C.3.2.4 Sprenkle conditioner

The Sprenkle conditioner consists of three perforated plates in series with a length equal to $D \pm 0{,}1D$ between successive plates. The holes should preferably be chamfered at 45° on the upstream side to reduce the pressure loss, and the total area of the holes in each plate should be greater than 40 % of the cross-sectional area of the pipe. The ratio of plate thickness to hole diameter should be at least 1 and the diameter of the holes should be less than or equal to $0{,}05D$ (see Figure C.8).

The three plates are held together by bars or studs, which are located around the periphery of the pipe bore, and which should be of as small a diameter as possible but should provide the required strength.

The pressure loss coefficient, K, for the Sprenkle conditioner is approximately equal to 11 if there is an inlet bevel or 14 if there is no inlet bevel.

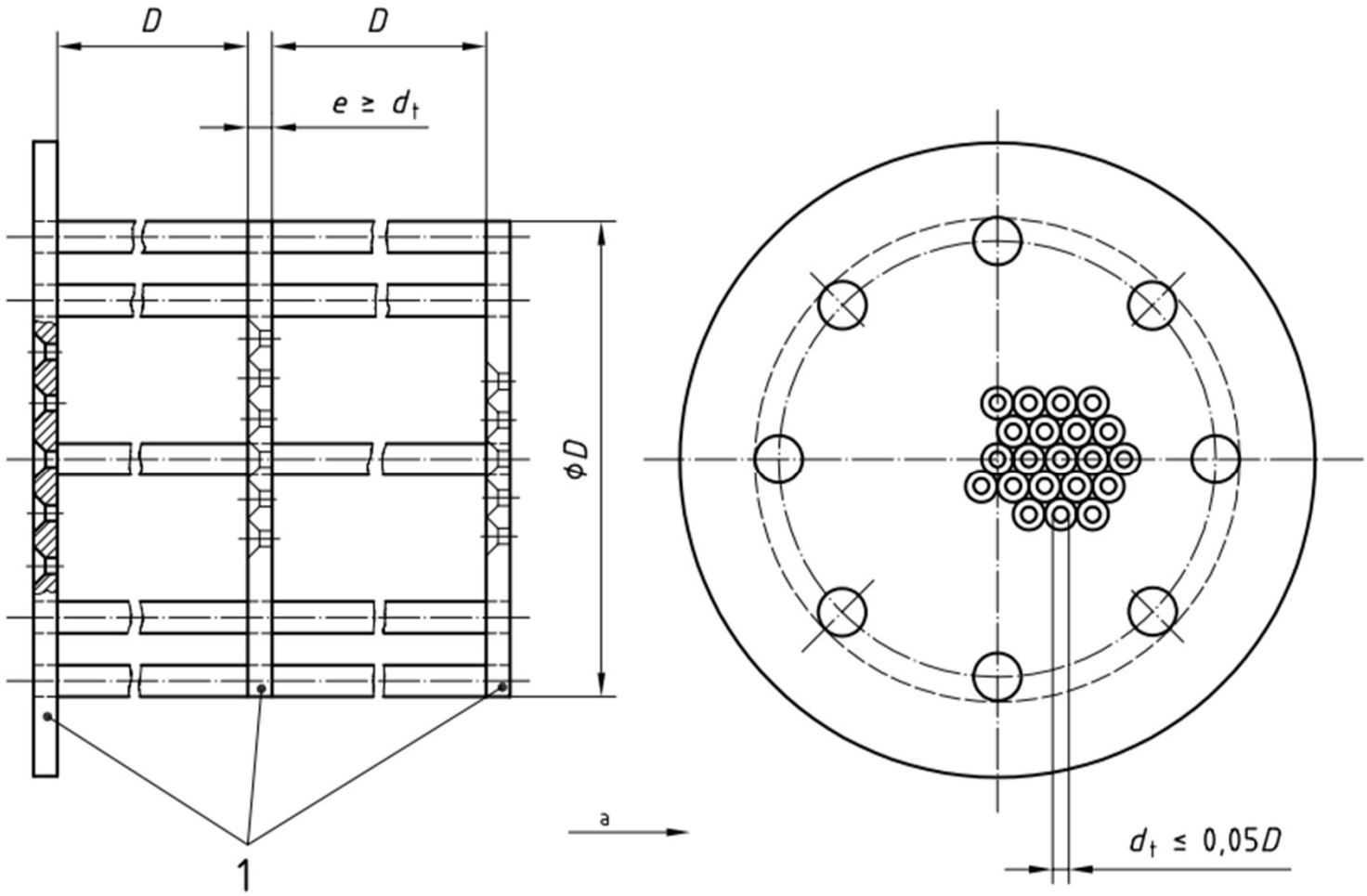


Figure C.8 — Sprenkle straightener

C.3.2.5 Zanker flow conditioner

The Zanker flow conditioner consists of a perforated plate with holes of certain specified sizes followed by a number of channels (one for each hole) formed by the intersection of a number of plates (see Figure C.9). The various plates should be as thin as possible but should provide adequate strength.

The pressure loss coefficient, K, for the Zanker flow conditioner is approximately equal to 5.

a Hole diameter 0,141D, pcd 0,25D, 4 holes

b Hole diameter 0,139D, pcd 0,56D, 8 holes

c Hole diameter 0,136 5D, pcd 0,75D, 4 holes

d Hole diameter 0,11D, pcd 0,85D, 8 holes

e Hole diameter 0,077D, pcd 0,90D, 4 holes

f Direction of flow

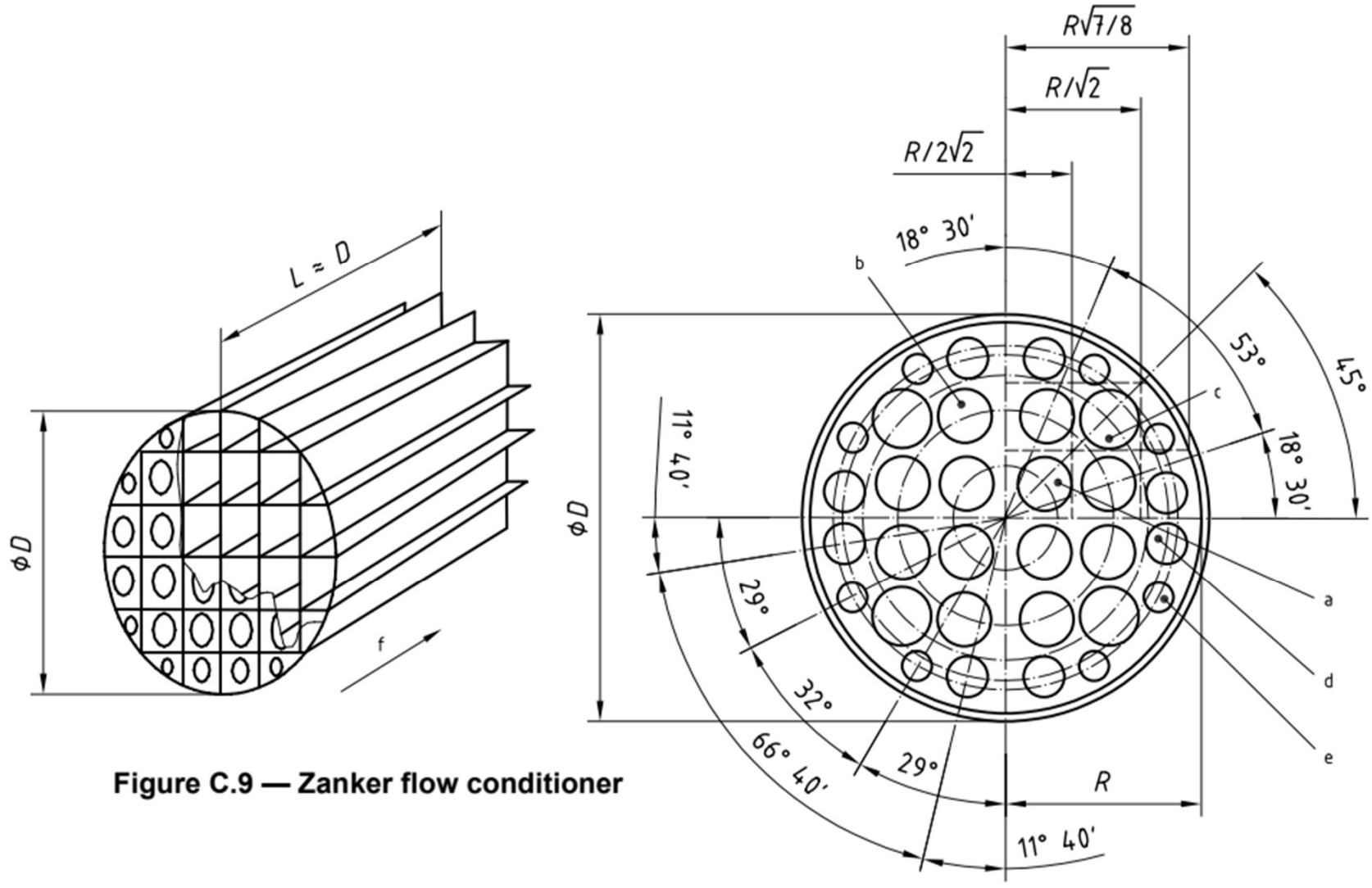


Figure C.9 — Zanker flow conditioner

C.3.2.6 Zanker flow conditioner plate

The Zanker flow conditioner plate described here is a development of the Zanker conditioner described in C.3.2.5. The Zanker flow conditioner plate has the same distribution of holes in a plate but does not have the egg-box honeycomb attached to the plate; instead the plate thickness has been increased to $D/8$.

The Zanker flow conditioner plate is illustrated in Figure C.10 and consists of 32 bored holes arranged in a symmetrical circular pattern. The dimensions of the holes are a function of the pipe inside diameter D. There are

a) a ring of 4 central holes of diameter $0{,}141D \pm 0{,}001D$ on a pitch circle diameter (pcd) of $0{,}25D \pm 0{,}002\ 5D$;

b) a ring of 8 holes of diameter $0{,}139D \pm 0{,}001D$ on a pitch circle diameter (pcd) of $0{,}56D \pm 0{,}005\ 6D$;

c) a ring of 4 holes of diameter $0{,}136\ 5D \pm 0{,}001D$ on a pitch circle diameter (pcd) of $0{,}75D \pm 0{,}007\ 5D$;

d) a ring of 8 holes of diameter $0{,}110D \pm 0{,}001D$ on a pitch circle diameter (pcd) of $0{,}85D \pm 0{,}0085D$;

e) a ring of 8 holes of diameter $0{,}077D \pm 0{,}001D$ on a pitch circle diameter (pcd) of $0{,}90D \pm 0{,}009D$.

The tolerance on the diameter of each hole is $\pm$ 0,1 mm for $D < 100$ mm.

The perforated plate thickness, t_c, is such that $0{,}12D \leqslant t_c \leqslant 0{,}15D$. The flange thickness depends on the application; the outer diameter and flange face surfaces depend on the flange type and application.

a Hole diameter 0,141D, pcd 0,25D, 4 holes

b Hole diameter 0,139D, pcd 0,56D, 8 holes

c Hole diameter 0,136 5D, pcd 0,75D, 4 holes

d Hole diameter 0,11D, pcd 0,85D, 8 holes

e Hole diameter 0,077D, pcd 0,90D, 8 holes

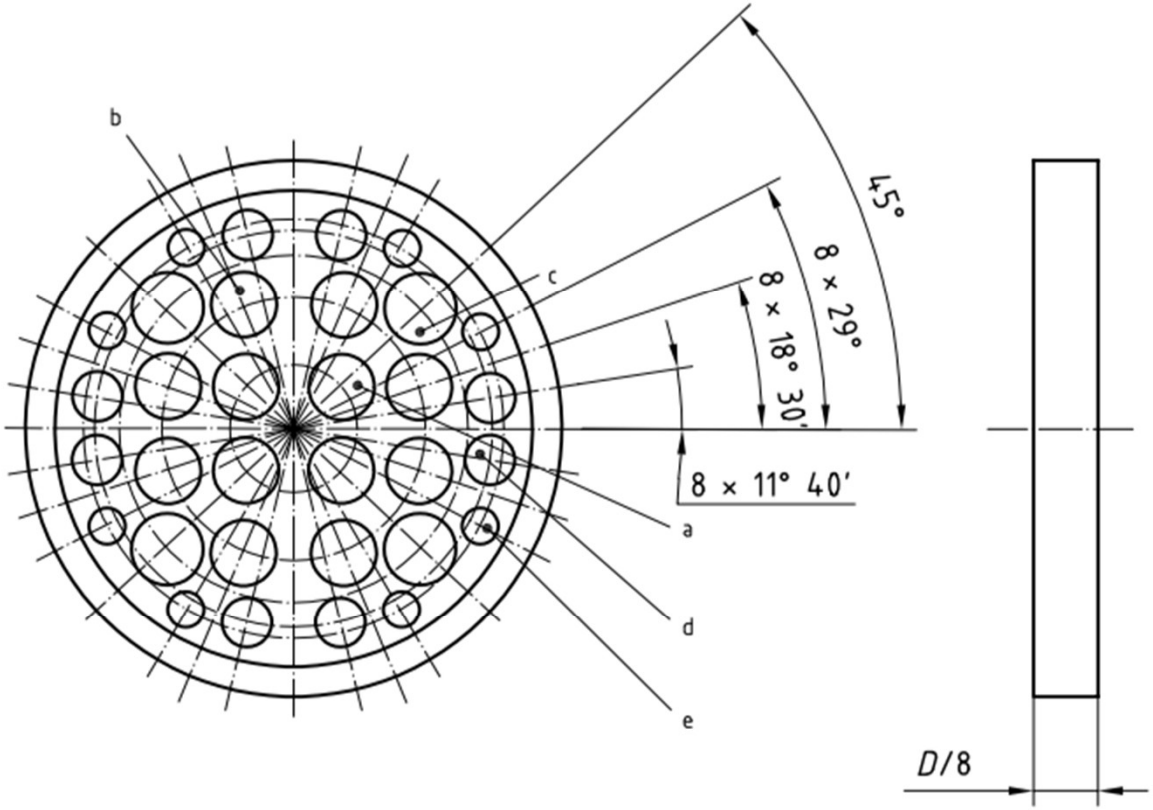
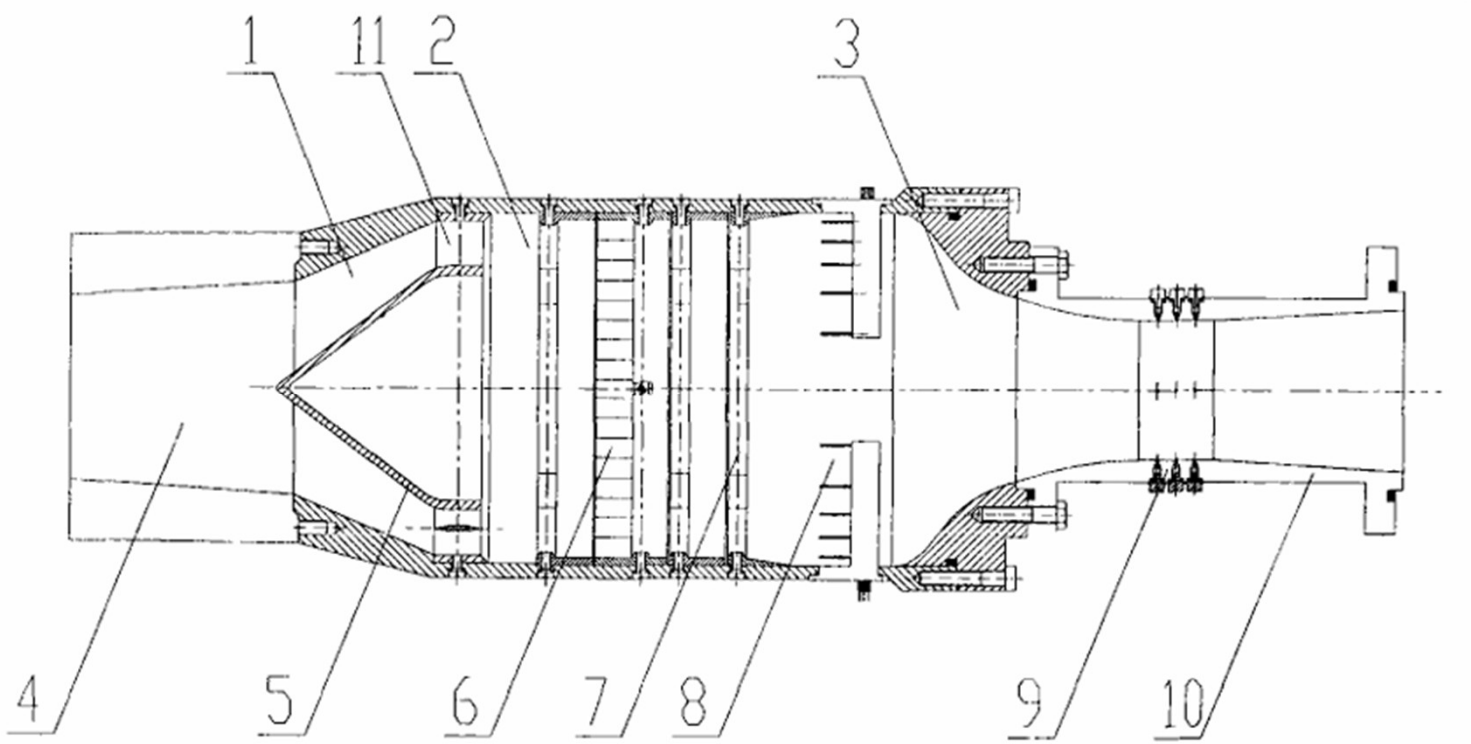


Figure C.10 — Zanker flow conditioner plate

The pressure loss coefficient, K, for the Zanker flow conditioner plate is approximately equal to 3.

6管道流量計兼具整流器結構專利

CN201795822U-一种高精度大范围气流流量计



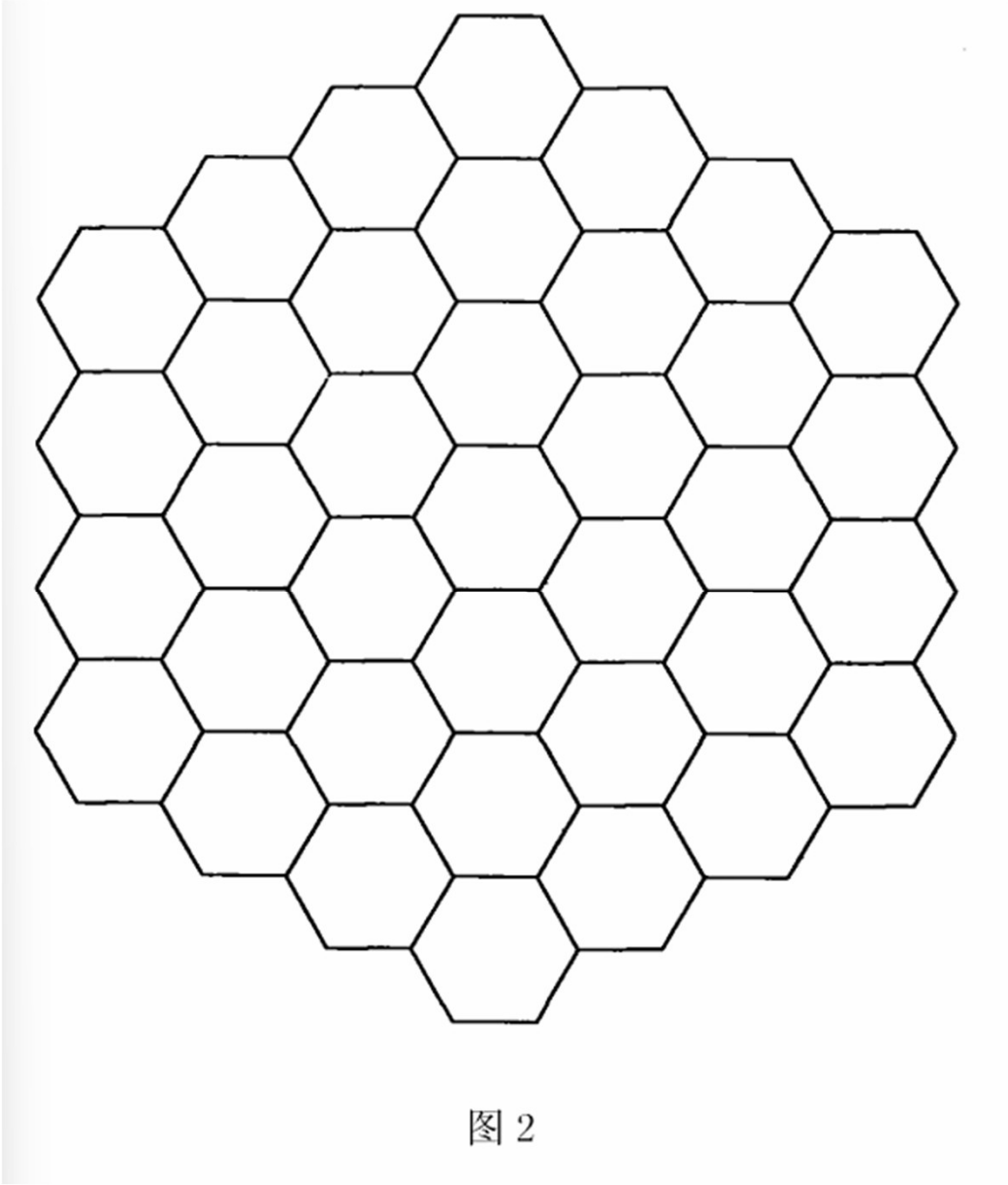
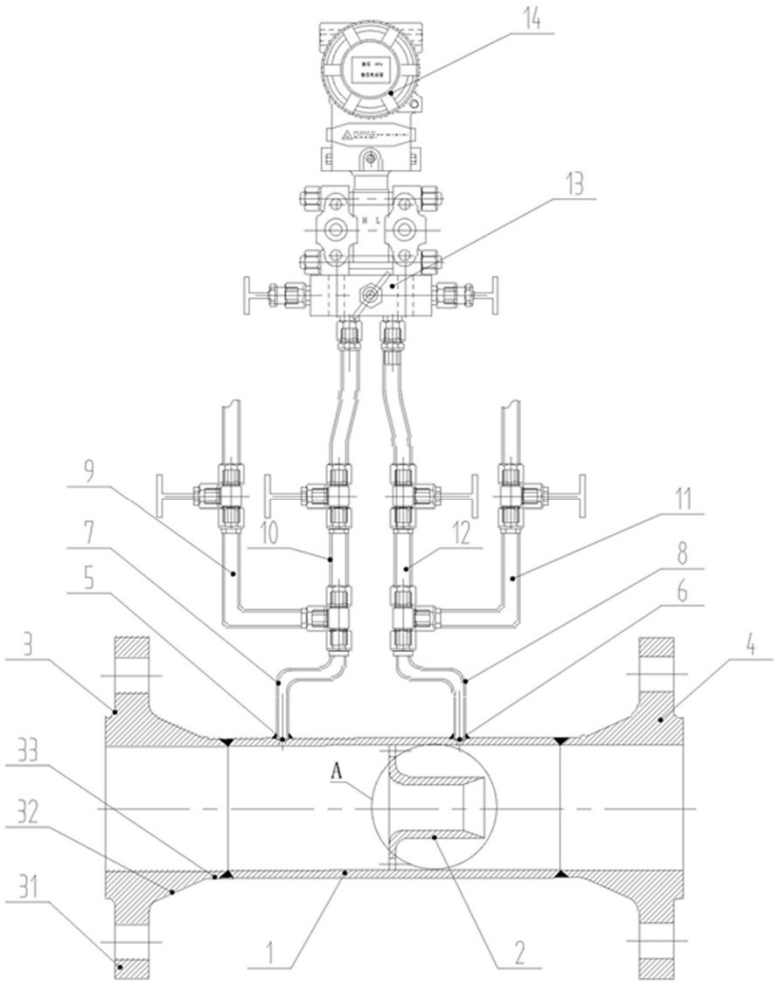


图 2

CN210321846U-一种喷嘴流量计

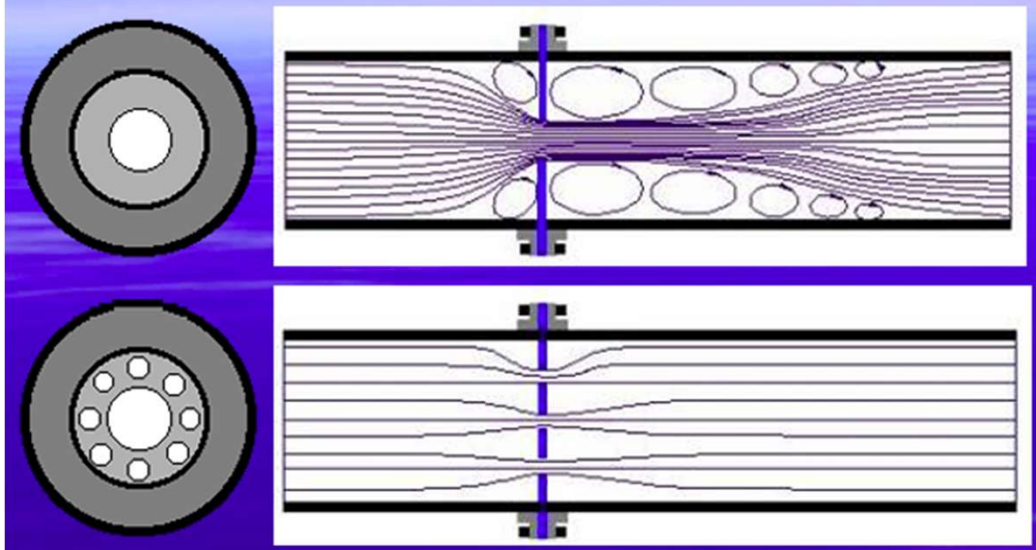


2005-balanced flow meter-NASA

- A thin, multi-hole orifice plate with holes sized and placed per a unique set of equations to produce mass flow, volumetric flow, kinetic energy, or momentum BALANCE across the face of the plate

Chevron-Texaco 18 inch Commercial Plate

How Does It Perform?



Comparison of standard orifice to balanced flow meter, both with 27.1% open area

Results based on compressed gas testing

- 10X better accuracy
- 2X faster pressure recovery (shorter distance)
- 15X noise reduction
- 2.5X less permanent pressure loss
- Exclusively licensed through NASA by A+FlowTek for commercialization

Configurations Tested in 2004

Figure 1 Slotted Configuration

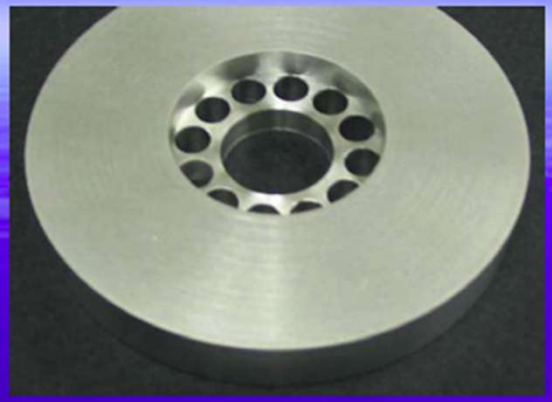


Figure 3 Single Ring of Holes Configuration

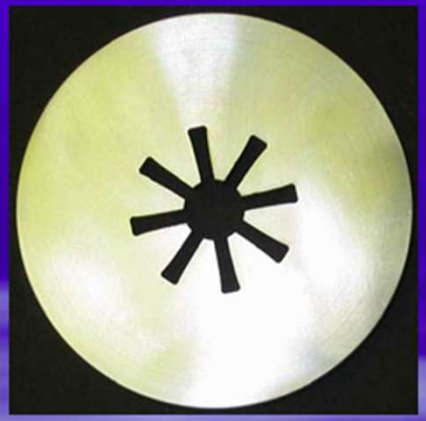


Figure 2 Iron Cross Configuration

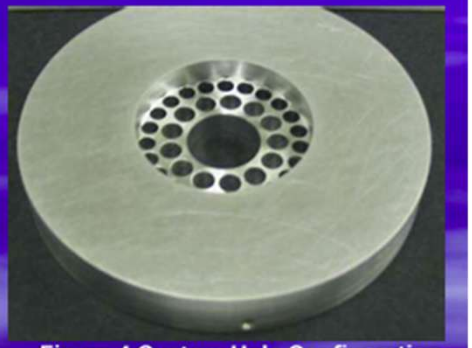


Figure 4 Custom Hole Configuration

Permanent pressure loss, accuracy and discharge coefficient comparable with a Venturi meter!

CN107429871B-Flow regulator and flow measuring dev

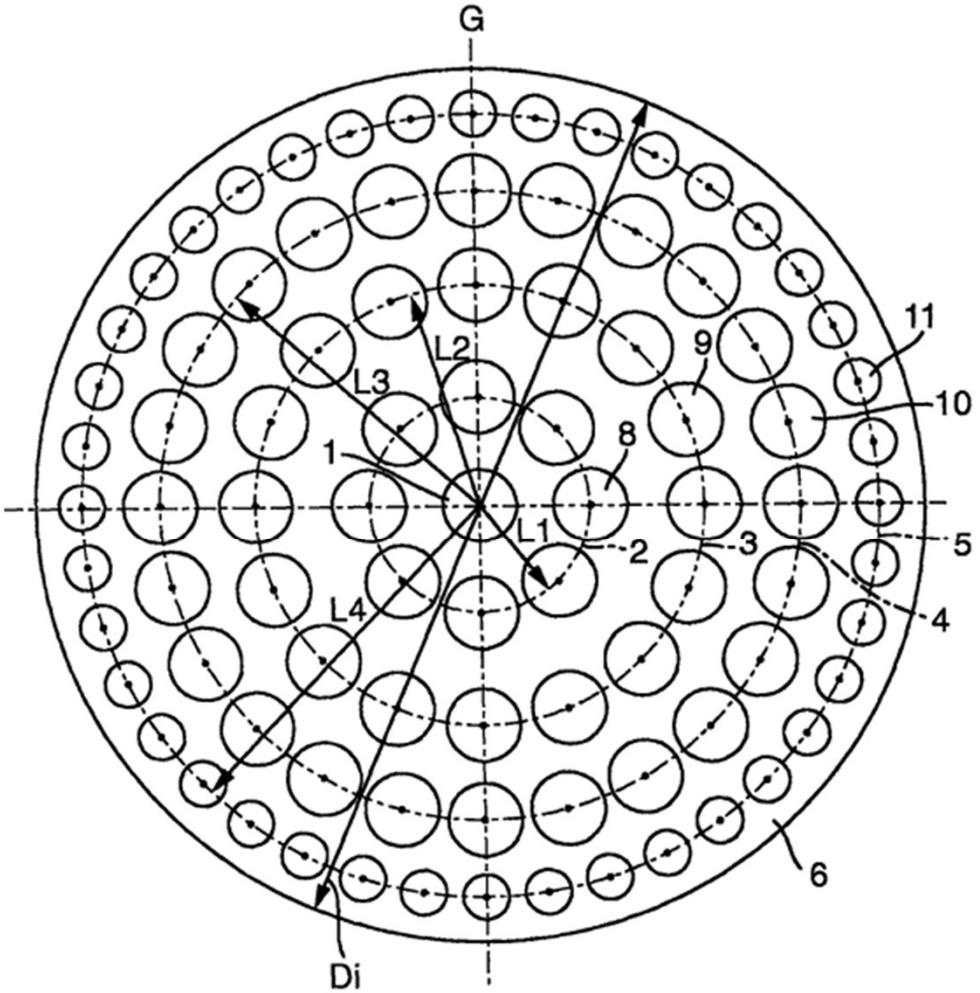


图1

CN103977919A-多孔喷嘴

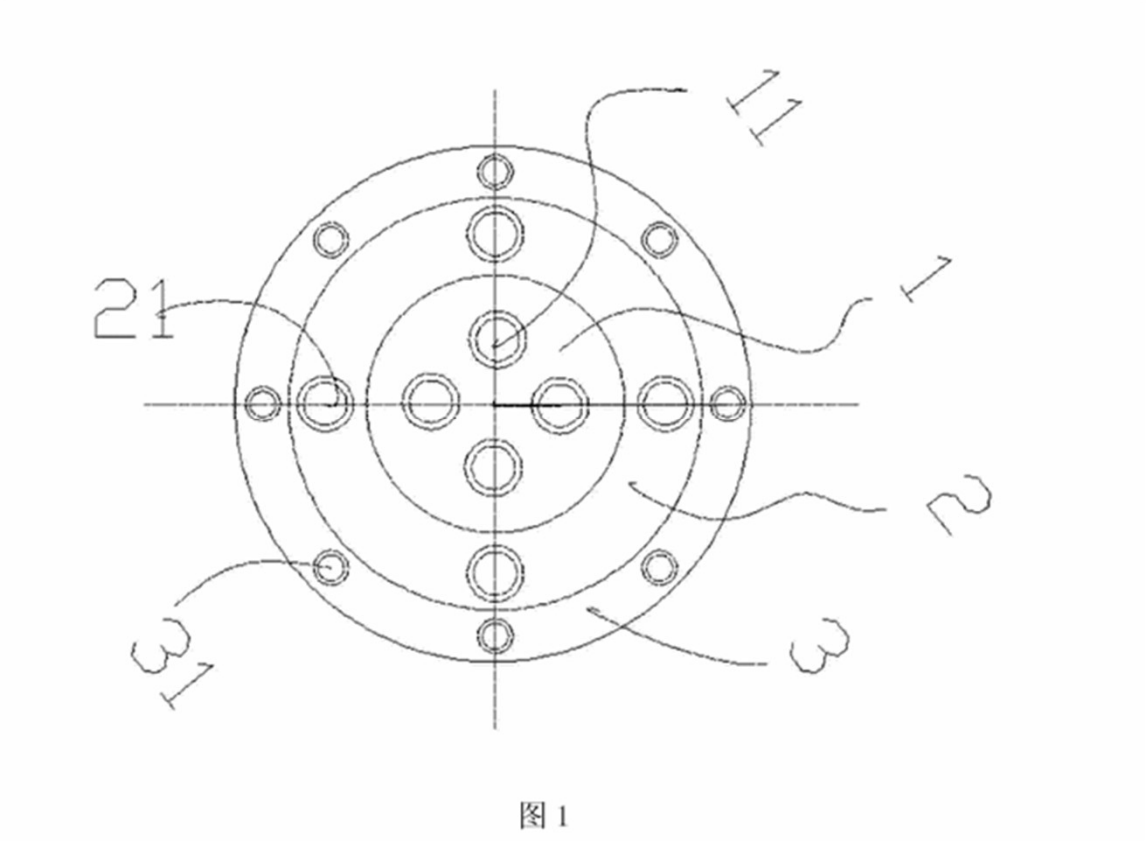


图 1

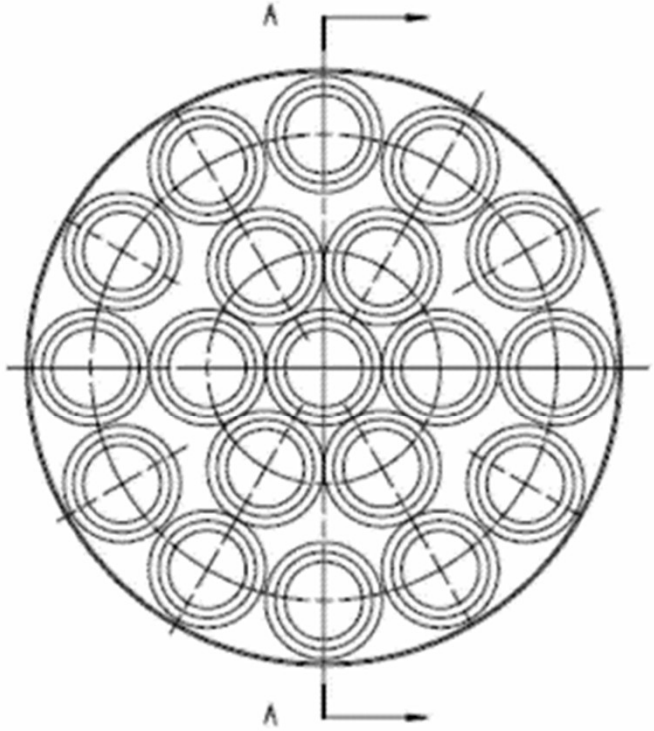


图 2

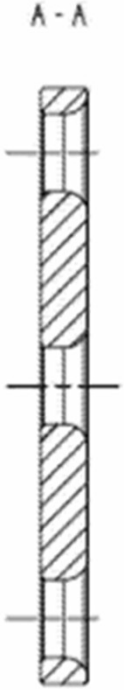


图 3

CN202631016U-一种函数孔平衡流量计

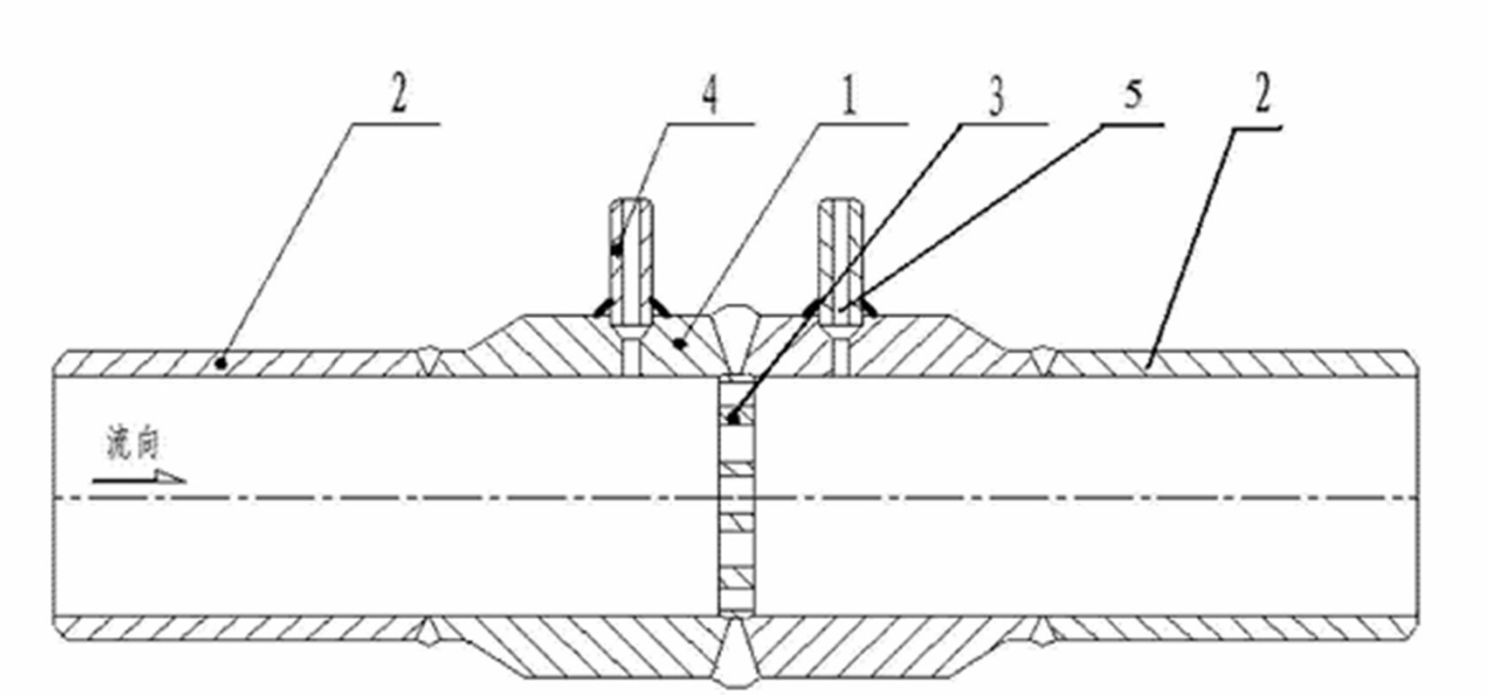


图 1

CN202018306U-一种多孔平衡流量计

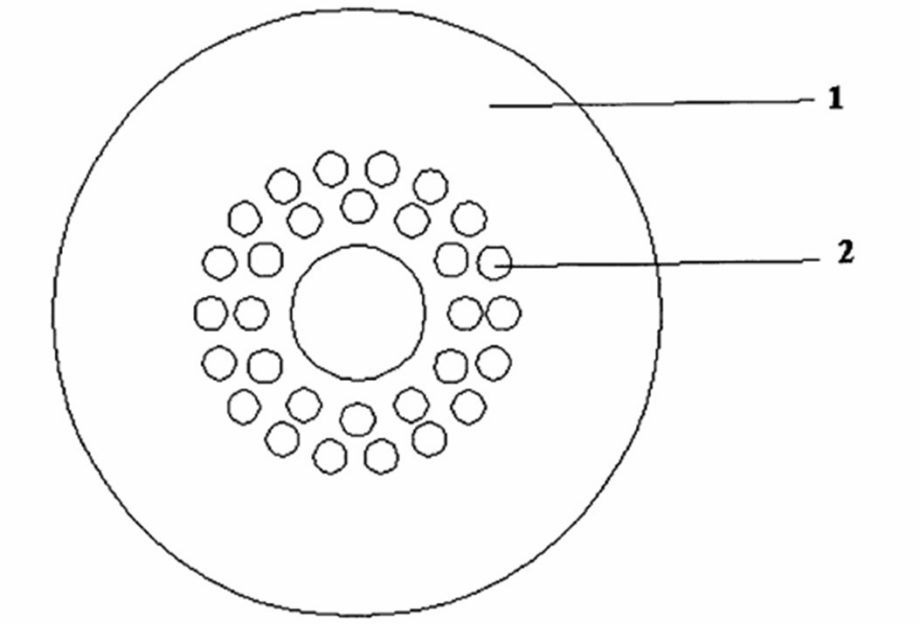


图 1

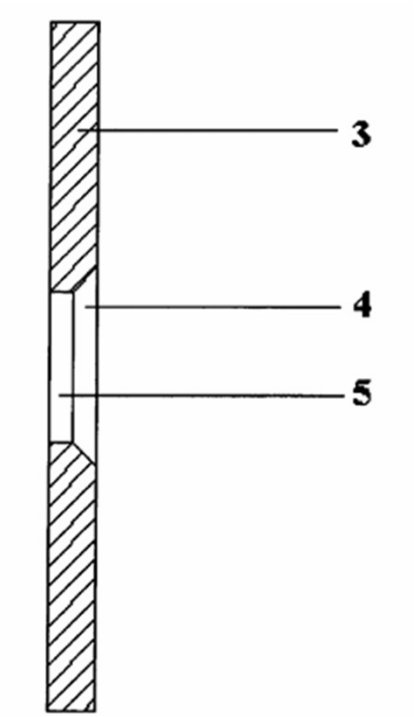


图 2

CN102435236B-多孔板流量计

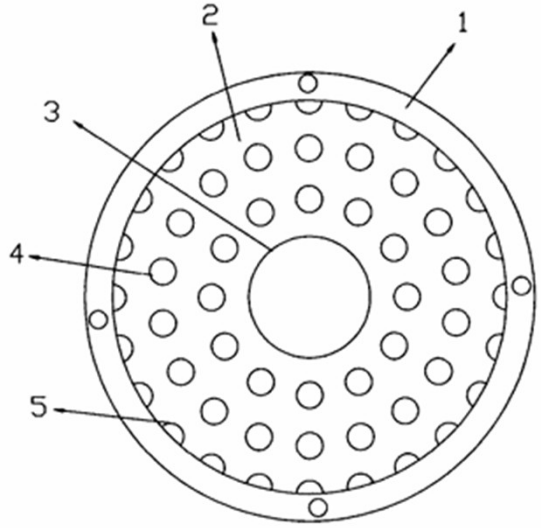


图 3

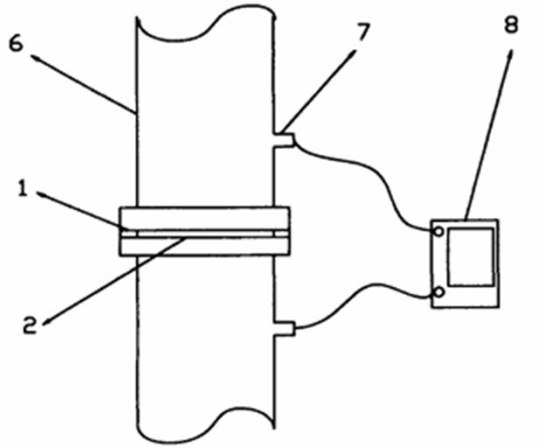


图 4

US11713986-Throttling component and rectification

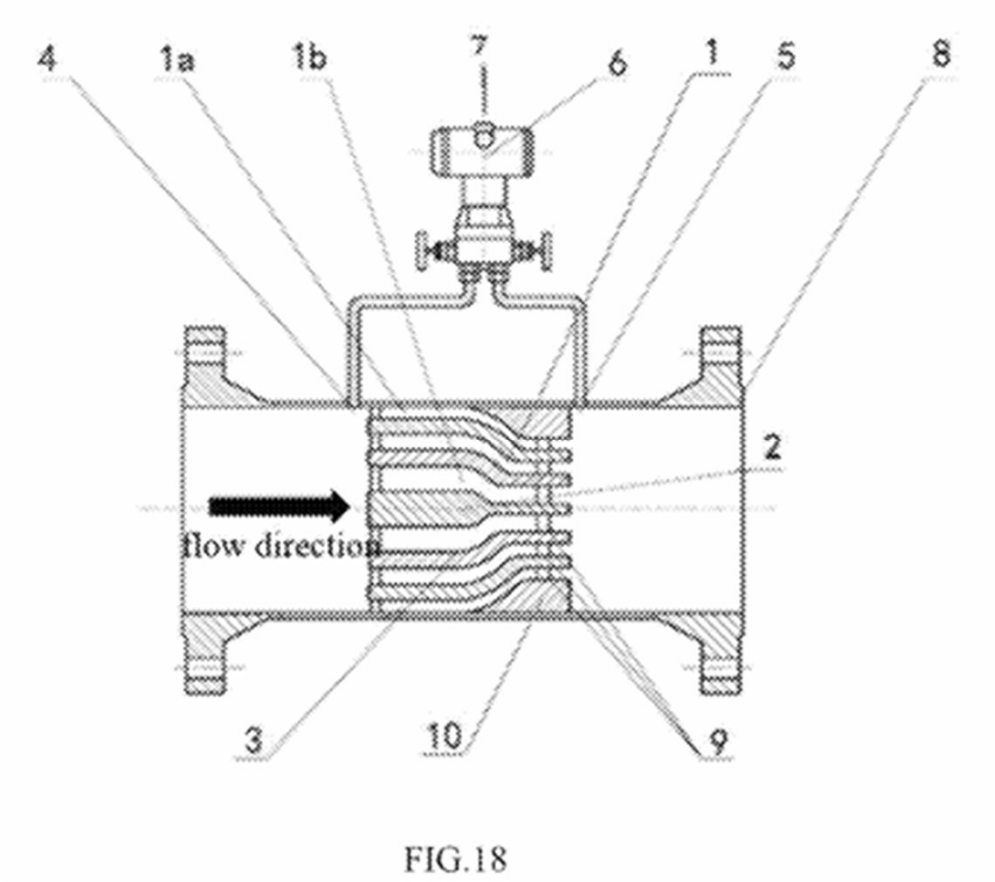


FIG.18

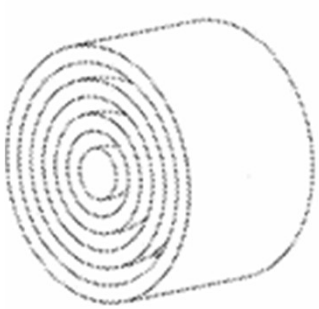


FIG.19

FIG.20

FIG.21

FIG.22

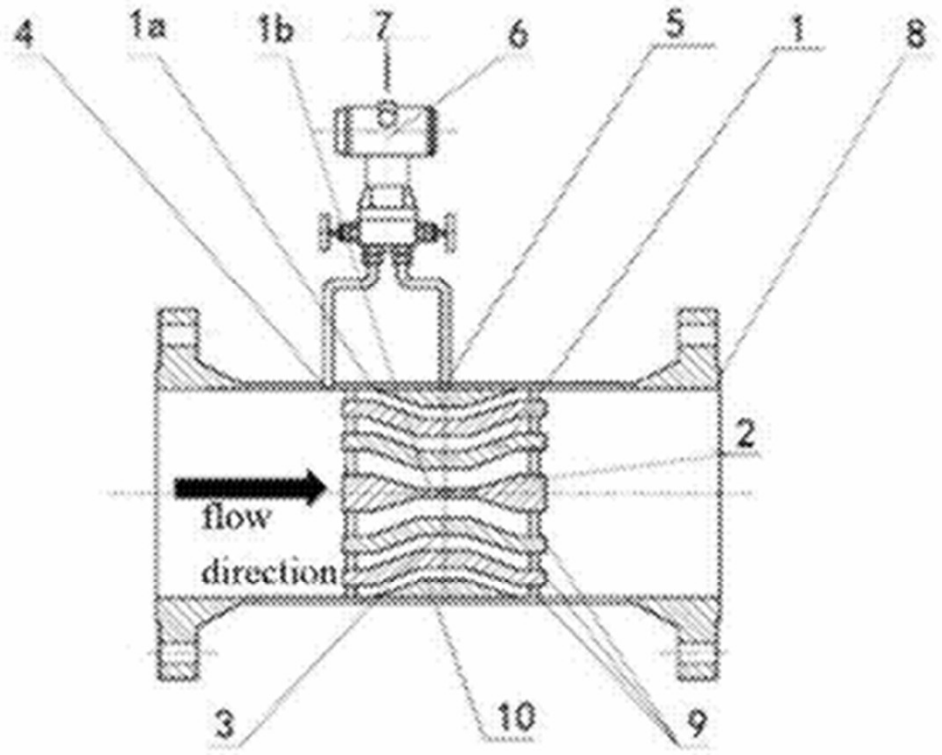


FIG.24

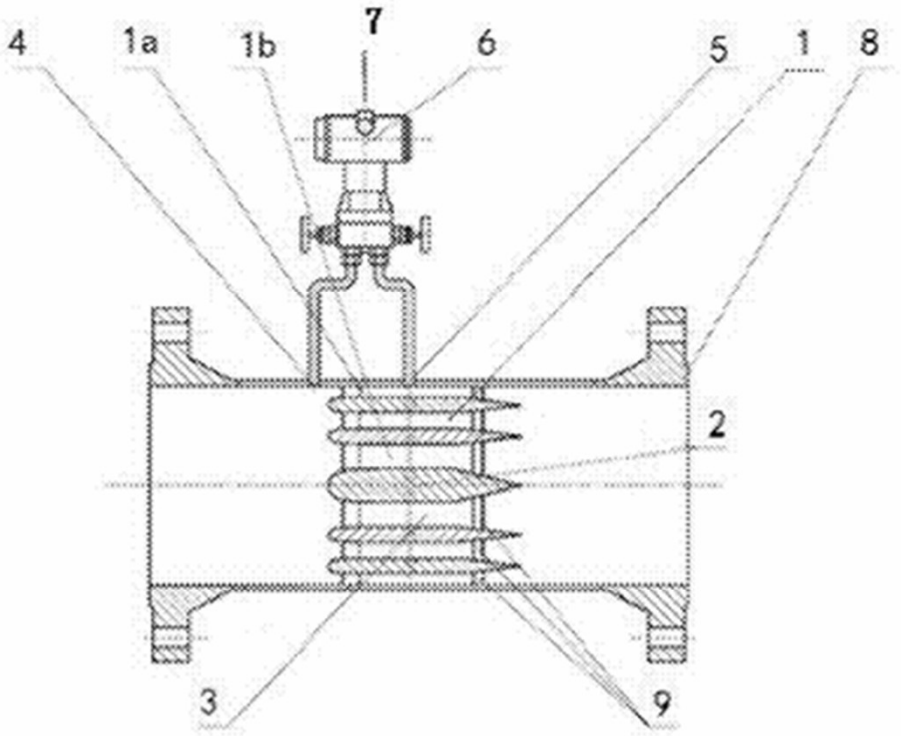
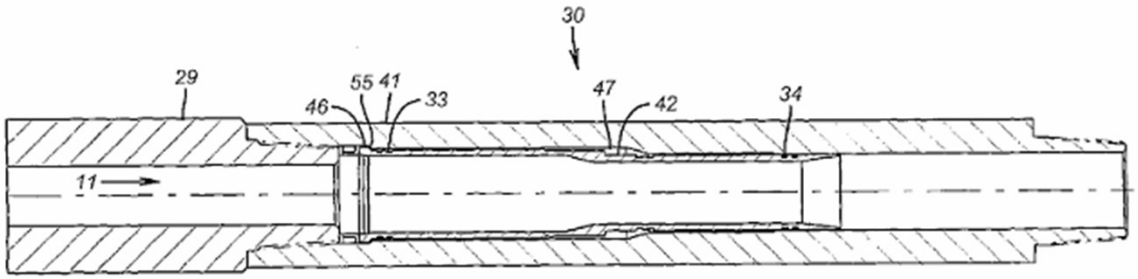
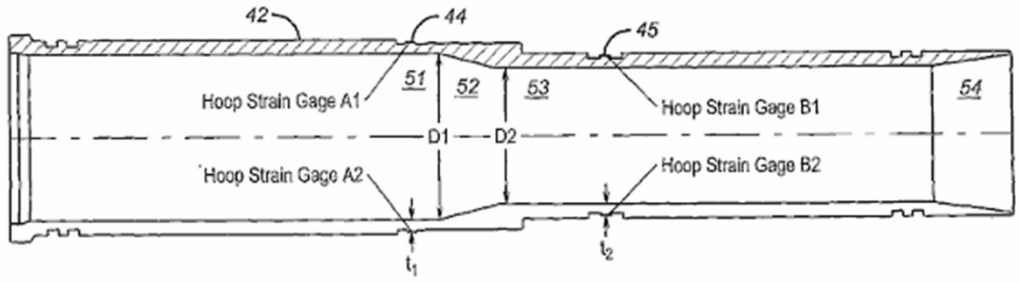


FIG.29

WO2006023607A1-FLOW METER USING STRAIN GUAGES

(54) Title: FLOW METER USING STRAIN GUAGES TO MEASURE A PRESSURE DIFFERENTIAL





(57) Abstract: A system and method provides a flow measurement system for steady-state and transient flow. A housing contains a sleeve such that the sleeve is isolated from external mechanical loads. A flow measurement element, such as a venture or nozzle, is located in the sleeve. Strains along the sleeve caused by flow pressure changes through the flow element are detected and related to fluid flow rate.

US2016076565A1-ORIFICE PLATES