Vibration Dampener and Stabilizer for Sucker Rods

Fig. 1.

Fig. 2.

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This invention relates to a sucker rod vibration damper and rod stabilizer for application to sucker rods operating within a well tubing.

In the mechanical pumping of wells, a tubing is run into the bore hole of the well to carry the pump on the lower end and provide for flow of fluid from the pump to the top of the well. Connected with the reciprocating element of the pump is a string of sucker rods that extends longitudinally within the tubing to connect with the pumping jack or other power capable of producing reciprocation of the rods and elevation of the well fluid through the tubing. In deep wells, such as oil wells, there is a tremendous load on the rods, resulting from weight of the rods, weight of the column of fluid in the tubing, friction, and the like, which produces stretch of the rods. The stretch of the rods increases on the upstroke and decreases on the downstroke, consequently, the rods are in constant vibration, which produces crystallization and results in ultimate breakage of the rods.

All wells are crooked, because it is impossible to drill a straight bore hole, therefore there is a rubbing and slapping of the rods on parts of the tubing. This not only increases stress on the rods, but produces wear thereon and rubbing through embrittling of the tubing. In deep wells, rod and tubing failures are frequent. Breakage of the rods, of course, necessitates shutting down of the production and difficult fishing jobs and replacement of the rods and tubing.

Various attempts have been made to provide rod guides, vibration dampeners, and the like, but most of them are unsatisfactory because they interfere with running the rods into and out of the well, interfere with flow of well fluid, and it has been difficult to make them rugged enough to withstand tremendous loads. In fact, tension of the rods literally crushed them against the tubing and caused the fastening devices and parts thereof to break loose and drop into the tubing so as to become wedged and difficult to remove.

It is, therefore, the principal object of the present invention to provide a sucker rod vibration damper and rod stabilizer which eliminates the above described difficulties and greatly prolongs the life expectancy of the rods.

Other objects of the invention are to provide a relatively light weight sucker rod vibration damper and stabilizer which is ruggedly constructed and capable of withstanding the working stresses to which they are subjected; to provide for mounting the damper and stabilizer on the rods in such a manner that the fastening devices are out of contact with the tubing; to provide a vibration damper and stabilizer with shoes covered with a composition material, to avoid metal-to-metal contact and to better dampen the vibration of the rods; to provide for securing the damper and stabilizer to the ends of the rods in a permanent manner, in such a manner that the damper and stabilizer is secured to the sucker rod.

Further objects of the invention are to provide a vibration damper and stabilizer which permits increasing the speed of the pump with less power cost; and to provide straightening of the rod action with respect to the tubing in crooked wells.

In accomplishing these and other objects of the invention, I have provided improved structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

FIG. 1 is a vertical section through a portion of well tubing, showing a sucker rod therein that is equipped with a vibration damper and stabilizer embodying the features of the present invention.

FIG. 2 is an enlarged section through the flow tubing and through the vibration damper and stabilizer, to better illustrate the construction and mounting thereof on the sucker rods.

FIG. 3 is a perspective view of the parts of one of the vibration dampeners and stabilizers, shown in disassembled, spaced relation.

FIG. 4 is a transverse section on the line 4—4 of FIG. 2, showing the position of the bolts and flanges of the support members and how they are kept out of contact with the wall of the tubing by the shoes of the device.

FIG. 5 is a similar section taken on the line 5—5 of FIG. 2.

FIG. 6 is a transverse sectional view of the parts of the stabilizer and damper in spaced apart relation and taken on the line 6—6 of FIG. 3.

Referring more in detail to the drawings:

1 designates a portion of well tubing that extends from the top of a bore hole to the bottom thereof for carrying a pump (not shown) on the lower end for elevating well fluids to the top of the well.

2 designates a portion of a string of sucker rods extending downwardly through the tubing to actuate the reciprocatory element of the pump.

The rods 2 are suspended at the upper end from the walking beam of a pumping jack (not shown) or the like, by which the rods are reciprocated as in the usual practice in the pumping of an oil well. As above mentioned, the string of rods reaching from the pumping jack to the well pump in deep wells is under considerable stretch, not only from weight of the rods themselves but also the added weight of the column of fluid being lifted in the tubing on each upstroke. Stretching of the rods varies during reciprocation, increasing on the upstroke and lessening on the downstroke, causing the rods to vibrate and pound with such force that they are under extreme stress and soon crystallize and, sometimes, break after only a short period of operation.

It is impossible to drill a bore hole straight, so that the tubing deviates from the perpendicular with deviation in the bore hole. Therefore, when the rods are reciprocated they make contact with the tubing at these places, with the result that the sucker rods exert tremendous pressure and wear upon the tubing, causing the tubing to be worn away and actually split apart under thrust of the rods thereon.

However, with the present invention the vibration on the rods and the excessive forces on the tubing are stabilized by providing the string of rods at places along the length thereof with vibration dampeners and stabilizers 5, as now to be described, only one being illustrated in the drawings, since the stabilizers and dampeners are all of like construction and may be located along the length of the string of sucker rods wherever they may be needed.

In accordance with the present invention, each vibration damper and stabilizer employs the component parts 4 and 5, each having a nearly semicylindrical collar portion 6 having an inner radius of such size as to firmly seat upon the face of the rod 2. The collar portions 6 each have laterally extending flanges 7 and 8 of only sufficient width to accommodate fastening devices 9 by which the collar portions are drawn tightly about the sucker rod 2, as shown in FIGS. 1, 4 and 5. The flanges 7 and 8 must be of ample strength to accommodate fast-
ening devices of the proper size, but they must be kept to
minimum size because they occupy fluid space, and if
made longer the end caps of the collar portions are elongated and may be two or three feet
in length, to provide stabilizers and dampeners having
desired contact with the inner face of the tubing.

The fastening devices preferably comprise bolts having threaded shanks 11 of a length to extend through register openings 12 and 13 in the respective flanges and
to mount acorn nuts 14, so as to cover the threads of the
bolts, since the threads would otherwise be subject to
the corrosive action of the well fluids.

Extending radially outwardly from the collar portions
are web portions 15 and 16, preferably formed integral-
ly with the collar portions 6, to carry a plate portion 17
that is of arcuate cross section, as best shown in FIGS. 4,
5 and 6. The plate portions 17 have marginal edges 18
and 19 that project from outer faces of the web portions
sufficient distances to provide anchoring flanges 20 for
shoes 21 and 22, as later described. The upper and lower
ends of the arcuate plate portions 17 extend beyond the
ends of the collar portions 6 and taper inwardly toward
the sucker rod, as designated by the numerals 23 and 24,
FIGS. 2 and 3.

The shoes 21 and 22 are of like construction, and each consists of a shell 25 having an arcuate cross section cor-
responding to the arcuate cross section of the plate por-
tions 17, and the shells have longitudinal edges 26 and 27,
preferably terminating in registry with the edges of the
flanges 20. The shells also have inwardly tapering ends 28
and 29 corresponding to the tapered ends 23 and 24 of the
plate portions that back them.

The edges 26 and 27 of the shells have tongues 30
spaced along the length thereof. The ends 28 and 29 of
the shells also have one or more tongues 31. The tongues
are bent over the flanges 20 and over the ends 23 and 24
of the arcuate plate portions 17 of the supporting mem-
ers 4 and 5.

Each of the shells has a facing 32 of composition ma-
terial which may include a fabric incorporated in a syn-
thetic rubber that is resistant to the action of the well
fluids. The facings 32 are preferably vulcanized to the
shells and further secured by rivets 33, as best shown in
FIGS. 3 and 4.

In assembling the parts of the vibration damper and
stabilizer on a sucker rod, the shells, with the facings
thereon, may be secured to the plate portions 17 of the
supporting members 4 and 5 by placing the concave side of the shells over the convex sides of the plate por-
tions 17, so that the shells fit snugly on the plate portion
both in circumferential and longitudinal directions. The
tongues 30 are then hammered over the flanges 20, as
shown in FIGS. 1, 4 and 5, so that the shells 25 of the
shoes 21 and 22 are drawn tightly and immovably
against the outer faces of the plate portions 17 of the sup-
porting members. The end tongues 31 are likewise bent
over the ends 23 and 24, as shown in FIGS. 1 and 2. The
supporting members 4 and 5 are then placed on opposite
sides of the sucker rod 2 and secured thereto by the
fastening devices 9, the nuts 14 of which are drawn tight
to clamp the collar portions 6 firmly against the sides of
the sucker rod, so that the assembled vibration damper and
stabilizer is immovable thereon even under stresses that
are imparted between the sucker rod and tubing when the sucker rods are in operation.

A vibration damper and stabilizer 3 may be applied as
needed along the length of the string of sucker rods 2, for
example, one of these may be applied to each sucker rod,
or only at places therealong that show rubbing of the
sucker rods on the tubing.

With the sucker rods in reciprocation, as when fluid is
being pumped through the tubing, the facings 32 ride in
frictional contact with the tubing so as to dampen vibra-
tions that produce breakage of the rods.

Attention is directed to the fact that the fastening de-

vices 9 are readily manipulated in the spaces between the
side edges of the shoes 21 and 22, yet the shoes are suf-

ficiently wide to prevent contact of the fastening devices
9 or the flanges 7 and 8 with the tubing when the sucker
rods are in operation. The spaces also, together with the
spaces between the webs 15 and 16, provide ample pas-
sage for flow of the well fluid to the top of the tubing.

When the facings 32 become worn, the shells may be
removed by hammering loose the tongues, so that the old
shoes can be removed and replaced with new shoes.

From the foregoing, it is obvious that I have provided
a vibration damper and stabilizer which may be readily
applied at desired points along the length of the sucker
rods to provide adequate support for straightening
the string of sucker rods within the tubing and reduce the vi-
bration which is so destructive to sucker rods. It is also
apparent that the dampeners and stabilizers constructed
as described are constructed to withstand the forces that
are applied thereto.

What I claim and desire to secure by Letters Patent is:
1. In combination, a flow tubing,
a string of sucker rods reciprocable within the flow
tubing, and
a stabilizer bodily mounted on one of the sucker rods
and reciprocable therewith for sliding contact with the
flow tubing to stabilize lateral movement of the rod
and to dampen vibration,
said stabilizer including
elongated collar segments seating upon and substantially
encircling the sucker rod and having outwardly ex-
tending flanges terminating short of the tubing,
fastening devices extending through the flanges of said
collar segments for drawing the segments together
in gripping contact with the sucker rod,

a plate of arcuate cross section coextensive with each
collar segment,
said plates having edges spaced circumferentially from
each other and from said flanges to accommodate in-
sertion of the fastening devices and provide flow pas-
sages therebetween,

shoes conforming with and covering outer faces of the
arcuate plates,
means for securing the shoes to said arcuate plates,
and
a composition facing having fixed connection with
outer faces of the shoes for sliding contact with the
flow tubing and to prevent contact of the flanges with
the flow tubing during reciprocation of the rods.
2. In combination,
a flow tubing,
a string of sucker rods reciprocable within the flow
tubing, and
a stabilizer bodily mounted on one of the sucker rods
and reciprocable therewith for sliding contact with the
flow tubing to stabilize lateral movement of the rod
and to dampen vibration of the string of sucker

rods,
said stabilizer including
elongated collar segments seating upon and substan-
tially encircling the sucker rod and having outwardly
extending flanges terminating short of the flow tub-
ing,
fastening devices extending through the flanges of said
collar segments for drawing the segments together
in gripping contact with the sucker rod,

a plate of arcuate cross section coextensive with each
collar segment,
said plates having edges spaced circumferentially from
each other and from said flanges to accommodate
insertion of the fastening devices and provide flow
passes therebetween,

said plates having inwardly tapering ends projecting
beyond upper and lower ends of the collar segments,
shoes conforming with and covering outer faces of the arcuate plate portions and having similarly tapering ends covering the tapering ends of the plates to fix the shoes from longitudinal movement of the shoes on said plates,

means for securing the shoes from radial movement on said arcuate plates, and

a composition facing having fixed connection with the plates to provide outer faces for sliding contact with the flow tubing and to prevent contact of the flanges with the flow tubing during reciprocation of the rods.

3. The combination as described in claim 2, wherein said means for securing the shoes comprises tongues on the shoes and bent over edges of the plates.