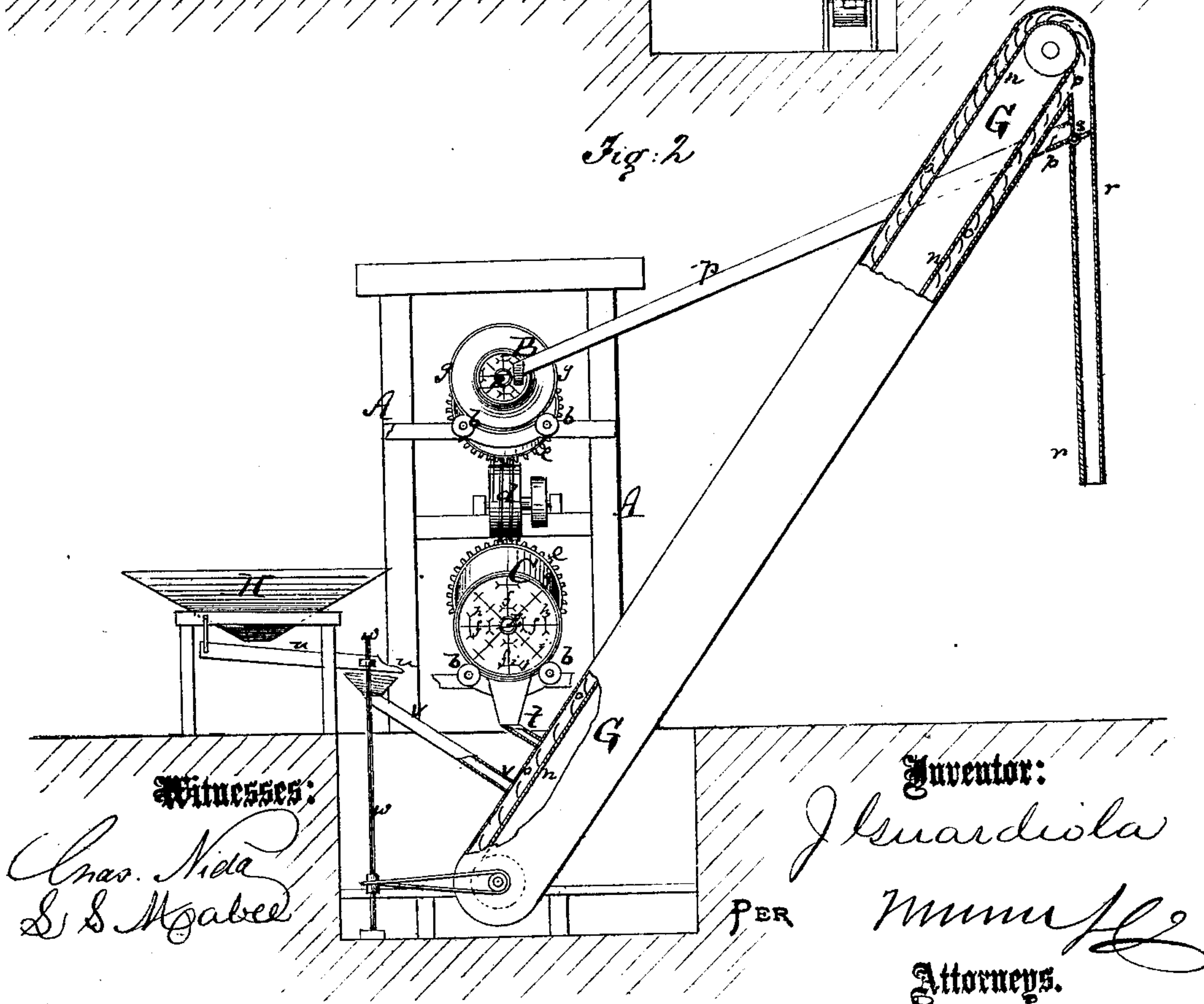
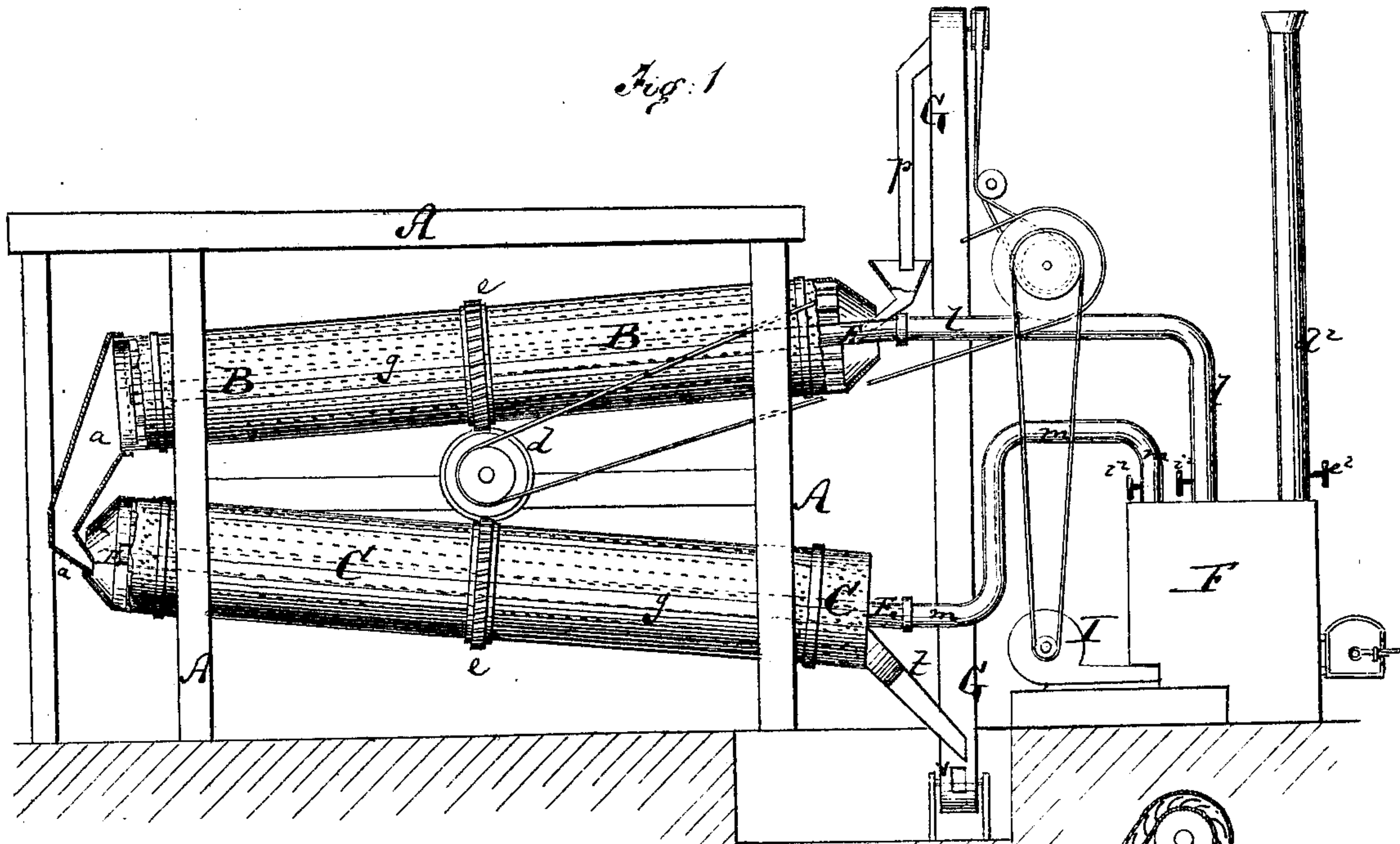


J. GUARDIOLA.

Improvement in Grain-Driers.

No. 126,455.

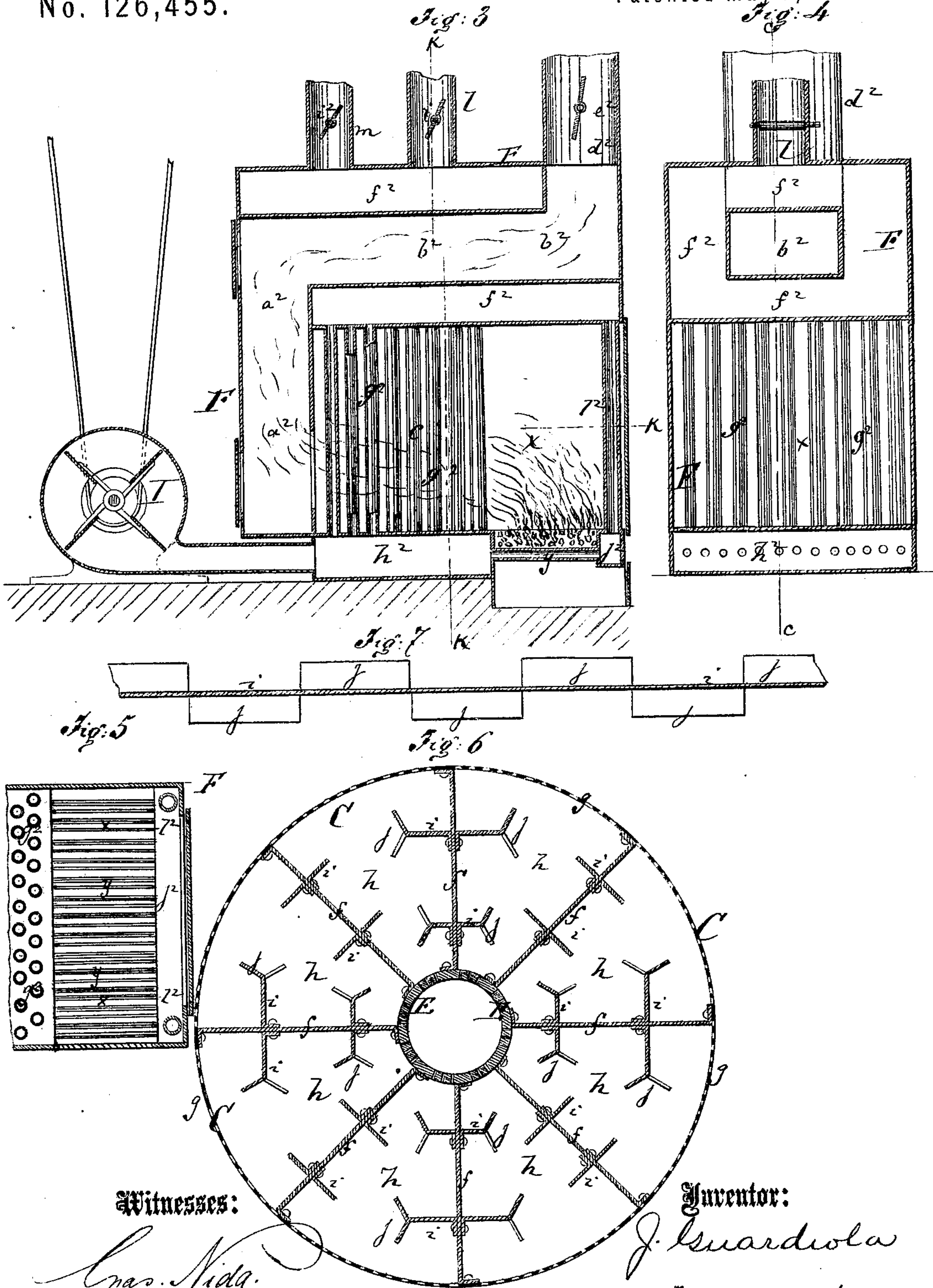
Patented May 7, 1872.



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JOSÉ GUARDIOLA, OF CHOCOLÁ, CENTRAL AMERICA.

IMPROVEMENT IN GRAIN-DRIERS.

Specification forming part of Letters Patent No. 126,455, dated May 7, 1872.

Specification describing a new and Improved Apparatus for Drying Grain, Coffee, Malt, and other substances, invented by JOSÉ GUARDIOLA, of Chocolá, in the Republic of Guatemala, Central America.

Figure 1 represents a side elevation, partly in section, of my improved drying apparatus. Fig. 2 is an end elevation, partly in section, of the same. Fig. 3 is a vertical longitudinal section on a more enlarged scale of the heating apparatus employed in the drier, the line *c c*, Fig. 4, indicating the plane of section. Fig. 4 is a vertical transverse section of the same on the line *k k*, Fig. 3. Fig. 5 is a detail horizontal section of the same on the line *c c*, Fig. 3. Fig. 6 is a detail vertical transverse section of one of the evaporating and agitating cylinders employed in the apparatus. Fig. 7 is a detail longitudinal section of one of the divisions within the cylinder.

Similar letters of reference indicate corresponding parts.

This invention relates to a new machine for artificially drying grain, coffee, malt, or other fruit, to prepare and fit the same for preservation, transportation, or other purposes. It is more particularly intended to supersede the common method of drying such articles by the heat of the sun, and thereby materially to hasten the evaporation of surplus moisture. The invention consists in a new arrangement of perforated rotary cylinders, containing central perforated hot-air tubes and radial winged partitions, to agitate the grain or substance to be dried in the compartments formed between the partitions, and meanwhile to expose the same to the influence of the hot air which permeates the entire cylinders. By this arrangement the grain or coffee can be conducted with suitable rapidity and under constant lateral agitation through the heated compartments. The invention also consists in a new construction of furnace for heating the air to be conducted to the above-mentioned cylinders, and in the combination therewith of a fan, whereby cold air will be forced through heating-pipes within said furnace, and thence into conductors for transmission to the drying-cylinders.

In the accompanying drawing, A represents the frame of the drying-machine, made of wood, metal, or other material. It serves as support

for two inclined perforated cylinders, B C, which are made of sheet metal or other proper material best adapted to the purposes for which the machine is intended. The cylinder B is directly above C, or at least so placed that its lower end is entirely or nearly above the upper end of C, where both cylinders are connected by an immovable neck or conduit, *a*. The cylinders B C are supported on small rollers *b b*, as indicated in Fig. 2, said rollers having their supports in the frame A. By this means the cylinders can be readily revolved around their respective axes. Rotary motion is imparted to the cylinders by a worm-gear, *d*, working into toothed wheels *e e*, which embrace the cylinders B C, in manner clearly illustrated in Fig. 1. Instead of this means of imparting motion to the cylinders, any other equivalent means may, however, be employed, such as belts, cranks, or other devices. Each cylinder B C contains an inner perforated tube, E, and around the same radial partitions *f f*, which extend from the perforated tube E to the perforated circumference *g* of the cylinders, as is more fully shown in Fig. 6. By means of these partitions *f* the annular space around the tube E and within the shell *g* is divided into a number of segmental compartments, *h h*. From the partition *f* project into the compartments *h* transverse plates *i i*, all or some of which have wings *j j* at their terminations, said wings projecting alternately inward and outward, as is more fully indicated in Figs. 6 and 7. The partitions *f f* and their appendages extend from end to end of each cylinder. The inner tubes E E of the two cylinders connect, respectively, with hot-air flues *l* and *m* that project from a heater, F. The coupling between the tubes E and the flues *l m* is of such kind that said tubes may revolve with the cylinders, with which they are rigidly connected, while said flues remain immovable, being rigidly connected with the stationary heater F. The perforations through the tubes E and shells *g* should be smaller than the grains to be acted upon in order to prevent such grains from falling through their meshes. G is an elevator containing an endless band, *n*, and buckets *o o* for raising the grain to be dried to the requisite height for conveyance to the drier. A spout, *p*, extends from the upper part of the elevator into the upper open end of

the cylinder B. Another spout, *r*, extends downward from the upper part of the elevator to lead to a suitable receptacle. A valve, *s*, shown in Fig. 2, serves to open whichever of the two spouts *p r* is to be used, and to shut the other. From the lower end of the cylinder C a spout, *t*, leads into the lower part of the elevator. H is a hopper, from which the grain is originally supplied to the elevator. This hopper feeds into a vibrating shoe, *u*, which empties into a spout, *v*, leading into the lower part of the elevator, as is clearly shown in Fig. 2. Oscillating motion is imparted to the shoe *u* by contact with an eccentric on a revolving shaft, *w*, or by other means. The heating apparatus F, of suitable size and shape, has a fire-chamber, *x*, Fig. 3, in which a tubular grate, *y*, is set up. The products of combustion pass from this chamber *x* up in a vertical flue, *a*², and forward again in a horizontal flue, *b*², whence they escape through the smoke-pipe *d*². A damper, *e*², in the latter regulates the rapidity of consumption. The flue *b*², it will be noticed, traverses a chamber, *f*², which is directly above the fire-chamber *x*. A series of vertical tubes, *g*², passes through the posterior part of the fire-chamber, and serves to connect the chamber *f*² with a cold-air supply-chamber, *h*², underneath. A fan, I, supplies the cold air which is to be heated to the chamber *h*², from where such air ascends in the tubes *g*², and enters the chamber *f*² thoroughly heated. The hot-air flues *l* and *m* conduct the air from the chamber *f*² to the inner tubes E of the cylinders B C, as hereinbefore specified, and are provided with dampers *i*², whereby the supply of hot air can be regulated. The tubular grate-bars serve to connect the chamber *h*² with a front air-chamber, *j*², whence pipes *l*² extend up to the chamber *f*², as shown. Every opportunity is thus utilized of exposing the air to the heat.

The operation is as follows: The grain, coffee, or other material to be dried is, from the hopper, conveyed to the lower part of the elevator, and thence to the upper end of the

cylinder B. It is, within said cylinder, distributed through the several segmental compartments and in them gradually conveyed to the lower end of the cylinder, whence, in the stationary neck, it is passed to the lower cylinder C, and therein again agitated and moved along. While in the cylinders B C the grain is constantly subjected to the influence of the heated air, which escapes through the apertures of the tubes E. Charged with the moisture from the grain such heated air leaves the cylinders through the openings in their shells. If after having passed through the lower cylinder the grain should not yet be in the desired condition, it may, being from the lower cylinder conveyed to the elevator, be recommitted to the upper cylinder, and once more passed through the machine, and as many times more as is necessary to make it as dry as required. When the desired object has been fully attained, the grain is finally discharged from the elevator through the spout *r*. The cylinders may be revolved as much as five or more times in a minute, or slower, according to the requirements of each case.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The perforated cylinders B C, containing the perforated air-tubes E E and the partitions and wings, substantially as herein shown and described.

2. The combination of the fan I and heater F with the pipes *l m*, tubes E, and rotary cylinders B C, all arranged substantially as herein shown and described.

3. The drying-machine, composed of the cylinders B C, tubes E, elevator G, heater F, and fan I, all arranged to operate substantially as herein shown and described.

The above specification of my invention signed by me this 22d day of December, 1871.

JOSÉ GUARDIOLA.

Witnesses:

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