve **24** and the closing of valve **26** cause the output of pump **20** to be delivered to the nozzle ring **13**. As a result, high-velocity descaling jets are discharged from the nozzles upon the advancing workpiece.

After passing the jets and being descaled thereby, the workpiece moves out of chamber **10**, and, in so doing, actuates switch **28**. Switch **27**, of course, opens as soon as the workpiece passes beyond it but this does not affect valve **24** since relay **29** maintains the circuit (through closed switch **28** and the lower contacts of relay **29**) for the valve coil and its own winding. When the workpiece strikes switch **28**, however, the latter opens the holding circuit for the relay winding, and the relay immediately drops out, thus opening the circuit of the valve coil. The valve then closes by virtue of a restoring spring therein, and the pressure in line **23** then builds up until valve **26** opens to bypass the output of the pump back to the tank **11**.

Should the workpieces follow each other in close-order succession, as will usually be the case, valve **24** will be kept open continuously. Thus if several workpieces are in chamber **10** at the same time, the one about to leave will not cause closure of valve **24** as explained above, because the one entering will maintain energization of the valve coil by closing switch **27**. If desired, the relay **29** may be of the slow-release type to insure descaling of the last few workpieces of a series since otherwise, the

first operation of switch **28** after the entry of the last piece would close valve **24**.

In cases where the intervals between the successive descaling operations are relatively great, it will be understood that the motors **21** and **22** of the pumps will be working against the pressure head of the spring loaded valve **26**, a pressure head of 1500 pounds or more per square inch in the illustrated embodiment of the invention. In order to eliminate or minimize the consequent waste of electric power required to operate the pump motors **21** and **22** under such circumstances, I illustrate in Fig. 4 a solenoid valve **39** arranged in a by-pass line **30** around valve **26**. The valve **39** is a solenoid valve which stands in open position when the solenoid valve **24** is closed, whereby during the "idle" operation of the pumps **17** and **20** the water is circulated against practically no head. When a workpiece enters the descaling chamber and operates the flag switch **27**, the relay **29** operates to close the valve **39** simultaneously with the opening of the valve **24**, it being understood that the terminals of the solenoids of both valves **24** and **39** are connected in parallel with upper contacts of relay **29**. In the event that the solenoid valve **39** should stick or fail to open, the relief valve **26** will open and prevent damage to the pumps or motors. Alternately, or supplementarily, the motors **21** and **22** may have circuit-breakers arranged to open and interrupt operation in the event the relief valve fails to open and overload the motors.

It will be apparent from the foregoing that the invention provides a simple and relatively inexpensive system for circulating descaling liquid continuously from a sump to nozzles discharging on the work. By using a low-pressure suction pump feeding water to the secondary or high-pressure pump, I avoid the necessity for costly accumulators and, at the same time, am able to maintain a continuing supply of liquid, whereas the capacity of an accumulator is limited.

Although I have described in detail only a preferred embodiment, changes therein may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. Apparatus for descaling heated masses of metal comprising in combination means for conveying scale-bearing hot masses of metal along a predetermined path, nozzles mounted for discharging violent scale-removing jets of liquid upon the metal masses moving along said path, a sump for collecting liquid discharged by said nozzles, a primary pump and a secondary pump each having an inlet and outlet, the inlet of said primary pump communicating with the liquid in said sump and the outlet of said primary pump communicating with the inlet of the secondary pump, a main delivery line leading from the outlet of the secondary pump to said nozzles, a by-pass delivery line connected for the delivery of liquid from the outlet of said secondary pump to said sump, a motor connected to drive said primary pump for delivering liquid from said sump to the inlet of said secondary pump at a pressure of relatively low value, a motor connected to drive said secondary pump for delivering liquid to said delivery lines at a pressure increased from said relatively low value produced by said primary pump to a value at least equal to the jet-producing pressure required at said nozzle a shut-off valve in said main delivery line between said secondary pump and said nozzles, a pressure-relief valve in said by-pass delivery line loaded for closing and remaining closed, while said shut-off valve is open and liquid is flowing through said main delivery line to said nozzles, and for opening and remaining open while said shut-off valve is closed with said pumps in operation, means responsive to the hot masses moving along said path for opening and closing said shut-off valve, with the consequent closing and opening, respectively, of said pressure-relief valve, whereby said pumps deliver liquid at substantially jet-producing pressure both when said jets are in operation and when they are not.

2. Apparatus for descaling heated masses of metal comprising in combination means for conveying scale-bearing hot masses of metal along a predetermined path, nozzles mounted for discharging violent scale-removing jets of liquid upon the metal masses moving along said path, a sump for collecting liquid discharged by said nozzles, a primary pump and a secondary pump each having an inlet and outlet, the inlet of said primary pump communicating with the liquid in said sump and the outlet of said primary pump communicating with the inlet of the secondary pump, a main delivery line leading from the outlet of the secondary pump to said nozzles, a by-pass delivery line connected for the delivery of liquid from the outlet of said secondary pump to said sump, a motor connected to drive said primary pump for delivering liquid from said sump to the inlet of said secondary pump at a pressure of relatively low value, a motor connected to drive said secondary pump for delivering liquid to said delivery lines at a pressure increased from said relatively low value produced by said primary pump to a value at least equal to the jet-producing pressure required at said nozzles, a shut-off valve in said main delivery line between said secondary pump and said nozzles, a pressure-relief valve in said by-pass delivery line loaded for closing and remaining closed, while said shut-off valve is open and liquid is flowing through said main delivery line to said nozzles, and for opening and remaining open while said shut-off valve is closed with said pumps in operation, means comprising an electric solenoid for operating said shut-off valve, an energizing circuit for said solenoid, flag-switch means responsive to the hot masses moving along said path for closing and opening said energizing circuit respectively to open and close said shut-off valve, with the consequent closing and opening, respectively, of said pressure-relief valve, whereby said pumps deliver liquid at substantially jet-producing pressure both when said jets are in operation and when they are not.

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