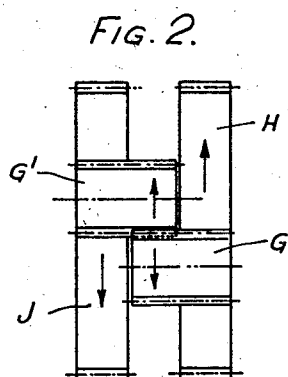
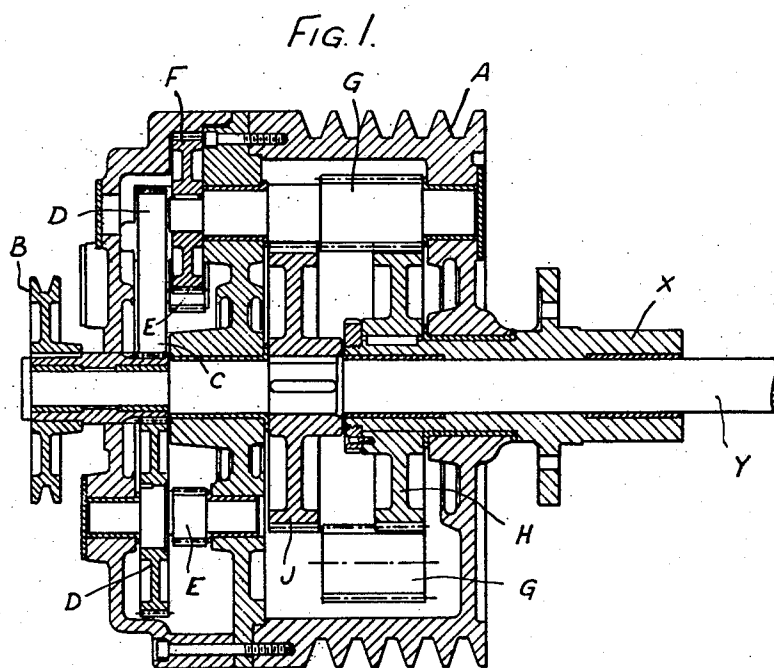


April 20, 1954

W. F. HARLOW ET AL
GEARING FOR CENTRIFUGAL MACHINES

2,675,716

Filed Jan. 19, 1950



INVENTORS
W. F. HARLOW &
R. W. EDWARDS
by *Wilkinson* *Attys.*

UNITED STATES PATENT OFFICE

2,675,716

GEARING FOR CENTRIFUGAL MACHINES

Walter F. Harlow, Quarndon, and Ronald W. Edwards, Derby, England, assignors to International Combustion (Holdings) Limited, London, England

Application January 19, 1950, Serial No. 139,452

2 Claims. (Cl. 74—675)

1

This invention constitutes an improved drive for rotating two members in the same direction, but at slightly different speeds of rotation where there is a considerable frictional force between them. It relates more particularly to the arrangement used in centrifugal machines where a cylindrical or conical shell is rotated at high speed and a screw conveyor is rotated coaxially at a slightly lower speed so that the conveyor will remove from the shell in a continuous manner material which has been separated from a liquid by the action of centrifugal force.

With such an arrangement the action of the centrifugal forces results in a very considerable resistance to the relative rotation of conveyor and shell but since this speed difference is small, for example 5 to 10 revs. per minute, compared with the very high rotational speed of the complete assembly, which may be in the region of 1,000 R. P. M., the work done in rotating the conveyor in the shell is not necessarily excessive compared with that of driving the machine as a whole.

In existing designs both the conveyor and the shell have been driven by separate shafts and gears from a common motor, and have suffered from a serious disadvantage in that the power to overcome the frictional resistance between the conveyor and the shell is transmitted at the very high speed at which the conveyor and shell are rotating. This necessitates the use of very much larger gears than would be required if the frictional torque were overcome at the differential speed only, namely, 5 or 10 R. P. M. In other words, the drives with such an arrangement must be capable of working at a horse-power about two hundred times greater than if the differential speed only were employed.

In the operation of such a machine the frictional force which may be set up is often quite unpredictable, and therefore the horse-power to be transmitted by the drives already referred to might easily become excessive and destroy the gears without warning.

To overcome this difficulty epicyclic gears have been proposed which are interposed between one rotating member and the other so that the conveyor is driven by this means from the rotating shell and the shell only is driven by an external source of power. The effect of this epicyclic gearing is to reduce the speed at which the high frictional resistance is overcome, and therefore the power to be transmitted by the gearing is proportionately less.

Even with this arrangement, however, there is

2

still the possibility of excessive strain on the gears due to abnormal resistance between conveyor and shell, and in known devices of this type this is prevented by limiting the torque which has to be applied to one member of the epicyclic train to enable the gear to function.

The present applicants have found that the resistance set up between the conveyor and the shell depends on the nature of the material being handled, the degree to which the solids are separated from the liquid and also on the differential speed between the conveyor and the screw. With some materials this resistance can become so excessive as to render the operation of the machine quite impracticable, but the applicants have found that this resistance can be greatly reduced by changing the differential speed, and that by this means it is possible to make the operation a practical one.

With fixed gearing, however, whether of the direct driven or epicyclic type, a change in the differential speed can only be made by providing new gears which is highly inconvenient and costly.

The purpose of this invention is to provide an epicyclic gear drive which, besides having the advantages already set forth permits the differential speed to be modified in a simple and expeditious manner by driving one member of the gear from an independent source in such a way that by varying the speed of rotation of this member the differential ratio can be modified.

A further advantage of the invention is that the auxiliary drive can be arranged to be cut out when the resistance between the conveyor and the shell becomes excessive thereby protecting the machine from damage.

It will be understood that with the main driving pulley revolving there will be no differential rotation of screw and shell as long as the auxiliary driving pulley rotates at the same speed; and that the extent of the relative movement will depend on the speed difference between the two pulleys and the ratio of the epicyclic reduction gear. Also that, notwithstanding a higher speed of rotation of the screw and shell, the relative movement (or speed of tooth engagement) of the gears is relatively low so that the gears may be of small dimensions and yet have long life. Also if the torque becomes excessive, as may often occur in practice due to overloading the machine with material, the gears may be protected by arranging to cut off the power from the auxiliary drive when this reaches a predetermined figure. This may be arranged by driving

the auxiliary pulley by a separate electric motor with the usual overload cut out device or through a slipping clutch from the main driving motor.

One form of construction of the invention is illustrated in the annexed drawings, in which

Fig. 1 is a vertical section, and

Fig. 2 is a diagram showing the direction of rotation of the driving wheels.

Referring more particularly to the drawings, X designates a tubular shaft adapted to be connected to drive the shell of a centrifugal machine, and Y is a shaft connected to drive the screw conveyor of the centrifugal machine. Shafts X and Y are concentric.

A drive drum A is adapted to be driven by a pulley from an appropriate source of power and has an end head 10 through which the shafts X and Y project with the tubular shaft X having a bearing 11 in the end head 10.

The end head 10 also provides bearings for rotary planetary shafts 12 and 13. Such shafts 12 carry fixedly thereon the planetary pinions G and G¹. The other ends of these planetary shafts 12 and 13 are accommodated in bearings in a partition member 14 fixedly mounted in the drum or casing A.

The planetary pinions G and G¹ mesh with one another, as shown in Figure 2 at overlapped portions thereof. These pinions are sufficiently wide to extend in opposite directions and respectively mesh with gear wheels H and J which are splined as indicated at 15 and 16 respectively to the shafts X and Y.

The rotation of the planetary shafts 12 and 13 is accomplished by pinions F splined at 17 to the shafts 12 and 13, such gear wheels F being driven by pinions E which are affixed to shafts 18 which are journaled both in the partition member 14 and in the opposite end head 19 of the rotary drum or casing A. These shafts 18 and the pinions E fixed thereon are rotated by gear wheels D also affixed to the shafts 18 and in mesh with a central pinion C mounted on a sleeve shaft 20 which has bearing and independent rotation of and about the shaft Y and the end head 19. This sleeve shaft 20 is driven by a pulley B fixed thereon, as by a key 21, outside the casing or drum.

In operation the drum A is driven by belt from one source of power while the pulley B is driven from a second independent source of power at a rate of speed independent of that of the drum.

The drive for the shell tubular shaft X is from the drum A through the pinions G and gear wheel H, this drive being regulated by the fixed condition of the gears against rotation or of the rotational rate of the planetary gears G. The condition of the gears G just referred to is also

controlled by the condition of the gears G¹ due to the overlapping engagement of these gears G and G¹. The rate of rotational speed of the conveyor shaft Y is dependent on the aforesaid condition of the planetary gears G and G¹. The rate of rotation of the planetary gears G and G¹ about their own shafts 12 and 13 is dependent upon the drive imparted at the pulley B.

It will be seen that if the pulley B is rotated relatively to the drum A, the gears H and J are displaced to a much lesser degree in opposite direction, resulting in a small differential speed between conveyor and shell.

We claim:

1. A centrifugal machine comprising a tubular shell shaft, a conveyor shaft extended therethrough and concentric thereto, separate drive gear wheels splined independently to said shafts, a driven hollow drum into which said shafts project and in which said gear wheels are contained, planetary shafts rotatably journaled in said drum, planetary pinions fixed on said planetary shafts and disposed respectively in mesh with said gear wheels, said planetary pinions having overlapping engaged portions, means independent of the drum drive for driving said planetary shafts, and comprising gear wheels affixed to said planetary shafts, pinions meshing with said last named gear wheels, other gear wheels in driving relation with said last named pinions, a sleeve shaft, a central pinion on said sleeve shaft in driving relation with other gear wheels, said sleeve shaft projecting through said drum to the exterior thereof and journaled for independent rotational movement about said conveyor shaft, and a drive member affixed upon the external end portion of said sleeve shaft.

2. A machine according to claim 1 wherein said two drives comprise a main drive and an auxiliary drive, the arrangement being such that the auxiliary drive can be cut out when the resistance between the shell and the conveyor becomes excessive.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
392,782	Clawson	Nov. 13, 1888
1,255,314	Jackson	Feb. 15, 1918
1,395,735	Sawyer	Nov. 1, 1921
1,720,018	Tubbs	July 9, 1929
1,740,788	Sheridan	Dec. 24, 1929
2,533,610	Norelius	Dec. 12, 1950

FOREIGN PATENTS

Number	Country	Date
551,490	Great Britain	Feb. 24, 1943